Wednesday, 8:00am - 9:30am

■ WA01

Hilton- Golden Gate 6

Mathematical Modeling and Operations Research in Military Decision Making II

Sponsor: Military Applications Society
Sponsored Session

Chair: William Fox, Professor, Naval Postgraduate School,
Department of Defense Analysis, Monterey, CA, 93943,
United States of America, wpfox@nps.edu

1 - Military Capital Budgeting with Risk and Effectiveness
Mike Teter, PhD Candidate, Colorado School of Mines,
1500 Illinois St, Golden, CO, 80401, United States of America,
mteter@mymail.mines.edu

We consider a new approach to modeling military capital budgeting with minimum risk while meeting an acceptable effectiveness level. We build a framework for computational methods, e.g., decision analysis and mathematical programming, used in deriving risk and effectiveness. We apply the corresponding framework to plan future procurement purchases of the US Army. We employ visualization techniques to demonstrate the results to senior-level planners.

2 - using Mathematical Models in Decision Making Methodologies to Find Node Influences in the Noordin Dark Network
William Fox, Professor, Naval Postgraduate School, Department of Defense Analysis, Monterey, CA, 93943, United States of America, wpfox@nps.edu

In dark network analysis, we use SNA measures and metrics. We use these in decision making concerning disrupting or deceiving a given network. We explore methods to identify the key nodes such as an average ranking scheme, AHP, and TOPSIS. We compare these methods using the Noordin Dark Network with seventy nine nodes.

3 - Sense Making of Narratives: Informing a Rapid Fielding Process
Michael Jaye, Associate professor, Naval Postgraduate School,
Dept of Defense Analysis, Monterey, CA, United States of America,
mjjaye@nps.edu

The Warfighter Technology Tradespace Methodolgy applies a construct that relies on technical, logistics, and user factors. The intent is to maximize the likelihood of technology acceptance upon fielding. To inform that process as feedback, we gathered and analyzed narratives from soldier end users. We present the narrative collection process and results. The intent is to highlight user dispositions as well as those factors influencing acceptance or rejection of the newly fielded equipment.

4 - The Value of a Whisper in Changing the Attitudes and Opinions of a Population
COL (R) Robert Burks, Department of Defense Analysis, NPS,
5125 Ocean Bluff Court, Seaside, 93955, United States of America,
reburks@nps.edu

This research seeks to develop a planning aid to facilitate the disruption of a dark network by triggering a cascade of influence in a competing environment by which individuals accept and spread a negative message to other individuals in the network as fast and efficient as possible. Presented is the progress and efforts to identify the key individuals in a network to ensure the dissemination of a rumor reaches and triggers a cascade eroding confidence and trust in the dark network.

■ WA02

Hilton- Golden Gate 7

Knowledge, Learning and Intellectual Capital (KLIC)

Sponsor: Technology, Innovation Management and Entrepreneurship
Sponsored Session

Chair: Charles Weber, Associate Professor, Portland State University,
PO Box 751 ETM, Engineering and Technology Management,
Portland, OR, 97207, United States of America, webercm@gmail.com

1 - Product Innovation through SMEs' Learning in Alliances with Buyers and Their Directives
Ricarda Bouncken, Professor Dr., University of Bayreuth,
Universitatsstr. 30, Bayreuth, 95447, Germany,
bouncken@uni-bayreuth.de, Robin Pesch, Manish K. Srivastava,
Boris D. Plüschke

By discriminating two types - inlearning and combinative learning - this study clarifies ambivalent results of prior studies on learning in alliances on product innovation. Results of our survey on 459 SMEs show that inlearning and

combinative learning poles apart on SME's speed to market and product innovativeness. The effectiveness of inlearning and combinative learning further is affected by directives set by buyer firms.

2 - What Impact Does Intellectual Property Have on the Business Performance of Technology Firms?
Kelvin Willoughby, Professor, Innovation & Entrepreneurship,
Skolkovo Institute of Science and Technology, 100 Novaya Street,
Skolkovo, Odintsovsky District, Moscow Region, 143025,
Russian Federation, ProfessorWilloughby@mac.com

This paper reports the results of a study of technology firms in the bio industries in which a statistically significant positive relationship was found between investment in intellectual property and business performance. The financial benefits of a strong intellectual property portfolio were observable regardless of whether the firms were strategically oriented towards R&D or strategically oriented towards the commercial production of products and services.

3 - Selective Absorption of Knowledge in the National Laboratories
Charles Weber, Associate Professor, Portland State University,
PO Box 751 ETM, Engineering and Technology Management,
Portland, OR, 97207, United States of America,
webercm@gmail.com, Pattravadee Ploykitikoon

An empirical study of the national laboratories of a technology latecomer country shows that the absorptive capacity of project groups is highly differentiated. Internal factors determine what kind of external knowledge is allowed to flow into the project group.

■ WA03

Hilton- Golden Gate 7

The Economic and Social Impacts of Mobile Apps

Sponsor: eBusiness
Sponsored Session

Chair: Sang Pil Han, Assistant Professor, Arizona State University,
W.P. Carey School of Business, Tempe, AZ,
United States of America, sangpil78@gmail.com

1 - Do App Descriptions Matter? Evidence from a Mobile App Store Market
Gunwoong Lee, Doctoral Candidate, Arizona State University, W.P.
Carey School of Business, Tempe, AZ, 85287-4606, United States of
America, gunwoong.lee@asu.edu, Raghu Santanam, Sungho Park

Mobile App markets enable developers to deliver an array of App-related attributes and/or marketing messages through the head of product descriptions. We evaluate whether extrinsic and intrinsic cues in App descriptions significantly impact App sales and whether they can complement the cues offered from a product page. Our results suggest that extrinsic cues are strongly related to App rankings, and substantiate the complementarities between extrinsic cues in App description and market formats.

2 - The Impact of the Freemium Strategy on the Adoption of Mobile Apps in Google Play Market
Charles Liu, Associate Professor, University of Texas at San Antonio,
1 UTSA Circle, College of Business, UTSA, San Antonio, TX, 78249,
United States of America, Charles.Liu@utsa.edu, Yoris Au

This study empirically examines the impact of offering free mobile apps on the adoption of their paid version in Google Play mobile app market. By analyzing a large panel dataset consisting of 1922 free and paid mobile apps, we found that the adoption of a paid mobile app is significantly accelerated when a high quality free mobile app is offered, and the lifecycle of a paid version of a mobile app is highly associated with the lifecycle of its free version. However, the effect of the freemium strategy is significantly reduced when free apps are prevalent in the same app category or when there is high quality differentiation between the free and paid versions of an app (e.g., limited time or limited functionality of the free version). Moreover, we found that such quality differentiation also has a significant impact on the revenue from the paid apps.

3 - Nature or Nurture? An Analysis of Rational Addiction to Mobile Platform Apps
Hyeokkoo Eric Kwon, Doctoral Candidate, KAIST School of
Business, Korea Advanced Institute of Science, Cheongnyangni-
dong, Dongdaemun-gu, Seoul, 130-722, Korea, Republic of,
hkkwon7@business.kaist.ac.kr, Hyunji So, Sang Pil Han,
Wonseok Oh

We extend the rational addiction model of Becker and Murphy (1988) to three types of mobile social apps (e.g., SNS, Social Game (SG), and Instant Messaging Service (IMS)) that are offered at a free of charge. Furthermore, using unique panel data set, we investigate their rational addictiveness. The initial findings suggest that all three apps are addictive. However, only users of SG are found to be rational, while such rational behaviors are not evident among users of SNS and those of IMS.

4 - An Empirical Analysis of Mobile App Time Use: Are Facebook and YouTube App Use Complements?
Sang Pil Han, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, United States of America, sangpil78@gmail.com, Sungho Park, Wonseok Oh

In this study, we use a unique panel data set detailing individual-level mobile app time-use and build a utility theory-based model for multiple discrete/continuous choice of app use. We quantify the baseline utility and satiation levels of different mobile app categories and examine how these vary with user demographics. To allow for category (dis)similarity in unobserved attributes, we employ a factor analytic structure in our multiple discrete/continuous model.

■ WA04

Hilton- Continental 1

Entrepreneurial/Innovative Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Onesun Steve Yoo, Assistant Professor, University College London, Gower Street, London, United Kingdom, o.yoo@ucl.ac.uk

1 - Optimal Learning and Development Strategy for Entrepreneurial Product Launch
Onesun Steve Yoo, Assistant Professor, University College London, Gower Street, London, United Kingdom, o.yoo@ucl.ac.uk, Tingliang Huang, Kenan Arifoglu

We examine the setting of an entrepreneurial firm engaged in an early product development process. We adopt a Bayesian approach and present a formal model of learning and development in the entrepreneurial firm's product development process. We examine whether or not such frequent developing and learning cycles are beneficial for the entrepreneur, and if so, when.

2 - Dynamic or Persistent? How to Spend on R&D
Christophe Pennetier, Student, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Christophe.Pennetier@insead.edu, Karan Girotra, Jurgen Mihm

We study the impact of R&D spend variability on the R&D performance of publicly traded US firms. Using a novel dataset that combines Compustat data with patent outcomes, we find that controlling for the level of total R&D spend, firms that employ more year-to-year variation get significantly lower R&D outcomes (patent+citation counts). Further dissecting the results, we identify their root causes. A steady hand approach in R&D spend is most productive, while responsiveness can hurt the firm.

3 - Supervising Major Projects You Do Not Fully understand
Svenja Sommer, HEC Paris, 1 Rue de la Libération, Jouy en Josas, France, sommers@hec.fr, Magnus Mahring, Christoph Loch

This study addresses the challenges facing senior executives who serve on supervising bodies of large and strategically important initiatives. They ultimately bear responsibility, but cannot understand all the details of what is going on. In this situation, how can executives provide the necessary guidance and supervision? Based on interviews with senior managers, we discover strategies on how to set targets, evaluate progress, respond to surprises and evaluate the people.

4 - When is Necessity the Mother of Invention?
Stelios Kavadias, Margaret Thatcher Professor Innovation and Growth, Cambridge Judge Business School, Trumpington Street, Cambridge, UK, CB2 1AG, United Kingdom, s.kavadias@jbs.cam.ac.uk, Sezer Ulkü

Many claim that "necessity if the mother of invention" and that adverse conditions induce creative thinking (e.g., Jugaad innovation). Yet, the unknowns of every innovation context, point to the need for unbounded, and thus unconstrained, search and exploration; constraints should(?) make it difficult for the firm to change direction in response to new information, resulting in inferior solutions. We explore how different types of constraints affect the performance of entrepreneurial efforts.

■ WA05

Hilton- Continental 2

Supply Chain Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Elodie Adida, University of California at Riverside, School of Business Administration, Riverside, United States of America, elodie.goodman@ucr.edu

1 - When Dynamic Pricing Meets Graph Theory
Georgia Perakis, William F. Pounds Professor, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02142, United States of America, georgiap@mit.edu, Swati Gupta, Maxime Cohen

We introduce a class of dynamic programs for multi-period pricing problems based on an equivalent graphical reformulation. Our formulation can handle several business rules that arise in practice and considers demand models that capture the stockpiling behavior of consumers through dependence on past prices. For fixed memory, we propose a polynomial time algorithm but also illustrate that when the memory is large the problem is NP hard. We introduce approximation schemes for solving the problem.

2 - Advance Demand Information in a Multi-Product System
Fernando Bernstein, Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, fernando.bernstein@duke.edu, Greg DeCroix

We examine the impact of different types of advance demand information on firm profit and on the benefits of resource flexibility. The firm receives information revealing either the total volume of demand across products or the mix of demand between products. We examine two scenarios: a setting with dedicated resources and one with a common resource. Mix and volume information are complements in systems with dedicated resources, but they are substitutes in a system with a common resource.

3 - Competition and Coordination in a Two-channel Supply Chain
Elodie Adida, University of California at Riverside, School of Business Administration, Riverside, United States of America, elodie.goodman@ucr.edu, Amy David

We study competition and coordination in a supply chain in which a single supplier both operates a direct channel and sells its product through multiple retailers competing in quantities. We find that the two-channel supply chain may be subject to inefficiencies not present in the traditional supply chain, and study its coordination both with symmetric and asymmetric retailers.

■ WA06

Hilton- Continental 3

Data-Driven Methods in Inventory Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Alp Akcay, Assistant Professor, Bilkent University, Ankara, 06800, Turkey, alp.akcay@bilkent.edu.tr

1 - Demand Fulfillment Probability under Parameter Uncertainty
Canan Gunes Corlu, Boston University, 808 Commonwealth Avenue, Boston, United States of America, canan@bu.edu, Bahar Biller, Sridhar Tayur

In a budget-constrained multi-item inventory system, we consider the case of unknown demand parameters estimated from historical data. The objective is to identify the inventory targets that maximize the demand fulfillment probability subject to a budget constraint on the total inventory investment. We show that the inventory targets accounting for parameter uncertainty achieve an increase of up to 6% in the expectation and a reduction of up to 86% in the variance of the fulfillment probability.

2 - Partner Evaluation in Continuous Replenishment Programs
Manuel Rossetti, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rossetti@uark.edu, Shengfan Zhang, Payam Parsa, Edward Pohl

A continuous replenishment program (CRP) is a supply chain initiative in which the manufacturer manages the replenishment process using shared demand information provided by the customer. This paper is focused on quantifying the partner selection process from the perspective of the manufacturer, who faces a set of customers. Several factors such as volume, customer location, requested product mix and desired service level are considered as inputs for this selection process.

WA07   *INFORMS San Francisco – 2014*

3 - The Newsvendor under Demand Ambiguity: Combining Data with Moment and Tail Information
Soroush Saghafian, Arizona State University, Tempe AZ, United States of America, Soroush.Saghafian@asu.edu, Brian Tomlin

Data-driven approaches typically assume that the planner has no information beyond the evolving history of demand observations. The planner may, however, have partial information about the demand distribution in addition to demand observations. We propose a non-parametric, maximum-entropy based technique, termed SOBME (Second Order Belief Maximum Entropy), which allows the planner to effectively combine demand observations with partial distributional information.

4 - A Novel Aggregation Method for Assemble-to-Order Systems
Emre Nadar, Assistant Professor, Bilkent University, Bilkent University, Ankara, Turkey, emre.nadar@bilkent.edu.tr, Mustafa Akan, Alan Scheller-Wolf, Alp Akcay

We present an approximate dynamic programming method to the inventory control of large assemble-to-order (ATO) systems, under Markovian assumptions on production and demand. We approximate the optimal cost function by reducing the state space of the original problem via a novel aggregation technique. We show the optimality of a lattice-dependent base-stock and rationing policy for the aggregate problem. We establish error bounds for this approximation and provide computational results.

■ WA07

Hilton- Continental 4

Supply Chain Management I
Contributed Session

Chair: Susan A. Slotnick, Professor, Cleveland State University, Monte Ahuja College of Business, 1860 E. 18th Street, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

1 - A Supply Chain with Third-party Reverse Logistics for Product Returns
Yertai Tanai, Kent State University, P.O. Box 5190, Department of Management and Information, Kent, OH, 44242, United States of America, ytanai@kent.edu, Butje Eddy Patuwo, Alfred L Guiffrida

We consider a two-echelon supply chain with reverse logistics. It consists of a supplier, a retailer and a 3PL provider that processes the product returns independently. The product flow is initiated by the supplier that directly supplies the retailer, which services the customers. Based on Markov processes and queuing network, we seek to find a base-stock level that minimizes the expected total cost for the retailer and a capacity that minimizes the total expected cost for the 3PL.

2 - The Value of Information Sharing in Supply Chains Facing Seasonal Demand
Vladimir Kovtun, Sy Syms School of Business, 500 W 185th Street, New York, NY, 10033, United States of America, vladimir.kovtun@yu.edu, Avi Giloni, Clifford Hurvich

We study the value of information sharing in a two player supply chain where the most downstream player (retailer) observes external demand that is generated by one of several seasonal autoregressive processes. We find that information sharing is valuable only in the presence of strong seasonality in the demand observed by the retailer. Furthermore there is never value in information sharing when the retailer and its supplier observe peak and low seasons at the same time.

3 - Practice of Supply Chain Management in Small- and Medium-sized Enterprise
Mi-Ae Kim, Ph.D. Candidate, Kyungpook National University, 80 Daehak-ro, Buk-gu, Daegu, 702-701, Korea, Republic of, olive5263@naver.com, Chang-Kyo Suh

The purpose of this study is to determine the underlying dimensions of supply chain management(SCM) practice in small- and medium sized enterprise(SEM). The study identifies current trends and adoption of SEM's SCM in South Korea. The results reveal the perceived benefits and major barriers of SCM to SEMs. The study provides thoughts on how SMEs can improve SCM within their own organizations and supply chain.

4 - Reverse Supply Chain for Remanufacturing with Uncertain Demand and Return Product Yield
Samar Mukhopadhyay, SKK University GSB, 53 Myungryun-dong 3-ga, Jongno gu, Seoul, Se, 110-745, Korea, Republic of, samar@skku.edu, Huafan Ma

Remanufacturing as a means of sustainability is increasingly resorted to. But it brings in the problem of uncertain yield, unlike new parts. We design a supply chain contract that also takes into account short and long manufacturing lead times. We consider two popular types of contracts, a push or a pull contract. We obtain optimal supply chain contracts for these contract types, and a random yield rate and demand. We compare the results of different scenarios and develop managerial insights.

5 - Supply Chain Transparency and Ethical Sourcing
Susan A. Slotnick, Professor, Cleveland State University, Monte Ahuja College of Business, 1860 E. 18th Street, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu, Jen-Yi Chen

Two firms produce the same product. One sources ethically and the second does not, and market share is affected by the nature of their sources and whether or not they disclose them. Costs include procurement, disclosure and discovery. We investigate the tradeoffs involved and the incentives for a firm to disclose the nature of its sourcing in response to its cost and market structure, as well as the characteristics of its competitors.

■ WA08

Hilton- Continental 5

Military Application 1
Contributed Session

Chair: Timothy Chung, Assistant Professor, Naval Postgraduate School, 777 Dyer Road, BU-218, Monterey, CA, 93943, United States of America, thchung@nps.edu

1 - Modeling of Probabilistic Search with Uncertain Prior Information
Timothy Chung, Assistant Professor, Naval Postgraduate School, 777 Dyer Road, BU-218, Monterey, CA, 93943, United States of America, thchung@nps.edu

This work investigates the impact of variability in the prior information in the probabilistic Bayesian search for a target. This analysis offers insights into the search process, and provides enhanced guidance to improve search performance. We present heuristics that inform the initialization and execution of the search process that address the uncertainty present in the initial probability values, and demonstrate the efficacy of the proposed search strategies through simulation studies.

2 - Inventory Optimization for the United States Navy Destroyer Fleet
Andrew Johnson, PhD Candidate, Rutgers Business School, 1 Washington Road, Newark, NJ, United States of America, andrew.johnson@rutgers.edu, Yao Zhao

A general problem that the US Navy has encountered is the need to optimize a set of mission critical parts, which make up the Ballistic Missile Defense System. Because of the low demand nature, the part(s) may not be readily available and can render the vessel non-operational. Also, an additional issue that leadership is having is quantifying the cost of not having a vessel at a designated location or region of responsibility because of the missing part(s).

3 - Analytical Models for Sea-Based Logistics Operations
Jennifer Pazour, University of Central Florida, 4000 Central Florida Blvd, Building 91 R, Orlando, Fl, 32816, United States of America, Jennifer.Pazour@ucf.edu

Sea Basing is a concept of the United States Navy that allows the Joint Forces to be supported from the sea. From a logistics perspective, sea-basing will require ship-to-objective locations, selective offloading, and transfer of cargo between ships. We develop models to quantify and evaluate sea-based logistic system design and to aid in analyzing the trade-offs associated with operating in a complex and uncertain environment where decisions must be made in the face of imperfect information.

4 - Advancing the State of the Art in Applying Network Science to Command and Control (C2)
Herman Monsuur, Netherlands Defence Academy, Faculty of Military Sciences, Enys House, Het Nieuwe Diep 8, Den Helder, 1781 AC, Netherlands, H.Monsuur@nlda.nl, Rene Janssen, Tim Grant

Modern C2 systems link tens of thousands of computers and their users. Network science provides the mathematical techniques for representing and analyzing networks with millions of nodes. C2 has been making a transformation from top-down, directive command to Network Enabled Capability (NEC), self-synchronization, and agility. Therefore C2 systems are regarded as networks, rather than a hierarchy. It is appropriate to view these processes and systems through the lens of network science.

5 - Risk-averse Stochastic Network Interdiction
Churlzu Lim, Associate Professor, University of North Carolina at Charlotte, 9201 University City Blvd., Charlotte, NC, 28269, United States of America, clim2@uncc.edu

We consider a stochastic network interdiction problem, where the leader interdicts arcs assuming the follower solves an optimization problem having stochastic parameters. In order to make a risk-averse interdiction, we propose to use CVaR, a popular financial risk measure, as the objective function. The efficacy of the risk-averse interdiction using CVaR will be discussed via numerical examples.

■ WA09

Hilton- Continental 6

Applications of Cognitive Analytics

Cluster: Cognitive Analytics

Invited Session

Chair: Horst Samulowitz, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, United States of America, samulowitz@us.ibm.com

1 - Medical Sieve: A Multimodal Cognitive Assistant for Radiologists and Cardiologists

Tanveer Syeda-Mahmood, Chief Scientist & Research Manager, IBM Research, 650 Harry Road, San Jose, CA, 95120, United States of America, stf@us.ibm.com

Medical Sieve is a new cognitive assistant system that filters the essential clinical information from patient records for diagnosis and treatment planning. It uses sophisticated medical text and image processing, pattern recognition and machine learning techniques guided by advanced clinical knowledge to process clinical data about the patient to extract meaningful summaries indicating the anomalies, and comparisons to similar patients.

2 - Measuring and Predicting Personal Traits and Behavior from Social Media

Eben Haber, Research Staff Member, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120, United States of America, ehaber@us.ibm.com

Psycholinguistic research has shown that traits such as personality affect a person's language, and that it is possible to infer those traits from samples of a person's writing. Social media makes millions of writing samples available, this has huge implications in areas from marketing to enterprise team building. We present the results of several studies in this area, showing what we can learn about people through social media and how we can use that information to better engage with them.

3 - FoodSIS: A Text Mining System to Improve the State of Food Safety in Singapore

Jayant Kalagnanam, Chief Scientist, IBM Research, Yorktown Heights, NY, 10598, United States of America, jayant@us.ibm.com, Sneha Chaudhari, Andy Prapanca, Kiran Kate

FoodSIS improves efficiency of such focused information gathering process with the use of machine learning techniques to identify and rank relevant content. We discuss the challenges in building such a system and describe how thoughtful system design and recent advances in machine learning provide a framework that synthesizes interactive learning with classification to provide a system that is used in daily operations.

■ WA10

Hilton- Continental 7

Operations/Sustainability 1

Contributed Session

Chair: Eylem Koca, Assistant Professor, Fairleigh Dickinson University, 1000 River Road, H-DH2-06, Teaneck, NJ, 07666, United States of America, koca@fdu.edu

1 - A Factorial Design for Factory Demand Response with Onsite Wind and Solar Energy

Victor Santana-Viera, Student, Texas State University - San Marcos, 601 University Drive, San Marcos, TX, 78666, United States of America, vas41@txstate.edu, Jesus Jimenez, Jose Espiritu, Tongdan Jin

We implement a demand response program for large industry consumers to meet the uncertain load curtailment requirement using onsite renewables generation as power backup. Instead of shutting down machines, onsite wind-solar generation allows the manufacturers to meet the curtailment goal while maintaining the normal production. We use design-of-experiment methodology to size the wind and solar generators such that the DR benefit is maximized under uncertain wind speed and weather condition.

2 - A New Modeling Approach to Waste Management

Mariapaola Testa, Research Assistant, Massachusetts Institute of Technology - Operations Research Center, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, mptesta@mit.edu, Stephen Graves, Timothy Gutowski

Waste treatment facilities receive municipal solid waste as input and separate it according to its recyclable and non-recyclable components, facing the challenge of operating with high variable inputs in a commodity market. So far, only a few studies have tried to optimize the waste separation process. In our work, we propose a network-flow modeling approach to increase the plant efficiency and the recovery of valuable recyclable material.

3 - Operations Strategy under Environmental Uncertainty

Baris Yalabik, University of Bath, School of Management, Claverton Down, Bath, BA2 7AY, United Kingdom, by212@management.bath.ac.uk, Gulsun Nakiboglu, Michael Lewis

Carbon price scenarios are used to investigate the likely impact of a range of operations strategies. We develop a simulation model (based initially on the characteristics of the iron and steel industry) to examine process improvement strategies in response to the uncertain nature of carbon prices and the trajectory of best available technology over time. The results compare and contrast two types of strategies: environmental investment strategies and production reduction strategies.

4 - How Green Policy Affect Market Share? An Empirical Study of European Automobile Industry

Kejia Hu, Northwestern University, 2001 Sheridan RD, Evanston, United States of America, kejia.hu@northwestern.edu, Yuche Chen

We investigate the lead-lag effect of a company's implementation of green policy on its market share in auto industry. From a dataset composed of 14-years real-world vehicle emission records in Europe, we extract two time series of emission indexes and market share for each car model. Then we examine the lead-lag effect by Spearman Rank Correlation and change point detection methods. The results show that implementation of green policy has effects on the market share in the auto industry.

5 - The Role of Ecolabels in Consumer Markets

Eylem Koca, Assistant Professor, Fairleigh Dickinson University, 1000 River Road, H-DH2-06, Teaneck, NJ, 07666, United States of America, koca@fdu.edu, Gil Souza

The proliferation of legitimate and false ecolabels has been reported to cause confusion as to the effectiveness of ecolabels in signaling and bolstering sustainability. Using an analytical model built on recent empirical findings, we investigate why and how firms adopt ecolabels, how consumers react to ecolabels and information provided, and the implications of ecolabels from a supply chain management perspective.

■ WA11

Hilton- Continental 8

Supply Chain, Risk Management I

Contributed Session

Chair: Shyam Mohan, London Business School, NW1 4SA, London, London, United Kingdom, smohan@london.edu

1 - using Influence Diagrams to Effectively Manage Supply Chain Risks

Xiaojuan Wang, Tsinghua University, Department of Industrial Engineering, Room 530, Shunde Building, Beijing, 100084, China, wxj13@mails.tsinghua.edu.cn, Wancheng Feng, Jeffrey David Tew, Wanshan Zhu

Supply chain risks have a very significant impact on a firm's vulnerability which can adversely affect its financial performance. This research attempts to reduce supply chain vulnerability via a coordinated holistic approach, involving all supply chain stakeholders. Specifically, we utilize the method of Influence Diagrams to build a decision support tool which identifies and analyzes the possible risks associated with each particular supplier in a given supply chain.

2 - On Cascading Disruptions in Interconnected Supply-chain Networks

Shyam Mohan, London Business School, NW1 4SA, London, London, United Kingdom, smohan@london.edu, Nitin Bakshi

Nearly 40% of all supply chain disruptions are said to originate in tier 2 and beyond. We propose an analytical framework to study the cascading of disruptions in supply-chain networks. We formalise the notion of supply-chain resilience as a measure of how quickly firms in a supply chain recover from a disruption. We also provide a comparative metric termed relative vulnerability to identify firms which are expected to suffer greater downtimes and consequently more losses due to disruptions.

3 - Credit-constrained Suppliers, Bankruptcy and the Use of Reverse Factoring

Ram Bala, Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, United States of America, rbala@scu.edu, Sripad Devalkar

Trade credit is a commonly observed form of financing in many supply chains. However, many big retailers source their products from small suppliers in developing countries who are significantly credit constrained and have a high probability of bankruptcy. In such cases, buyers have begun to provide 'reverse-factoring' programs to help their small suppliers get access to capital. We study the efficacy of such reverse factoring programs.

4 - Contracting for Continuity of Mission Critical Services
Marc Jansen, PhD Candidate, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, mcj32@cam.ac.uk, Nektarios Oraiopoulos, Daniel Ralph

Major interruptions to outsourced IT services are high-profile and costly, with costs increasing in frequency and duration of outages. This paper examines how contract decisions between an IT vendor and client across a sales and after-sales phase can mitigate downtime costs through appropriate system design and response capacity investments.

■ WA12

Hilton- Continental 9

Sustainable Operations in Electric Vehicle and Electricity Generation Systems

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations
Sponsored Session

Chair: Yangfang Zhou, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, helenzhou@smu.edu.sg

1 - To Sell and to Provide? The Implications of the Auto Manufacturer's Involvement in Car Sharing
Ioannis Bellos, Assistant Professor, George Mason University, 4400 University Drive, MS 5F4, Fairfax, VA, 22030, United States of America, ibellos@gmu.edu, Beril Toktay, Mark Ferguson

We study the auto manufacturer's choice regarding whether to offer a car sharing business model in conjunction with the traditional sales channel. We explicitly model the consumer's choice of transportation mode as well as vehicle usage decisions and we characterize the environmental and economic implications of the auto manufacturer's strategy.

2 - A Framework for the Analysis of Probabilistic Demand Response Schemes
Mayank Sharma, IBM, mxsharma@us.ibm.com, Pavithra Harsha, Soumyadip Ghosh, Ramesh Natarajan

We describe the class of probabilistic demand response (PDR) schemes that are particularly suited for dynamic load management in the residential sector. Our main contribution is a new method for implementing and analyzing these schemes based on an operational objective that balances the total cost and revenue of meeting demand. We evaluate the suitability of various PDR schemes and illustrate the effectiveness of the method for a collection of thermostatically controlled loads with simulations.

3 - Service Region Design for Urban Electric Vehicle Sharing Systems
Long He, PhD Candidate, University of California, Berkeley, 1117 Etcheverry Hall, Berkeley, CA, 94720, United States of America, longhe@berkeley.edu, Ho-Yin Mak, Ying Rong, Zuo-Jun Max Shen

We consider a service area design problem of an electric car sharing business model that is subject to uncertain driver usage behavior, for which only limited knowledge may be inferred from survey data. With partial distributional information, we obtain a robust formulation as a mixed integer second-order cone program. Using data from California Household Travel Survey, we demonstrate the impacts of factors such as fleet size, battery capacity and charging time on the expansion of service area.

■ WA13

Imperial A

Education 1

Contributed Session

Chair: Walter A Garrett, Jr, Instructor of Decision Sciences, Saint Louis University, 221 N Grand Blvd, Saint Louis, MO, 63103, United States of America, wgarrett@slu.edu

1 - Meta-Analysis in Online Engineering Education
Ling Zu, Clemson University, 2517 Moorcroft Ln, duluth, GA, 30096, United States of America, lzu@g.clemson.edu, Mary Elizabeth Kurz, Wennian Li

There is limited meta-analysis of online engineering education research especially focused in two-year colleges. This study considers online engineering education papers since 1998 and conducts meta-analysis to explore possible factors that could affect students' preferences in choosing e-learning instead of traditional education. As a result, demographic factors such as social status including ethnicity, race, gender, financial status are considered as well as the effectiveness of education.

2 - The Appointment Scheduling Game
Antoine Sauré, Post-Doctoral Fellow, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, antoine.saure@sauder.ubc.ca, Martin Puterman, Charles Ko, Drew Paulin

We describe the Appointment Scheduling Game (ASG), an easy to use teaching tool that reveals the main challenges in managing advance patient scheduling systems and provides an introduction to simulation and decision analysis. The ASG simulates a system with limited service capacity in which daily appointment requests, characterized by their urgency, arrive randomly. Students assume the role of a scheduling clerk who must assign appointment dates to these requests without knowing future demand.

3 - An Innovative Approach to Teaching Operations Management through Experiential & Online Learning
Kristen Sosulski, Assistant Professor, NYU Stern, 40 West 4th Street, Suite 509, New York, NY, 10012, United States of America, ksosulsk@stern.nyu.edu, Harry Chernoff

The authors present an experiential approach to teaching operations management through the study of business processes in situ. There is no classroom; instead a flipped-classroom model is employed where students learn new topics through faculty-led online videos and exercises. Class meeting time is used to observe a company's operations process in practice. Results suggest that students better synthesize their knowledge of operations through the study of processes in a real business setting.

4 - Incorporating Content Balancing with Ant Colony Optimization for a Balanced Incomplete Block Design Exam
Pei-Hua Chen, National Chiao Tung University, 1001 University Rd, Dept. of Management Science, Hsin-Chu, 300, Taiwan - ROC, peihuamail@gmail.com, Shu-Wei Huang, Wan-Yu Tsai, Pei-Ru Hong

We proposed three content balancing methods and incorporated them with the Ant Colony Optimization approach to construct balanced incomplete block design forms. 13 blocks with 65 items were constructed from a 292-item bank. Three proposed methods will be evaluated in terms of their computation time and measurement precision.

5 - A Systemic Model of Public School Failure
Walter A Garrett, Jr, Instructor of Decision Sciences, Saint Louis University, 221 N Grand Blvd, Saint Louis, MO, 63103, United States of America, wgarrett@slu.edu

The identification of at-risk schools is a desirable public-policy objective; early intervention may reduce the consequences and costs of school failure. This paper presents a general-systems model of public school performance, in which failure" is one of several output states. Various economic, social, political, financial, and achievement variables are used as inputs to an Ordered Logistic Regression to build a prescriptive model. The model is tested using data from Missouri school districts.

■ WA15

Hilton- Exec. Boardroom

Revenue/Yield Management II

Contributed Session

Chair: Wei Zhang, University of California, Los Angeles, 110 Westwood Plaza, B501, Los Angeles, CA, 90095, United States of America, zhangw.03@gmail.com

1 - Influencing Adoption Patterns via Contract Structures in Hi-Tech Supply Chains
Wei Zhang, University of California, Los Angeles, 110 Westwood Plaza, B501, Los Angeles, CA, 90095, United States of America, zhangw.03@gmail.com, Reza Ahmadi, Sriram Dasu

An OEM who adopts a new product may bring various externalities to other OEMs and incentivize them to make similar adoption decisions. Positive correlation of adoptions can be harmful for the seller and OEMs, as it can lead to adoption rush or delay, which results in demand-supply mismatch and may undermine the seller's ability to reinvest in R&D. We propose that sellers can influence buyer behavior through the structure of contract.

2 - Dynamic Pricing and Capacity Management for Stochastic Rental System with Advance Demand Information
Wen Jiao, The Hong Kong Polytechnic University, Dept. of Logistics & Maritime Studies, Kowloon, Hong Kong - PRC, wendy.j@connect.polyu.hk, Hong Yan

This paper examines the pricing and capacity management problem for a car rental company facing advance demand information (ADI) and walk-in customers. ADI customers request a booking by paying the booking fee in advance and enjoy a discounted price at demand realization, while walk-in customers require immediate service. At each period, the company decides the booking limit for ADI customers and current unit price. We characterized the structure of the optimal pricing and booking limit policy.

3 - Competitor-Risk Optimized Price Matching in an Omni-Channel Environment

Shiva Subramanian, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, subshiva@us.ibm.com, Markus Ettl, Joline Uichanco, Pavithra Harsha

Consumers browse products and prices across multiple channels and retailers to finalize purchases today. To remain competitive, retailers have adopted either a risk-averse price strategy of matching competitor prices, or a high-risk strategy that focuses on profit margin. In our work, we use real data from a retailer to demonstrate the business impact of a novel prediction-optimization based price-matching approach that profitably manages a retailer's value-at-risk due to competition.

4 - A New Predictive Model Application in Social Networking Revenue Management

Yingying Kang, Principal Operations Research Consultant, Sabre Holdings Inc., 3150 Sabre Drive, Southlake, TX, 76092, United States of America, Yingying.Kang@sabre.com

Accurately predicting the customer behavior and CTR is a key factor for maximizing the revenue of a social network. The classic models like logistic regression model rely on the accurate estimation of significant factors and their coefficients. And it relies on the accuracy of historical data. We propose a Bayesian Inference based predictive model to estimate parameters of network attractiveness distribution based on the observed CTR distribution. It is proven effective under highly uncertainty.

■ WA16

Hilton- Franciscan A

Returns Management at the Operations-Marketing Interface

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Tolga Aydinliyim, Assistant Professor, Baruch College, CUNY, Zicklin School of Business, Box B9-240, New York, NY, 10010, United States of America, tolga.aydinliyim@baruch.cuny.edu

1 - Savvy Consumers, Lenient Return Policies: Mitigating Strategic Waiting in Online Retailing

Tolga Aydinliyim, Assistant Professor, Baruch College, CUNY, Zicklin School of Business, Box B9-240, New York, NY, 10010, United States of America, tolga.aydinliyim@baruch.cuny.edu, Mehmet Sekip Altug

In an online retailing context, we study return management decisions when consumers are discount seeking and sensitive to stock-outs. We find that allowing returns enhances profit if the retailer can salvage with a mild discount, and the ability to do so is a strategic advantage in case of competing retailers.

2 - Optimal Pricing and Return Policies for Loss Averse Customers

Wenjing Shen, Drexel University, 3200 Market Street, 735, Philadelphia, PA, 19104, United States of America, ws84@drexel.edu, Gulay Samantli, Ben Lev

Customer return policies reduce product misfit uncertainty and improve customer satisfaction. Previous studies on customer return have assumed loss neutral customers. In this paper, we study the impact of customer loss aversion on the optimal price, inventory, and return policies.

3 - An Empirical Analysis of Product Return Episodes

Paul Messinger, University of Alberta, Edmonton, AB, Canada paulm@ualberta.ca, Michele Samorani, Aydin Alptekinoglu

A product return episode is a sequence of transactions composed of the purchase of a product, a return of that product, a repurchase of a similar product, etc., concluding with a final purchase or return. We empirically study return episodes using data from a national consumer electronics retailer.

4 - Intertemporal Pricing and Return Policies for Strategic Consumers

Wenbo (Selina) Cai, Assistant Professor, New Jersey Institute of Technology, MEC 308, University Heights, Newark, NJ, 07102, United States of America, cai@njit.edu, Ying-Ju Chen

We develop a model that takes into account both consumer valuation uncertainty and strategic consumer behavior, and derive the optimal pricing and return policy for a retailer. We find that a generous return policy encourages high-valued consumers to purchase early, but lessens the capacity rationing effect in the latter period and consequently may induce some consumers to wait.

■ WA17

Hilton- Franciscan B

Managing Queues in Service Systems

Sponsor: Manufacturing & Service Operations Management/Service Operations
Sponsored Session

Chair: Philipp Aféche, Rotman School of Management; University of Toronto, 105 St.George Street, Toronto, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Robust Capacity Planning under Service Constraints

Hussein Naseraldin, Professor, Ort Braude College, Snunit St, Karmiel, 21982, Israel, nhussein1@braude.ac.il, Opher Baron

Capacity decisions are strategic in nature and are determined at the beginning of the horizon. Then it constrains the possible capacity in any single period. Data uncertainty plays a key role in such decisions. We propose optimal robust capacity decisions subject to service requirements. We adopt a Robust Optimization approach in which one searches for a feasible solution that is at least as good as all other feasible solutions for most data realizations.

2 - Information Sharing in the Presence of Loss Averse Customers

Gad Allon, Northwestern University - Kellogg, 2001 Sheridan Rd., Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Pengfei Guo

We study the impact of information sharing in the presence of loss averse customers in a service system.

3 - Allocation Policies in Blood Transfusion

Vahid Sarhangian, Rotman School of Management; University of Toronto, 105 St.George Street, Toronto, ON, Canada, vahid.sarhangian11@rotman.utoronto.ca, Hossein Abouee Mehrizi, Opher Baron, Oded Berman

Recent studies suggest an increased risk of adverse clinical outcomes in patients receiving transfusions of older" blood. We analyze a stylized queueing model of a hospital blood bank and investigate the potential of a family of allocation policies in reducing the age of transfused blood without significantly affecting its availability. We evaluate the outcome of the policies and investigate when they are more likely to be effective as an alternative to reducing the shelf-life.

4 - Designing, Scheduling, and Pricing Differentiated Services under Quality-Speed Tradeoffs

Sherwin Doroudi, Tepper School of Business; Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdoroudi@andrew.cmu.edu, Philipp AfËche, Mustafa Akan, Mor Harchol-Balter

Quality-speed tradeoffs are inherent in designing and providing various products and services: longer processing increases quality and allows customization, but also increases utilization and waiting times. We consider a queueing model with utility-maximizing, time-sensitive customers whose service valuations are increasing in processing time. We study the problem of optimally designing, scheduling, and pricing the set of differentiated services, both under welfare- and revenue-maximization.

■ WA18

Hilton- Franciscan C

Data-driven Revenue Management Studies

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, serguei.netessine@insead.edu

1 - Cost Efficient Cloud Resource Virtualization

Andrew Li, MIT, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, aali@mit.edu, Devavrat Shah, Muhammad J. Amjad, Vivek Farias

The Cloud has become synonymous with virtual computing, and users now face the challenging problem of choosing from a vast array of compute resources differing in price and quality. In this work, we present policies for efficient use of cloud resources by dynamically maintaining a portfolio of resources. Experiments on Amazon's EC2 cloud platform show that this achieves significant cost savings with negligible loss in quality.

WA19   *INFORMS San Francisco – 2014*

2 - The Value of Clickstream Data in the Competitive Analysis: Evidence from Hotel Bookings
Sergei Koulayev, Economist, CFPB, 1700 G st NW, Washington, DC, 20002, United States of America, sergei.koulayev@gmail.com, Serguei Netessine, Jun Li

Today, half of hotel bookings are originated in the online channel. A major role in the online distribution is played by OTAs: two-sided platforms that connect travelers and hotel properties. Consumer activity on such platforms leaves a trace of clickstream data, combined with displays of hotel options presented to the user. We show that such data provides an insight into the structure of hotel's competition set, in addition to traditional datasets of prices and sales volumes.

3 - Two Sided Platforms: Case of Service Level Tradeoff
Ashish Kabra, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Ashish.KABRA@insead.edu, Karan Girotra, Elena Belavina

Recently there has been a rapid rise of online intermediaries that match offline supply and demand in transportation, delivery and hospitality (such as Uber, Beauty Bureau). In these system "service level" to one side of the platform comes at the expense of "service level" to other side. Using data from a Taxi demand-supply matching app we estimate how past experience of the supply and demand predict their future usage of the platform. We use these estimates to improve system design.

4 - The Impact of Returning Customers at an Internet Fashion Retailer
Ngai-Hang Leung, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-14, Boston, MA, 02139, United States of America, zacleung@mit.edu, Georgia Perakis, Pavithra Harsha

Our analysis of clickstream data collected from an online fashion retailer shows that a significant number of sales are due to returning customers. We propose a demand model where customers may not buy the item on their initial visit, but may return and purchase the item in a subsequent visit. We propose and analyze a markdown optimization pricing model with returning customers. We estimate our demand model and quantify the benefit of applying our pricing model.

■ WA19

Hilton- Franciscan D

Innovative Applications in Pricing and Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Pelin Pekgun, Assistant Professor, University of South Carolina, 1014 Greene Street, Moore School of Business, Columbia, SC, 29208, United States of America, pelin.pekgun@moore.sc.edu

1 - Taking it to a Higher Level: Integrated Revenue Management from Vision to Reality
Jon Higbie, Managing Partner & Chief Scientist, Revenue Analytics, Inc., 3100 Cumberland Blvd., Suite 1000, Atlanta, GA, 30339, United States of America, jhigbie@revenueanalytics.com, Vedat Akgun

Revenue management began as a specialized function buried deep in the organization. Through case studies we will describe how revenue management has elevated its game to a higher level and is evolving into the analytics center of excellence for organizations who are seeking a unified view of their business data, one version of the truth, and prescriptive capabilities that serve strategic planning, finance, sales, marketing, and distribution.

2 - Notes on the Journey Towards Total Hotel Revenue Management
Tudor Bodea, InterContinental Hotels Group, 3 Ravinia Drive, Atlanta, GA, 30346, United States of America, tudor.bodea@ihg.com, Alex Kao, Dev Koushik, Christy Zhao, Darlene Fenix, Quentin Taylor, Clint Nall, Ying Song

Organizations in industries as diverse as airline, hospitality or television broadcasting use revenue management (RM) tactics to maximize their revenue growth. In the hospitality industry, hotel companies have long implemented RM decision support systems that optimize the availability and prices of their retail transient products. In this work, we offer opinions on what hotel companies that consider moving towards a Total Hotel RM framework may witness along the way.

3 - Hotel Standby Upgrades - How and When Do They Work?
Ovunc Yilmaz, PhD Student, University of South Carolina, 1705 College Street, Columbia, SC, 29201, United States of America, oyilmaz@email.sc.edu, Mark Ferguson, Pelin Pekgun

Inspired by e-standby upgrades" in the hotel industry, this study examines how and when these upgrades can provide additional revenue for a hotel. We develop optimal pricing strategies under both myopic and strategic customer behavior through an analytical model. Using data from a major hotel chain, we also provide some empirical findings.

4 - Customer Choice Modeling in Revenue Management Systems
Shadi Sharif Azadeh, Polytechnique Montreal, Apt 108, 50 Willowdale, Montreal, Canada, shadi.sharifazadeh@polymtl.ca, Gilles Savard, Patrice Marcotte

One of the main challenges in Revenue Management systems is to estimate demand of each product at a given time when some products in the choice set are not available (censored demand). Most of choice-based RM researches assume that choice parameters are known a priori. However, in reality, the only information at hand is the registered transactions. In this research, we estimate product utilities for different customer segments as well as daily potential demand using registered bookings.

5 - An Empirical Study of Price Movements of Airlines Industry in Indian Market
Goutam Dutta, Professor, Indian Institute of Management, Ahmedabad, Wing 3, Room No 3H, PMQ Area, Ahmedabad, 380015, India, goutam@iimahd.ernet.in, Sumitro Santra

We analyze the movement of airline prices of Indian domestic sector. We first conduct a detailed econometric analysis of five domestic routes. Next we develop the power divergence statistic (PDS) for each route and built a direct comparison study on average PDS and average prices. Our research suggests that the competition and price dispersion steps up as departure date comes closer. It also shows that route characteristics affect price movement as well as price dispersion in different routes.

■ WA20

Hilton- Yosemite A

Analytics for the Tactical Edge: Better Business through Operations Research in the DoD

Sponsor: Military Applications Society
Sponsored Session

Chair: Aaron Burciaga, Senior Manager, North America Inventory Analytics Lead, Accenture, 4305 Majestic Lane, Fairfax, VA, 22033, United States of America, adburciaga@gmail.com

1 - The Influence of Cognition on Decision Making & Decision-Making Support Methods
Rafael Matos, President, Military Operations Research Society, 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, president@mors.org

Continued advances in decision analysis and decision making support systems, with rigorous mathematical approaches, are very important. It is also important to create consciousness on the cognitive elements that affect the individual and collective decision-making process. This lecture explores the way we think and some of the most common heuristics and biases that affect our problem solving and decision-making activities, and how they can affect the results of rigorous quantitative methods.

2 - The Marine Corps Way: using Maneuver Warfare to Lead Analytics
Aaron Burciaga, Senior Manager, North America Inventory Analytics Lead, Accenture, 4305 Majestic Lane, Fairfax, VA, 22033, United States of America, adburciaga@gmail.com

Over its storied 238-year history the Marine Corps has built a powerful brand ñ one that connotes leadership, discipline, training, and management. We present how proven battlefield practices empower success in analytics where "fog of war" and "asymmetric threats" also characterize business opportunities, data, and adoption.

3 - Ready, Fire, Aim – Executing Before Planning
Josh Janes, Consultant, Accenture, 1936 North Clark Street, Apt. 516, Chicago, IL, 60614, United States of America, janesj@gmail.com

Organizations often execute actions before completing a plan. Once actions are executed, the team responsible for the project's success must determine how to overcome the hasty start. Case studies impacting the DoD are presented comparing courses of action to mitigate the rash decisions which diminish mission or project success. Courses of action are rated on a cost, timeline, and customer confidence scale.

■ **WA21**

Hilton- Union Sq 1

Maritime Logistics and Operation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Deniz Ozdemir, Yasar University, Universite Caddesi, No:35-37, Agacli Yol, Bornova, Izmir, 35100, Turkey, deniz.ozdemir@yasar.edu.tr

1 - Vessel Crew Scheduling: Formulations and Heuristics
Kerem Akartunali, Lecturer, Department of Management Science, University of Strathclyde, 40 George Street, Glasgow, G1 1QE, United Kingdom, kerem.akartunali@strath.ac.uk, Alex Leggate, Seda Sucu, Robert Van Der Meer

Crew scheduling is a well-studied area of research, in particular for airlines, but very little attention has been given to companies operating fleets of vessels. The maritime setting presents its own challenges such as long duty times and weather uncertainties. In this talk, we discuss different formulations and solution methods (including customized heuristics and approximate formulations) for solving these problems. We will conclude with preliminary computational results and a case study.

2 - Yard Assignment in Bulk Material Terminals
Ceyda Oguz, Koc University, College of Engineering, Istanbul, Turkey, coguz@ku.edu.tr, Isil Koyuncu

We developed a mathematical model for the yard assignment of bulk materials, such as coal, to determine the location of loading and unloading vessels while minimizing the total distance traveled in ports. The model also determines the dimensions of the bulks given that the area of each bulk is fixed.

3 - Heterogeneous Bulk Service Queuing Models with Applications to Transportation Systems
Nishant Mishra, Assistant Professor, Erasmus University Rotterdam, Rotterdam School of Management (RSM) Erasmus University Rotterdam, Burgemeester Oudlaan 50, 3062 PA, Rotterdam, Netherlands, nmishra@rsm.nl, Niek Baer, Debjit Roy, J an-Kees van Ommeren

We study multi-server queuing models with heterogeneous servers, and specifically, show that the steady state waiting time in a queuing system with two types of servers has a phase-type distribution. We then present approximations for heterogeneous bulk service queues for a semi-open queuing network with batch-size dependent service time, and finally, conclude by discussing an application of the model for a container transportation system at the Port of Rotterdam.

4 - Stochastic Berth Allocation and Quay Crane Assignment for Quayside Operations
Deniz Ozdemir, Yasar University, Universite Caddesi, No:35-37, Agacli Yol, Bornova, Izmir, 35100, Turkey, deniz.ozdemir@yasar.edu.tr, Gokberk Ozsakalli, Huseyin Gencer

Traditional planning of quayside operations cause unnecessary waiting of vessels and inefficient utilization of resources. Moreover, most of the integrated approaches consider deterministic vessel arrivals and quay crane handling time which is actually not realistic in practice. To this end, an integrated stochastic multi objective model has been developed to minimize the vessel service time and quay crane movement. The mixed integer model was solved by using stochastic programming and applied at Izmir Container Terminal based on the historical data. It has shown promising results.

■ **WA22**

Hilton- Union Sq 2

Business and the Bottom of the Pyramid

Sponsor: Organization Science
Sponsored Session

Chair: Emily Block, Assistant Professor of Management, University of Notre Dame, Notre Dame IN 46556, United States of America, esblock@gmail.com

1 - The Impact of Community and MFI Logics in Shaping KIVA Loan Framing
Todd Moss, Emily Block

The purpose of this paper is to consider the relative strength of institutions in directing the activities of organizations in a field. We seek to understand the conditions under which one institution is likely to dominate the behavior of organizations over another. Specifically, we consider the relative impact of professional and national institutions on hybrid microfinance organizations. We suggest that temporal, organizational and field characteristics are likely to influence the power of professional and national institutions on not only the activities that microfinance organizations engage and the language that they use to describe

themselves, but also the timing of their responses to external events. We hypothesize the effect of organizational form, ownership structure, timing of founding, peer effects, strength of national institutions and governance and community characteristics.

2 - Implications of Chinese Investment in Africa on Social, Environmental and Economic Vulnerability
Emily Block, Assistant Professor of Management, University of Notre Dame, Notre Dame IN 46556, United States of America, esblock@gmail.com, Viva Bartkus, Taylor Boyd, Jessica Helmann, Kerri Martin, Todd Moss

Despite its late entry into the market, China has become the largest trading partner with sub-Saharan African countries. In fact, China pumped over $210 million into Africa last year. The consequence of this recent trend, for both African countries and MNCs looking to invest there, has been widely debated and speculated. This paper empirically investigates the economic, development, and environmental consequences of Chinese investment in a full population of sub-Saharan African countries. We discuss implications for Base of the Pyramid and strategy research, seeking to understand the conditions under which different foreign investments are likely to be profitable.

3 - Organizational Responses to Public and Private Politics: An Analysis of Climate Change Activists and U.S. Oil & Gas Firms
Shon Hiatt

Abstract is not available at this time.

■ **WA23**

Hilton- Union Sq 3

Sustainable Logistics: Models and Applications

Sponsor: TSL/Freight Transportation & Logistics
Sponsored Session

Chair: M. Ali Ulku, Associate Professor, Rowe School of Business, Dalhousie University, Halifax, NS, Canada, ulku@dal.ca

1 - Carbon Allocation in Traveling Salesman Problems
Josue Velazquez-Martinez, Instituto Tecnolögico y de Estudios Superiores de Monterrey, Campus Santa Fe, Mexico City, Mexico, josue.velazquez@itesm.mx, Jan C. Fransoo, Bart Leenders

We develop a methodology to allocate carbon to multiple clients that are being served on a single route. We demonstrate analytically a number of desirable properties of the allocation mechanism, and apply the mechanism in a European retail distribution setting.

2 - Carbon Emissions Considerations in Joint Replenishment Problems: Direct vs. Indirect Grouping
Dincer Konur, Assistant Professor, Missouri University of Science and Technology, Engineering Mgmt. & Systems Engineering, Rolla, MO, 65406, United States of America, konurd@mst.edu, Brian Schaefer

In this study, we model and solve a bi-objective joint replenishment problem with cost and carbon emissions minimization for each of the two common grouping strategies: direct and indirect. An evolutionary heuristic method is discussed for each strategy. A set of numerical studies demonstrates that a retailer's preference for a specific grouping strategy depends on not only economical but also environmental objectives.

3 - Carbon Emissions Comparison of Third Party Last Mile Delivery Versus Customer Pickup
Jay R. Brown, Assistant Professor, Loyola University Maryland, Sellinger School of Business and Mgmt., Baltimore, MD, 21210, United States of America, jbrown11@loyola.edu, Alfred L Guiffrida

Carbon emissions resulting from conventional shopping involving customer pickup with trip chaining is compared to e-commerce-based online retailing involving third party last mile delivery to customers' homes. The break-even number of customers for carbon emissions equivalence is approximated and analyzed for feasibility. A methodology for calculating the difference in expected carbon emissions is formulated and demonstrated.

4 - Supply Chain Management of a Modular Product with Returns
M. Ali Ulku, Associate Professor, Rowe School of Business, Dalhousie University, Halifax, NS, Canada, ulku@dal.ca, Juliana Hsuan, Dennis Yu

Modularity and returns relate to sustainability. In a retailer-manufacturer setting and when the demand for a returnable product depends on both price and modularity level, we develop a profit-maximizing stochastic model. The solution includes optimal expressions for the price, and the order quantity. We derive managerial insights from our structural and numerical results relating to the management of such a perishable product and its implications on sustainable supply chain management.

■ **WA24**

Hilton- Union Sq 4

Challenges in Dynamic Ride-sharing

Sponsor: TSL/Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Niels Agatz, Rotterdam School of Management, Burgemeester Oudlaan 50, Rotterdam, 3000DR, Netherlands, nagatz@rsm.nl

1 - A Matching Model and Solution Approach for Ride-sharing with Meeting Points

Mitja Stiglic, Faculty of Economics, University of Ljubljana, Kardeljeva ploöcad 17, Ljubljana, 1000, Slovenia, mitja.stiglic@ef.uni-lj.si, Niels Agatz, Mirko Gradisar

We consider a ridesharing system that uses meeting points to allow more flexibility in the rider's pickup and drop-off locations. Riders can either be picked up from home or from a meeting point that is within a certain acceptable walking distance. We develop a model and devise an exact and a heuristic optimization approach to match drivers and riders and determine their routes.

2 - Finding Optimal Stable Ride Matches for Dynamic Ride-sharing Systems

Xing Wang, GE Global Research, 1 Research Circle, Schenectady, NY, 12309, United States of America, xwstella@gmail.com, Niels Agatz, Alan Erera

Automated ride-share systems provide most convenience to the individual users and provide most potential for vehicle miles savings to the system. However, system optimal matches may not provide the maximum costs savings for each individual. We introduce the notion of stability for ride-share matches and present mathematical programming methods to establish stable matching.

3 - Dynamic Ridesharing: How to Get Started?

Martin Savelsbergh, Professor, University of Newcastle, Callaghan, Newcastle, NSW2308, Australia, martin.savelsbergh@newcastle.edu.au, Alan Lee

Dynamic ridesharing services have now been successfully introduced in several countries. Their ultimate success critically depends on (initial) participation rates. We investigate different ways in which a service provider can attract participants during the start up phase.

4 - Structure of Routes as a Function of Incentives for Ridesharing

Xiaoqing Wang, University of Southern California, 3715 McClintock Ave, OHE 235A, Los Angeles, CA, 90089, United States of America, xiaoqinw@usc.edu, Maged Dessouky, Fernando Ordonez

We consider varying passenger travel time under congestion and load dependent toll cost in a pickup and delivery problem with time windows. The objective is to study how optimal routes change if a cost reduction and time savings are available for ridesharing. Both 0-1 integer programming model and heuristics are developed to solve the problem. A set of computational experiments are performed to explore how the ridesharing are affected by the different time savings on HOV lanes and toll savings.

■ **WA25**

Hilton- Union Sq 5

Transportation Planning III

Contributed Session

Chair: Milad Keshvari Fard, ESSEC Business School, HB 314-ALEGESSEC- 60 Avenue du Hazay, Cergy, 95000, France, milad.keshvarifard@essec.edu

1 - The Hub Location Problem with Discrete Cost functions

Milad Keshvari Fard, ESSEC Business School, HB 314-ALEGESSEC- 60 Avenue du Hazay, Cergy, 95000, France, milad.keshvarifard@essec.edu, Laurent Alfandari

We propose a new formulation for the Hub Location Problem by considering the cost as a discrete function of the number of vehicles used for transportation. We observe that the difference between the continuous and discrete cost function is too high to be ignored. Moreover, for cost reduction benefits, we study advantages of using direct shipments as well as using simultaneous intermodal transportation. Finally we design a hybrid metaheuristic algorithm to solve large scale problems.

2 - The Identification of Transport Bundling Opportunities in a Horizontal Supply Chain

Gert Woumans, PhD Student, IESEG School of Management, 3, Rue de la Digue, Lille, 59000, France, g.woumans@ieseg.fr, Jeroen Belien, Stefan Creemers, Robert Boute

Horizontal cooperation is a powerful concept to increase supply chain efficiency: by bundling transports and by reducing empty backhauling, efficiency is increased through improved load factors and increased frequency of deliveries. Finding

suitable collaboration partners is challenging. We present an algorithm that uses a clever sorting and filtering technique to detect potential partners, based on the geographical compatibility of transports. The algorithm is being used by 4PL TRI-VISOR.

3 - Multiclass O-D Estimation using Probit-Based Stochastic User Equilibrium and Multiple Data Types

Qing Zhao, Cornell University, 220 Hollister Hall, Ithaca, NY, 14850, United States of America, qz74@cornell.edu, Mark Turnquist

This paper proposes a bi-level optimization model and corresponding solution method for static multiclass O-D estimation using various data types. The upper level optimization derives O-D entries by minimizing the sum of squared differences between observations from different data sources and the corresponding predictions. A probit model is used in the lower-level stochastic user equilibrium problem for flow prediction. Extensive experiments have been performed on two test networks.

4 - Risk Equitable Routing and Prohibition Stratesis for Hazardous Materials Transportation

Ashrafur Rahman, Visiting Assistant Professor, Bunknell University, 116 Court Street, New Haven, CT, 06511, United States of America, arahman@engr.uconn.edu, Nicholas Lownes

A new risk measure for hazardous materials transportation is proposed. The new risk measure is used in mathematical modeling considering equity concept to suggest routing and prohibition strategies for hazmat transportation.

■ **WA26**

Hilton- Union Sq 6

Vehicle Routing I

Contributed Session

Chair: Shong-Iee Su, Professor, Soochow University, No. 56, Sec.1, Kwei-Yang Street, Taipei, 100, Taiwan - ROC, sisu@scu.edu.tw

1 - An ALNS for a Two-echelon Vehicle Routing Problem Arising in City Logistics

Philippe Grangier, Ecole des Mines de Nantes, 4 Rue Alfred Kastler, Nantes, 44300, France, philippe.grangier@mines-nantes.fr, Michel Gendreau, Fabien Lehuédé, Louis-Martin Rousseau

We consider a Two Echelon Vehicle Routing Problem (2E-VRP) which integrates constraints arising in City Logistics such as: time windows, synchronization, and multiple trips for some vehicles. We have developped an ALNS that benefits both from custom ruin and recreate heuristics and an efficient feasibility check.

2 - The Cross-docking Delivery Route Planning for a Supermarket Chain

Shong-Iee Su, Professor, Soochow University, No. 56, Sec.1, Kwei-Yang Street, Taipei, 100, Taiwan - ROC, sisu@scu.edu.tw

This paper presents the delivery route planning background, methodology and results of a study of a new cross-docking logistics center for a large supermarket chain in Taiwan. The number of stores is 274 with revenue at about US$ 9 billion. The transformation of the supermarket from a multi-layer distribution network to a single-layer cross-docking network has shown dramatic improvement on the delivery efficiency, assent productivity, and the reduction of green house gas emissions.

3 - Vehicle Routing with Uncontrolled Batch Arrivals

Wouter van Heeswijk, PhD Candidate, Universiteit Twente, Hallenweg 17, Enschede, Netherlands, w.j.a.vanheeswijk@utwente.nl, Martijn Mes, Marco Schutten

We study a VRP with uncontrolled batch arrivals of LTL goods at an urban consolidation center. These arrivals reflects the delivery of goods by independent carriers. By assessing waiting policies and considering delivery windows at the customers, we propose a heuristic approach aimed at efficiently dispatching city freighters. As such, we facilitate the need for planning at the urban distribution level, where the arrival process of goods at the consolidation center has a significant impact.

4 - The One-to-one Pickup and Delivery Problem with Unloading Considerations

Marjolein Veenstra, University of Groningen, Nettelbosje 2, Groningen, 9747 AE, Netherlands, marjolein.veenstra@rug.nl

We present a new variant of the one-to-one pickup and delivery problem that aims at minimizing the sum of travel, loading and unloading times. The sequence in which locations are visited determines the sequence of packages in the vehicle and thereby the time needed to unload the packages. In this paper, we present models that take into account the effects of loading and unloading times on the vehicle routing decisions.

5 - Multiobjective Green Vehicle Routing Problem under Uncertainty
Nazanin Tajik, Graduate student, ProfessorKash Barker/University of Oklahoma, 202 W. Boyd St., Room 434, Norman, Ok, 73071, United States of America, nazanin.tajik@ou.edu, Kash Barker

The aim of green vehicle routing problems-G-VRP-is to develop technical solutions minimizing not only economic costs but also pollution resulting CO2 emissions.We provide a robust multiobjective G-VRP that accounts for costs such as travel distant,travel time,tardiness/earliness while also minimizing CO2 emissions as a function of acceleration,speed,and loads,among others,accounting for the stochastic nature of inputs.The formulation is solved with MIOCA

■ WA27

Hilton- Union Sq 7

Logistics 1

Contributed Session

Chair: Meltem Peker, Bilkent University, 06800, «ankaya, Ankara, Turkey, meltem.peker@bilkent.edu.tr

1 - A Hierarchical Model for Cash Transfer System Design Problem
Abdullah Dasci, Sabanci University, Orta Mahalle, Tuzla, 34956, Istanbul, Turkey, dasci@sabanciuniv.edu, Engin Topaloglu

We present a model that incorporates location of cash management centers, number and routes of vehicles, and the cash inventory control to minimize the cost of owning and operating while maintaining a pre-defined service level. An iterative solution approach with a feedback mechanism is proposed. Numerical results show that such an approach is quite effective in reaching greatly improved solutions with just a few iterations, making it a promising approach for similar hierarchical models.

2 - Incentive-Compatible, Budget-Balanced Combinatorial Double Auctions for Carrier Collaboration
Su Xiu Xu, The University of Hong Kong, Dept. of IMSE, The University of Hong Kong, Hong Kong, Hong Kong - PRC, xusuxiu@gmail.com, Shuyan Lin

This paper is the first proposing incentive-compatible, budget-balanced combinatorial double auctions (CDA) for the carrier collaboration problem with bilateral exchange (CCPBE), which is generally the problem of how to realize the potential of carrier collaboration over a bilateral exchange transportation network. In the CCPBE, each carrier may ask for or offer a bundle of lanes and each lane may include multiple truckloads. The model realizes asymptotical efficiency in some conditions.

3 - Propagation of Uncertainty in Dense Storage Environments
Patrick Reilly, University of Central Florida, 4000 Central Florida Blvd, Building 91 R, Orlando, Fl, 32816, United States of America, pjreilly@knights.ucf.edu, Jennifer Pazour

In dense storage systems, where all items are not directly accessible, to retrieve an item often requires shifting of other items. In such systems, uncertainty in item location due to a lack of asset tracking results in wasteful search time. The model proposed intends to describe how this uncertainty propagates throughout a dense storage system over time and develops an expected search time for a given item at a certain point in time.

4 - Integer Programming Formulations for Integrated Hub Location and Vehicle Routing Problems
Zuhal Kartal, Anadolu University, Industrial Engineering Departmant, Eskisehir, Turkey, zkartal@anadolu.edu.tr, Andreas Ernst, Servet Hasgul

In this study, we present integer programming formulations of five types 'Integrated Hub Location and Vehicle Routing Problems' which are integrated fixed p-hub location and vehicle routing problem, integrated p-hub location and vehicle routing problem, integrated hub location with fixed costs and vehicle routing problem, integrated p-hub center and vehicle routing problem and lastly, integrated p-hub covering and vehicle routing problem.

■ WA28

Hilton- Union Sq 8

Airline Crew Management

Sponsor: Aviation Applications
Sponsored Session

Chair: Shahram Shahinpour, Senior of Operations Research, Sabre Holdings, Inc, 3150 Sabre Dr., Southlake, TX, 76092, United States of America, Shahram.Shahinpour@sabre.com

1 - Exploiting underlying Network Structures to Solve the Crew Pairing Problem via the Pulse Framework
Daniel Duque, Instructor, Universidad de los Andes, Cra 1 No. 18A-12, Bogota, Colombia, d.duque25@uniandes.edu.co, Daniel Matteo Eslava, Manuel A. Bollvar, Andrés L. Medaglia

In the airline industry, the crew pairing problem consists in determining the minimum-cost pairings such that every flight is covered exactly once. Under a column generation scheme, it is customary to solve repeatedly a shortest path problem with resource constraints. In this work, we adapt a specialized framework for hard shortest paths that exploits the underlying network structure to efficiently generate diverse and feasible pairings.

2 - The Best Strategy in using an Option-based Mechanism to Reduce Overbooking Risk for Allied Airlines
Xiaojia Wang, PhD Student, City University of Hong Kong, A,14/F,Palatial Stand,118 Wuhu St., Hung Hom, Kowloon, Hong Kong, Hong Kong - PRC, xiaojia.wang@my.cityu.edu.hk, Y.K., Richard Fung

In the context of parallel alliances, we propose an option-based mechanism that allows an airline to transfer bumped passengers to its alliance partner's flight. Based on an analytical model built to calculate the net benefit that the airlines can obtain from the proposed mechanism, we develop a simulation-based algorithm to derive the best strategy in using the mechanism, namely how many options the allied airlines should transact between each other and how much the option should be priced.

3 - Scheduling Aircraft and Personnel to Meet On-station Patrol Requirements
Ramzi Mirshak, Defence R&D Canada, 101 Colonel By Drive, Ottawa, ON, Canada, ramzi.mirshak@drdc-rddc.gc.ca, Alex Bourque, Paul Massel, Bill Ansell, Bao Nguyen

Determining the number of aircraft and personnel required to maintain a given presence on station is an important problem in surveillance contexts. Here, integer programming is used to minimize the number of aircraft and crews required to meet an on-station requirement. Unplanned maintenance is captured with a parameterized serviceability model. As illustrated by a case study, this easy to implement methodology provides quick and insightful results to the decision makers.

4 - Progress in Airline Crew Recovery at Sabre Airline Solutions
Chunhua Gao, Lead Operations Research, Sabre Holdings, 3150 Sabre Drive, Southlake, United States of America, chunhua.gao@sabre.com, Tina Shaw

This presentation will update progress and developments in airline crew recovery at Sabre Airline Solutions. We proposed an approach for handling disruptions during irregular operations that simultaneously solves the crew pairing and roster recovery problems to quickly find solutions that are fully deployable. In this talk, we will introduce how the approach is enriched to meet airline requirements and applied to solve real-time airline crew recovery problems.

■ WA29

Hilton- Union Sq 9

Manufacturing 1

Contributed Session

Chair: Kiwook Jung, Guest Researcher, National Institute of Standards and Technology, 100 bureau drive, Gaithersburg, MD, 20899, United States of America, kiwook.jung@nist.gov

1 - How Does Human Resource Management Influence JIT and TQM Implementation? A Meta-analysis
Yiwen Chen, Tsinghua University, Beijing, China, www.yiwenchen@gmail.com, Sriram Narayanan, Li Zheng, Jayashankar Swaminathan

Through meta-analytic technique employed on a database of 101 studies, we examine how HRM influences the implementation of JIT and TQM. Previous literatures differ on whether, and which, specific HR practice facilitates JIT and TQM implementation. So, we develop a structural equation model to synthesis these studies. We find that all three dimensions of HR system positively influence JIT and TQM implementation, among which opportunity-enhancing HR practices have the strongest effect.

WA30   *INFORMS San Francisco – 2014*

2 - Early Detection of Unforeseen Failure in Seasonal Manufacturing via Control of Sensitivity Parameter
> Kiwook Jung, Guest Researcher, National Institute of Standards and Technology, 100 bureau drive, Gaithersburg, MD, 20899, United States of America, kiwook.jung@nist.gov, Hyunbo Cho

The impact of unforeseen failures in seasonal manufacturing is significant. A timely review of failure records to detect failure modes is not always possible. This talk presents several techniques for quantifying failure records in a vector space model to conduct automated cluster analysis. The techniques are validated with real data sets. The proposed model quickly detects unforeseen-failures via control of sensitivity parameters.

3 - Stochastic Assembly Line Design with Work-sharing in the Bottleneck Station for Assembly Planning
> Ehsan Nazarian, Post-doctoral Research Associate, University of Nebraska Lincoln, 135 Nebraska Hall, Lincoln, NE, 68588, United States of America, enazarian@unl.edu, Jeonghan Ko, Hui Wang

Processing time variation over a cycle time can result in line stop in synchronous assembly lines, but utility workers and extra offline processing increase costs. We present a stochastic chance-constrained programming model utilizing non-productive times in the next station of the bottleneck to handle the possible overload with preemption allowed. We also present statistical evaluations of stochastic station times. The result can be used for subassembly planning with uncertain joining times.

■ WA30

Hilton- Union Sq 10

Operations Management/Marketing Interface II
Contributed Session

Chair: Emre Ertan, PhD Candidate, University of Texas at Dallas, Sm30, Jindal School of Mgmt, 800W Campbell Road, Richardson, TX, 75080, United States of America, emre.ertan@utdallas.edu

1 - Analysis of Consumers' Purchase Timing Decisions
> Emre Ertan, PhD Candidate, University of Texas at Dallas, Sm30, Jindal School of Mgmt, 800W Campbell Road, Richardson, TX, 75080, United States of America, emre.ertan@utdallas.edu, Ozalp Ozer, Kathy Stecke

The consumer purchase timing decision is analyzed by using discounted expected utility theory, where consumers act to maximize their utility over time. The consumer's sequential decision-making process is formalized under uncertain product availability. An optimal purchase timing policy is identified in a market environment, in which a strategic customer knows the markdown pricing scheme, available inventory level, and remaining time to the end of the selling horizon.

2 - Price and Inventory Competition with Customer Switching
> Chunyan Gao, Assistant Professor, Southwestern University of Finance and Economics, No. 555 Liutai Avenue, Wenjiang District, Chengdu, 611130, China, gaochy_2007@126.COM, Qiang Gong, Dongling Cai

This paper invests price and inventory competition with market uncertainty. There exist multiple pure strategy sub-game perfect equilibria. It is possible that the profit of retailers with customer switching is Pareto better than that with no customer switching, because the retailer can better take advantage of the inventory pooling in asymmetric equilibrium. In addition, customer switching leads to higher inventory level but not necessary lower price.

3 - Joint Production and Pricing Decisions for Multiple Products with Cap-and-Trade Regulation
> Xiaoping Xu, University of Science and Technology of China, School of Management, 96 Jinzhai Road, Hefei, China, xxp2010@mail.ustc.edu.cn

This paper studies the joint production and pricing decisions under cap-and-trade regulation. We find that the emission trading decisions follow a two-threshold policy and the optimal total emissions and production quantities are constants when the cap is low or high. We also find that the profit may increase when the cap is sufficiently large. We then explore the impact of the emission trading prices on the optimal decisions. We finally conduct numerical examples to illustrate our findings.

4 - Dynamic Pricing, Production, and Channel Coordination with Stochastic Learning
> Tao Li, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95053, United States of America, tli1@scu.edu, Xiuli He, Suresh Sethi

We study a decentralized two-period supply chain in which a manufacturer produces a product with stochastic cost learning, and sells it through a retailer facing a price-dependent demand. The manufacturer may or may not have inventory carryover option. We examine the impact of learning on the strategies of channel members. We show the traditional double marginalization problem becomes worse in the presence of learning. We obtain revenue sharing contracts that coordinate the dynamic supply chain.

■ WA31

Hilton- Union Sq 11

Matching-Based Service Allocation Models
Sponsor: Service Science
Sponsored Session

Chair: Yichuan Ding, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Daniel.Ding@sauder.ubc.ca

1 - A Dynamic Pricing Mechanism via Fisher Market Equilibrium
> Dragos Florin Ciocan, Assistant Professor, INSEAD, 70 Pacific St, Apt 227, Cambridge, Ma, 02139, United States of America, florin.ciocan@gmail.com, Vivek Farias

We consider a general equilibrium inspired allocation mechanism for online advertising. This allows an ad network to dynamically price impressions achieving several attractive properties. In particular, regardless of inventory uncertainty, the budgets of the advertisers are exhausted, while simultaneously guaranteeing that even in the presence of arbitrarily large inventory volatility, the utility that each advertiser achieves is a constant factor of the offline Pareto optimal.

2 - Dynamic Matching in Overloaded Waiting Lists
> Jacob Leshno, Columbia University, 3022 Broadway, Uris Hall, 406, New York, NY, 10027, United States of America, jleshno@columbia.edu

We consider the efficiency of the allocation via waiting lists. Welfare is maximized when agents decline mismatched items; as items can be assigned to others agents and generate higher value without effecting aggregate waiting costs. However, agents may misreport preferences to get an earlier item. Abstract We calculate welfare loss from misallocation of standard waiting lists. Using derive optimal policies which use randomization and present a simple and robust policy.

3 - An Overloaded Bipartite Queueing System with Scoring-Based Priority Rules
> Yichuan Ding, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Daniel.Ding@sauder.ubc.ca, Peter Glynn, Stefanos Zenios

We consider an overloaded bipartite queueing system (OBQS) with multitype customers and service providers. Service is provided first to the customer with the highest score, which is computed based on customer type, waiting time, and server type. We characterize the fluid limit process in such a system. This result has three immediate applications: (1)it predicts the outcome of the OBQS; (2) it derives the optimal score formula; (3) it addresses the open question raised by Talreja & Whitt (2008).

■ WA32

Hilton- Union Sq 12

Operations/Service 1
Contributed Session

Chair: Andriy Shapoval, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, ashapoval3@gatech.edu

1 - Empirical Study on Surgery Delays
> Elvin Coban, Assistant Professor, Ozyegin University, Orman Sok. Cekmekoy, Istanbul, 34794, Turkey, elvin.coban@ozyegin.edu.tr, Gulsah Alper, Tugce Pinar

We examine delays in surgery schedules using a dataset from a leading hospital in Turkey. Various steps starting from surgery appointment till patient discharge are analyzed for different medical departments. In this talk, we will discuss patterns of existing delays in addition to how we can manage them to compute robust surgery schedules.

2 - On Inpatient Bed Capacity Management by Cluster Analysis
> Andriy Shapoval, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, ashapoval3@gatech.edu, Eva Lee

We consider a problem of partitioning clinical services in hospitals into groups with the goal to allocate efficiently inpatient beds. One strategy is pooling the bed capacity. Alternatives include dividing the capacity into groups with restricted access up to the complete specialization, also called focused care. Using the similarity principle from cluster analysis, we propose a two-stage framework with discrete optimization and queueing components.

3 - Trends in Servitization
Jina Kim, PhD Student, Korea University Business School, LG-POSCO Hall, KUBS, 145 Anam-ro Seoungbook-gu, Seoul, Korea, Republic of, jina0810@korea.ac.kr, Hosun Rhim, Kwangtae Park

Servitization is the concept including Product Servitization added service into product and Service Productization added product into service. Manufacturing Company can improve its performance and create customer value by combining service with product. Also, Service Company adds product into service in order to increase financial performance and satisfy customer satisfaction. This paper investigates trends in servitization: Product Servitization and Service Productization. .

4 - The Probabilistic Profitable Tour Problem
Mengying Zhang, University of Science and Technology of China, Jin Zhai Road 96, Hefei, China, zmy0908@mail.ustc.edu.cn

The probabilistic profitable tour problem is the problem of finding an a priori tour which maximizes the difference between the expected profits collected by visiting customers and the corresponding expected traveling costs. We formulate this problem and propose a genetic algorithm to solve it.

■ WA33

Hilton- Union Sq 13

Health Care Modeling Optimization IV
Contributed Session

Chair: Banafsheh Behzad, Assistant Professor, California State University, Long Beach, Department of Information Systems, College of Business Administration, Long Beach, CA, 90840, United States of America, behzad1@illinois.edu

1 - using Subject Specific Data to Improve Biomechanical Modeling
Menekse Salar, PhD Student, Auburn University, 215 S. Gay Street, #204, Auburn, AL, 36830, United States of America, mzs0053@auburn.edu, Richard Sesek, Celal Gungor, Ruoliang Tang

Many bio-mechanical modeling methods rely on oversimplifying assumptions regarding muscle geometry. The aim of this study was to build regression relationships that can predict low back geometry using only easily measured subject parameters such as height, weight and gender. This paper explores the errors that would be expected using this regression relationship as compared to assuming a fixed muscle lever arm based on the population or gender stratified mean values which is typically done.

2 - Hazard Rate Models for Estimating Patient's Length-of-Stay in Emergency Departments
Seung Yup Lee, Wayne State University, Wayne State University, Detroit, MI, 48202, United States of America, seungyup@wayne.edu, Michael Lederle, Ratna Babu Chinnam, Alper Murat, Evrim Dalkiran, Qingyu Yang, Sina Faridimehr, Azade Tabaie, Hakimuddin Neemuchwala

Research suggests that effective prediction of a patient's length-of-stay is an important prerequisite for evaluation of ED service quality as well as the performance of real-time decision support systems for improving patient flow. We present results from statistical and machine learning hazard rate models using data from a VA Medical Center that offer a number of interesting insights.

3 - Capacity Planning of Operating Rooms
Tarun Mohan Lal, Senior Health Services Analyst, Mayo Clinic, Robert D. and Patricia E. Kern, Rochester, MN, United States of America, mohanlal.tarun@mayo.edu, Kal Pasupathy, Narges Hosseini, Jeanne Huddleston

Effective use of operating rooms is critical for meeting the patient demand and for the financial viability of hospitals. This presentation will discuss a decision support system that was developed for Urology practice of a large academic medical center to estimate number of different types of OR's(robotic, non robotic)required considering practice constraints as well as balancing the over and underutilized costs. Future research opportunities to improve the model will also be discussed.

4 - Asymmetric Bertrand-Edgeworth-Chamberlin Competition: A Pediatric Vaccine Pricing Model
Banafsheh Behzad, Assistant Professor, California State University, Long Beach, Department of Information Systems, College of Business Administration, Long Beach, CA, 90840, United States of America, behzad1@illinois.edu, Sheldon Jacobson

The pricing strategies in the United States pediatric vaccines market are studied using a Bertrand-Edgeworth-Chamberlin price game. The game analyzes the competition between asymmetric capacity- constrained manufacturers producing differentiated products. The model completely characterizes the unique pure strategy equilibrium in this game in an oligopoly setting. Complete characterization of mixed strategy equilibrium is provided for a duopoly setting.

5 - Optimal Rotation of Duties of Hemodynamics Units: A Case Study
Giovanni Righini, University of Milan, Via Bramante, 65, Crema, Italy, giovanni.righini@unimi.it

We consider optimization problems arising in the reorganization of the regional health care system in the province of Milan, concerning the treatment of patients affected by acute myocardial infarction. Namely we consider some tactical level problems to suitably define a cyclic schedule of hemodynamics units to be un duty during nights and week-ends. We present integer linear programming models and we provide computational results obtained for the province of Milan.

■ WA34

Hilton- Union Sq 14

Homeland Security and Energy Policy
Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Xiaojun Shan, Postdoctoral Research Associate, CEEEP at Rutgers University, 33 Livingston Ave, New Brunswick, NJ, 08901, United States of America, xiaojun.shan@ejb.rutgers.edu

1 - Pareto Optimal Designs for CO2 Cap and Trade Policies on Deregulated Electricity Networks
Felipe Feijoo, University of South Florida, 4202 E. Fowler Ave, ENB118, Tampa, United States of America, felipefeijoo@mail.usf.edu, Tapas Das

This paper presents two layers model to develop Pareto optimal designs for CO2 Cap and Trade policies. The top layer involves design of optimal cap-and-trade policy over a planning horizon. The bottom layer involves, for a given cap-and-trade policy, finding equilibrium bidding strategies of the competing generators while maximizing social welfare via DC-OPF.

2 - The Modern Electric Grid: Implications for National Security
Anu Narayanan, Associate Engineer, RAND corp, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States of America, anarayan@rand.org

The modernization of the electric power grid includes the deployment of intelligence, controls and distributed generation resources across the power delivery system. These upgrades come with opportunities for increased system resilience and security as well as potential risks. In this talk I will touch on both sides, considering technical, economic and policy issues and identifying questions to ask as we try to make the best use of available and emerging technologies.

3 - Effectiveness of Defensive Investments in the Light of Cascading Failure
Sinan Tas, Penn State University-Berks, 1800 Tulpehocken Road, Reading, Pe, 19610, United States of America, sut12@psu.edu

Limited capacities and old technologies make cascading failure a crucial aspect of our critical infrastructure including power grids and telecommunication networks. In this talk, we will analyze how effective our defensive investments can be when intelligent adversaries consider cascading failure as part of their attack strategies. We will also discuss the practical implications of efficient security investments that may lead to more sustainable security policies.

4 - Designing Intervention Scheme for Public-Interest Goods: California Electric Vehicle Market Case
Ece Demirci, Ph.D. Student, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, edemirci@bilkent.edu.tr, Nesim K. Erkip

This study explores the problem of designing an intervention scheme for public-interest goods. We consider a system composed of a retailer and a central authority with fixed budget. The central authority regulates the system by two intervention tools: investment on demand increasing strategies and subsidies. We use bi-level programming for modeling the system, provide some structural properties and calibrate our model with California electric vehicle market data.

■ WA35

Hilton- Union Sq 15

Healthcare and Humanitarian Logistics

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Maria Besiou, Associate Professor of Humanitarian Logistics, Kuehne Logistics University, Grosser Grasbrook 17, Hamburg, 20457, Germany, maria.besiou@the-klu.org

**1 - Global Vehicle Supply Chain Management in
      Humanitarian Operations**
   Alfonso Pedraza-Martinez, Assistant Professor, Kelley School of Business, Indiana University, 1309 E 10th Street, Kelley School of Business, IU, Bloomington, In, 47405, United States of America, alpedraz@indiana.edu, Luk Van Wassenhove, Jon Stauffer

We use dynamic hub location models to investigate the vehicle supply chain of an international humanitarian organization. Using real data we obtain vehicle demand following the Haiti earthquake and multiple development programs. We show how temporary hubs in major disaster areas can balance costs and responsiveness in global humanitarian supply chains.

**2 - Predicting the Unpredictable: Deciding Where to Locate Strategic
      Stock using Real Data**
   Marianne Jahre, Professor, BI Norwegian Business School, Visiting Researcher MIT Humanitarian Response Lab, Sorgenfrigata 18a, Oslo, Ch, 0365, Norway, marianne.jahre@bi.no, Stein Erik Grönland

The Humanitarian Assistance Demand Forecast (HADF) is a tool to establish annual global demand for disaster relief goods and logistics services in international assistance. IFRC used HADF as a decision support tool to make evidence based decisions on locations and volumes of relief items to be prepositioned, thus forming their new global structure of physical, human and financial resources. The paper presents how real data helped IFRC make optimal decisions in designing their network.

**3 - Humanitarian Transportation Planning: Human and
      Modeling Approaches**
   Erica Gralla, Assistant Professor, George Washington University, 1776 G St NW Suite 101, Washington, DC, 20052, United States of America, egralla@email.gwu.edu

A key logistics challenge in disaster response is planning and prioritizing the use of trucks and helicopters to transport humanitarian aid to affected communities. This paper explores ways to improve humanitarian transportation planning by building on the strengths of both humans and models. We identify decision-making algorithms, prioritization policies, and organizational structures that are nearly as effective as optimizers, but much simpler to implement in the humanitarian context.

4 - Patients with Chronic Disease: A System Dynamics Approach
   Maria Besiou, Associate Professor of Humanitarian Logistics, Kuehne Logistics University, Grosser Grasbrook 17, Hamburg, 20457, Germany, maria.besiou@the-klu.org, Charalampos Tziogas, Patroklos Georgiadis, Reinhard Angelmar

Chronic diseases are lifelong medical conditions that evolve over a person's lifespan. Even if they can be treated and controlled, their long-term effects pose great pressure to the global healthcare sector. Motivated by the need for active and sustainable interventions in the healthcare sector, we develop a system dynamics model to capture the chronic disease patient flow. We also use a numerical example to study the non-linear complex dynamic behavior of the system under study.

■ WA36

Hilton- Union Sq 16

Information Systems 3

Contributed Session

Chair: Zsolt Ugray, Utah State University, 3515 Old Main Hill, MIS Department, Logan, UT, 84322-3515, United States of America, zsolt.ugray@usu.edu

1 - Optimized Autoscaling in Cloud Computing
   Parijat Dube, IBM, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, pdube@us.ibm.com, Anshul Gandhi, Alexei Karve, Andrzej Kochut, Li Zhang

We develop a Kalman-filtering based automated solution to dynamically scale cloud deployments to meet application-level performance targets. Our solution leverages resource-level and application-level statistics to determine the required scaling actions in a cost-effective manner. The core of DC2 is a modeling and execution engine that internalizes the monitored statistics and infers the necessary system parameters.

**2 - What Value Does Management Expect from BI/BA Projects?
      – Findings from Qualitative Case Studies**
   Zsolt Ugray, Utah State University, 3515 Old Main Hill, MIS Department, Logan, UT, 84322-3515, United States of America, zsolt.ugray@usu.edu, David Paper, Jeffrey Johnson

The use of business intelligence and business analytics (BI/BA) tools has become quite common in the past two decades. Some companies choose to make big investments in resources to support these efforts, while others approach possible investments very cautiously. We report on findings from our qualitative case studies of a variety of firms where our focus is to investigate management's perceptions of the value they can gain from BI/BA projects.

**3 - How Strategic IT Organizations Enable Business Teams to Make
      Well-informed Business Decisions**
   Phil Weinzimer, President, Strategere Consulting, Alltentown, PA, 18104, United States of America, pweinzimer@strategere.com

The power of Information is valuable if it enhances the knowledge and enables operational personnel, business unit management, and executives to make well-informed business decisions that lead to significant business outcomes. A new book, The Strategic CIO; Changing the Dynamics of the Business Enterprise, based upon 150 CIO and business Executive interviews, explores, via case studies, how CIOs, using a common four-phase methodology, leverage information/technology for competitive advantage.

4 - Crowdsourced Digital Goods and Firm Productivity
   Frank Nagle, Harvard Business School, Wyss 100, Soldiers Field, Boston, MA, 02163, United States of America, fnagle@hbs.edu

Crowdsourced digital goods are becoming more freely available and more frequently used as inputs by firms. However, the current literature on the returns to IT investment mismeasures non-pecuniary digital inputs. I measure the impact of one such good, open source software (OSS), on firm productivity. I find a positive and significant return to the usage of OSS. I address endogeneity concerns by using an instrumental variable approach and a matching estimation.

■ WA37

Hilton- Union Sq 17

Big Data 2

Contributed Session

Chair: Hing Kai Chan, Associate Professor, University of Nottingham Ningbo China, Business School China, Ningbo 315100, China, hingkai.chan@nottingham.edu.cn

1 - A Multi-disciplinary Approach to Quantify Social Media Data
   Hing Kai Chan, Associate Professor, University of Nottingham Ningbo China, Business School China, Ningbo 315100, China, hingkai.chan@nottingham.edu.cn

Social media data are freely available and lots of useful data are available. Unfortunately, they are not fully utilized partly because of their nature: unstructured, subjective, and massive size. The proposed approach makes use of multiple research methods to process the social media. First part of the method is exploratory in nature, followed by statistical cluster analysis. The exact meaning of the data will then be extracted by entropy concept.

**2 - A Knowledge Driven Hypotheses Generation Method to Uncover
      Actionable Information from Medical Data**
   Nuo Xu, Assistant Professor, University of Alabama at Birmingham, 1150 10th Ave South, Birmingham, AL, United States of America, nuoxu@uab.edu, Xuan Huang

The greatest challenge in utilizing Big-Data in healthcare is the hypotheses-driven paradigm that dominates clinical practice and research and its incompatibility to data driven paradigm. We propose an expert knowledge driven hypotheses generation mechanism to discover actionable knowledge based on two techniques, 1) knowledge driven feature creation and 2) model-free feature selection. We demonstrate the effectiveness of our approach with a 2-year diabetic intervention study at UAB hospital.

**3 - Antecedences and Consequences of Multichannel
      Sharing Behaviors**
   Tianshu Sun, PhD Candidate, Smith School of Business, University of Maryland, 3330 Van Munching Hall, PhD Student Office, College Park, MD, 20742, United States of America, tianshusun@rhsmith.umd.edu, Elena Zheleva, Siva Viswanathan

With the rapid rise of the "sharing economy" there has been a renewed interest in understanding the antecedents and consequences of information sharing behaviors. We examine how product and social network characteristics drive information sharing across channels and before/after purchase. Using a granular dataset on customer sharing of daily deals and a rich set of product and social network characteristics our study provides novel insights into multi-channel sharing behaviors

4 - Clickstream Big Data and Delivery before Order Making" Mode for Online Retailers
Yeming Gong, EMLYON Business School, Rue Dunoir 12, Lyon, 69003, France, gong@em-lyon.com, Haoxuan Xu

Our research is inspired by a leading online retailer using clickstream big data to estimate customer demand and then ship items to customers or hubs near customers by a mode of "delivery before order making" (DBOM) mode. Using clickstream data to obtain advance demand information in order quantities, we integrate the forecasting with a single-item uncapacitated dynamic lot sizing problem in a rolling-horizon environment.

5 - A One-shot Approach to Distributed Sparse Regression
Yuekai Sun, Stanford University, 475 Via Ortega, Stanford, United States of America, yuekai@gmail.com, Qiang Liu, Fernando Perez, Jason Lee, Jonathan Taylor

We devise a one-shot approach to distributed sparse regression in the high-dimensional setting. The main idea is to estimate the regression coefficients by averaging corrected lasso estimates. We show the approach recovers the convergence rate of the lasso as long as the number of machines does not grow too quickly.

■ WA38

Hilton- Union Sq 18

Health Care Modeling Optimization VI
Contributed Session

Chair: Michelle Alvarado, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, alvarado.michelle.m@gmail.com

1 - Scheduling for a Clinical Network
Dongyang Ester Wang, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78712, United States of America, wdy@utexas.edu, Douglas Morrice, Kumar Muthuraman

The process that prepares outpatients for surgery is service intensive and requires timely access to multiple services. However, scheduling outpatient appointments is not coordinated among the clinics. We develop a model that centralizes scheduling for a clinical network and our approach has the potential to identify a system-wide optimal solution.

2 - ICU Nurse Scheduling under Uncertainty
Ece Karpuz, Hazine Mustesarligi, Inonu Bulvari, No: 36, Emek, Ankara, Turkey, ece.karpuz@hazine.gov.tr, Sakine Batun

In this study, we consider the problem of scheduling ICU nurses under uncertainty in the required patient care. We formulate the problem as a two-stage stochastic program that minimizes the expected overtime and undertime hours. We estimate the value of the stochastic solution by considering practical instances constructed based on real data.

3 - Nurse Scheduling in Infusion Center
Kamil Ciftci, Lehigh University, 200 West Packer Avenue, Bethlehem, 18015, United States of America, kac208@lehigh.edu

Recently, it is a big challenge for infusion center management to control the environment in order to reduce operation cost, improve the quality of care, satisfy patients, and provide staff preferences. In this paper, MILP models are developed to find optimal nurse scheduling in an infusion center while minimizing patient waiting time. A heuristic policy is proposed for large problems. We design simulation model to compare proposed models with current practice in a local hospital.

4 - Analyzing the Financial Effects of HIE in a Health Care System using Simulation
Yu Fu, Graduate Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, yufu.ise@tamu.edu, Andy Banerjee

A Health Information Exchange (HIE) is expected to improve the effectiveness of healthcare services and reduce cost for the payers and providers. The focus of this research study is to model the complicated interactions of multiple participants in the health care system using simulation, compare the financial outcomes under different scenarios, and therefore analyze the financial effects of HIE in a health care system.

5 - Integrated Simulation and Optimization for Scheduling Chemotherapy Appointments under Uncertainty
Michelle Alvarado, Ph.D. Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, alvarado.michelle.m@gmail.com, Lewis Ntaimo

Scheduling of chemotherapy appointments is a difficult task due to uncertainty in appointment durations, acuity levels, and resource availability. To address this problem, we developed a new methodology that integrates a discrete event system specification (DEVS) simulation model with a stochastic mixed integer programming model (SMIP). The methodology and SMIP scheduling algorithms are evaluated from both the patient and management perspectives using data from a Texas oncology clinic.

■ WA39

Hilton- Union Sq 19

Inverse Optimization in Healthcare
Sponsor: Health Applications
Sponsored Session

Chair: Taewoo Lee, PhD candidate, University of Toronto, 5 King's College Road, Toronto, Canada, taewoo.lee@mail.utoronto.ca

Co-Chair: Timothy C. Y. Chan, University of Toronto, 5 King's College Rd., Toronto, Canada, tcychan@mie.utoronto.ca

1 - Eliciting Cholesterol Management Guidelines' Valuation of Future Life
Iakovos Toumazis, PhD Student, University at Buffalo (SUNY), Buffalo, NY, United States of America, iakovost@buffalo.edu, Osman Ozaltin, Murat Kurt, Nilay Shah, Brian Denton

Lipid abnormalities increase the risk of heart attack and stroke. Treatment guidelines are developed to deal with the complexity of treating these abnormalities. We consider the trade-off between the benefits and side effects of statins, and develop an inverse stochastic dynamic program to elicit time valuation of current guidelines. We use clinical data to illustrate the outcomes on Type 2 diabetes patients.

2 - Estimating Lipid Management Guidelines' Risk Value of a Life Year on Treatment
Niraj Kumar Pandey, University at Buffalo (SUNY), 342 Bell Hall, University at Buffalo(SUNY), Buffalo, NY, 142602050, United States of America, npandey@buffalo.edu, Murat Kurt, Mark Karwan

Statins reduce the risk of coronary heart disease and stroke, but may have adverse side effects. Except for some surveys there has not been any emphasis on the measurement of these side effects to be used for better decision making. In this study, we develop an inverse dynamic programming model to quantify the side effects of statin treatment from a central policy maker's point of view. We present computational results based on the national lipid management guidelines from several countries.

3 - Reverse Engineering Bacterial Metabolism via Inverse Optimization
Ioannis Paschalidis, Professor, Boston University, Dept of ECE, 8 Saint Mary's St, Boston, MA, 02215, United States of America, yannisp@bu.edu

We develop an Inverse Flux Balance Analysis (IFBA) method which is a novel inverse linear optimization framework for inferring the metabolic objective function. Understanding the structure of the cell's objective can help reverse engineer" a bacterium of interest and infer useful information regarding its evolution. We validate IFBA under both simulated (E. coli and Yeast) and experimental data (TEAM) with excellent results. (Joint work with Q. Zhao, A. Stettner, and D. Segre)

4 - Preference Preservation in Inverse Optimization for Radiation Therapy Treatment Planning
Taewoo Lee, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, Canada, taewoo.lee@mail.utoronto.ca, Timothy C. Y. Chan

We present a new inverse convex optimization model that accommodates any input solution, including one that cannot be optimal for the forward problem, and determines a nonzero weight vector that preserves the original preference of the decision maker who generated the solution. We show how a linear approximation to the model and a successive linear programming algorithm can trade off between preference preservation and computational efficiency, using prostate cancer radiation therapy data.

■ **WA40**

Hilton- Union Sq 20

HSEA -I- Undergraduate Projects in Healthcare Engineering

Sponsor: Health Applications
Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, amycohn@med.umich.edu

1 - Using Multidisciplinary Group to Create a Simulation Tool to Help Surgeons understand Uncertainty
Nathan Janes, University of Michigan, Ann Arbor, MI, United States of America, njanes@umich.edu, Amy Cohn

We present our multidisciplinary project comprised of engineering, medical, and nursing students and faculty on helping a cardiothoracic surgeon to understand the impact of stochasticity on training programs for surgical residents. The design and implementation of the tool has been impacted by the input of all involved in the project and this has allowed for an intuitive, user-friendly design that may be used by both clinical and administrative personnel to assess their own programs.

2 - Predicting Disposition for Pediatric Asthma Patients
Vanessa Morales, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, vmorales@umich.edu, Amy Cohn, Elizabeth Olin

We present predictive modeling based approaches to determine the disposition for children arriving to a pediatric emergency department with respiratory illnesses.

■ **WA41**

Hilton- Union Sq 21

Health Care, Public Health

Contributed Session

Chair: Alexander Rothkopf, Post Doc, Julius-Maximilians-University, Stephanstrafle 1, Wuerzburg, 97070, Germany, alexander.rothkopf@uni-wuerzburg.de

1 - Bayesian Network Detection of Breast Cancer Treatment Disparities
Milton Soto-Ferrari, Western Michigan University, 4601 Campus Drive, Kalamazoo, MI, 49008, United States of America, miltonrene.sotoferrari@wmich.edu, Diana Prieto, Lorena Pena

We developed a Bayesian network (BN) and a logistic regression model (LR) that simulate the decision process of physicians in diagnosing a hormone therapy treatment, and the effect of non-clinical factors in the final receipt of the treatment in breast cancer patients. The clinical factors include: post-menopausal and hormone receptor status, treatment and adjuvant treatment received. We calculate the statistical power of the two methods and compare their results and performance.

2 - Profiling and Visualizing Utilization and Cost for Pediatric Asthma Care in the Medicaid System
Ross Hilton, PhD Candidate, Georgia Institute of Technology, 755 Ferst Dr. NE, Atlanta, GA, 30332, United States of America, rhilton3@gatech.edu

We summarize the utilization and cost relational system between providers for pediatric asthma care in the Medicaid system using large patient-level claims data. We apply sequence clustering analysis to the utilization profiles and derive a probabilistic network of care and a cost relational system for each cluster. ED visits contribute a large portion of the total cost while the majority of ED costs-per-visit are similar to other care types suggesting that many ED visits are for routine care.

3 - Drug Procurement with Long Term Considerations: Volume Splits and Volume Guarantees
Alexander Rothkopf, Post Doc, Julius-Maximilians-University, Stephanstrafle 1, Wuerzburg, 97070, Germany, alexander.rothkopf@uni-wuerzburg.de, Eirini Spiliotopoulou

Our analysis is motivated by recent decisions of global health procurement organizations to grant volume guarantees to existing suppliers: in addition to awarding the volume of the upcoming procurement cycle to incumbent suppliers a procurer also guarantees a specific volume of future procurement cycles to these suppliers today. With this mechanism organizations aim to reduce prices through competition and higher economies of scale at the suppliers.

4 - Random Acts of Violence: Examining Mass Killing Events in the United States as a Stochastic Process
Douglas King, University of Illinois at Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews Ave., MC-238, Urbana, IL, 61801, United States of America, dmking@illinois.edu, Sheldon Jacobson

Recent mass killings such as those in Newtown, CT and Aurora, CO, have brought attention to mass killings in the United States. This talk examines 236 mass killings between 2006 and 2014, finding that they do not significantly differ from a homogeneous Poisson process. This implies a stable frequency of mass killings from 2006 to 2014, and that mass killing events are random in the sense that the occurrence of one mass killing event does not signal whether another mass killing event is imminent.

■ **WA42**

Hilton- Union Sq 22

System Dynamics in Health I

Sponsor: Health Applications
Sponsored Session

Chair: Mohammad S. Jalali, Virginia Tech / MIT, 113 Harvard St, Apt 1, Cambridge, MA, 02139, United States of America, mj@vt.edu

1 - Increasing Healthy Food Access and Equity? Dynamics of Nutritious Food Innovation
Jeroen Struben, Assistant Professor, Desautels Faculty of Management - McGill University, 1001 Sherbrooke Street W, Montreal, QC, H3A1G5, Canada, jeroen.struben@mcgill.ca, Derek Chan, Laurette Dube

We examine dynamics of and trade-offs between market-driven and social innovations in efforts to increase healthy food consumption, especially within disadvantaged populations. We develop a behavioral, dynamic, and empirically grounded nutrition market transformation model with population socio-demographically disaggregated. We identify conditions under which single-faceted or collaborative policies, involving multiple stakeholders promoting nutritious food and healthy lifestyles, are effective.

2 - Impact of Patient Non-compliance on Diabetes Care System
Sahar Hashmi, MD, PhD candidate, Massachusetts Institute of Technology, 10 Emerson Place, 16C, Boston, MA, 02114, United States of America, drhashmi@mit.edu

We studied the effect of diabetes patients with increased missed appointments on their disease progression with different insurance coverage. We measured the impact of disease progression on the cost of the diabetes management system. We have developed a system dynamic model, which identifies the key variables and causal loops involved. We suggest better aligning of the insurance coverage on preventive and counseling services to save the cost of overall spending in the diabetes clinic services.

3 - Optimal Screening Policy for Post-Traumatic Stress (PTS)
Navid Ghaffarzadegan, Assistant Professor, Virginia Tech, Blacksburg, VA, United States of America, navidg@vt.edu, Richard Larson

We develop a screening policy model for PTS including social forces that inhibit receiving early care. We simulate to analyze the characteristics of the optimal" screening policy for PTS. We show that there is a tipping point in this system, and to make a long-term difference, the screening rate should be much higher than the current numbers. Otherwise, investments only have short term effects. Implications include potentially screening everyone and tolerating false positives.

4 - System Dynamic Models of Dengue Fever
Kun (Maggie) Hu, Research Scientist, IBM, 650 Harry Rd, San Jose, CA, 95120, United States of America, khu@us.ibm.com, James Kaufman

Dengue is a major international public health concern with no vaccine. Infection with one strain affords temporary cross immunity (CI) to other strains which increases the risk of having lethal complications due to antibody-dependent enhancement (ADE). We propose two SD models of dengue fever which exhibit a transition from steady state to periodic dynamics as a function of CI and ADE. Our results show the need for ADE to explain the dynamics of the epidemiological behaviors observed in reality.

■ WA43

Hilton- Union Sq 23

Applications and Computation

Sponsor: Computing Society
Sponsored Session

Chair: Todd Trautman, Sr. Manager, Kaiser Permanente, Colorado, 2530 S. Parker Rd, CIDS, Aurora, Co, 80014, United States of America, todd.c.trautman@kp.org

1 - Optimal Order Splitting on a Multi-slot Machine in the Printing Industry
> Philipp Baumann, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, Bern, 3012, Switzerland, philipp.baumann@pqm.unibe.ch, Salome Forrer, Norbert Trautmann

In the real-world offset printing process under study, customer-specific designs are imprinted on napkin pouches. For the planning of this process, given customer orders are to be split among several slots of printing plates, such that the total costs are minimized subject to several technological and organizational constraints. We present two alternative MILP formulations and analyze how symmetric solutions can be removed efficiently from the search space.

2 - Media Selection with Yield Uncertainty
> Justin Goodson, Assistant Professor, Saint Louis University, 3674 Lindell Blvd., St. Louis, MO, 63108, United States of America, goodson@slu.edu, Reuven Levary, Luca Bertazzi

Firms advertising a product or service seeking to maximize target audience exposure often face yield uncertainties, i.e., indeterminate future events resulting in bumped media spots. Yield may be affected by breaking news, natural disasters, or political events. Although advertisers may receive refunds for bumped spots, it is difficult to recover lost exposure. We consider strategies to hedge against yield uncertainty, developing upper and lower bounds on the value of an optimal policy.

3 - Weighted Target Set Selection
> Rui Zhang, University of Maryland, R. H. Smith Business School, College Park, MD, United States of America, ruizhang@rhsmith.umd.edu, Raghu Raghavan

The Target Set Selection (TSS) problem is a fundamental problem about the diffusion of influence in social networks. In our work, we consider the weighted version of it (WTSS problem). Motivated by the desire to develop mathematical programming approaches, we first focus on developing a strong formulation for the problem on trees. We present a tight and compact extended formulation for it. Furthermore, based on this strong formulation, a branch and cut approach is proposed for general networks.

4 - Assortment Optimization in Fashion Retail
> Marie-Claude Côté, JDA Software, 4200 st-laurent, Montreal, Canada, marie-claude.cote@jda.com, Louis-Martin Rousseau, Marc Brisson, Eric Prescott-Gagnon, Vincent Raymond

The assortment problem aims at selecting the best set of items to be carried in each store of an chain for a future season based on user-defined constraints. To support the particularity of the fashion industry where items can change significantly from one season to another, we use a genetic algorith, a MIP and a Neural Network to create new interesting items and items with similar characteristics considering the constraints to give the user a meaningful set of product to create his assortment.

■ WA44

Hilton- Union Sq 24

Strategic Value of IT/IS

Sponsor: Information Systems
Sponsored Session

Chair: Ling Xue, Assistant Professor, University of North Carolina at Greensboro, 479 Bryan Building, Dept. of ISSCM, UNC-Greensboro, Greensboro, NC, 27402, United States of America, l_xue@uncg.edu

1 - Are You on the Edge of Failure? Let the Customer Checkin Tell You
> Lei Wang, Assistant Professor, Pennsylvania State University, 454 Business Building, University Park, PA, 16802, United States of America, Lei.Wang@business.uconn.edu, Joseph Pancras, Ramesh Shankar, Ram Gopal

It is vital to understand how businesses can leverage the real-time data generated by location-based services. Using data collected from Foursquare and Yelp, we aim to find out the predictive power of customer checkins on business failure for restaurants in New York City. We find that customer checkin data from the focal restaurant and its neighbors have shown strong predictive power on business failure. Incorporating customer checkins data gives a remarkable improvement on predictive accuracy.

2 - Push or Pull? Design of Content Delivery Systems
> Sean Marston, Assistant Professor, Western Kentucky University, 1906 College Heights Blvd. #21058, Bowling Green, KY, 42101, United States of America, Sean.marston@wku.edu, Hong Guo, Yuwen Chen

Advances in information technology, especially the expansion of cellular and WiFi networks, are dramatically changing how people consume digital content. This paper addresses this challenge by identifying the key factors for the design of content delivery systems and explicitly modeling their interactions. We investigate two content delivery systems ñ push and pull systems, and solve for the content provider's optimal push frequency decision and consumers' push versus pull decision.

3 - Information Technology and Transformation of Government Services
> Min-Seok Pang, Assistant Professor, Temple University, United States of America, mins.pang@gmail.com, Henry C. Lucas, Jr., Sunil Mithas

In the context of U.S. Social Security, we study how use of online self-service technologies (SST) is associated with customer satisfaction. Using a large-scale individual-level dataset with more than 2,700 respondents, we find that successful use of SST in Social Security benefit applications is associated with higher levels of service satisfaction, compared to the in-person channel. We also show that a service failure on the online channel is related to customer dissatisfaction.

■ WA45

Hilton- Union Sq 25

Behavior, Queueing, and Processing Times

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Ken Schultz, Associate Professor, Air Force Institute of Technology, 4950 Hobson Way, WPAFB, OH, 45433, United States of America, kenneth.schultz@afit.edu

1 - Individual Behavior and Supplier Pricing to a Newsvendor
> Julie Niederhoff, Syracuse University, Syracuse, NY, United States of America, Jniederh@syr.edu, Panos Kouvelis

Previous studies have examined pricing in contracts to find that they are on average sub-optimally set. However, current literature is primarily focused on average behavior. This neglects the heterogeneity of decision makers. We explore 3 individual biases within a price-setting supplier context to better understand which decision makers get it right, which deviate, and why..

2 - Data Analysis of Service Times in Call Centers
> Noah Gans, OPIM Department, Wharton - University of Pennsylvania, Philadelphia, PA, United States of America, gans@wharton.upenn.edu, Haipeng Shen, Han Ye

We have been analyzing large datasets from telephone call centers to better characterize pervasive but little-studied phenomena that affect their operations. In this talk, we'll discuss agent call times, which show considerable heterogeneity and evolve according to somewhat predictable patterns.

3 - A General Framework for the Influence of Load on Service Time
> Ken Schultz, Associate Professor, Air Force Institute of Technology, 4950 Hobson Way, WPAFB, OH, 45433, United States of America, kenneth.schultz@afit.edu, Bora Kolfal, Mahammad Delasay, Armann Ingolfsson

Do service times increase or decrease with load? The answer is "Yes" or, more accurately, "It depends". We construct a general framework that is useful to both researches and practictioners investigating the affects of load on service times. We propose a thorough examination of the interactions of "load characteristics," "system components," and "service time determinants.

■ WA46

Hilton- Lombard

Games and Optimization over Networks

Sponsor: Optimization/Integer and Discrete Optimization
Sponsored Session

Chair: Swati Gupta, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, MIT ORC, E40-149, Cambridge, MA, 02139, United States of America, swatig@mit.edu

1 - On the Quickest Flow Problem in Dynamic Networks – A Parametric Min-cost Flow Approach

Maokai Lin, Massachusetts Institute of Technology, 7 7 Massachusetts Avenue,MIT ORC,, Cambridge, MA, 02139, United States of America, lmk@mit.edu, Patrick Jaillet

We consider the quickest flow problem in dynamic networks: given flow F, find the minimum time to send it through a network over time. We introduce a new linear programming model for the problem. Using the parametric nature of the model, we develop a cost-scaling algorithm that runs in O(nmlog(n^2/m)log(nC)) time, where C is the maximum arc cost. This result shows for the first time that the quickest flow problem is no harder than the min-cost flow problem in static networks.

2 - A Decentralized Coalition Loyalty Program using Credit Networks

Arpit Goel, Student, Stanford, 1520 Sand Hill Road, Apt 302, Palo Alto, Ca, 94304, United States of America, argoel@stanford.edu, Pranav Dandekar, Ashish Goel

We propose a decentralized system for forming coalition loyalty programs by extending the model of 'credit networks'. We show two important properties of the proposed `path independence' and `no arbitrage'. We introduce a model of customer utility in frequency loyalty program, and show under what conditions coalitions perform better than individual programs.

3 - Finding Small Stabilizers for Unstable Graphs

Karthekeyan Chandrasekaran, Harvard University, 19 Pleasant St, Apt 12, Cambridge, MA, 02139, United States of America, karthe@gatech.edu, Britta Peis, Jochen Koenemann, Laura Sanita, Adrian Bock

Stable graphs play an important role in cooperative game theory. An undirected graph is stable if its inessential vertices (those that are exposed by at least one maximum matching) form a stable set. In this work we study the following edge-deletion question: given a graph G, can we find a minimum-cardinality subset of edges whose removal from G yields a stable graph? We show hardness results and efficient approximation algorithms for sparse graphs and for regular graphs.

4 - Games People (could not) Play

Swati Gupta, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, MIT ORC, E40-149, Cambridge, MA, 02139, United States of America, swatig@mit.edu, Patrick Jaillet, Michel Goemans

Every 2-player zero-sum game has an optimal mixed strategy that can be found by solving an LP. But this approach fails to give a polytime algorithm when the number of pure strategies for each player is exponential in the representation of the game, e.g. if players play spanning trees of a graph. We give fast algorithms to compute approximate Nash-equilibria for exponential succinct games for a class of payoff functions using ideas from convex and combinatorial optimization and machine learning.

■ WA47

Hilton- Mason A

Computational Challenges for Sequential Stochastic Optimization

Sponsor: Optimization/Optimization Under Uncertainty
Sponsored Session

Chair: Warren Powell, Professor, Princeton University, Sherrerd Hall, Charlton St, Princeton, NJ, 08544, United States of America, powell@princeton.edu

1 - Multiple Timescale Stochastic Optimization for Integrating Renewable Resources

Suvrajeet Sen, Professor, University of Southern California, University Park Campus, LA, CA, 90089, United States of America, s.sen@usc.edu, Harsha Gangammanavar

We present a stochastic optimization model which accommodates decisions at multiple timescales: a coarse timescale for thermal generation decisions and a fine timescale to control of renewable resources, storage devices etc. This model is solved using a joint stochastic decomposition-approximate dynamic programming algorithm. Our computational results are based on incorporating wind simulation into this algorithm.

2 - Dynamic Measures of Risk on Dynamic Programs

Ricardo Collado, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, ricardo.collado@stevens.edu, Warren Powell

We discuss dynamic measures of risk on finite and infinite horizon dynamic programs. We focus our attention on identifying main properties of such dynamic risk measures and its implementation challenges. We finish our presentation with a discussion of threshold risk measures and its application to finite and infinite horizon dynamic programs.

3 - Approximation Strategies for Multistage Stochastic Programs

Tsvetan Asamov, Post-doctoral associate, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, tasamov@princeton.edu, Warren Powell

Using the contextual setting of optimizing grid-level energy storage, we study the effect of dimensionality on the performance of different approximation strategies. We build on the algorithmic framework of approximate dynamic programming to introduce novel machine learning strategies which overcome the curse of dimensionality inherent in scenario trees. The energy storage setting is used to create families of problems which exhibit different characteristics of the information state.

4 - A Nested Newsvendor Model to Integrate Rolling Wind Forecasts in the Energy Commitment Problem

Genna Gliner, Graduate student, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, genna@princeton.edu, Warren Powell

We formulate the energy commitment problem with wind energy as a lagged, nested newsvendor problem in the presence of rolling forecasts. We present a stochastic model of the rolling forecasts, and show how these can be used to produce an analytical solution of the energy commitment problem. We then study the sensitivity of the solution to changes in forecasts and use the model to predict how these changes affect the commitment decisions and the objective function value.

■ WA48

Hilton- Mason B

Optimization, Robust 2

Contributed Session

Chair: Dimitri Papadimitriou, Pr.Eng.Research, Bell Labs, Copernicuslaan 50, Antwerp, 2018, Belgium, dimitri.papadimitriou@alcatel-lucent.com

1 - Multi-agent Probe Localization/Configuration Problem

Dimitri Papadimitriou, Pr.Eng.Research, Bell Labs, Copernicuslaan 50, Antwerp, 2018, Belgium, dimitri.papadimitriou@alcatel-lucent.com

The probe localization/configuration problem aims at minimizing the number of probes/workload together with their placement to realize a measurement task under various spatial and resource constraints. When applied to systems subject to uncertainty, one often lacks full information on the nature of this uncertainty. We propose a multi-agent computational method capable to resolve large-scale instances of this problem over time for any realization of uncertainty (in a given set).

2 - Robust Optimization and Predictive Model: A Marketing Use Case

Oliver Bastert, FICO, Maximilianstr. 35a, Munich, Germany, OliverBastert@fico.com, Sébastien Lannez, Shalini Raghavan, Susanne Heipcke

In this paper we present FICO's solution to optimize marketing campaigns, and describe an extension that is used to take into account information about the forecast accuracy during the optimization process. The scalability of the tool is ensured by FICO Xpress Optimization Suite and its distributed computation capability.

3 - Robust Optimization Formulations for Planning Problems

Susanne Heipcke, FICO, Starley Way, Birmingham, United Kingdom, susanneheipcke@fico.com, Zsolt Csizmadia, Pietro Belotti, Sébastien Lannez

Planning, whether long-term or short-term, typically involves uncertain data: demand forecasts rarely are fixed values, availability of resources or raw materials may be uncertain. Robust Optimization provides a means of incorporating such uncertainties into standard" optimization problems. We discuss robust formulations for examples from various application domains, including production planning, logistics, and power generation, and comment on their implementation with Xpress-Mosel.

4 - Options-Mix Demand Specification for Robust Assembly Line Rebalancing

Bryan Pearce, Clemson University, Freeman Hall, Clemson, SC, 29634, United States of America, bpearce@g.clemson.edu, Mary Elizabeth Kurz, Laine Mears, Kavit Antani

We consider the assembly line rebalancing problem that emerges in make to order facilities. Specification of the demand model-mix becomes intractable with very large product customization options. An options-mix demand structure is presented instead, for a single period forecast. A two-stage robust optimization procedure is applied to maximize line efficiency and a horizontal balancing metric.

■ **WA49**

Hilton- Powell A

Routing Problems

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, United States of America, ksulliv@uark.edu

1 - The Shortest Path Problem with Replenishment

Sarah Nurre, Assistant Professor, Graduate School of Engineering & Management, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, Sarah.Nurre@afit.edu, Brian Lunday

We examine the problem of identifying a path through a network from a start node to a terminus node, wherein traversing any arc both increments the length of the path traveled and depletes a capacitated resource. Such a resource is necessary for arc traversal, but it may be replenished at any one or more of a subset of the nodes. We seek to minimize a combination of the path length and number of replenishments. Three exact methods which map the efficient frontier are computationally compared.

2 - Hybrid Optimization Approaches for Dynamic Network Interdiction Models

Chase Rainwater, University of Arkansas, Bell Engineering Center, Office #4207, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Thomas Sharkey, Forough Enayaty

We consider a dynamic network interdiction problem in which adversarial actors seek to maximize illegal flow while protective actors utilize resources to minimize this flow. We discuss an integer programming representation of our problem and then explore hybrid constraint and integer programming techniques for solving larger problem variants. We conclude with a discussion of the role that information plays when our problem is applied to a law enforcement application.

3 - Study on Multi-objective Home Health Care Nurse Routing Problem

Kunlei Lian, Graduate Student, University of Arkansas, Bell 4130, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, klian@email.uark.edu, Ashlea Milburn, Ronald Rardin

The nurse routing problems in this research involves providing consistent service to patients with the objectives of minimizing traveling cost and improving service quality. An improved non-dominated sorting genetic algorithm is proposed to find the trade-offs between these objectives. Large neighborhood search is employed to improve solution diversity and quality. Computational results are presented and observations regarding tradeoffs among the competing objectives are made.

■ **WA50**

Hilton- Powell B

Optimization, Integer 1

Contributed Session

Chair: Pierre Le Bodic, School of Industrial Systems and Engineering, Georgia Institute of Technology, Atlanta, 30332, United States of America, lebodic@gatech.edu

1 - Insights on Branching in MIP Solvers

Pierre Le Bodic, School of Industrial Systems and Engineering, Georgia Institute of Technology, Atlanta, 30332, United States of America, lebodic@gatech.edu, George Nemhauser

The branch and bound algorithm is the standard component around which MIP solvers are designed. We will give insights on branching and show the importance of taking good branching decisions. In particular, we will exhibit a family of instances for which a fixed-size branch-and-bound tree exists, but for which state-of-the-art MIP solvers need an increasing amount of resources.

2 - Cloud Branching – How to Exploit Dual Degeneracy in Global Search

Timo Berthold, Fair Isaac Europe Ltd, Takustr. 7, Berlin, 10551, Germany, timoberthold@fico.com

We study branching strategies for mixed-integer programs that exploit the knowledge of *multiple* alternative optimal solutions (of the current LP relaxation. They naturally extend state-of-the-art methods like strong branching, pseudocost branching, and their hybrids. We show that by exploiting dual degeneracy (thus, alternative optima) it is possible to enhance traditional methods.

3 - Inequality Merging in the Multiple Knapsack Polyhedron

Randal Hickman, Assistant Professor, United States Military Academy, 3428 Westbaker St., Manhattan, KS, 66503, United States of America, hickman97@earthlink.net, Todd Easton

Inequality merging constructs a new category of cutting planes for IP problems. The technique merges two or more valid inequalities into a single cutting plane. Theoretical results related to merging cover inequalities for the multiple knapsack (MK) polyhedron are presented. A computational study demonstrates an average decrease of about 9% in computational effort for some benchmark MK instances.

4 - The Multi-Point Separation Strategy as a Column Generation Stabilization Technique

Francois Vanderbeck, Prof, University of Bordeaux & INRIA, 351, Cours de la Libération, Talence, 33405, France, fv@math.u-bordeaux1.fr, Ruslan Sadykov, Eduardo Uchoa, Artur Pessoa

Column generation suffers from slow convergence. Algorithmic strategies have been designed to accelerate convergence of cutting plane algorithms in mixed integer programming. They have their counterpart in column generation. We show that the Multi-Point Separation" strategy translates into a column generation stabilization technique that consists in restricting the dual solution to be in the convex hull of the selected multi-point set.

■ **WA51**

Hilton- Sutter A

Operations/Quality Management

Contributed Session

Chair: Miri Gilenson, Technion - Israel Institute of Technology, Industrial Engineering and Management, Technion City, Haifa, 3200003, Israel, miray.g@gmail.com

1 - In-Situ Quality Control of High Concentration CNT Suspension and Multistage Buckypaper Manufacturing

Mingchia (Dawn) Yang, Florida State University/High Performance Material Institute, 2005 Levy Ave, Tallahassee, Fl, 32310, United States of America, myang@fsu.edu, Sida Luo, Richard Liang, Michael Moench, Brian Wiesner, Arda Vanli

A multistage quality monitoring approach is proposed to achieve reproducible and repeatable buckypaper manufacturing with the aid of UV-vis-NIR spectroscopy and Dynamic Light Scattering (DLS) techniques to quantify dispersion quality of high concentration CNT suspensions. Process variables in different stages are specified and studied through in-situ suspension characterization, design of experiments statistical modeling and process control techniques.

2 - Setting Quality Control Requirements to Balance Cycle Time and Yield

Miri Gilenson, Technion - Israel Institute of Technology, Industrial Engineering and Management, Technion City, Haifa, 3200003, Israel, miray.g@gmail.com, Michael Hassoun, Liron Yedidsion

The design of quality monitoring operations has direct impact on cycle time and yield. A major design factor of these operations is the control limits, traditionally set by yield requirements. To challenge this concept, we develop a bi-criteria trade-off formulation between yield and cycle time in a system monitored by inspection stations, where the control limits are decision variables. Our model enables decision makers to knowingly sacrifice yield to shorten cycle time and vice versa.

3 - The Supply Chain Construct Imbedded within the Malcolm Baldridge National Quality Award

Xianghui Peng, University of North Texas, 1155 Union Circle #311396, Denton, TX, 76203, United States of America, xianghui.peng@unt.edu, Victor Prybutok

In this research, we examine the conceptual framework of the Malcolm Baldridge National Quality Award (MBNQA) and the items associated with supply chain issues. This examination resulted in the positing of a restructured MBNQA model that includes and emphasizes the supply chain construct.

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4 - Managing Service Delivery Contracts
> Ray Strong, Research Staff Member, IBM,
> Almaden Research Center, 650 Harry Rd, San Jose, CA, 95120,
> United States of America, hrstrong@us.ibm.com

We describe how to convert the business process for worldwide delivery of long
term service contracts into a comparative management technique using historical
financial data.

■ WA52

Hilton- Sutter B

Optimization, Heuristic

Contributed Session

Chair: Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road,
Suite 260, Maitland, FL, 32751, United States of America,
mhirsch@iseatek.com

1 - Information Workflow Optimization with Bandwidth Constraints
> Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road,
> Suite 260, Maitland, FL, 32751, United States of America,
> mhirsch@iseatek.com, Hector Ortiz-Pena

Workflow management systems allow for visibility, control, and automation of
some of the business processes. Recently, nonbusiness domains have taken an
interest in the management of workflows. In this research we have developed a
rigorous mathematical programming formulation of the information workflow
optimization problem, incorporating bandwidth constraints. Multiple heuristics
have been developed to solve this problem, and results will be presented.

2 - Heuristic Approach to Navigation Dredge Scheduling
> Furkan Oztanriseven, University of Arkansas, BELL Engineering
> Center, Office #4207, Fayetteville, AR, 72701, United States of
> America, foztanri@uark.edu, Heather Nachtmann, Edward Pohl,
> Ridvan Gedik

Dredging operations are necessary to maintain the navigation channels within the
U.S. maritime transportation system. Due to budget limitations, equipment
availability, and environmental restricted periods, there is a need for system-level
dredge project scheduling and vessel assignment. We present a simulated
annealing-based heuristic approach to this problem.

3 - A Parallel Heuristic Solution to the Quadratic Assignment Problem
> Clara Novoa, Associate Professor, Texas State University, 601
> University Dr, San Marcos, TX, 78666, United States of America,
> cn17@txstate.edu, Apan Qasem, Abhilash Chaparala

We solve a Quadratic Assignment Problem by developing a parallel 2-opt heuristic
that runs in the Graphical Processing Unit (GPU). We fine tune the thread block
configuration and exploit inter-thread data locality through improved shared
memory allocation. We experiment with 17 QAPLIB data sets. Our algorithm on
average, outperforms an OpenMP implementation by a factor of 16.31. Algorithm
accuracy is satisfactory. It is contrasted to a Tabu search GPU implementation
performed by other authors.

4 - Unitload Warehouse Control: A Time Based Approach for Routing
> Nadeepa Wickramage, Graduate Student, Clemson University,
> 110 Freeman Hall, Clemson, SC, 29631, United States of America,
> nwickra@g.clemson.edu, William Ferrell Jr.

Most unitload containers are capable of being stacked on each other. We explore
the ability to improve the efficiency of storing and picking unit-load operations in a
warehouse by stacking containers. A time-based approach is used to generate pick
and store routes that minimizes total routing and handling time. For warehouses
that have millions of trips per year, the multiplicative effect of small time saving in
each trip can have a dramatic cumulative effect on the cost savings.

**5 - Concurrent Generation of Feasible Integer Solutions using
Random Walks**
> Utku Koc, Post Doctoral Fellow, Northwestern University, 2145
> Sheridan Rd, Industrial Engineering and Mgmt Sciences, Evanston,
> IL, United States of America, utkukoc@northwestern.edu,
> Sanjay Mehrotra, Kuo-Ling Huang

We present an approach to parallelize generation of feasible solutions for mixed
integer linear programs. The approach runs multiple feasibility pump instances
concurrently, with different starting solutions generated by random walks, and
allowing them to share information. Computational results suggest that the
improvement resulting from parallelization is statistically significant. The heuristic
starting from vertices generated by random walk points outperforms other
heuristics tested.

■ WA53

Hilton- Taylor A

Finance, Financial Engineering 1

Contributed Session

Chair: Joongyeub Yeo, PhD Student, Institute for Computational and
Mathematical Engineering, Stanford University, 88 Hulme Court, Apt
107, Stanford, CA, 94305, United States of America,
yeo@stanford.edu

1 - Regime Change in Dynamic Correlation Matrices of Financial Data
> Joongyeub Yeo, PhD Student, Institute for Computational and
> Mathematical Engineering, Stanford University, 88 Hulme Court,
> Apt 107, Stanford, CA, 94305, United States of America,
> yeo@stanford.edu

We propose a new computational method to estimate the correlation structure of
high-dimensional financial data. We use free random variable techniques and
minimize the spectral distance between the theoretical and empirical spectral
density. The comparison between the estimated parameters and the mean-
reversion time from an Ornstein-Uhlenbeck model give consistent results for
regime changes in residuals. We discuss applications in algorithmic trading. Joint
work with George Papanicolaou.

2 - Limit Order Books with Stochastic Market Depth
> Ningyuan Chen, Columbia University, 321 S. W. Mudd Building,
> 500 W. 120th Street, NEW YORK, NY, 100275811, United States of
> America, nc2462@columbia.edu, Steven Kou, Chun Wang

We propose a model for limit order books with stochastic market depth, consistent
with empirical studies. To show the analytical tractability of the model, in addition
to a dynamic programming formulation of the optimal execution problem, we
provide easily computable and tight upper and lower bounds for the optimal
execution cost, as well as their resulting trading strategies via quadratic
programming and jump-linear-quadratic control.

**3 - Investment Decisions and Debt Priority Structure:
Straight Debt and Convertible Debt**
> Kyoko Yagi, Akita Prefectural University, 84-4 Ebinokuchi,
> Tsuchiya, Honjo, Akita, 015-0055, Japan, yagi@akita-pu.ac.jp,
> Ryuta Takashima

In this paper we consider an investment problem of a firm with outstanding
straight debt. The firm finances the investment cost with convertible debt. We
explore the interaction between financing and investment decision. Furthermore,
we discuss the effect of the debt priority structure on the agency cost of debt and
the some consistencies of results in our theoretical model with empirical evidences.

4 - Perpetual Game Call Options with Jumps
> Atsuo Suzuki, Meijo University, Nijigaoka 4-3-3, Kani, Gifu, Japan,
> atsuo@urban.meijo-u.ac.jp, Katsushige Sawaki

In this paper, we deal with perpetual game call options with jumps. Game option is
a contact that the seller and the buyer have the rights to cancel and to exercise it at
any time, respectively. We give the optimal boundaries for the seller and buyer and
present the value function of perpetual game call option with jumps. The pricing of
this option can be formulated as a coupled optimal stopping problem which is
analyzed as Dynkin game.

5 - On the Impulse Control Problem with Outside Jumps
> Makoto Goto, Hokkaido University, Kita 9, Nishi 7, Kita-ku,
> Sapporo, Japan, goto@econ.hokudai.ac.jp

In this paper, we study the impulse control problem with oudside jumps. As
represented by (s,S) policies, impulse control problems usually have inside jumps.
Namely, when the inventory level goes down and hits a threshold, it jumps up by
the order placement. However, in terms of capacity choice problems, firms should
install additional capacities when the demand is increasing. That is, the impulse
control problem we consider has outside jumps, which is hard to solve through
usual approaches.

■ WA54

Hilton- Taylor B

Behavioral Portfolio Selection and Asset Pricing

Sponsor: Financial Services Section

Sponsored Session

Chair: Xuedong He, Assistant Professor, Columbia University, 316 Mudd, 500 W. 120th street, New York, NY, 10027, United States of America, xh2140@columbia.edu

1 - Equilibrium Asset Pricing with Rational and Irrational Investors
Jing Guo, Columbia University, 500 W 122nd Street, Apt. 1E, New York, NY, 10027, United States of America, jg3222@columbia.edu, Xuedong He

We study multi-period asset pricing with rational and irrational investor. The rational investor maximizes log utility and the irrational has additional cumulative-prospect-theory utility. We prove the existence and uniqueness of equilibrium price. We derive a stock performance measure and show that irrational investor invests less if and only if his loss-aversion degree is higher than the measure. We show the market dominance of rational investor. We do numeric analysis for polynomial utility.

2 - A Processing-Consistent Non-Bayesian Inference Model
Di Xiao, Columbia University, United States of America, dx2125@columbia.edu, Xuedong He

We consider a generic dynamic inference model, which is a generalization of the Bayesian model by applying distortion on the prior density and replacing likelihood with quasi-likelihood. We show this model is processing consistent, i.e., the posterior density resulting from this model does not depend on how the samples are grouped and processed, if and only if there is no distortion on the prior density at any time except for the initial time and the quasi-likelihood satisfies a product rule.

3 - Sensitivity Analysis of Nonlinear Behavior with Distorted Probability
Xiangwei Wan, Assistant Professor, Shanghai Jiao Tong University, RM108, 4 Building, 535 Fahuazhen Road, Shanghai, 200052, China, xwwan@sjtu.edu.cn, Xi-Ren Cao

We propose a sensitivity-based analysis to study portfolio selection problem under non-expected utility with probability distortions. For the complete markets case, the first-order condition is derived and optimal wealth deduced. For the incomplete markets case, a dual characterization of optimal policies is provided; a solvable incomplete market example with unhedgeable interest rate risk is also presented.

4 - Self-control in Time Inconsistent Decision Making via Commitment by Punishment
Duan Li, Professor, The Chinese University of Hong Kong, Dept. of Syst. Eng. & Eng. Manag., Shatin, Hong Kong - PRC, dli@se.cuhk.edu.hk, Xiangyu Cui, Yun Shi

To cope with time inconsistent dynamic decision problems, we develop a planner-doer two-tier game model with self-control, where planner and doers represent different facets of the same decision maker at different time instants and the planner can manipulate the decisions of the doers through commitment by punishment. This strategy of self-control enables an optimal decision to attain a degree of coordination between inherently conflicting long- and short-term objectives.

■ WA55

Hilton- Van Ness

Industrial Applications of MINLP

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Claudia D'Ambrosio, CNRS & LIX, Ecole Polytechnique, Batiment A. Turing, Palaiseau CEDEX, 91128, France, dambrosio@lix.polytechnique.fr

1 - Short-term Hydro Scheduling and Unit Commitment with Head-Dependent Reservoirs
Raouia Taktak, LIX, Ecole Polytechnique, 91128 Palaiseau CEDEX, Palaiseau, France, taktak@lix.polytechnique.fr, Wim van Ackooij, Claudia D'Ambrosio, Claudio Gentile, Antonio Frangioni, Kostas Tavlaridis-Gyparakis

The problem we study consists in finding an optimal short-term scheduling of a multi-unit power stations in hydro valleys. The problem is extremely hard due to its strong non-linearity and its combinatorial constraints. Using an enhanced linearization technique, we model the problem as a MILP that takes into account the head effects on power production. We also devise an algorithm based on decomposition techniques and Lagrangian relaxation in order to solve real-world instances.

2 - Optimal Location of Smart Technologies within an Electrical Distribution Network
Sonia Toubaline, LIX - Ecole Polytechnique, 91128 Plaiseau Cedex, Palaiseau, France, s.toubaline@gmail.com, Pierre-Louis Poirion, Leo Liberti, Claudia D'Ambrosio

Reporting from the SO-grid project: we discuss a mixed-combinatorial optimization problem occurring in running smart grids, i.e. the optimal positioning of electrical equipment on a power distribution network, some algorithmic ideas, and preliminary computational results.

3 - A Robust Optimal Placement of Smart Technologies within an Electrical Distribution Network
Pierre-Louis Poirion, LIX - Polytechnique, LIX - UMR 7161 Ecole Polytechnique, 91128 Palaiseau, France, Pierre-Louis.Poirion@ensta-paristech.fr, Leo Liberti, Sonia Toubaline, Claudia D'Ambrosio

Reporting from the SO-grid project: we continue Dr. Toubaline's presentation by discussing aspects related to solution robustness for a localization problem in a power distribution network. We will present a mathematical model which takes into account uncertainties in the demand and production of electricity, and some algorithmic ideas to solve the problem.

■ WA56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Cogentus - Smart Decisions End-to-End Problem Solving
Ian Seed, Vice President, Cogentus LLC, Washington, DC, United States of America, iseed@cogentus.co.uk

The presentation will explain how Smart Decisions can benefit organizations by enhancing a systematic approach to problem solving. Each step in the framework and some of the tools available in the software will be demonstrated. Attendees will be able to see the value added of this end-to-end approach, how the software aids each step, how it can speed up the overall process dramatically without compromising quality and how it works in a collaborative environment.

■ WA57

Hilton- Golden Gate 1

Teaching Sustainability

Sponsor: INFORM-ED

Sponsored Session

Chair: Michael Racer, Assistant Professor, University of Memphis, 334 Fogelman, Memphis, Te, 38135, United States of America, mracer@memphis.edu

1 - Georgia Tech's Quality Enhancement Plan: Community, Sustainability, Service Learning
Beril Toktay, Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, beril.toktay@scheller.gatech.edu, Ellen Zegura

As part of the 10-year reaffirmation of its accreditation, Georgia Tech has selected a Quality Enhancement Plan (QEP) for student learning that focuses on learning anchored in real-world sustainability problems and that emphasizes community engagement through service learning. This presentation will outline the high-level objectives and structure of the QEP.

2 - Useful Tools in Teaching Sustainability
Xu Yang, Assistant Professor, San Jose State University, Dept of Marketing and Decision Sciences, San Jose State University, San Jose, CA, United States of America, xu.yang@sjsu.edu

Topics can be included in the sustainability curricular need to be defined and discussed. Several tools were introduced in an undergraduate business logistics course (under the topic of sustainability). Examples include: EIO-LCA, "sourcemap", and EPA GHG Equivalencies Calculator. Students applied these tools in a course project and demonstrated the effectiveness of teaching/learning sustainability.

3 - Teaching Sustainable Operations to MBAs at Tepper
Alan Scheller-Wolf, Professor, Carnegie Mellon University, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

I will share some successes, failures, insights and lessons I have learned from teaching the MBA elective Sustainable Operations at Tepper.

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4 - Integrating Sustainability Concepts within a Traditional Operations Management Course
Ravi Subramanian, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree NW, Atlanta, GA, 30318, United States of America, ravi.subramanian@scheller.gatech.edu

This presentation will discuss how sustainability and ethics issues have been integrated within the core MBA-level Operations Management course offered at the Scheller College of Business at Georgia Tech. This curriculum development was supported by the Rich Foundation.

■ **WA58**

Hilton- Golden Gate 2

Scheduling II

Contributed Session

Chair: Seyedehfarzaneh Nojabaei, PhD Candidate/Researcher, University of Toledo, 2255 University Hills Apt,# F206, Toledo, 43606, United States of America, farzanehn25@gmail.com

1 - Optimizing of Efficiency Supply Chain System via Development of Priority Oriented Scheduling Method
Seyedehfarzaneh Nojabaei, PhD Candidate/Researcher, University of Toledo, 2255 University Hills Apt,# F206, Toledo, 43606, United States of America, farzanehn25@gmail.com, Matthew Franchetti

Optimization of supply chain is becoming a pivotal aspect for each manufacturing system and scheduling plays a crucial role in sustaining it. The applicability of distributed computing to coordinate and execute jobs has been investigated in the past literature. Moreover, it is ostensible that even for sensitive industrial systems the only criterion of allocating jobs to appropriate machines is based on the FIFO policy. On the other flip, many researchers are of the opinion that the main reason behind failing to provide fairness in distributed systems is considering the only criterion of time stamp to judge upon and form the queue of jobs with the aim of allocating those jobs to the machines. In order to increase the efficiency of supply chain in industrial system, this paper takes into consideration of three criteria of each job including priority, time action and time stamp. The methodology adopted by this paper is definition of job scheduler and positioning jobs in temporary queue and sorting via developing bubble sort. In sorting algorithm criterion of priority, time action should be considered besides time stamp to recognize the tense jobs for processing earlier. To evaluate this algorithm first a numerical test case (simulation) is programmed and then the case study performing in order to optimize supply chain efficiency in real manufacturing system. Eventually the results of this study provided evidence on that the rate of supply chain efficiency is increased.

2 - Major Systems Acquisition Planning as a Resource-Constrained Project Scheduling Problem (RCPSP)
Roger Burk, Associate Professor, US Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, Roger.Burk@usma.edu, Abram Gross

The US Army has been exploring how to formulate its long-range acquisition plan as a variation of the RCPSP and using a heuristic to quickly build schedules based on system priority. We show how this procedure can save both time and money, which making the long-range planning process quicker, more accurate, and easier.

3 - Job Shop Scheduling with Machine Breakdowns by using Risk Assessment
Shudong Sun, Professor, Northwestern Polytechnical University, No.127 West Youyi RD, Xi'an, 710072, China, sdsun@nwpu.edu.cn

The paper considers makespan and risk assessment simultaneously. Risk assessment is determined by the expected value of the difference between the deterministic and actual makespans. The probability models of the occurrence and degree of machine breakdowns are constructed. A risk assessment model of machine breakdowns is set up. A schedule with a better efficiency and robustness is finded. Simulation results shown that the proposed method has good performance and robustness.

4 - Single Machine Scheduling under Availability Constraints
Mohamed Labidi, Assistant Professor, King Saud University, King Abdallah Road, Riyadh, Saudi Arabia, mlabidi@ksu.edu.sa, Anis Gharbi, Mohamed Haouari

We investigate the one machine problem under availability constraints.It arises in the context of machine scheduling with planned preventive maintenance.A new lower bound based on the concept of semi-preempton is proposed (SPLB) and an exact algorithm that requires solving a sequence of one-machine problems without availability constraints is developed.Experiments show that the SPLB is very tight and that our algorithm consistently delivers optimal solution for big instances with short CPU times.

■ **WA59**

Hilton- Golden Gate 3

Inventory Management V

Contributed Session

Chair: Emre Berk, Professor, Bilkent University, Department of Management,, Bilkent University, Central Campus, Ankara, 06800, Turkey, eberk@bilkent.edu.tr

1 - Optimal Policies for a Dual-Sourcing Inventory Problem with Stochastic Leadtimes
Li Xiao, National University of Singapore, BIZ 2 Building,Basement B2-03, 1 Business Link, NUS Business School, singapore, Singapore, lixiao@nus.edu.sg, Hanqin Zhang, Paul Zipkin, Jing-Sheng Song

We consider a single-product dual-source system. The normal supply system consists of a two-stage tandem queue with finite capacity. However, we can expedite an order by skipping the first stage of the supply process with a fee. We characterize the optimal ordering policy that minimizes the discounted system cost.

2 - Leadtime Backordering in Multiechelon Systems: A Simulation Assessment
Emre Berk, Professor, Bilkent University, Department of Management,, Bilkent University, Central Campus, Ankara, 06800, Turkey, eberk@bilkent.edu.tr, Ozgur Toy

We study via simulation divergent two-echelon inventory systems in the presence of Poisson demands and lead time dependent backordering. Based on a large experimental set, we investigate the sensitivity of the policy parameters and system structures, impact of information content and its managerial implications, and dynamic assignment policies.

3 - Net Effect of Batching on the Expected on-hand Stock in (r,q) Policies with Fixed Service Level
Agustin Bompadre, SAP Labs, LLC, 1251 Waterfront Place, Third Floor, Pittsburgh, PA, 15222-4212, United States of America, abompadr@gmail.com

In Reorder-Point/Order-Quantity policies with fixed service level target, the effect of the batch size on the expected on-hand stock is twofold. On the one hand, it increases the on-hand stock by creating cycle stock. On the other hand, because of the presence of the cycle stock, there is less need of safety stock. We show that, under certain conditions, increasing the batch size never decreases the expected on-hand stock.

4 - Segmentation Methods for Large-Scale Service Parts Performance Based Logistics Systems
Alireza Sheikhzadeh, Graduate Student, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, 72701, United States of America, asheikhz@uark.edu, Manuel Rossetti

Performance based logistic (PBL) is a new generation of after-sale repair, maintenance and spare part provisioning contracts. The purpose of this research is to create, analyze new methods that can significantly improve the management of service parts systems within the context of performance based logistics. Innovative approaches that significantly reduce the size and complexity of problems through the use of inventory segmentation methods.

5 - Integrated Optimization of Safety Stock and Transportation Capacit
Horst Tempelmeier, Professor, University of Cologne, Albertus Magnus-Platz, Koeln, 50923, Germany, tempelmeier@wiso.uni-koeln.de, Oliver Bantel

We consider an inventory and a transportation system facing random demands. A given in-house transportation capacity can be extended by costly external transportation capacity. We show that stock-outs introduce volatility in the workload of the transportation system. Geunes and Zeng 2001 have shown for a base-stock system, that backordering decreases the variability of transportation orders. We show that in inventory systems with order cycles longer than one period the opposite is true.

■ WA60

Hilton- Golden Gate 4

Inventory Management IV

Contributed Session

Chair: Atri Mahapatra, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, mahap010@umn.edu

1 - A Hybrid Joint Replenishment Policy for A Stochastic Inventory System with Lost Sales

Ulku Gurler, Professor, Bilkent University, Department of Industrial Engineering,, Bilkent University, Central Campus, Ankara, 06800, Turkey, ulku@bilkent.edu.tr, Emre Berk, deniz yenigun

We consider a stochastic inventory problem with multiple products and negligible lead times under a hybrid periodic review joint replenishment policy, where the unsatisfied demand is lost. The proposed control policy classifies the items into two sets - a leader set and a follower set - and employs two separate control policies for each set conjunctively. We derive the operating characteristics and provide numerical results.

2 - Inventory Optimization for the U.S. Navy

Javier Salmeron, Associate Professor, Naval Postgraduate School, Operations Research Dept., Glasgow Hall, Monterey, CA, 93943, United States of America, jsalmero@nps.edu, Emily Craparo

We present a mixed-integer linear optimization model designed to guide wholesale inventory decisions for the Naval Supply Systems Command (NAVSUP), Weapons Systems Support. Optimal reorder points minimize deviations from target fill rates for tens of thousands of repairable and consumable items while modeling demand uncertainty and budget constraints. We solve the problem using Lagrangian relaxation and compare our results with those of other tools used by NAVSUP.

3 - A Risk-averse Inventory Model with Fluctuating Purchasing Costs

Sungyong Choi, Assistant Professor, Yonsei University, 1 Yonseidae-gil, Wonju, 220-710, Korea, Republic of, sungyongchoi@gmail.com

I study a dynamic risk-averse inventory model using additive utility functions. I also assume Markovian behavior of purchasing costs. For finite-time models, I first prove (joint) concavity of the model for each state and obtain a (modified) base-stock optimal policy. Then, I conduct comparative static analysis for model parameters and derive monotone properties to the optimal solutions. For infinite-time models as a limiting case, I show that stationary base-stock optimal policies exist.

4 - Inventory Control for Spectrally Positive Levy Demand Processes

Kazutoshi Yamazaki, Associate Professor, Kansai University, Faculty of Engineering Science, 3-3-35 Yamate-cho, Suita, 606-8354, Japan, kyamazak@kansai-u.ac.jp

We revisit the single item continuous-time inventory model. In the same problem setting as in Bensoussan et al. (2005), we show the optimality of an (s,S)-policy for a general spectrally positive Levy demand process. Using the fluctuation theory of spectrally one-sided Levy processes, we express the value function analytically using the scale function. The case with no fixed ordering costs is also studied.

5 - Ordering Problem with Updated Demand Forecast and Quantity Constraints

Meimei Zheng, PhD Student, Nanyang Technological University, #0544, Jurong West Avenue 5, blk 19, Singapore, 649492, Singapore, meimeizheng2009@gmail.com, Kan Wu

When facing highly uncertain demand, a retailer can utilize an emergency order to enhance his responsiveness. However, the emergency ordering quantity is constrained due to the short lead time. This study analyzes a two-stage system with regular and emergency orders under demand forecast updating and quantity constraints. Through dynamic programming, the optimal ordering policy is obtained, and the properties of the optimal solutions are derived. Some insights are gained from numerical results.

■ WA61

Hilton- Golden Gate 5

Organization Theory 1

Contributed Session

Chair: Zhehui Xiao, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, China, zhehuixiao@gmail.com

1 - The Role of Entrepreneurial Leadership in New Ventures

Shenglan Huang, University of Science and Technology of China, School of Management, Hefei, 230026, China, Huangsl@mail.ustc.edu.cn

The literature has called for more research on entrepreneurial leadership. However, few studies has investigated entrepreneurial leadership in entrepreneurial context. This paper will explore the influence mechanisms of entreprenrial leadership on new venture performance.

2 - Cross-Functional Integration, Organizational Transactive Memory Systems and Performance

Diogo Cotta, PhD Candidate, IE Business School, Calle Maria de Molina, 12, bajo, PhD office, Madrid, 28005, Spain, dcotta.phd2015@student.ie.edu, Fabrizio Salvador

How do firms integrate organizationally dispersed knowledge? This research shows that firms facing high levels of cross-functional interdependence manifest the operation of distinct Transactive Memory Systems acting as integration devices in the execution of different organizational routines. However, contrary to what is posited by both TMS and integration literature, the research finds evidence that the concurrent deployment of several TMSs may have detrimental effects on performance.

3 - A Conceptual Framework of Talent Management in Virtual Organization

Muhammad Yasir, Assistant Professor, Hazara University Mansehra, Department of Management Sciences,, Hazara University Mansehra, Mansehra, 21300, Pakistan, Abdul Majid, Philip Johnson

In this paper we have developed a conceptual framework for talent management (TM) in virtual organization (VO) which explains that process of TM must be performed at three levels i.e. individual-level; organization-level; and extra-organization level for outsourced operations. We argue that VOs require special emphasis on the development of media and social talent to maintain effective communication and collaboration. We conclude that effective TM strategies could improve the performance of VOs.

■ WA62

Hilton- Plaza A

Applied Probability 1

Contributed Session

Chair: Harsha Honnappa, University of Southern California, 3740 McClintock Ave, Los Angeles, CA, 90089, United States of America, honnappa@usc.edu

1 - Assessing the Additional Information Obtained by an Ultrasound Following a Mammogram in BCS Problem

Sait Tunc, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, stunc@wisc.edu, Oguzhan Alagoz, Elizabeth Burnside

We construct an information-theoretic framework to assess the additional information obtained by an ultrasound following a mammogram in Breast Cancer Screening (BCS) problem to understand ultrasound recommendation. We provide a new information function, a modified version of Shannon's mutual information and determine the relation between this function and BCS performance measures like false positive rate with the assumption that screening decisions are described by a linear regression function.

2 - Generalized Empirical Process Limits

Harsha Honnappa, University of Southern California, 3740 McClintock Ave, Los Angeles, CA, 90089, United States of America, honnappa@usc.edu

We develop generalizations of the well known Glivenko-Cantelli and Donsker's Theorems in empirical process theory, where in samples are non-i.i.d. By using the notion of a random distribution function (Dubins and Freedman 1963), we provide constructive proofs of the limit theorems. These results have interesting implications for mean field theory in games and queues, that we discuss in detail.

3 - Optimal Maintenance Policy for the Repairable System under Warranty

Minjae Park, Hongik University, 72-1 Sangsu-dong Mapo-gu, Seoul, Korea, Republic of, mjpark@hongik.ac.kr, Ki Mun Jung, Dong Ho Park

The effects of renewable free-replacement warranty are investigated on the classical age replacement policy for a repairable product with an increasing failure rate. The expected cost rates are developed for two cases: when the preventive replacement age occurs before or after the warranty expires. The optimal replacement ages that minimized the cost rates are determined and the impact of a warranty on the optimal replacement age is illustrated with a numerical example.

WA63

INFORMS San Francisco – 2014

4 - A General Intuitive Design Pattern for Optimally Sequencing Treatment Combinations in 2^k DOE

H,-S. Jacob Tsao, Professor, San Jose State University, 1 Washington Square, Industrial & Systems Engineering Dept., San Jose, CA, 95192-0085, United States of America, jacob.tsao@sjsu.edu, Minnie Patel

Parameter count of a 2^k experiment grows exponentially. Conventional methods seek a fractional/partial design that best fits the problem. Necessary number of treatment combinations (TCs) for estimability of significant parameters is often exceeded; confounding often results. Given a parameter sequence in decreasing significance, we propose a general design pattern to produce a corresponding sequence of TCs for estimability of significant parameters with least TCs and without confounding.

5 - Evaluating the Performance of Various Control Charts for Short Production Runs

Ioannis Nikolaidis, Assistant Professor, University of Macedonia, Applied Informatics Department, Egnatia 156, Thessaloniki, 54636, Greece, nikolai@uom.gr, Mingyuan Chen

In aerospace manufacturing the application of SPC tools is challenging because usually these processes produce large size items with slow production rates. Consequently there cannot be the Phase I period when control chart parameters are estimated. In this paper several types of control charts for self-starting production runs are evaluated using simulation, such as simple, CUSUM and EWMA X and Q charts, with various control limit and parameter (e.g. K for CUSUM, ? for EWMA etc.) values.

■ WA63

Hilton- Plaza B

Dynamic Programming/ Control 1

Contributed Session

Chair: Marek Petrik, IBM, 1101 Kitchawan Rd, Yorktown, NY, United States of America, mpetrik@us.ibm.com

1 - Dynamic Information Acquisition for Emissions Control

Viet Anh Nguyen, Ecole Polytechnique Federale de Lausanne, EPFL CDM MTEI OES, Odyssea, Station 5, Lausanne, 1015, Switzerland, viet-anh.nguyen@epfl.ch, Thomas Weber

To implement emissions-reduction targets, regulators can impose state-contingent taxes. At each time period, policy makers obtain a current estimate of the pollution state and decide whether to acquire costly information of a chosen precision. We show that information collection is optimal whenever the current state-variance estimate is above a threshold and provide analytical results for the value function. We also provide optimality conditions when information collection involves fixed cost.

2 - Approximate Dynamic Programming for Lateral Transshipment Problem in Multilocation Inventory Systems

Olga Rusyaeva, Kuehne Logistics University, Grofler Grasbrook 17, Hamburg, Germany, olga.rusyaeva@the-klu.org, Joern Meissner

To fix the mismatch between actual customer demand and the available stock in multiple locations, companies often turn to lateral transshipments. We introduce a transshipment policy that answers questions ñ when, how much, and from which location to transship in advance to maximize the revenue of the network and to avoid stock outs. For high-dimensional instances, we develop a heuristic that constructs a concave piecewise-linear approximation and updates it using stochastic sample gradients.

3 - Using ANN in Approximate Dynamic Programming for Controlling Complex Production Systems

Han Wu, Student, University of Louisville, 2301 S 3rd St, Louisville, KY, 40294, United States of America, h0wu0009@louisville.edu, Gerald Evans

Development of efficient production and inventory control policies for complex and dynamic production systems is very difficult. The uncertain demands and large changeover times at the work stations cause significant problems. In this research, an Artificial Neural Network (ANN) model is embedded in approximate dynamic programming algorithm to approximate the state value of the system and look for a better production and inventory control policy for a dishwasher wire rack production system.

4 - New Cuts for Unbounded Knapsack Problem with Dynamic Programming

Xueqi He, University of Florida, 3800 SW 34th St, Apt. P138, Gainesville, FL, 32608, United States of America, xueqihe@gmail.com

We present a new cut-and-branch approach for solving the unbounded knapsack problem, where valid inequalities are generated for an integer programming formulation based on intermediate solutions of an equivalent dynamic programming formulation. These inequalities provide more accurate description for the feasible region defined in the equivalent integer programming formulation, and therefore improve the computational efficiency.

5 - Approximate Dynamic Programming by Robust Markov Decision Processes

Marek Petrik, IBM, 1101 Kitchawan Rd, Yorktown, NY, United States of America, mpetrik@us.ibm.com

State aggregation is one of the simplest forms of value function approximation for solving large Markov decision processes (MDPs). A major improvement in approximation error bounds can be achieved if aggregation weights are based on the limiting state occupancy distribution. However the the state occupancy distribution is not known apriori. In this paper, we show that the same error bounds can be achieved when robust Markov decision processes are used for the approximation.

■ WA64

Parc- Cyril Magnin I

Flexibility, Inventory and Resource Pooling

Sponsor: Applied Probability Society

Sponsored Session

Chair: Yehua Wei, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, yehua.wei@duke.edu

1 - Retailing with Opaque Products

Adam Elmachtoub, Ph.D. Candidate, MIT, 77 Mass. Ave., Cambridge, MA, 02139, United States of America, adamelmachtoub@gmail.com, Yehua Wei

A product is said to be opaque when the customer only knows what they have purchased after the transaction is complete. Opaque products have been used in the hotel industry where customers purchase rooms without knowing the brand name. Here we propose the use of opaque products in the retail industry, where there are nonperishable goods and supply chain costs. We show that a small amount of opaque selling can achieve significant ordering and holding costs savings for the supply chain.

2 - Optimal Sparse Designs for Process Flexibility via Probabilistic Expanders

Yuan Zhou, Carnegie mellon University, 5840 Alderson Street, Apt 1, Pittsburgh, PA, 15217, United States of America, yuanzhou@cs.cmu.edu, Xi Chen, Jiawei Zhang

We study the problem of designing a sparse flexible process structure in a balanced and symmetrical production system to match supply with random demand more effectively. By introducing a new concept called probabilistic graph expanders, we provide an optimal design, i.e., the sparsest design, to achieve (1-eps)-optimality relative to the fully flexible system, improving the previous result by Chou et al. We also show the analysis for chaining systems by Wang and Zhang is asymptotically tight.

3 - Optimality Gap of Constant-order Policies Decays Exponentially in the Leadtime for Lost Sales Models

Linwei Xin, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, lwxin@gatech.edu, David A. Goldberg

Recently, Goldberg et al. (2012) laid the foundations for a new approach to solving lost sales inventory models with lead times, by proving as the lead time grows large, a simple constant-order policy is asymptotically optimal. However, the bounds proven there are impractical. In this work, we prove that the optimality gap of the same constant-order policy actually converges exponentially fast to zero. We also derive explicit bounds which make the result practical for realistic lead time values.

4 - Inventory Allocation: Analysis of Myopic Policies under Sparse Preferences

Arash Asadpour, NYU Stern, New York, NY, United States of America, aasadpou@stern.nyu.edu, Jiawei Zhang, Xuan Wang

We study the effect of consumer substitution behavior on the performance of inventory policies. In particular, we investigate the number of stock-outs under a simple myopic offline policy. We show that even with sparse, local, and deterministic customers' preferences, the total number of stock-outs only depends on the number of variants in the choice model — and not the size of the market. We will provide experimental results that suggest a similar effect under myopic online policies.

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■ WA65

Parc- Cyril Magnin II

Learning in Stochastic Systems

Sponsor: Applied Probability Society

Sponsored Session

Chair: John Birge, Jerry W. and Carol Lee Levin Professor of Operations Management, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, john.birge@chicagobooth.edu

1 - Designing Selling Mechanisms to Learn and Earn

Bora Keskin, The University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu, John Birge

We consider a dynamic mechanism design problem in which a firm sells multiple products to a population of potential customers that are heterogeneous in terms of their price-sensitivity. We show how the firm should design a selling mechanism that can dynamically identify customers' price-sensitivities, and accumulate revenues in the optimal way.

2 - Learning by Competing: Dynamic Duopoly Pricing with Unknown Linear Demands

Matthew Stern, University of Chicago - Booth School of Business, 5807 S Woodlawn Ave, Chicago, 60637, United States of America, stern@chicagobooth.edu, John Birge

We consider the problem of dynamic pricing under uncertainty while competing against a rival product. Observing the prices in each period, as well as their own private demand realizations, firms compete for profits while learning the parameters of their linear demand curves. We examine pricing policies that balance the tradeoffs between actively learning the demand parameters, pricing to optimize current period rewards and favorably influencing the rival firm's future prices.

3 - Demand Model Estimation for a Competitive Airline Market

Xinchang Wang, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332-0205, United States of America, xwang336@gatech.edu, Anton Kleywegt

We describe various models of customer booking choices in a competitive airline market, and the estimation of the models with available data. The models are designed to capture several important aspects, such as customer sensitivity to price and change refund, and unobserved heterogeneous customer preferences for different departure times. We also compare the revenues obtained using the choice models in optimization problems with the actual revenue.

4 - A Leader-Follower Partially Observed Markov Game: Value of Information

Yanling Chang, Georgia Institute of Technology, North Avenue, Atlanta, GA, 30324, United States of America, changyanling@gatech.edu, Alan Erera, Chelsea White

We consider a partially observed Markov game involving two agents: a leader and a follower. The follower selects its policy knowing the leader's policy. Each agent inaccurately observes the other's state at each epoch. We investigate how the leader's criterion value changes due to changes in the leader's quality of observation of the follower.

5 - Fast Demand Learning for Ad Allocation

Vivek Farias, MIT, 100 Main Street, E62-566, Cambridge, MA, 02139, United States of America, vivekf@mit.edu, Dragos Florin Ciocan

This talk is motivated by Ad-Display type network RM problems, where each impression (demand) type is a vector in a high-dimensional user feature space. We show that such demand spaces can still be estimated efficiently with a sample complexity scaling polynomially in the feature dimension. We use importance sampling to construct a demand estimator that informs a simple near-optimal bid-price allocation policy.

■ WA66

Parc- Cyril Magnin III

Journal of Quality Technology Invited Session

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Bradley Jones, SAS/JMP, Bradley.Jones@jmp.com

1 - Some Current Directions in the Theory and Application of Statistical Process Monitoring

William Woodall, Virginia Tech, Blacksburg, VA, United States of America, bwoodall@vt.edu, Douglas Montgomery

The purpose of this talk is to provide an overview of recent research and applications of statistical process monitoring. The focus is on work done over the past decade or so. We review briefly a number of important areas and offer some ideas for further research.

2 - Bayesian Binomial Assurance Tests for System Reliability using Component Data

Brian Weaver, theguz@lanl.gov, H. F. Martz, Alyson Wilson, Randy Griffiths, Michael Hamada

This talk illustrates the development of Bayesian assurance test plans for system reliability assuming that binomial data will be collected on the system and that previous information is available from component testing. The posterior consumer's and producer's risks are used as the criteria for developing the test plan. Using the previous component information reduces the number of tests needed to achieve the same levels of risk. The proposed methodology is illustrated with examples.

■ WA67

Parc- Balboa

Gaussian Process and Spatial Data Analysis (I)

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Chia-Jung Chang, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, cchang@psu.edu

Co-Chair: Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, kbwang@tsinghua.edu.cn

1 - Manifold Learning and Visualization of Variation Sources in Dimensional Metrology Data

Daniel Apley, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States of America, apley@northwestern.edu, Zhenyu Shi, George Runger

Spatially dense dimensional metrology data (e.g., laser or machine vision) is prevalent in manufacturing quality control. Although fitting parametric features like circles and planes to individual parts is common, there has been little prior research on how to utilize the data to discover the nature of part-to-part variation patterns that are more nuanced than simple, premodeled parametric patterns. We propose the use of manifold learning techniques to extract and visualize such information.

2 - Control Charts for Spatial Data

Scott Grimshaw, Professor, Brigham Young University, Statistics Department, Provo, UT, 84602, United States of America, grimshaw@byu.edu

New technology provides the opportunity to obtain multiple measurements at different locations on the same unit. While the hope is that control charts using more measurements will be more sensitive to detecting flaws in local regions, the intuition is that measurements close together will be correlated. Multivariate SPC is extended to spatial data by modeling the covariance matrix with a semivariogram. The spatial control chart is illustrated with an application from bottle manufacturing.

3 - Approximating and Calibrating a Computer Model with Non-Gaussian Spatial Output

Murali Haran, Associate Professor, Statistics, 326 Thomas Building, University Park, PA, 16802, United States of America, mharan@stat.psu.edu, Won Chang, Patrick Applegate, Klaus Keller

Predicting the future behavior of the Greenland ice sheet is a difficult problem that involves combining output from a Greenland ice sheet model with observational data regarding the past and present state of the ice sheet. Emulation and calibration for the ice sheet model is challenging due to the nature and size of the spatial data and model output. I will describe a computationally expedient Gaussian process-based approach to address these challenges.

4 - Unaligned Profile Monitoring with Fused LASSO

Yangyang Zang, PhD Student, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, zangyy12@mails.tsinghua.edu.cn

It's common that the means of a profile change or shift from a change point. Under this practical assumption, we proposed a monitoring profiles method with the equal lengths. The profiles are firstly aligned by using the adaptive DTW. And then monitoring the GLRT statistic to the aligned curve, in which, the process mean is estimated by the fused LASSO algorithm. Both the simulation studies and a real example are used to demonstrate the effectiveness of the proposed monitoring procedure.

■ WA68

Parc- Davidson

Recent Advances in Stochastic Simulation

Sponsor: Simulation

Sponsored Session

Chair: Henry Lam, Boston University, 111 Cummington Mall, Boston, United States of America, khlam@bu.edu

1 - Ordinal Optimization and Pure Exploration Multi-armed Bandit Methods

Sandeep Juneja, Professor, Tata Institute of Fundamental Research, HB Road, Colaba, Mumbai, 400005, India, juneja@tifr.res.in, Peter Glynn

Consider finding a design amongst many with largest mean when means are unknown but design samples can be simulated. Typically, by selecting design with largest sample mean, false selection probability Pf decays exponentially. Lately researchers have sought algorithms to get guarantees on Pf by estimating its large dev rate function. We argue that such guarantees are misleading. We adapt methods from multi-armed bandit literature to devise algorithms with exponential decay guarantees on Pf.

2 - Rare-event Simulation for Stochastic Korteweg-de Vries (KdV) Equation

Jingchen Liu, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Gongjun Xu

We consider the dynamics of a soliton wave that is described by the stochastic Korteweg-de Vries Equation with homogeneous Dirichlet boundary conditions under a stochastic time-dependent force. The random force is modeled as a time-dependent Gaussian noise. The asymptotic approximation and an efficient rare-event simulation algorithm of the probabilities that the soliton wave exceeds a high-level is derived.

3 - Epsilon-Strong Simulation for Multidimensional SDEs via Rough Path Analysis

Jing Dong, Northwestern University, 2145 Sheridan Road, Evanston, 60208, United States of America, jdong028@gmail.com, Jose Blanchet, Xinyun Chen

Under standard regularity conditions for SDEs, we construct a probability space, supporting both the SDE and a piecewise constant, fully simulatable process which is within epsilon bound from the SDE with probability one. Our construction requires a detailed study of continuity estimates of the Ito map using Lyon's theory of Rough Paths. We approximate the underlying Brownian motion, jointly with the Levy areas with a deterministic error in the corresponding rough path metric.

4 - Sampling Rare Events of Random Walks with Regularly Varying Increments: A Dichotomy

Guido Lagos, Georgia Institute of Technolgy, 755 Ferst Drive NW Room 326, Atlanta, GA, 30332-0205, United States of America, glagos@gatech.edu, Ton Dieker

We consider the problem of sampling paths up to the maximum of a random walk and study the case where the step-sizes are regularly varying with parameter alpha. The threshold alpha=3/2 appears in several papers that develop the framework of Blanchet and Glynn (2008), and we reveal how it is connected to a sharp dichotomy related to the boundedness of the likelihood ratio. Our work has implications for Acceptance-Rejection type algorithms for sampling heavy-tailed random walks.

■ WA69

Parc- Fillmore

OR for the Developing World

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Carlos Abad, IEOR, Columbia University, 321 S. W. Mudd Building, 500 W 120th St, New York, NY, 10027, United States of America, ca2446@columbia.edu

1 - Macro-level Hybrid Energy Planning Model with Pumped Hydro Storage – India Case Study

A. Selin Kocaman, askocaman@gmail.com, Tim Huh, Vijay Modi

Fast depleting fossils fuels and their environmental hazards increase the importance of renewable sources for sustainable energy planning. However, renewable energy sources are intermittent and heavily dependent on spatial location. Here, we address the problem of modeling hydro and solar energy production and allocation, including pumped hydro storage. We examine the role of solar energy and high hydropower potential in Himalaya Mountains in meeting the growing electricity demand of India.

2 - Two-Stage Stochastic Model for Optimal Operation of Combined Wind-Pumped Storage System in Kenya

Maureen Murage, Graduate Student, Cornell University, 319 Riley Robb, Ithaca, United States of America, mwm88@cornell.edu, Gabriela Martinez, C. Lindsay Anderson

Wind power in Kenya will contribute approximately 17% of the total installed electricity capacity once the Lake Turkana Wind Power (LTWP) project is completed. High wind penetration may lead to curtailment of wind power, especially during surplus periods. Pairing of the wind farm with storage could mitigate this problem, and provide enhanced reliability. We therefore propose a two-stage stochastic model for the optimal operation of the LTWP coupled with pumped hydro storage system.

3 - Dynamic Power Allocation in Solar Micro-grids

Carlos Abad, IEOR, Columbia University, 321 S. W. Mudd Building, 500 W 120th St, New York, NY, 10027, United States of America, ca2446@columbia.edu, Garud Iyengar, Vijay Modi

Solar micro-grids are currently being deployed in Sub-Saharan Africa. These micro-grids service 10-20 customers, have a storage backup, and use very simple control algorithms. Customers are assigned constant power limits and daily energy limits and, whenever their consumption exceeds these values, they are shut off. The algorithm we propose dynamically sets the limits in order to maximize the profit of the operator while maintaining system reliability.

■ WA70

Parc- Hearst

Economics

Contributed Session

Chair: Indranil Chakraborty, Professor, National University of Singapore, Department of Economics, 1 Arts Link, AS2 #06-02, Singapore, 117570, Singapore, indro@nus.edu.sg

1 - Screening in Auctions with Risk Averse Bidders

Indranil Chakraborty, Professor, National University of Singapore, Department of Economics, 1 Arts Link, AS2 #06-02, Singapore, 117570, Singapore, indro@nus.edu.sg

Revenue-optimal IPV-auctions involve screen bidders via equivalent tools of reserve and bidding fee. This is inefficient. Not screening becomes optimal if the seller can charge an ex ante entry fee before bidders become privately informed. We show that when bidders are risk averse it is optimal for the seller to screen even if she can charge ex ante fee. Reserve price and bidding fees are also not equivalent for screening and which is better varies under first- and second-price rules.

2 - Sentiments, Systemic Risk and Financial Stability

Diego Feijer, Massachusetts Institute of Technology, 32 Vassar St. D758, Cambridge, MA, 02139, United States of America, feijer@mit.edu, Munther Dahleh

We study welfare of competitive equilibria in an economy with banks runs and costly fire sales, formalizing the importance of ''animal spirits'' for financial stability. Feedback between financial constraints and market prices results in a systemic externality not internalized by banks in the process of private money creation. Macroprudential policies that acommodate to fluctuations in market confidence can restore constrained efficiency.

3 - Optimal Government Debt Management: Currency Portfolio and Payments

Ricardo Huaman-Aguilar, PhD Student, University of Alberta, 632 Central Academic Building, Edmonton, AB, T6G 2G1, Canada, huamnagu@ualberta.ca, Abel Cadenillas

We develop a theoretical model for optimal currency government debt portfolio and debt payments, which allows both jumps in the exchange rates and aversion of the government to debt. We derive first a stochastic differential equation for public debt, and then solve explicitly the optimal currency debt problem. This is the first theoretical model that provides a rigorous explanation of why developing countries have reduced consistently their proportion of foreign debt in their portfolios.

■ WA71

Parc - Lombard

Ad Auctions

Cluster: Auctions

Invited Session

Chair: Eric Sodomka, Facebook, 1601 Willow Rd, Menlo Park, Ca, 94025, United States of America, eric.sodomka@gmail.com

1 - Partner-Tiering in Display Ads
  Anand Bhalgat, bhalgat@fb.com

In display ads delivery system, the ad allocation engine assigns ads to satisfy contracts between advertisers and publishers, at the same time, try to maximize the overall quality of assignment. The classical online-matching model of this problem misses an important aspect that a set of varying quality of publishers are presented by middle-man, and advertsiers prefer these publishers differently. We formulate this problem as a hierarchical online matching problem and study its properties.

2 - Lessons from Agent Design for the Online Advertising Trading Agent Competitions
  Elizabeth Hilliard, Brown University, Providence, RI, United States of America, betsy@cs.brown.edu

We present algorithms and analysis of bidding strategies for the two Trading Agent Competitions which simulate the two predominate methods of auctioning online advertisement impressions, keyword auctions and ad exchange bidding. Focusing on the optimization step of agent design for these two scenarios, we show how these problems can be modeled as a knapsack problem and weighted matching problem and then analyze the performance of classic and modified algorithmic solutions to these problems.

3 - Approximate Revenue Maximization in Interdependent Value Settings
  Hu Fu, Microsoft Research, Cambridge, MA, United States of America, hufu@microsoft.com

We study revenue maximization in settings where agents' values are interdependent: each agent receives a signal drawn from a correlated distribution and agents' values are functions of all of the signals. We introduce a variant of the generalized VCG auction with reserve prices and random admission, and show that this auction gives a constant approximation to the optimal expected revenue in matroid environments.

4 - Advertising in a Stream
  Samuel Ieong, Stanford University, Stanford, CA, United States of America, sieong@cs.stanford.edu

We formulate an optimization problem that captures how to place ads in a streaming setting, such as a news feed. We give an approximation algorithm that provably achieves a value close to the optimal, and show how this algorithm can be turned into an incentive compatible mechanism. We also give a simple practical algorithm that makes the allocation decisions in an online fashion. We prove this algorithm to be approximately welfare-maximizing and show that it also has good incentive properties.

■ WA72

Parc- Stockton

Energy V

Contributed Session

Chair: Alcides Santander-Mercado, Universidad del Norte, Km 5 Via Pto. Colombia, 8-44 K, Barranquilla, Colombia, asantand@uninorte.edu.co

1 - Bundle Methods for Convex Hull Pricing in Energy Markets
  Yu Zhang, University of Minnesota, 117 Pleasant St, SE, Room 450, Minneapolis, MN, 55455, United States of America, zhan1220@umn.edu, Georgios Giannakis

Leveraging dual variables associated with the supply-demand constraints of unit commitment problems, convex hull pricing (CHP) minimizes uplift payments. A dual decomposition based distributed approach is formulated for CHP with large-scale demand response in day-ahead energy markets. A convergence-guaranteed bundle method is also developed for solving the dual problem. Numerical results corroborate the improved convergence of the novel approach which results in reduced communication overhead.

2 - A Multiobjective Program with Equilibrium Constraints to Determine Volume Requirements for the RFS
  Sauleh Siddiqui, Assistant Professor, Johns Hopkins University, 3400 N Charles St, Baltimore, MD, 21218, United States of America, siddiqui@jhu.edu, Adam Christensen

The Renewable Fuel Standard (RFS) ensures that a minimum volume of renewable fuel is included in transportation fuel sold in the United States.

Determining the RFS volume requirements involves anticipating market reaction as well as balancing policy objectives. We present a multiobjective program with equilibrium constraints to model the biofuels market, with the upper-level giving policy choices of volume obligations for the RFS.

3 - Distributed Coordination of DERs in Imperfect Information Regimes
  Hesamoddin Ahmadi, Student, Penn State University, 107 Holderman Hall, University Park, PA, 16802, United States of America, hza108@psu.edu

We investigated the distributed management of distributed energy resources (DERs) in settings when cost functions or demand are unavailable but may be learnt by a distinct learning process. We develop distributed joint first order schemes in which optimization and learning is coupled. Preliminary numerics suggest the schemes perform well.

4 - Integration of Clean Energy Sources into a Power Grid using Optimal Control Theory
  Maryam Parsa, PhD Student, Purdue University, 550 Stadium Mall Dr., West Lafayette, IN, 47907, United States of America, mparsa@purdue.edu, Nasir Uddin Ahmed, Mustapha C.E. Yagoub, Srinivas Peeta

Pontryagin Minimum Principle of Optimal Control Theory is utilized to find the optimum strategy for integration of all currently available renewable energy sources into a power grid. The ultimate goal is to eliminate production from fossil fuels while minimizing the implementation costs. Dynamic Lotka-Volterra model represents the level of power generation from each energy source at any time. Official released data from the U.S. Energy Information Administration is used as a case study.

5 - A Bat-inspired Algorithm for the Solution of a Location and Sizing of Distributed Generation Units
  Alcides Santander-Mercado, Universidad del Norte, Km 5 Via Pto. Colombia, 8-44 K, Barranquilla, Colombia, asantand@uninorte.edu.co, John Candelo, Helman Hern·ndez

Location of distributed generation units for renewable energy has important technical and economic benefits for the performance of energy distribution systems. This research presents the development of a bat-inspired algorithm (BA) for the solution of a multiobjective problem, considering location and sizing, of distributed generation units for renewable energy and capacitors. The results show that BA obtains good solutions regarding the minimization of power loss as well as generation cost.

■ WA73

Parc- Mission I

Models and Algorithms for Renewable Energy Integration

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Neng Fan, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, United States of America, nfan@email.arizona.edu

1 - Production-Inventory Planning with Integration of Onsite and Grid Renewable Energy
  Mehdi Golari, Graduate Research Assistant, University of Arizona, Systems and Industrial Engineering Department, Tucson, AZ, 85719, United States of America, golari@email.arizona.edu, Tongdan Jin, Neng Fan

Recently a growing number of companies see low-carbon manufacturing as a new competitive edge in the global market and directly invest in onsite wind and solar technologies for powering their energy-intensive facilities. In this talk, we present a multistage stochastic optimization model to guide the manufacturers how to design and operate the production system under intermittent power as well as an efficient decomposition algorithm to tackle this problem.

2 - Limited Corrective Actions for the Security-constrained Optimal Power Flow Problem
  Dzung Phan, Reseach Staff Member, IBM Research, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, phandu@us.ibm.com, Andy Sun

We present a new model for the corrective security-constrained optimal power flow problem. The main purpose of our study is to reduce the number of corrective actions and run time by using sparse optimization techniques and an efficient decomposition algorithm.

3 - Two-Stage Robust Unit Commitment Considering Fast Generators
Bokan Chen, Iowa State University, 203 Campus Ave, Unit 4, Ames, IA, 50014, United States of America, bokanc@iastate.edu, Lizhi Wang

Robust optimization is a popular method for stochastic power system operation problems. In this project, we take fast-responding generators into consideration and present a new two-stage robust unit commitment model. The resulting trilevel optimization problem is decomposed into a master problem and a bilevel subproblem. To solve the bilevel mixed-integer subproblem, we also developed a new branch and cut algorithm, which is among the first algorithms to solve such problems.

4 - A Decision Dependent Power Generation Expansion Model with Wind Power
Yiduo Zhan, University of Central Florida, 4000 Central Florida Blvd, P.O. BOX 162993, Orlando, FL, 32816, United States of America, yzhan@knights.ucf.edu, Jianhui Wang, Qipeng Zheng

Decision dependent stochastic model has played an important role on expansion planning for wind power generation dealing with future uncertainty. Here we present a discrete choice model with non-fixed stochastic probability in the multi-stage stochastic model to provide decision dependent information to the decision makers.

■ WA74

Parc- Mission II

Advanced Algorithms for Power System Operations

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Anna Danandeh, University of South Florida, 4202 E Fowler Ave, Tampa, FL, United States of America, annadanandeh@mail.usf.edu

1 - Optimal Distributed Control of Power Systems
Ghazal Fazelnia, Columbia University, 120th St, New York, NY, 10027, United States of America, ghazal.fazelnia@gmail.com, Ramtin Madani, Abdulrahman Kalbat, Javad Lavaei

This talk studies the optimal distributed control of power systems. Since future power networks will have a large number of controllable distributed devices, the objective is to design an optimal distributed control to guarantee some global performance. We show that there is an effective convex relaxation for this NP-hard problem. The efficacy of our method will be demonstrated in several examples, including the frequency control of the New England system and optimal penetration of renewables.

2 - Coordinated Scheduling of Electric Vehicle Fleets and Wind Generation in Power Systems
Mohammad Khodayar, Assistant Professor, Southern Methodist University, 62, Dallas, TX, 75205, United States of America, mkhodayar@smu.edu

The increase in penetration level of variable wind energy resources affects the hourly schedule of thermal power generation in electricity markets and brings significant challenges in power system operation and control. The proposed approach for the coordinated operation of wind generation and charging/discharging scheduling of plug-in electric vehicle fleets mitigates the variability of the wind energy, decreases the operation cost, and reduces the spinning reserve capacity in power grids.

3 - Improved Formulations for the Unit Commitment Problem
Semih Atakan, PhD Student, University of Southern California, University Park Campus, Los Angeles, CA, 90089, United States of America, atakan@usc.edu, Guglielmo Lulli, Suvrajeet Sen

In this talk, we propose alternative formulations to the Unit Commitment problem that lead to significant time savings, when compared to the state-of-the-art formulations in the literature. We emphasize that these savings carry great potential for efficiently solving more sophisticated models, such as the ones that consider uncertainty in the problem parameters.

4 - Concentric Relaxations and Transmission Switching
Mike Hare, University of Tennessee, 525K John D. Tickle Building, 851 Neyland Drive, Knoxville, Tn, 37996, United States of America, mhare1@utk.edu, Jim Ostrowski, Jianhui Wang

Transmission switching (TS) alters the structure of an electrical network to reroute flow. For a large network, the problem becomes computationally difficult. To combat this problem, we use the fact that switching a line typically only affects the local neighborhood of that line. We use TS in the relaxation neighborhood to reduce the number of switched lines. This will render a problem that is more computationally tractable.

■ WA75

Parc- Mission III

Reliability III

Contributed Session

Chair: David Han, University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, david.han@utsa.edu

1 - Multi-objective Optimization of Degrading System Considering System Reliability and Redundancy Cost
Sanling Song, PhD Candidate, Rutgers University, 707B, Donaldson St, Highland Park, NJ, 08904, United States of America, sanling@eden.rutgers.edu, David Coit, Qing Li

In this research, we propose a method to optimization system maintenance cost as well as performance by determine the number of standby units for subsystem/component.We develop an integer programming model to maintain high and up-to-date system reliability while saving system maintenance cost, and the model also uses the number of standby for each component as decision variables. The developed techniques are illustrated by numerical examples of a multi-component degrading system.

2 - A Capacity and Travel Time Reliability Analysis on Transportation Networks for Emergency Operations
Ayberk Kocatepe, Doctorate Student, Florida State University Civil Engineering Department, Florida State University, 2525 Pottsdamer St, Tallahassee, FL, 32310, United States of America, ak13y@my.fsu.edu, Eren Ozguven, Arda Vanli

This research presents a network capacity and travel time reliability analysis on transportation networks in the aftermath of a disaster focusing on the stochastic conditions where some or all links of a roadway network cannot be fully utilized due to extreme events such as flooding or hurricanes.

3 - Applying Trend Analysis Methods in Degradation-based Prognostics
Seyed Niknam, Western New England University, 1215 Wilbraham Road, Springfield, MA, 01119, United States of America, seyed.niknam@wne.edu, John Kobza, J Wesley Hines

In degradation-based prognostic, monotonicity is an important parameter feature that deals with underlying positive or negative trend of parameters assuming that systems do not experience any form of healing. The objective of this research is to minimize the uncertainty in remaining life estimation by means of trend analysis techniques, estimation of monotonic trends and trend-based segmentation of degradation data for repairable systems with potential non-monotonic prognostic parameters.

4 - Spatio-temporal Monitoring for Highway Safety
Rupert Giroux, Florida State University and Florida Department of Transportation, 2525 Pottsdamer St, Tallahassee, United States of America, Rupert.Giroux@dot.state.fl.us, Eren Ozguven, Arda Vanli

Highway safety is part of the Strategic Highway Research Program (SHRP) and monitoring crash hot spots is a critical component of ensuring transportation safety. In this talk we present a multivariate CUSUM control chart approach for spatio-temporal monitoring of traffic crash data to identify crash hot spots and determine if significant changes occur. A case study involving data from Leon County, Florida is presented.

5 - Optimal Accelerated Life Tests under a Cost Constraint with Non-uniform Stress Durations
David Han, University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, david.han@utsa.edu

Due to constrained resources, several variables such as the allocation proportions and stress durations must be determined carefully at the design stage of ALT. This talk discusses these optimal decision variables based on several optimality criteria under the constraint that the total cost is below a pre-specified budget. A general scale family of distributions is considered to accommodate different lifetime models for flexible modeling with linearly decreasing stress durations.

■ **WA77**

Parc- Market Street

Exposing Students to Practice with a Case Competition

Sponsor: Analytics

Sponsored Session

Chair: Polly Mitchell-Guthrie, Sr. Manager, Advanced Analytics Customer Liaison, SAS, SAS Campus Dr., Cary, NC, 27513, United States of America, Polly.Mitchell-Guthrie@sas.com

1 - Creating a Student Case Competition
Polly Mitchell-Guthrie, Sr. Manager, Advanced Analytics Customer Liaison, SAS, SAS Campus Dr., Cary, NC, 27513, United States of America, Polly.Mitchell-Guthrie@sas.com

SAS and the Analytics Section of INFORMS created the Student Analytical Scholar Competition to help students learn more about the practice of analytics by challenging them to try the process of structuring and presenting a compelling proposal for analytical work. This talk will cover how we went about creating the competition, what benefits students have reported to us from their participation, what we have learned along the way, and implications for teaching and learning of analytical practice.

2 - Choosing Case Studies and Judging Submissions
Ivan Oliveira, SAS, 100 SAS Campus Dr, Raleigh, NC, United States of America, ivan.oliveira@sas.com, Jeff Day

This talk will address the kinds of projects that we use for the case studies in the student competition, what we look for in winning submissions (similar to our recruiting), and the skills we use in working with customers on these kinds of problems.

3 - Creating Big Industry Success Cases through Academic-Industry Collaboration in Business Analytics
Young Jae Jang, Assistant Professor, KAIST, 291 Daehak ro, Industrial and Systems Eng, KAIST, Daejeon, 305701, Korea, Republic of, yjang@kaist.ac.kr, Shin Woong Sung

We present successful industry case studies in Business Analytics through academic-industry collaborations. We particularly discuss the students' role in the industry projects as well as role we believe academia has in relationship to practice. We also present how industry cases are utilized in classroom.

4 - Great Opportunity for Students in Business Analytics
Shin Woong Sung, Ph.D. Candidate, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, Korea, Republic of, sw.sung@kaist.ac.kr, Young Jae Jang

We share the experience on participating SAS and INFORMS Analytics Section Student Analytical Scholar Competition. The motivation to apply to the competition and the solution approach based on the framework of business analytics are presented. We also discuss what we learn through the competition. Finally, we present the current business analytics project with Kolon Sports, the biggest outdoor retailer in Korea.

■ **WA78**

Parc- Mason

Decision Analysis 6

Contributed Session

Chair: Chao Fang, Associate Professor, Wuhan University, Economics and Management School, Wuhan, 430072, China, chao.c.fang@gmail.com

1 - Ensemble Methods in Credit Scoring
Waldyn Martinez, Assistant Professor Business Analytics, Miami University, 117 Country Club Dr., Oxford, OH, 45056, United States of America, martinwg@miamioh.edu

Credit Scoring refers to the utilization of analytical techniques to determine the creditworthiness of a person. In this research we explore the use of ensemble methods in this area. Ensemble methods generally perform better than individual classifiers and have been shown to possess some desirable statistical properties. Specifically, we explore the most common ensemble methods and compare them to the more traditional statistical techniques used in credit scoring.

2 - Risk Analysis and Management for Critical Infrastructures in the Age of Complexity
Chao Fang, Associate Professor, Wuhan University, Economics and Management School, Wuhan, 430072, China, chao.c.fang@gmail.com

The growing complexity renders the engineering systems exposed to more risks of interdependency. Under complexity, the nature and assessment of the identified risks would change. This paper presents some work about using network theory and importance measures for risk analysis in critical infrastructures. The approach

shall be used for identifying key risk factors or vulnerabilities in the system. It brings innovative insights on risks and guides the subsequent managerial decision-makings.

3 - Modelling Latent Preferences in Discrete Choice Analysis.
Martin Spollen, Dr, Queens University Belfast, David Bates Building, University Road, Belfast, BT7 1NN, United Kingdom, martin.spollen@gmail.com, Karen Cairns, Adele Marshall

The observed outcome of consumer choice behavior may conceal true (or latent) preferences when the availability of some popular alternatives is insufficient to meet market demand. Standard RP studies will return biased parameter estimates in these circumstances. We present three models to analyse latent preference data that correct for such bias; with potential for application to non-market situations or where price may not clear the market efficiently.

4 - A Real Options Analysis Framework Based on Managerial Cash-Flow Estimates Accounting for Timing Risk
Yuri Lawryshyn, Associate Professor, University of Toronto, 200 College Street, Toronto, ON, M5S3E5, Canada, yuri.lawryshyn@utoronto.ca, Matt Davison

We propose a real options (RO) approach which utilizes cash-flow and timing estimates from managers as key inputs. We introduce an observable, non-traded indicator process. The process is partially correlated to a traded index. By applying the minimum martingale measure, we are able to develop a financially consistent RO model ñ properly accounting for market and private risk. We introduce a second process, to account for timing risk. We apply our model to an actual drug development project.

5 - Characterizing Hidden Risks using Knowledge Gap and Separation Principles
Seong Dae Kim, assistant professor, University of Alaska Anchorage, 3211 Providence Dr. University Center R, Anchorage, AK, 99508, United States of America, sdkim2@uaa.alaska.edu

Unidentified risks have traditionally been underemphasized by risk management. Most of them are believed to be impossible to find or imagine in advance. But this study reveals that many are not truly unidentifiable. After comprehensive literature review, this study develops a model using different types of knowledge gap and separation principles of TRIZ to explain the mechanism that makes some risks hard to find in advance and show potential areas for identifying hidden risks.

■ **WA79**

Parc- Powell I

Joint Session DAS/MAS: Game Theory, Decision Analysis, and Homeland Security, Part I

Sponsor: Decision Analysis & Military Applications Society

Sponsored Session

Chair: Jun Zhuang, University at Buffalo, 317 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Improving the Value of Analysis for Biosurveillance
Henry Willis, Director, RAND Homeland Security and Defense Center, RAND Corporation, 4570 Fifth Avenue, Pittsburgh, PA, 15217, United States of America, hwillis@rand.org

Biosurveillance provides information that improves decisions about mitigating the effects of disease outbreaks and bioterrorism. Applying two standard risk and decision analysis tools to biosurveillance -decision trees and value-of-information analysis. I demonstrate an approach for evaluating strategies to enhance biosurveillance and to improve decisions about whether and how to act after detection of a biosurveillance signal.

2 - Regret-based Optimization and Preference Elicitation for Stackelberg Security Games with Uncertainty
Thanh Nguyen, USC, 3737 Watt Way, Los Angeles, United States of America, nguyenhongthanh87@gmail.com, Milind Tambe

Stackelberg security games (SSGs) have been deployed in a number of real-world domains. One key challenge in these applications is the uncertainty in attacker payoffs. Previous work has studied SSGs with uncertain payoffs modeled by interval uncertainty and provided maximin-based robust solutions. In contrast, in this work we propose the use of the less conservative minimax regret decision criterion and address the challenge of preference elicitation, using minimax regret.

3 - Combating Nuclear Materials Smuggling: Making Effective Use of Container Inspection History

Gary Gaukler, Associate Professor, Peter F. Drucker Graduate School of Management, Claremont Graduate University, Claremont, CA, 91711, United States of America, Gary.Gaukler@cgu.edu, Yu Ding, Chenhua Li

DHS and other agencies are concerned about adversaries attempting to smuggle special nuclear materials into the US. In response, both domestic and overseas ports have been equipped with radiation detection equipment, providing distributed detection data. In this talk, we provide insights into two primary questions: First, how should a decision maker at a domestic port use detection data from an overseas port? Second, can the use of prior data actually harm decision making at the domestic port?

4 - Multi and Parallel Stage Screening Strategies in the Face of Strategic Applicants

Cen Song, University at Buffalo, 317 bell hall, Buffalo, censong@buffalo.edu, Christopher Diaz, Jun Zhuang

This paper analyzes the optimal screening policy in an imperfect screening system, balancing security and congestion in the face of strategic normal and adversary applicants. We provide analytical optimal level of screening strategies for the approver and best application strategies, integrating game theory and queueing theory. We extend the basic model to: (a) comparison between one-stage and two-stage screening systems; and (b) parallel model.

5 - Choosing What to Protect, and How: Resource Allocation Among Countermeasures With Multiple Attribute

Elisabeth Paulson, Department of Mathematics, The Pennsylvania State University, 201 Old Main, University Park, PA, 16802, United States of America, elisabethpaulson63@gmail.com, Jeffrey Keisler, Igor Linkov

We study a sequential game between an attacker and defender. The defender allocates resources amongst countermeasures and targets, and the attacker chooses a threat and target. We propose a model for optimal resource allocation by combining game theory with a multi-attribute utility model. We find that (i) losses are worst in a zero-sum game, (ii) the defender makes the attacker indifferent between multiple attacks, and (iii) secret/target-independent countermeasures increase cost-effectiveness.

■ **WA80**

Parc- Powell II

How Sound Decision-making Can be Taught and Measured

Sponsor: Decision Analysis

Sponsored Session

Chair: Nadine Oeser, PhD Candidate, LSE, Rheinstrasse 63, Berlin, 12159, Germany, N.Oeser@lse.ac.uk

1 - On the use of Team-Based Learning (TBL), Games and Clickers for Teaching Analytics

Michael Johnson, Simon Fraser University, 8888 University Dr, Burnaby, BC, V5A 1S6, Canada, mjohn@sfu.ca

There is a growing body of evidence that classroom engagement and learning can be stimulated through the use of a variety of pedagogical approaches. In this study, we discuss and evaluate student perceptions of three interactive approaches (TBL, games and clickers) that were utilized in a third year analytics class in a school of business.

2 - Challenges and Successes in Teaching and Assessing Decision Skills

Chris Spetzler, Executive Director, Decision Education Foundation, 2 Oak Forest Ct, Portola Valley, CA, 94028, United States of America, Chris@decisioneducation.org

Decision Education Foundation has made assessment and evaluation an ongoing commitment and goal of our programs. This talk will highlight both our successes and our struggles to capture measurable changes in Decision Competence. Two core issues - what is being taught and what is being measured - are at the heart of this quest as we seek to both improve curriculum and prove the value of tools to capture the essence of executive function.

3 - Developing the Multidimensional Proactive Decision-Making Scale

Johannes Siebert, Habilitand, University of Bayreuth, Universitatsstr. 30, Bayreuth, Germany, johannes.siebert@uni-bayreuth.de, Reinhardt Kunz

We conducted two studies for developing a theoretically consistent and psychometrically-sound scale of proactive decision-making (PDM). PDM consists of four proactive cognitive skills 'systematical identification of objectives', 'systematical search for information', 'systematical creation of alternatives', 'decision radar', and two proactive personality traits 'striving for improvement' and 'showing initiative'. Individuals with high PDM scores show higher decision satisfaction.

4 - Individual Decision-Making Competence (IDMC) – Validation of a Psychometric Test

Nadine Oeser, PhD Candidate, LSE, Rheinstrasse 63, Berlin, 12159, Germany, N.Oeser@lse.ac.uk

Most advanced research defines IDMC mainly in terms of an individual's ability to resist decision biases, a concept that is derived from behavioral decision theory. This approach does not cover decision analytical components such as the ability to envision one's objectives. To provide a broader understanding of IDMC from a DA perspective, this research aims to validate a psychometric test that allows one to measure decision-making performance on various decision analytic components.

■ **WA81**

Parc- Divisadero

Data Analytics for Manufacturing System Design

Sponsor: Data Mining

Sponsored Session

Chair: Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, United States of America, kliu8@wisc.edu

1 - An Integrated Monitoring and Scheduling System for Energy Reduction of Machine Shop Operations

Chao Meng, The University of Arizona, 1127 E. James E. Rogers Way Room 162, Tucson, AZ, 85721, United States of America, meng@email.arizona.edu, Sung Joong Kim, Young-Jun Son, Sojung Kim

A real-time monitoring and scheduling system for machine shop operations is proposed to reduce their energy consumption while enhancing the productivity. The proposed system consists of 1) power meter to monitor the energy consumption, 2) in-line refractometer to monitor the machine coolant concentration, 3) smartphone apps for alert notification and automatic machine control, and 4) simulation for operation scheduling. The proposed system is demonstrated at a manufacturing company in Arizona.

2 - Adaptive Data Collection Algorithm for Decision Making of Manufacturing System

Leyuan Shi, Professor, Department of Industrial and System Engineering, University of Wisconsin-Madison, 1513 University Avenue,Madison,Wisconsin, Madison, WI, 53706, United States of America, leyuan@engr.wisc.edu, Xianchao Zhang

The data used for decision making of manufacturing system are from a variety of sources, including process data, manufacturing data, operations data, etc. We study an algorithm of adaptive data collection guided by the decision making based on Nested-Partitions Method and Nonlinear Programming to increase the accuracy of data, reduce collecting time and improve decision quality. Some cases are shown to demonstrate the validity of the algorithm.

3 - Analytics in Smart Manufacturing

Soundar Kumara, Allen E. Pearce/Allen M. Pearce Professor, The Pennsylvania State University, 222 Leonhard Building, Industrial Engineering, University Park, PA, 16802, United States of America, skumara@psu.edu, Sudarsan Rachuri, Christopher Saldana

The advent of Internet of Things and the advances in network science has triggered new directions of research in manufacturing systems design. In this work we look at the use of clustering in large scale networks and develop a novel application in the smart manufacturing context. We develop the framework from a sustainability point of view and discuss the modeling methodology, and implementation details.

4 - A Systematic Approach for Business Data Analytics with a Real Case Study

Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, United States of America, kliu8@wisc.edu, Jianjun Shi

Business data analytics is a process of utilizing analytic techniques for resolving business issues based on the business performance data. In this talk, we propose a systematic step-by-step procedure for business data analytics. This proposed framework is illustrated and validated by a real case study involving choosing an optimal location for opening of a new retail site.

■ WA82

Parc- Haight

Multicriteria Decision Making 1

Contributed Session

Chair: Jian Hu, Assistant Professor, University of Michigan - Dearborn, 4901 Evergreen Rd., HPEC 2220, Dearborn, MI, 48128, United States of America, jianhu@umich.edu

1 - Evaluating Efficiency under Uncertainty with a GPDEA Model & Fuzzy Theory: A Real Application
Fernando Marins, Full Professor, UNESP, Rua Vigario Martiniano, 74, Centro, Guaratinguet·, SP, 12501060, Brazil, fmarins@feg.unesp.br, Marcos Santos, José Roberto Luche, Aneirson Silva

The paper proposes a new model, called Fuzzy Goal Programming & Data Envelopment Analysis (FGPDEA) to aid in determining efficiencies of DMUs (Decision Making Units) in environments subject to uncertainty. A real application of the FGPDEA model was carried out to evaluate the efficiency of seven automotive component mini-factories. Results obtained identified which mini-factories were efficient and which were more sensitive to the uncertainty effect.

2 - An Improved PROMETHEE III Based on DMs' Risk Preferences
Yu-Ting Chang, Tamkang University, Dept. of Management Science, 151 Yingzhuan Road, Taipei, 25137, Taiwan - ROC, balindachang@gmail.com, Hsu-Shih Shih

The study tries to integrate S-shaped value functions with gains and losses into PROMETHEE III for considering the risk preferences of DMs. In addition to the risk preference incorporation, the proposed method has an ability to differentiate many more alternatives. An evaluation of E-waste recycling plants is illustrated.

3 - Synergy of Multicriteria Methods for Common Agricultural Policy's Reform
Athanasios Valiakos, University of Piraeus, 80, Karaoli & Dimitriou Street, Piraeus, 18534, Greece, avaliakos@unipi.gr, Yannis Siskos

Under the Common Agricultural Policy's reform, governments take action to distribute correctly the direct payments to farmers. A framework is proposed to calculate the direct payment, based on evaluation of agricultural units using robust ordinal regression (ROR) approach. The synergy of two methods, additive evaluation model and goal programming regression model is proposed to measure the final financial aid. Post-optimality analyses are applied by computing complementary robustness measures.

4 - A Robust Additive Multiattribute Preference Model using a Nonparametric Shape-Preserving Perturbation
Jian Hu, Assistant Professor, University of Michigan - Dearborn, 4901 Evergreen Rd., HPEC 2220, Dearborn, MI, 48128, United States of America, jianhu@umich.edu, Yung-Wen Liu, Sanjay Mehrotra

We develop a multiattribute preference ranking rule in the context of robustness. A nonparametric perturbation of a given additive reference utility function is specified to solve the problem of ambiguity and inconsistency in utility assessments, while preserving the additive structure and the decision maker's risk preference under each criterion. A concept of robust preference value is defined using the worst expected utility of an alternative incurred by the perturbation.

5 - Generating Natural Language Explanations for MCDM Problems
K.Nadia Papamichail, Associate Professor in Information and Decision Systems, The University of Manchester, Manchester Business School, Booth Street East, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk, Theodor J. Stewart

This paper discusses a method for developing explanation facilities in MCDM tools. We present a system that generates natural language explanations for interpreting MCDM decisions. We focus firstly, on explanations that support the choice of a single alternative and secondly, on explanations of pairwise comparisons. Finally, we explain how we have designed a text planner to structure the content of the explanations and a sentence generator to produce the explanatory text.

■ WA83

Parc- Sutro

Data Mining 1

Contributed Session

Chair: Jeaha Yang, IBM Research, Thomas J Watson Research Center, Yorktown Heights, NY, 10598, United States of America, jeaha@us.ibm.com

1 - Bounded Isotonic Regression
Ronny Luss, IBM, 1101 Kitchawan Rd Route 134, Po Box 218, Yorktown Heights, NY, United States of America, rluss@us.ibm.com, Saharon Rosset

Isotonic regression offers a flexible modeling approach under monotonicity assumptions, however often suffers from overfitting as the monotonicity constraints do not offer sufficient complexity control. We propose regularization using the range of the fitted model (i.e., the difference between the maximal and minimal predictions). Given the non-regularized solution, we show how to easily derive a path of range-regularized solutions, making this approach applicable to large datasets.

2 - A Cloud-Based Hub of Incident Analytics in IT Services
Jeaha Yang, IBM Research, Thomas J Watson Research Center, Yorktown Heights, NY, 10598, United States of America, jeaha@us.ibm.com, Ta-Hsin Li, Juhnyoung Lee

An important IT service is to resolve incidents related to IT infrastructures. Incidents are recorded as structured and unstructured ticket data, which contain characteristics such as timestamps, problem description and resolution. This cloud-based hub facilitates in-depth statistical analysis of incident tickets, enables root-cause analytics and benchmarking across accounts. Actionable insights are also provided.

3 - A Heuristic Boosting Algorithm for Classification and Regression Trees with Reserved-judgment Region
Abdolmanaf Zargoush, PhD Candidate, McGill University, 1001 Sherbrooke, Montreal, QC, H3A1G5, Canada, abdolmanaf.zargoush@mcgill.ca, Vincenzo Esposito Vinzi, Farrokh Alemi

We propose a heuristic algorithm for boosting the accuracy of CART methods. As we show through extensive simulated and real experiments, this algorithm not only improves the classification accuracy of CART in majority of instances, but it also retains the graphical strength of CART by providing few ensemble of trees. This is a key advantage over the competing ensemble methods like Boosting and Bagging, which deliver too many small tree classifiers that can't be used for scientific reasoning.

4 - Control Charts Pattern Recognition and Fault Diagnostic in Multivariate Process
Parvaneh Jahani, PhD Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, U of L, Louisville, KY, 40292, United States of America, p0jaha01@louisville.edu, Suraj Alexander

SPC methods for detecting process mean shift have high computational costs and they are not effective in detecting trends. We propose a new methodology to recognize the abnormal patterns of multivariate process using Control Charts Pattern Recognition (CCPR). Two strategies of fault diagnostics after failure occurrence are presented and compared in term of accuracy. The validation of the model is tested in a real world case study.

Wednesday, 11:00am - 12:30pm

■ WB01

Hilton- Golden Gate 6

New Voices in Military Operations Research

Sponsor: Military Applications Society

Sponsored Session

Chair: Harrison Schramm, Campaign Analysis Deputy, OPNAV N81, 1507 22nd Street South, Arlington, VA, 22202, United States of America, Harrison.Schramm@gmail.com

1 - Theory-Driven Modeling and Big Data in the Quest to Identify Threats to US National Security
Robert Lantz, Manager and Operations Analyst, Sentinel Applied Analytics, 8618 Westwood Center Drive, Suite 315, Vienna, VA, 22182, United States of America, rob.lantz@sentinelappliedanalytics.com, Jennifer Stave, Alonzo Barnett

Using the illegal proliferation of unmanned aerial systems (UAS) as an example, we explain how agencies can use big data to augment their operations. We investigate data-driven techniques to find illicit shipments of military equipment to foreign destinations. We show that big data can reveal threat signal from the abstracted perspective of a predictive model that would not otherwise be evident. Finally, we explain how these techniques can be used to address other threats to national security.

WB02   *INFORMS San Francisco – 2014*

2 - Evaluating Structural Disruption in Adaptive Networks
    Jon Roginski, PhD Student, Naval Postgraduate School,
    833 Dyer Road, BLDG 232, Spanagel 249B, Monterey, CA, 93940,
    United States of America, roginskij21@gmail.com, Erik Rye

The promise of network science is to provide a foundation that supports
understanding the large, dynamic, complex networks that characterize life today.
In the military, as in any competitive pursuit, we seek to leverage this
understanding toward insight into how we may influence tomorrow. Ongoing
research at the Naval Postgraduate School contributes by providing a means to
compare the structures of graphs and networks-as in determining how a network
is structurally different after an attack.

■ **WB02**

Hilton- Golden Gate 7

Modularity in the Context of Service Management

Sponsor: Technology, Innovation Management and Entrepreneurship
Sponsored Session

Chair: Juliana Hsuan, Professor, Copenhagen Business School, Dept.
of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-
2000, Denmark, jh.om@cbs.dk

**1 - The Impact of Product and Service Modularity on
    Servitization Strategy**
    Thomas Frandsen, Assistant Professor, Copenhagen Business
    School, Dept. of Operations Management, Solbjerg Plads 3,
    Frederiksberg, DK-2000, Denmark, tfr.om@cbs.dk, Juliana Hsuan

Manufacturers are increasingly bundling products with service offerings as
integrated solutions to improve competitiveness. Based on case research and an
industry workshop, we report on how value propositions can be extended through
servitization, and how companies should strategize in order to move forward
through the lenses of product and service modularity.

**2 - Commonalities and Differences in Measuring Service Modularity
    and Related Effects**
    Tilo Boehmann, Professor, University of Hamburg, Department of
    Informatics, Vogt-Koelln-Str. 30, Hamburg, 22527, Germany,
    Tilo.Boehmann@uni-hamburg.de, Regine Dˆrbecker

The principle of modularity has become increasingly important as service providers
seek to reduce time and cost of delivering customized services. Extant research on
the topic has mainly conceptual character and there is a dearth of empirical studies
on the antecedents and effects. We study the measurement of service modularity
and its effects in comparison to other contexts like product or software
development. We particularly analyse whether a service-specific measurement
concept is needed.

**3 - Innovation, Modularity and Standardization in KIBS:
    The Performance Implications**
    Anna Cabigiosu, Assistant Professor, Universita Ca' Foscari,
    San Giobbe Dorsoduro 873, Venezia, 30121, Italy,
    diego.campagnolo@unipd.it, Diego Campagnolo

Using fs/QCA on a sample of 319 KIBS, we explore how innovation and service
types interact in firm's performance. Our results highlight complementarity
between process innovations and service standardization on a firm's profitability,
while they emphasize complementarity between process innovations, service
customization, and modularity of a firm's growth.

4 - Modularity used as a Pricing Model in a Software Company
    Eric Bentzen, Associate Professor, Copenhagen Business School,
    Dept. of Operations Management, Solbjerg Plads 3, Frederiksberg,
    DK-2000, Denmark, eb.om@cbs.dk

In this paper we will look at a pricing model used in a software company that use
the principle of modularity in their pricing of products. The company has many
available software products and with the use of modularity they have now moved
further from originally software algorithm and procedures to software applications.

■ **WB03**

Hilton- Golden Gate 7

Social Media and Business Analytics

Sponsor: eBusiness
Sponsored Session

Chair: Hailiang Chen, City University of Hong Kong, Department of
Information Systems, Kowloon, Hong Kong - PRC,
hailchen@cityu.edu.hk

**1 - Nudging Consumers' Behaviors in Recommender Systems with
    Capacity Constraints**
    Na Zhang, Purdue University, nancy.zhangna@gmail.com,
    Karthik Kannan, George Shanthikumar

This paper investigates how customers may be nudged by information and coupons
to purchase products with capacity constraints. A Support Vector Machine based
recommender system is developed to rank order customers based on their
purchase potential and identify targeted customers. We compared our technique
with standard ones using a rolling time window based on data from an online
grocery store. A field experiment was also conducted to evaluate our approach and
found consistent results.

**2 - Relationships among Minimum Requirements, Facebook Likes,
    and Groupon Deal Outcomes**
    Gang Wang, University of Connecticut, 2100 Hillside road,
    Storrs, CT, 06269, United States of America,
    Gang.Wang@business.uconn.edu, Bill Ross, James Marsden,
    Xue Bai

The empirical work examines the relationships between minimum requirements
and social media linkages and deal outcomes for one major daily deal site,
Groupon. Using time-stamped empirical data we captured electronically, we
complete an initial high-level statistical analysis followed by a propensity score
approach to analyze causal effects for four major Groupon product categories. We
find that the presence of a minimum requirement increases Facebook likes, and
coupon outcomes.

**3 - Dynamics among Social Media Marketing, Word of Mouth, and
    Movie Revenues**
    Hailiang Chen, City University of Hong Kong, Department of
    Information Systems, Kowloon, Hong Kong - PRC,
    hailchen@cityu.edu.hk

Social media sites have recently become a venue for firms to interact with
consumers and influence their conversations. This study explores how firms could
influence word-of-mouth (WOM) among consumers through proactive social
media marketing efforts. The dynamics among movie studios' marketing
communication, consumer-to-consumer communication, and box office sales are
examined.

■ **WB04**

Hilton- Continental 1

Operations Management and Marketing Interface

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Hamed Mamani, Assistant Professor, University of
Washington, Foster School of Business, ISOM Department,
Seattle, WA, 98195, United States of America, hmamani@uw.edu

Co-Chair: Foad Iravani, Assistant Professor, University of
Washington, Foster School of Business, Seattle, WA, 98195,
United States of America, firavani@uw.edu

1 - Gray Markets, Contracts and Supply Chain Coordination
    Foad Iravani, Assistant Professor, University of Washington, Foster
    School of Business, Seattle, WA, 98195, United States of America,
    firavani@uw.edu, Hamed Mamani, Reza Ahmadi

The diversion of genuine products to gray markets continues to challenge many
companies. Industry surveys report that the abuse of channel incentives
contributes to the growth of gray markets. We analyze the impact of gray markets
on classic contracts. We show contracts that solely depend on order quantity
cannot coordinate the supply chain and propose priceñdependent quantity
discount contracts to coordinate the supply chain. Our proposed contracts also
enhance consumer welfare.

2 - Optimizing Product Launches in the Presence of Strategic Consumers

Ilan Lobel, Assistant Professor, NYU Stern School of Business, 44 W 4th St, New York, NY, 10012-1126, United States of America, ilobel@stern.nyu.edu, Jigar Patel, Gustavo Vulcano, Jiawei Zhang

We consider the problem of a technology firm deciding the optimal timing of its product launches. Consumers are strategic and weigh the value of purchasing improved products in light of future technological improvements. We characterize the optimal launch policies for two cases: one where the firm pre-announces the product launch times in the market, and the second where no information about the future launches is divulged.

3 - Optimal Design of Crowdfunding Campaigns

Saeed Alaei, Cornell University, Upson Hall, Ithaca, United States of America, saeed@cs.cornell.edu, Azarakhsh Malekian, Mohamed Mostagir

Crowdfunding is quickly emerging as an alternative to traditional methods of funding new products. In a crowdfunding environment, a producer solicits financial contributions from consumers in the form of pre-purchasing a still-unrealized product. These contributions are collected only if a pre-determined funding goal is met before a deadline. We model the social dynamics of contributors and show how they are affected by the funding goal, the price of the product, and the campaign duration.

4 - Collaboration between Competitors through Inventory Exchange

Liang Ding, University of Michigan, 701 Tappan Street, R0400, Ann Arbor, MI, 48109, United States of America, lgding@umich.edu, Roman Kapuscinski, Ozge Sahin

An increasing number of companies establish some level of partnership with their competitors. This paper studies the effect of collaboration and competition by a resource exchange model. We explore that whether/when a resource exchange contract can help both firms and what is the influence on consumer surplus. The results show that the resource exchange is a win-win solution when there is no competition, or when purchasing cost is neither very low nor very high given strong competition.

■ WB05

Hilton- Continental 2

Economics in Operations

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Manu Goyal, Assistant Professor, University of Utah, College Of Business, Salt Lake City, UT, United States of America, Manu.Goyal@business.utah.edu

1 - On the use of Public Warnings in Counterterrorism Operations

Nitin Bakshi, Assistant Professor, London Business School, NW1 4SA, London, United Kingdom, nbakshi@london.edu, Edieal Pinker

Public warnings have long been deemed an effective lever to ward off terrorist threats. Paradoxically, warnings might be a victim of their own success. Previous alerts that negated an attack result in the perception of a false alarm. Going forward, when a warning is issued, people would be less inclined to believe that an attack will materialize. We study the trade-off between the short-term benefit of a deferred attack, and long-term costs such as erosion of credibility through false alarms.

2 - Stage-Gate Contracts for New Product Development

Chunlin Wang, PhD Candidate, David Eccles School of Business, University of Utah, 1655 East Campus Center Drive, Salt Lake City, UT, 84112, United States of America, chunlin.wang@business.utah.edu, Glen Schmidt, Krishnan Anand

In the setting of outsourcing an NPD project, either the agent or the principal can have inside information on the project's viability. We study the principal's use of stage-gate contracts as a screening device in the former scenario and as a tool of achieving separating and pooling equilibria in the latter, and compare the performance of stage-gate contracts with traditional outsourcing contracts.

3 - Honesty in Incomplete Supply Chain Contracts

Manu Goyal, Assistant Professor, University of Utah, College Of Business, Salt Lake City, United States of America, Manu.Goyal@business.utah.edu, Krishnan Anand, He Chen

In a world with bounded rationality, we study a multi-period (incomplete) contractual relationship between a manufacturer and his supplier. We prove that a profit-maximizing manufacturer, who is constrained by honesty, can outperform the quintessential unconstrained profit-maximizer, even though the unconstrained manufacturer can mimic the honest manufacturer. Thus, honesty emerges endogenously as an optimal policy.

■ WB06

Hilton- Continental 3

Urban Spatial Issues

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Elena Belavina, Assistant Professor, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, United States of America, belavina@uchicago.edu

Co-Chair: Karan Girotra, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, karan.girotra@insead.edu

1 - Bike Share: Accessibility and Availability

Karan Girotra, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, karan.girotra@insead.edu, Ashish Kabra

We study bike-share systems as implemented in large cities such as Paris, London, New York. We develop a structural empirical model that captures the elasticity of user demand w.r.t. distance to a station as well as long-term and short-term effects of service level. We exploit changing choice set due to stockouts as well as instrument variables for identification. To deal with computational challenges, we transform our estimation problem from the time-domain to the system state-space domain.

2 - Which is Environmentally Friendlier- Online Retailing or Brick-and-Mortar Retailing?

Gerard Cachon, Wharton University, Philadelphia, PA, United States of America, cachon@wharton.upenn.edu

Products can travel from suppliers to consumers via on-line retailers or brick-and-mortar retailers. Traditional brick-and-mortar retailing involves consumers completing the final mile" to their home, whereas with on-line retailing products arrive at a consumer's doorstep. This paper discusses which distribution approach is better from the point of view of carbon emissions.

3 - Household-level Economies of Scale and Package Delivery

John Carlsson, Assistant Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, jgc@umn.edu

One of the fundamental concerns in the analysis of logistical systems is the trade-off between localized, independent provision of goods and services versus provision along a centralized infrastructure such as a backbone network. We study the mini-economies" of scale that arise when households make multi-stop trips rather than using package delivery services.

4 - Pricing for Grocery Delivery: Subscription of Per-Order Pricing

Elena Belavina, Assistant Professor, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, United States of America, belavina@uchicago.edu, Karan Girotra

Grocery delivery is a market that many try to conquer. Appropriate pricing is key for success. There is little consensus among different players (at times even within one firm operating in different locations) on what is the best pricing scheme. For example, Amazon Fresh in Seattle is using per order pricing while in San Francisco - subscription fee. We provide recommendation for the preferred pricing scheme based on various characteristics (delivery logistics, demand variability etc.).

■ WB07

Hilton- Continental 4

Supply Chain Management III

Contributed Session

Chair: Xiaojuan Zhang, Xi'an Jiaotong University, School of Management, No.28, Xianning West Road, Xi'an, China, xiaojuanzh@stu.xjtu.edu.cn

1 - Newsvendor Game with Limited Supply and Inventory Transshipment

Ziteng Wang, North Carolina State University, Daniels 443, North Carolina State University, Raleigh, NC, 27695, United States of America, zwang23@ncsu.edu, Sha Luo, Tiantian Nie, Jian Luo, Shu-Cherng Fang

When the supply is limited, the newsvendors may manipulate their orders to receive a preferred inventory allocation. Inventory transshipment can satisfy more demand and complicate newsvendors' decisions. In such a game, Nash equilibrium exists under certain conditions and its uniqueness depends on the supply capacity. A larger supply capacity brings more profit to the newsvendors and the supply chain. The newsvendors can be coordinated if they are allowed to negotiate the transshipment prices.

WB08   *INFORMS San Francisco – 2014*

2 - A Stochastic Facility Location Problem with Supply Chain Risk Propagation
Myles Garvey, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, myles.garvey@rutgers.edu, Steven Carnovale

Many current FLP in the extant literature have either single objectives such as cost or distance minimization or multiple objectives. However, much of the literature does not capture the intricacies of risk for supply chain disruption and it's potential to propagate through a supply network due to its structure. In this paper, we develop a model and a solution methodology to solve the capacitated and constrained FLP problem by considering risk propagation as the main objective.

3 - Measuring Resilience in an Agricultural Supply Chain
Daniel Romero, PhD Student, University of South Florida/ Universidad Autonoma del Caribe, East Fowler Avenue, SVC1034, Tampa, FL, 4202, United States of America, danielromero@mail.usf.edu, Fabian Sanchez, Fernando Gonzalez, Alex Savachkin, Weimar Ardila

Resilience has been measured in different type of systems but is not clear the differences between the different types of metrics in real settings. The following research is a case study of an agricultural supply chain in Colombia were resilience is measured using different metrics in order to establish advantages and disadvantages of each approach.

4 - Competition and Cooperation in a Duopoly Transportation Market with Empty Equipment Repositioning
Xiaojuan Zhang, Xi'an Jiaotong University, School of Management, No.28, Xianning West Road, Xi'an, China, xiaojuanzh@stu.xjtu.edu.cn, Sheng Hao Zhang

We consider a transportation market with two firms providing service between two locations. Their realized demands in both directions depend on the price decisions of both firms. Because equipment is needed to transport goods, each firm may face unbalanced demands and has to reposition empty equipment. Cooperation on empty equipment repositioning reduces both firms' cost. We study firms' competition and cooperation strategies and their impact on environments such as carbon emission.

■ WB08

Hilton- Continental 5

Text Analytics Applications in Social Media

Cluster: Social Media Analytics

Invited Session

Chair: Praveen Lakkaraju, Manager, Advanced Analytics R&D, SAS, SAS Campus Dr, Cary, NC, 27513, United States of America, Praveen.Lakkaraju@sas.com

1 - Identifying Emerging Researchers using Social Network Analysis
Syed Billah, University of Arkansas, 41 Fireside Ln, East Setauket, NY, United States of America, syed.masum.billah@gmail.com, Susan Gauch

Finding rising stars in academia early in their careers has many implications. Typically, the impact of a researcher is assessed by a measurement called h-index that grows linearly with the academic age. Therefore, h-indices of researchers in the early stages of their careers are almost uniformly low, making it difficult to identify those who will emerge as influential leaders. Here, we make use of social network analysis to identify young researchers most likely to become successful.

2 - Sports Analytics - Uncovering Patterns in Social Media
Dan Zaratsian, Text Analytics Consultant, SAS Institute, 100 SAS Campus Dr, Cary, NC, 27513, United States of America, Dan.Zaratsian@sas.com

If you take a look at all of your customer touch-points, all of the opportunities that your business has to interact with customers, what percentage are you leveraging today? Analyzing online conversations for major sporting events can drive fan engagement, understand fan sentiment, enhance marketing campaigns and more. Through this process we are able to identify trends and opportunities within social media relating to sports analytics that deliver business value.

3 - Analyzing Tweets: Text Mining and Sentiment Mining
Goutam Chakraborty, Professor (Marketing), Oklahoma State University, 420 A Spears School of Business, Stillwater, OK, 74078, United States of America, goutam.chakraborty@okstate.edu

In this presentation, we will discuss results from analyzing tweets that provide insights on the impact of the Digital Rights Management (DRM) policies of a major software manufacturer on their customers' reactions. Results from sentiment analysis of tweets pre-post of a launch of a new product by the manufacturer will also be presented.

4 - Probabilistic Semantics for Customizable Social Media Analytics
Viswanath Avasarala, Manager, SAS, World Headquarters, SAS Campus drive, Cary, NC, 27513, United States of America, Viswanath.Avasarala@sas.com, Praveen Lakkaraju, David Styles, Richard Crowell, Saratendu Sethi, James Tetterson

SAS provides sophisticated rule-based natural language processing (NLP) technology to enable accurate categorization and identification of complex relationships within unstructured data. In this paper, we will discuss the design of our new technology, the semantic framework, that allows enterprise analysts to build powerful social media applications with minimal configuration.

■ WB09

Hilton- Continental 6

Meta-Algorithms – Algorithms That Improve Other Algorithms

Cluster: Cognitive Analytics

Invited Session

Chair: Meinolf Sellmann, Co-Lead Global Technology Outlook, IBM Research Headquarters, 1101 Kitchawan Rd, Yorktown, NY, United States of America, meinolf@us.ibm.com

1 - Programming by Optimization: A Practical Paradigm for Computer-Aided Algorithm Design
Kevin Leyton-Brown, Professor, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, kevinlb@cs.ubc.ca, Holger Hoos, Frank Hutter

Programming by Optimization means specifying a large design space and then applying machine learning and optimization to find a design that will perform well in a given use context. This talk will share the vision of PbO, describe key algorithmic techniques that make PbO practical, and illustrate the power of the approach. Specifically, it will describe some state-of-the-art methods for automated algorithm configuration, portfolio-based algorithm selection, and automated portfolio construction.

2 - Algorithm Portfolios Based on Cost-Sensitive Hierarchical Clustering
Horst Samulowitz, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, United States of America, samulowitz@us.ibm.com, Meinolf Sellmann, Ashish Sabharwal, Yuri Malitsky

Different solution approaches for combinatorial problems often exhibit incomparable performance that depends on the concrete problem instance to be solved. Algorithm portfolios aim to combine the strengths of multiple algorithmic approaches by training a classifier that selects solvers dependent on the given instance. We discuss a classifier that selects solvers based on a cost-sensitive hierarchical clustering model.

3 - Instance-Specific Algorithm Tuning
Yuri Malitsky, Cork Constraint Computation Centre, School of Computer Science & IT, Cork, Ireland, Yuri.Malitsky@gmail.com, Carlos Ansótegui, Meinolf Sellmann

We present ISAC++, a tool for tuning algorithms instance-specifically. ISAC++ is based on the instance-oblivious algorithm tuner GGA and the CSHC algorithm portfolio methodology. A portfolio of MaxSAT solvers was tuned with ISAC++ and won six out of eleven categories at the 2013 International MaxSAT Evaluation.

■ WB10

Hilton- Continental 7

Operations/Sustainability 2

Contributed Session

Chair: Adam Ng, National University of Singapore, 1 Engineering Drive 2, Singapore, 025874, Singapore, isentsa@nus.edu.sg

1 - Linear Programming Models for Resilient Supply Systems Planning
Adam Ng, National University of Singapore, 1 Engineering Drive 2, Singapore, 025874, Singapore, isentsa@nus.edu.sg, Muchen Tang

We consider linear programming models of general supply systems subject to supply disruptions. Our objective is to develop a framework to measure supply resilience for such models. We first propose axiomatic characterizations of resilience measures, and then show their representation using adjustable uncertainty sets. We next develop algorithms for evaluating resilience measures defined by some simple adjustable sets, and present computational studies on a natural gas supply network.

2 - Green Procurement Behaviors Observation from Game Theory Perspective
Ping JI, The Hong Kong Polytechnic University, EF606, Hung Hom, Hong Kong, Hong Kong - PRC, p.ji@polyu.edu.hk, Xin Ma

An increasing number of manufacturers pay more attention to green procurement. Selection green supplier has become an important issue in supply chain management. A game model is proposed to study the relationship between manufacturers and green suppliers. Behaviors of two players are presented by using different strategies, which also be demonstrated by simulation.

3 - Analysis of Recycled Content Claims under Supply Uncertainty and Demand Benefit
Aditya Vedantam, Doctoral Student, Krannert School of Management,Purdue University, 147 Arnold Drive Apt 14, West Lafayette, IN, 47906, United States of America, avedanta@purdue.edu, Ananth Iyer, Paul Lacourbe

Manufacturers making claims regarding recycled content on product packaging, see demand from Environmentally Preferable Purchasing (EPP) and industry buy recycled procurement. However, the availability of quality post-consumer recycled content is cause for concern due to contamination in the municipal waste stream. We study the impact of uncertain supply and demand benefit and show that concerted effort to ease supply constraints and create demand side incentives can lead to win-win conditions.

4 - Collaborative Planning to Increase Resource Efficiency in Industrial Symbiosis
Renzo Akkerman, Professor, Technische Universitat München, Arcisstrafle 21, München, 80333, Germany, renzo.akkerman@tum.de, Gabor Herczeg

Resource efficiency is a key aspect in relation to economic and environmental performance in sustainable supply chains. To improve resource efficiency in industrial symbiosis, one company's production waste substitutes virgin resources in another company's production process. Tactical planning activities need to include waste treatment, storage, as well as resource procurement. We develop collaborative planning models that consider the matching of waste supply and demand.

■ WB11

Hilton- Continental 8

Supply Chain, Risk Management II

Contributed Session

Chair: Seyed Vahid Rez Nooraie, PhD Student, North Carolina A&T State University, 1601 E Market Street, Greensboro, NC, 27411, United States of America, vnooraie@gmail.com

1 - Backup Sourcing Model with Credit Guarantee Mechanism
Cheng-Feng Wu, National Taiwan University, College of Management, Floor 9, Taipei, Taiwan - ROC, d99741006@ntu.edu.tw, David Chiang

The strait of capital shortage in SMEs causes them difficult to fulfill orders, resulting in poor performance of the supply chain. Therefore, obtaining and operating financial support for SMEs is a significant issue. This study attempts to develop the dual sourcing model with a backup supplier under trade guarantee mechanism by applying incentive theory from manufacturer's perspectives.

2 - Innovative Menu of Contracts for Coordinating a Supply Chain with Multiple Mean-Variance Retailers
Chun-Hung Chiu, Associate Professor, Sun Yat-sen Business School, Business School, Sun Yat-sen University, No. 135 Xingang West Road, Guangzhou, 510275, China, chchiu2000@gmail.com, Tsan-Ming Choi, Gang Hao, Xun Li

We consider the coordination challenge with a risk-neutral manufacturer which supplies to multiple heterogeneously mean-variance (MV) retailers. To achieve coordination, we develop an innovative menu of TSR contracts. All contracts in the menu that achieves SCC must be non-MV inferior and non-dominated, and the associated conditions are examined.

3 - Mitigating Supply Chain Risks through the Assessment of Trade-off among Investment in Capabilities
Seyed Vahid Rez Nooraie, PhD Student, North Carolina A&T State University, 1601 E Market Street, Greensboro, NC, 27411, United States of America, vnooraie@gmail.com, Mahour Parast, Saeed Zamiri Marvizadeh

One of the central questions in supply chain design is how to properly invest in supply chain capabilities in order to be more responsive to supply chain disruptions.

■ WB12

Hilton- Continental 9

Incentive Issues in Sustainable Operations

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations

Sponsored Session

Chair: Luyi Gui, luyig@uci.edu

1 - On the Effectiveness of Emission Penalties in Decentralzied Supply Chains
Saif Benjaafar, Distinguished McKnight University Professor Professor, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Xi Chen

We show that pricing emissions in a decentralized supply chain can paradoxically lead to higher overall supply chain emissions and for this emission to increase in the emission price. We discuss potential remedies and the social welfare implications of each. We illustrate our analysis with several applications.

2 - Manufacturers' Recycling Strategies: Competition and Cooperation in Sustainability
Fang Tian, Ph.D. Candidate, Department of Data Sciences and Operations, Marshall School of Business, University of Southern California, Los Angeles, CA, 90089, United States of America, tianfang@usc.edu, Greys Sosic, Laurens Debo

We study recycling of products from two categories, each with (possibly) multiple brands, and focus on product heterogeneity vs. economies of scale. Our analysis suggests that recycling organized by government disregards product brands, and either focuses on categories or takes advantage of economies of scale (through all-inclusive recycling). On the other hand, if competing manufacturers form recycling coalitions, all products from the same brand may be recycled together regardless of category.

3 - Supply Chain Design for Unlocking the Value of Remanufacturing under Uncertainty
Wenyi Chen, MIT-Zaragoza, C/ Bari 55, Edificio N·yade 5, Zaragoza Logistics Center, Zaragoza, 50197, Spain, wchen@zlc.edu.es, Maria Jesus Saenz, Beste Kucukyazici, Vedat Verter

We present a two-stage stochastic closed-loop supply chain design model that incorporates uncertainties as well as the differences in customer valuations of new and remanufactured products. We integrate SAA with integer L-shaped to tackle the arising mixed integer quadratic program, which we implement in a German company.

4 - The Value of Product Returns: Intertemporal Product Management with Strategic Consumers
Narendra Singh, Narendra.Singh@scheller.gatech.edu, Karthik Ramachandran, Ravi Subramanian

Consumer product returns are a significant and growing concern in many industries, and firms typically deem returns to be undesirable. We study the impact of returns on the intertemporal product strategy of a firm facing strategic consumers. Importantly, we show that returns may act as a device for the firm to mitigate the well-known time inconsistency problem, and firm profit could increase with the return rate.

■ WB13

Imperial A

Education 2

Contributed Session

Chair: Fikret Korhan Turan, Asst. Professor Dr., Istanbul Kemerburgaz University, Mahmutbey Dilmenler Cad., No:26 Bagcilar, Istanbul, 34217, Turkey, korhan.turan@kemerburgaz.edu.tr

1 - using Predictive Analytics to Increase Graduation Rates
Helmut Schneider, Professor, Louisiana State University, LSU BEC, Baton Rouge, LA, 70803, United States of America, hschnei@lsu.edu, Xuan Wang

Predictive analytics will be used to deploy advising and mentoring to increase graduation rates. We also employ Bayesian networks and simulation to gain further insight into what drives graduation rates. Using four years of data this paper also identifies key performance indicators that affect graduation rates.

2 - A Learner-Analytics Based Approach for Attenuating the Course-Level Dropout Rate
Aysegul Demirtas, Arizona State University, 1055 W 5th St, Apt 10, Tempe, AZ, 85281, United States of America, Aysegul.Demirtas@asu.edu, Esma Gel, Jennifer Bekki, George Runger

Despite their potential to attract large numbers of diverse students, online courses remain plagued by a critical student attrition problem. Using data from three different online undergraduate courses, we apply data mining techniques to model the relationship between learner interactions with the Learning Management System (LMS) and course level dropout. The findings serve as the basis for incorporating earlier detection of at-risk students in online courses.

3 - OR Education with LEGO Mindstorms EV3
Young Jae Jang, Assistant Professor, KAIST, 291 Daehak ro, Industrial and Systems Eng, KAIST, Daejeon, 305701, Korea, Republic of, yjang@kaist.ac.kr

The Industrial and Systems Engineering at KAIST recently developed Automated Manufacturing Systems with LEGO Mindstorms EVS. With the tool kit, a physical production line was constructed that produce a multiple products with automated material handling systems. We explain how the system has been applied to OR classrooms. The motivational benefit and pedagogical implication of the system are also discussed.

4 - Sustainability in Higher Education: A Statistical Analysis of Stakeholder Needs for Group Decision
Fikret Korhan Turan, Asst. Professor Dr., Istanbul Kemerburgaz University, Mahmutbey Dilmenler Cad., No:26 Bagcilar, Istanbul, 34217, Turkey, korhan.turan@kemerburgaz.edu.tr, Saadet Cetinkaya, Ceyda Ustun

Istanbul Kemerburgaz University management considers implementing a set of projects to improve the university's sustainability performance as a higher education institute. Using analytic hierarchy and network processes, we conduct a 30-participant stakeholder survey whose results will be used in a multi-objective stochastic program to find an optimal portfolio. Survey results show statistical differences in stakeholder needs, and how they change under low, medium and high financial constraints.

5 - Capturing Heterogeneity in University Choice
Ricardo Paredes, Prof Economics, PUC, Vicuna Mackenna 4860, Macul, Santiago, Chile, rparedes@ing.puc.cl, Alejandro Schmidt, Juan de Dios Ortuzar

Considering the possibility groups differ on their preferences, we estimate a latent-class logit model to analyse the determinants of university choice in Chile, and show how these vary depending on group characteristics. We conclude that groups of individuals with different selection patterns exist, that those groups are not only differentiated by their income and that their choice sensitivity to different university characteristics (cost, quality, and location).

■ WB14

Imperial B

Supply Chain, Practice, Empirics

Contributed Session

Chair: Jing Zhou, Associate Professor, UNC Charlotte, 9201 University City Blvd, Belk College of Business, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu

1 - Lean Supply Chain in Small Businesses
Steve Zhou, University of Houston Downtown, One Main Street, Houston, TX, United States of America, drbinzhou@yahoo.com

This research investigates lean supply chain management and its impacts on small businesses' performance. It has provided insights into the current status of lean supply chain practices and related implementation issues in small businesses.

2 - Generational Shift and Consumer Complaints in Automobile Industry
Sourish Sarkar, Penn State Erie, 4701 College Drive, Erie, PA, 16563, United States of America, szs15@psu.edu, Balaji Rajagopalan

We analyze consumer complaints data for light vehicles sold in U.S. during the years 2002-2013 by 41 major brands. Based upon this data, we investigate the factors that influence the number of complaints for any specific car-model. Factors that significantly contribute to the complaints are analyzed.

3 - Who Should Build the Network of Charging Stations for Electric Vehicles, Manufacturers or Dealers?
Tian Wang, School of Management, Huazhong University of Science of Technology, 1037 Luoyu Road, Wuhan City, Hu, 430074, China, wangtian3261@gmail.com, Shiming Deng

We investigate the issue of how to facilitate the expansion of the network of charging stations for Electric Vehicles (EVs). In particular, who should take the lead to build and own the network of charging station, manufacturers or dealers, to achieve a larger network to alleviate consumers' driving range anxiety? We study this from the supply chain perspective and provide strategies that may lead to a large market acceptance of EVs.

4 - Penalty – Reward Contracts to Coordinate a Manufacturer and its Logistics Service Provider
Emel Aktas, Senior Lecturer, Cranfield University, Cranfield School of Management, Cranfield, United Kingdom, emel.aktas@cranfield.ac.uk, Fusun Ulengin, Seda Yanik

Contracts coordinate disparate but interdependent members of the supply chain. Conflicting objectives of members and lack of coordination among them lead to inefficiencies in matching supply with demand. We model the logistics contract between a manufacturer and its service provider. We examine delivery order, penalty, and reward as contract parameters and report contract efficiency relative to full and no coordination. Delivery order, penalty, and reward contracts help achieve coordination.

■ WB15

Hilton- Exec. Boardroom

Revenue/Yield Management III

Contributed Session

Chair: Yalcin Akcay, Assoc. Professor, Koc University, Sariyer, Rumelifeneri Yolu Sariyer, Istanbul, 34450, Turkey, yakcay@ku.edu.tr

1 - Approximate Dynamic Programming for Network Revenue Management under Substitution
David Sayah, Johannes Gutenberg University Mainz, Chair of Logistics Management, Jakob-Welder-Weg 9, Mainz, 55129, Germany, sayah@uni-mainz.de

In network revenue management, algorithms producing high-fidelity value function approximations like approximate linear programming and Lagrangean decomposition recently have been the centre of attention within the community. This presentation will show extensions of some of these approaches to generalized problem settings in which the assortment may consist of flexible products allowing companies to choose a specific execution mode from a given set of alternative modes.

2 - Joint Pricing and Sourcing under Supply and Demand Risk
Amirmohsen Golmohammadi, McMaster University, 1280 Main Street West, DeGroote School of Business, Hamilton, ON, L8S4M4, Canada, golmoha@mcmaster.ca, Elkafi Hassini

We consider a newsvendor sourcing and pricing problem in a single and multiple period models. We present new results on joint optimal prices and order quantities when both supply and demand are uncertain. We present the concept of expected lost sale fill rate elasticity and show how it can be used to find the optimum policy in both single and multiple period cases. We also show how some of the previous results in the deterministic yield case relate to our models.

3 - How to Use Dynamic Local Knowledge: The Case for Intermodal Revenue Management
Yalcin Akcay, Assoc. Professor, Koc University, Sariyer, Rumelifeneri Yolu Sariyer, Istanbul, 34450, Turkey, yakcay@ku.edu.tr, Long Gao, Ting Luo

We focus on core operations of a local manager for an intermodal transportation company, load acceptance and container leasing/repositioning, over a short horizon. We develop a decentralized framework that jointly optimizes local operations and achieves network coordination. We introduce an MDP-based scarcity pricing scheme which self-regulates how each location interacts with the transportation network. We characterize the impact of dynamic forecasting on profitability and policy choice.

4 - Supply Allocation under Advance Demand Information
　　　Felix Papier, Associate Professor, ESSEC Business School,
　　　Av. Bernard Hirsch, Cergy, 95021, France, papier@essec.edu

We study the problem of allocating limited supply to different markets with uncertain demand but for which advance demand information (ADI) can be obtained. Our research is motivated by an agri-food manufacturer that operates in several European countries and tries to maximize revenues. We use Markov Decision Processes to model the problem, develop an efficient heuristic solution, and derive structural properties that lead to several insights for supply chain managers in the agri-food industry.

5 - Analysis of Optimal Threshold in Batch Service Queueing Systems
　　　Yun Zeng, Ohio State University, OH, United States of America,
　　　zeng.153@buckeyemail.osu.edu, Cathy Xia

In delivery systems with limited resources, one critical issue is to properly schedule the service so as to ensure customer satisfaction. We consider a batch service queueing system with Poisson arrivals and infinite holding/serving capacity, and study the optimal batching policy so as to minimize the expected waiting time of customers. Through closed-form analysis, we reveal the structure of the optimal policy and propose a simple strategy to find the optimal threshold. The results are further supported by simulation and can be applied to various practical delivery systems.

■ **WB16**

Hilton- Franciscan A

Behavorial Bias and Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Michael Z. F. Li, Professor, Nanyang Technological University, Nanyang Business School, Nanyang Avenue, Singapore, 639798, Singapore, zfli@ntu.edu.sg

1 - Advance Selling with Overconfident Consumers
　　　Michael Z. F. Li, Professor, Nanyang Technological University,
　　　Nanyang Business School, Nanyang Avenue, Singapore, 639798,
　　　Singapore, zfli@ntu.edu.sg

We study a retailer's advance selling strategy when some consumers are overconfidence in their valuations. We prove that advance selling is not always beneficial to retailer. The retailer should do advance selling when the difference of the regular consumers' expected valuation and expected surplus when not buying in advance is no less than a threshold.

**2 - When Fixed Pricing Meets Priority Auction: Dual Modes of
　　Service Systems**
　　　Jiayang Gao, Cornell University, 296 Rhodes Hall, Cornell
　　　University, Ithaca, NY, 14853, United States of America,
　　　jg838@cornell.edu, Huseyin Topaloglu, Krishnamurthy Iyer

Consider a service center operating both a fixed price, FIFO market (pay as you go, PAYG), and a spot market running priority auction. We derive the unique equilibrium, in which customers with both high and low patience participate in spot market and the rest goes to PAYG. We discuss the social optimality of operating only the spot market, and the revenue maximizing price and server allocation.

3 - Pricing Product Versions for Strategic Impatient Customers
　　　Vinod Cheriyan, School of Industrial and Systems Engineering,
　　　Georgia Tech, 755 Ferst Drive NW, Atlanta, GA, 30332,
　　　United States of America, vinod.cheriyan@gatech.edu,
　　　Anton Kleywegt, Ravi Subramanian

We consider a monopolist who regularly introduces new product versions. Potential buyers anticipate new versions, and are heterogeneous in their ownership of versions and in their impatience to own a new version. The seller has to decide what discount to offer for the current version before each new version is introduced or what trade-in discount to offer after each new version is introduced. We characterize the seller's optimal pricing decisions and buyers' optimal purchase decisions.

**4 - Estimating Elasticity of Demand for
　　Commodity-based Manufacturers**
　　　David Rodriguez-Gomez, Director, PROS, 101 Montgomery Street,
　　　Suite 400, San Francisco, CA, 94104, United States of America,
　　　drodriguez@pros.com

We describe an econometric model that predicts the quantity demanded of a product in a demand segment at a certain time period given a particular lead time. The quantity demanded is a function of the net price quoted, history, trends, seasonality and the customer's elastic response to price and other marketing drivers. We discuss the methodology for estimating the parameters of the model given observed transactional data, with a focus on the own-price elasticity of demand.

■ **WB17**

Hilton- Franciscan B

Reducing and Accommodating Customer Variability in Services

Sponsor: Manufacturing & Service Operations Management/Service Operations

Sponsored Session

Chair: Ryan Buell, Assistant Professor, Harvard Business School, Morgan Hall 429, Boston, MA, 02163, United States of America, rbuell@hbs.edu

**1 - Collection Control with Customer Choice Behavior for
　　Rental Companies**
　　　Marco Bijvank, University of Calgary,
　　　Haskayne School of Business, Calfary, AB, T2N1N4, Netherlands,
　　　marco.bijvank@haskayne.ucalgary.ca, Iris Vis, Jaap Boter

We study the availability of items within a collection of items in a setting of public libraries, where we include the behavior of customers in case of a stock out. Next to field experiments about customer behavior, we model the setting as a continuous review inventory system with base-stock levels and emergency lateral transshipments to analyze library collections. A case study demonstrates the performance of our heuristic procedure to redistribute books over the different branches.

2 - On the Value of Customer Flexibility in (Electrified) Car-sharing
　　　Philipp Ströhle, Karlsruhe Institute of Technology, Englerstr. 14,
　　　Karlsruhe, 76131, Germany, philipp.stroehle@partner.kit.edu,
　　　Christoph Flath

We present a multi-objective scheduling model that lets car-sharing providers decide between fleet utilization and customer walkways. We evaluate the model based on real-world customer reservation behavior and estimate the value of spatial flexibility to the provider. Moreover, we show to what extent flexibility can assist in introducing electric vehicles into car-sharing fleets. Our results show that car-sharing poses a promising field for the electrification of individual transportation.

**3 - When and How to Differentiate? Implications for Strategic Delay,
　　Prioritization, and Free Service**
　　　Arvind Sainathan, Nanyang Business School, NTU, S3-B2A-03 50
　　　Nanyang Avenue, Singapore, Singapore, asainathan@ntu.edu.sg

We consider customers purchasing a service from a retailer/service provider. They may be heterogeneous both in their delay sensitivity and how much they value this service. We analyze the retailer's problem of minimizing her cost while providing them adequate service. Strategic delay and prioritization are two simple ways of differentiating customers, while a free service has key implications for marketing. We find conditions under which these features are optimal for the retailer.

4 - Staffing Service Systems when Capacity has a Mind of its Own
　　　Itai Gurvich, Kellogg School of Management, Northwestern
　　　University, 2001 Sheridan Road, Evanston, IL, 60201,
　　　United States of America, i-gurvich@kellogg.northwestern.edu,
　　　Antonio Moreno-Garcia, Martin Lariviere

We study capacity optimization when (nonsalaried) workers determine their own work schedule. Our study is motivated by recent innovations in service delivery such as work-from-home call centers and ride-sharing services. The provider in these settings cannot directly assign agents to time intervals but has to guarantee sufficient participation. Tensions between profit maximization and agent-earning constraints lead to departures from standard operations both in terms of decisions and outcomes.

■ WB18

Hilton- Franciscan C

Joint Session RM/TSL: Pricing Applications in Logistics: Inventory Control, Distribution, and Transportation

Sponsor: Revenue Management & Pricing &
Transportation Science & Logistics

Sponsored Session

Chair: Sila Cetinkaya, Cecil H. Green Professor, SMU, Lyle EMIS and Cox ITOM, Dallas, TX, United States of America, sila@smu.edu

Co-Chair: Fatih Mutlu, Qatar University, MIE Department, Doha, 2713, Qatar, fatihmutlu@qu.edu.qa

1 - Linearly Decreasing Pricing for Shipment Consolidation
Bo Wei, research assistant, Dept of ISEN at Texas A&M, 1501 Holleman Dr Apt 166, college station, TX, 77840, United States of America, feixianxing@neo.tamu.edu, Lin Feng, Sila Cetinkaya

In this work, we study the optimal pricing strategies in the pure shipment consolidation model with linear demand function. We propose a linearly decreasing pricing strategy and analytically show that it achieves more profit than the optimal static price strategy. Finally, we prove rigorously that the linearly decreasing pricing strategy is optimal by using Pontryagin's maximum principle.

2 - Optimal Inventory and Warranty Pricing for Items with Imperfect Quality under Trade Credit
Yi Zhang, ISE Department, Texas A&M University, 1001 Harvey Rd. Apt. 50, College Station, TX, 77840, United States of America, dolphinazy@neo.tamu.edu, Sila Cetinkaya, Elif Akcali

Trade credit and warranty compensation are ubiquitous in B2B transactions. Trade credit can ease the financial burden of large upfront payments for purchasing the goods. Warranty compensation provides protection against potential losses due to imperfect quality of the goods. We develop a stochastic model to determine the optimal inventory and warranty pricing decisions in a two-stage supply chain to model and investigate the impact of imperfect quality and the duration of trade credit period.

3 - Contractual Pricing for a Carrier under Vendor-Managed-Inventory (VMI)
Sila Cetinkaya, Cecil H. Green Professor, SMU, Lyle EMIS and Cox ITOM, Dallas, United States of America, sila@itu.edu, Fatih Mutlu

We address channel coordination issues in a simple yet practical setting where a carrier is to ship the items within a two-echelon supply channel consisting of a supplier and a buyer. We consider the case where the supplier-buyer pair is operated under a VMI agreement whereas the carrier is a separate entity. We develop alternative transportation pricing contracts between the carrier and VMI partnership.

■ WB19

Hilton- Franciscan D

Revenue Optimization under Uncertainty in Healthcare

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Aurelie Thiele, Visiting Associate Professor, MIT, 77 Mass Ave Rm E40-121, Cambridge, MA, 02139, United States of America, aut204@lehigh.edu

Co-Chair: Tengjiao Xiao, Doctoral student, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, tex209@lehigh.edu

1 - A Forward Looking Risk Adjustment Approach using Markov Chains
Gregory McKinney, Business Analytics Consultant, Kaiser Foundation Healthplan, Inc., 1950 Franklin St. (MIA/MARS), Oakland, CA, 94612, United States of America, gmckinne@pacbell.net

Risk Adjustment models are used to set payments so health plans receive more for members with multiple chronic conditions compared to healthier members. The Centers for Medicare & Medicaid Services (CMS) define a model for payments covering over 15 million members. CMS payments use diagnoses from the prior year leading to a backward looking process. Revenue planning requires future risk score prediction. This paper offers an approach to predict future risk scores using Markov Chains.

2 - Robust Optimization Models in Healthcare Finance: The Role of Community Benefit Programs
Shuyi Wang, Doctoral student, Lehigh University, 217 W Packer Ave, Room 201, Bethlehem, PA, 18015, United States of America, shw210@lehigh.edu, Aurelie Thiele

Most hospitals in United States are non-profit and are federal tax exempt. In order to maintain their tax exempt status, these hospitals must contribute part of their revenue to benefit their communities. Most of the contributions are in the form of direct financial assistance. Many believe that if we can shift that amount of money upstream to invest in community-based activities that can prevent disease, we can improve people's health while decrease the rising healthcare cost.

3 - Robust Hospital Readmission Payment Adjustment
Tengjiao Xiao, Doctoral student, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, tex209@lehigh.edu, Aurelie Thiele

This paper introduces robust optimization models to address uncertainty in hospital readmission reduction, which imposes a financial penalty on hospitals with excess readmissions. We investigate the level of nurse staffing to minimize the probability of being penalized, while balancing between provider margins and payer costs. The impact lag is also incorporated in the models to ensure the financial viability of the hospital as the benefits are slower to materialize than expected.

■ WB20

Hilton- Yosemite A

Analysis

Contributed Session

Chair: Fethi Calisir, Industrial Eng. Department, Istanbul Technical University, Istanbul, Turkey, calisirfet@itu.edu.tr

1 - Assessment of Intellectual Capital (IC) Efficiency of Food Industry with DEA
Fethi Calisir, Industrial Eng. Department, Istanbul Technical U., Istanbul, Turkey, calisirfet@itu.edu.tr, Ayse Elvan Bayraktaroglu, Mine Isik

In this work, the Value-Added Intellectual Coefficient (VAIC) method that deals with financial, structural and human capitals are used to evaluate the efficiency of value creation. Then, DEA is used to reveal the relative performance of 12 companies on the Istanbul Stock Exchange. The IC performances and efficiency values of the companies are gathered by means of Charnes Cooper Rhodes methods. The benchmark set and the input, output evaluations are depicted by the efficient frontier. Additionally, the change of VAIC during the years 2009 to 2012 is compared with utilizing Malmquist index.

2 - Intellectual Capital and Firm Performance in Turkish Chemicals, Petroleum, Plastic Products Industry
Ayse Elvan Bayraktaroglu, Industrial Eng. Department, Istanbul Technical U., Istanbul, Turkey, ayseelvan@gmail.com, Murat Baskak, Fethi Calisir

Using the VAIC approach, the relationship between intellectual capital performance and firm performance for some firms listed in Istanbul Stock Exchange is analyzed. The relationship between VAIC components (human capital efficiency: HCE, structural capital efficiency: SCE, capital employed efficiency: CEE) and firm performance indicators are examined using canonical correlation analysis and commonality analysis. The common contribution of the three VAIC dimensions is found to be more decisive on the firms' performance compared to the individual effects of HCE, SCE, and CCE.

3 - The Use of Qualitative Data When Managing External Variety for Configurable Products
Erkin Isiklie, Bogazici University, Department of Industrial Engineering, Bebek, Istanbul, 34342, Turkey, ErkinIsiklie@itu.edu.tr

The reduction of external variety is a strategic decision that is made under the consideration of various factors. In this study, using online consumer reviews on a configurable product, text mining techniques were employed with the aim of helping this decision making process by shrinking the set of product variants without losing too much critical information. The results indicate that when building demand models, such qualitative models should Definitely be utilized in order to obtain better insights.

■ WB21

Hilton- Union Sq 1

Maritime Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Harilaos Psaraftis, Professor, Technical University of Denmark, Bygningstorvet 1, Lyngby, 2800, Denmark, hnpsar@transport.dtu.dk

1 - Optimal Compliance Strategies to Shipping Emission Regulation
    Michele Acciaro, Assist. Professor of Maritime Logistics, The Kuehne Logistics University (KLU), Grosser Grasbrook 17, Hamburg, 20459, Germany, michele.acciaro@the-klu.org, J. Rod Franklin

The development of emission regulation in shipping has increased managerial complexity. In order to provide support to shipping firms, this paper presents an application of decisions analysis under technology and fuel price uncertainty. Results show that operational strategies are optimal only as long as fuel price variability remains high.

2 - Practical Applications of Operations Research Tools in Marine Transportation
    Henry Chen, Chief Naval Architect, Jeppesen Marine, 1000 Atlantic Avenue, Suite 108, Alameda, CA, 94501, United States of America, henry.chen@jeppesen.com

More than 90% of world's cargo are carried by ships. Optimizing design, operations and logistics can greatly improve the efficiency and safety of this supply chain, especially in today's high fuel cost and restricted carbon emission. Examples are: Voyage simulations for comparing ship designs, and establishing METOCEAN criteria for tows; Minimizing fuel consumption on a given schedule, specific ship loading conditions under a set of response based constraints and weather forecast.

3 - Planning Liner Shipping Services
    Christian Vad Karsten, The Technical University of Denmark, Produktionstorvet Bygning 426, Kgs. Lyngby, 2800, Denmark, chrkr@dtu.dk, Anant Balakrishnan

We address the Liner Shipping Service Selection Problem that entails selecting the best subset of sailing routes from a pool of candidate routes to maximize the satisfied demand subject to limits on the number of transshipments and routing constraints. We propose a hop-constrained multi-commodity arc flow model on an augmented network, and outline a preprocessing procedure to reduce problem size. We present computational results for problems from the LINER-LIB benchmark suite.

4 - Efficient Dynamic Programming Approach for the Container Relocation Problem
    Virgile Galle, MIT Operations Research Center, Cambridge, United States of America, vgalle@mit.edu, Cynthia Barnhart, Setareh Borjian, Vahideh Manshadi, Patrick Jaillet

We propose a fast and efficient Dynamic Programming approach for optimally solving the container relocation problem (also referred to as block relocation problem). Our method is capable of obtaining optimal solutions in a reasonably short time and is thus applicable in real time operations. Further, we extend our solution approach to a new version of the container relocation problem: the incomplete information case when the entire departure schedule of containers is not known beforehand.

5 - Emissions Minimization Ship Routing Problem
    Christos Kontovas, Assistant Professor, Technical University of Denmark, Bygningstorvet 115, Lyngby, 2880, xkontovas@gmail.com, Harilaos Psaraftis

We investigate some possible reformulations of existing ship routing and scheduling models so as to incorporate emissions considerations. Speed decisions are also taken into account. Because of the non-linear relationship between speed and fuel consumption, it is obvious that a ship that goes slower will emit much less than the same ship going faster. In that context, some fundamentals are outlined, the main trade-offs are analysed, and some decision models are presented.

■ WB22

Hilton- Union Sq 2

Identity and Change in Organization Science

Sponsor: Organization Science
Sponsored Session

Chair: Emily Block, Assistant Professor of Management, University of Notre Dame, Notre Dame IN 46556, United States of America, esblock@gmail.com

1 - The Identity of Religious Research Universities in the Face of Secularization
    Dave Whetten, Emily Block, Alan Wilkins

Abstract is not available at this time.

2 - Bottle Revolution: Constructing Consumer and Producer Identities in the Craft Brewery Industry
    Cameron Verhall, Emily Block, Michaela DeSoucay, Jo-Ellen Pozner, Katarina Sikavika

This paper considers the conundrum that in a market that co-evolved with an identity movement and that possesses a clearly defined organizational form identity, how do market participants manage to de-partition the market to the point that generalists and specialists compete directly? We believe this unexpected dynamic is driven by the intentional use of language on the part of both generalist and specialist producers, and aided by the evolution of the identity movement itself. We investigate the ways that language drives market structure, drawing on organizational ecology, neo-institutional theory, and theories of linguistic and cultural framing. We focus on language as a set of shared meanings that mobilize actors in support of change, propagate new identities, and help actors make or dispute claims of legitimacy.

3 - Coopting Contention: The Rise and Routinization of Corporate-Sponsored Insurgency
    Mae McDonnell

Abstract is not available at this time.

4 - Embeddedness and Borrowed Identitiy: The Case for California Franchisee Restaurant
    Nydia McGregor

Abstract is not available at this time.

■ WB23

Hilton- Union Sq 3

Container Supply Chain Coordination

Sponsor: TSL/Freight Transportation & Logistics
Sponsored Session

Chair: Jan C. Fransoo, Professor, Eindhoven University of Technology, School of Industrial Engineering, PO Box 513, Pav F4, Eindhoven, 5223 GV, Netherlands, j.c.fransoo@tue.nl

1 - Cost, Carbon Emissions and Modal Shift in Intermodal Network Design Decisions
    Yann Bouchery, Ecole de Management de Normandie, 30, Rue de Richelieu, Le Havre, 76087, France, y.bouchery@tue.nl, Jan C. Fransoo

Intermodal transportation is generally considered as efficient for reducing carbon emissions without compromising economic growth. In this article, we present a new intermodal network design model in which the terminal location and the allocation between direct truck transportation and intermodal transportation are optimized. The model allows for studying the dynamics of intermodal transportation in the context of hinterland networks from a cost, carbon emissions and modal shift perspective.

2 - The Impact of Demurrage and Detention Tariffs on Hinterland Container Planning
    Jan C. Fransoo, Professor, Eindhoven University of Technology, School of Industrial Engineering, PO Box 513, Pav F4, Eindhoven, 5223 GV, Netherlands, j.c.fransoo@tue.nl, Stefano Fazi, Tom Van Woensel

Demurrage and detention are charged to shippers and freight forwarders for the usage of containers between the port of arrival and unloading at the receiver's location. In this study, we investigate the consequences of D&D, based on actual tariff structures in Rotterdam. Our findings show that the tariff structure leads to increased overall costs of transportation and to excessive storage of containers in the scarce space of the deepsea quay.

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3 - Barge Port-Hinterland Container Network Design with Synchronization Constraints
Rob Zuidwijk, Professor, Rotterdam School of Management, PO Box 1738, Rotterdam, 3000 DR, Netherlands, rzuidwijk@rsm.nl, Panagiotis Ypsilantis

A barge operator schedules its minimum cost barge services at the tactical level to accommodate container transport between seaport and its hinterland. He decides on deployment and routing of his barge fleet exploiting economies of scale. The corresponding MIP problem is solved for a particular real-life case in the Netherlands. Our results show the effects of economies of scale, number of calls per trip, and required service frequency on total costs.

4 - Carrier Portfolio Management in Liner Shipping
Tao Lu, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, tluaa@ust.hk, Chung-Yee Lee, Jan C. Fransoo

We study a shipper transporting seasonal products from overseas to the destination market. In addition to spreading the risk arising from uncertain transit times, we find that using a combination of fast and slow liner services can help tackle the demand uncertainty in the destination. When carriers' arrival sequence is fixed, we fully characterize the optimal solution with an efficient frontier. A DP-based algorithm is further proposed to optimally solve the problem with setup costs.

5 - Fractional Price Matching Policies Arising from the Ocean Freight Service Industry
Rui Yin, Associate Professor, Arizona State University, Dept of Supply Chain Management, W.P.Carey School of Business, Tempe, AZ, 85287, United States of America, rui.yin@asu.edu, Jaehyung An, Chung-Yee Lee, Chris Tang

We consider a situation in which shippers can purchase ocean freight services either directly from a carrier in advance or from the spot market just before the departure of an ocean liner. The price is known in the former case, while the spot price is uncertain ex-ante in the latter case. We examine if the carrier should bear some of the price risk by offering a "fractional" price matching contract that will "partially match" the realized spot price when it is lower than the regular price.

■ WB24

Hilton- Union Sq 4

Transportation, Intelligent Systems I
Contributed Session

Chair: Young-Ji Byon, Khalifa University (KUSTAR), Al Saada St. and Muroor Rd., Abu Dhabi, United Arab Emirates, youngji.byon@kustar.ac.ae

1 - using Smartphones to Improving Safety and Mobility for Pedestrians
Sara Khosravi, Research Assistant, University of Arizona, 811 E Prince Rd #221, Tucson, AZ, 85719, United States of America, sarakhosravi@email.arizona.edu, Larry Head, Navin Katta

The purpose of this project is to make use of emerging and state-of-the-art technologies including Smartphones and 3G/4G/LTE, Wi-Fi, and DSRC communications, to find innovative and effective ways to improve pedestrian safety and mobility. These improvements can be achieved by integrating pedestrian information with the Connected Vehicle system to provide effective and timely warnings to both pedestrians and motorists.

2 - Finding the Distribution of Maximum Queue Length using Probe Vehicle Data with Low Penetration Rate
Xin Qi, Tsinghua University, Shunde Building 519A, Beijing, 100084, China, x-qi12@mails.tsinghua.edu.cn, Hai Jiang

We develop a model to estimate the distribution of queue lengths at signalized intersections using GPS data from probe vehicles. We validate our model using data from both microscopic simulation and NGSIM. Results show that our model can produce satisfactory results.

3 - Comparing Efficiency of Different Intelligent Transportation Systems using Agent Based Simulation
Amirhosein Gholami, State University of New Yourk at Binghamton, 13 Goethe St., Binghamton, United States of America, agholam1@binghamton.edu, Nasim Nezamoddini

The traffic congestion problem in urban areas has been addressed by developing different types of intelligent systems. Agent based modeling has been applied to model systems including system with intelligent traffic signal timing and dynamic route guide and combination of them. Efficiency of each system, has been tested in presence of the unexpected events with different failures rates. Proposed transportation management systems have been tested under different assumption and traffic situations.

4 - Determination of Noise Accumulation using ADS-B Signals and Geographic Information Systems
Young-Ji Byon, Khalifa University (KUSTAR), Al Saada St. and Muroor Rd., Abu Dhabi, United Arab Emirates, youngji.byon@kustar.ac.ae, Joonsang Baek, Young-Seon Jeong

Emerging ADS-B technologies enable transportation engineers access real-time trajectories of airplanes. Near airports, the density of such signals are higher. Since ADS-B passively emits information about type of each airplane, it is possible to estimate the amount of noise accumulation that affects the nearby grounds. By using DEM in GIS, more accurate distribution of the noise can be determined.

5 - Semi-quantitative Risk Assessment of Adjacent Track Accidents on Shared-use Rail Corridors
Chen-Yu Lin, Graduate Research Assistant, University of Illinois at Urbana-Champaign, Room B-118, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, clin69@illinois.edu, Mohd Rapik Saat

Adjacent track accident (ATA) is one of the most important safety concerns on shared-use rail corridors. ATA refers to train accident scenarios where a derailed equipment intrudes adjacent tracks. The research described in this paper presents a comprehensive risk assessment to identify factors affecting the likelihood and consequence of ATA. A semi-quantitative risk analysis model is developed to evaluate the ATA risk.

■ WB25

Hilton- Union Sq 5

Transportation Planning IV
Contributed Session

Chair: Seong Wook Hwang, The Pennsylvania State University, 232 Leonhard Building, The Pennsylvania State University, University Park, PA, 16802, United States of America, soh5223@psu.edu

1 - An Global Approximation Model for the Continuous Network Design Problem
BO DU, Nanyang Technological University, N1-B4b-07, 50 Nanyang Avenue, Singapore, 639798, Singapore, bdu1@e.ntu.edu.sg, Zhiwei Wang

Continuous network design problem is often formulated as a bi-level program with equilibrium constraints, and only approximation solution can be obtained due to its non-convexity. Based on geometric programming, this paper develops an equivalent single-level model to find an approximated global optimal solution. The principle of solving this problem is to apply a monomial approximation method to transform it to an equivalent nonlinear but convex problem, which is amenable to a global solution.

2 - Temporal Analysis of Origin-destination Matrices Estimation based on Passenger Cars Traffic Counts
Carlos Gonzalez-Calderon, Postdoctoral Research Associate, Rensselaer Polytechnic Institute, 110 8TH ST, JEC 4037, TROY, NY, 12180, United States of America, gonzac8@rpi.edu, Susana Restrepo Morantes, John Jairo Posada Henao, Catalina Osorio

This research introduces an entropy maximization demand model to estimate origin-destination matrices for passenger vehicles on the basis of traffic counts for different years. The performing of the formulation for the different time periods (2001-2008) is tested in the Medellin, Colombia network.

3 - Unit-Train Multiple Car Expected Quantity of Release Modeling
Hsiao-Hsuan Liu, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, Il, 61801, United States of America, hliu70@illinois.edu, Jesus Aguilar Serrano, Christopher PL Barkan, Mohd Rapik Saat

Railroads transport large quantities of hazardous materials over long distance in North America. The release size of an incident is a crucial factor for hazardous materials transportation risk. A probabilistic methodology is developed in this study to estimate the expected quantity of release based on the number of tank cars releasing.

4 - On-route Ride Sharing in Closed User Groups
Rick van Urk, University of Twente, P.O. Box 217, Enschede, 7500AE, Netherlands, r.vanurk@utwente.nl, Martijn Mes, Marco Schutten

A challenge ride sharing initiatives face is to encourage users to accept a shared ride even though this results in longer travel times. To solve this, we propose a method where only on-route ride sharing is allowed. We consider a closed user group, which creates a network of trusted drivers using the ride sharing network. We match users using the arcs of individual optimal routes of users.

5 - Robust Strategy for Alternative Fuel Refueling Station Location under Demand Uncertainty
Seong Wook Hwang, The Pennsylvania State University, 232 Leonhard Building, The Pennsylvania State University, University Park, PA, 16802, United States of America, soh5223@psu.edu, Sang Jin Kweon, Jose A. Ventura

In this research, we apply robust optimization to a multi-period planning problem of locating refueling stations on a transportation network with uncertain alternative fuel vehicle (AFV) demand. Forecasting AFV demand over multiple periods, we consider a refueling station location problem to find the number of stations and their locations over each period.

■ WB26

Hilton- Union Sq 6

Vehicle Routing II

Contributed Session

Chair: Wei Zhou, Research Assistant, University of Illinois at Chicago, 892 W Taylor St, Chicago, IL, 60607, United States of America, wzhou27@uic.edu

1 - An Adaptive Large Neighborhood Search Method for Solving the Electric Vehicle Routing Problem
Bulent Catay, Sabanci University, FENS, Tuzla, Istanbul, 34956, Turkey, catay@sabanciuniv.edu, Merve Keskin

The Electric Vehicle Routing Problem with Time Windows is a new variant of the classical Vehicle Routing Problem with Time Windows where the vehicles are routed to service a set of customers under recharging constraints. In this study, we propose an Adaptive Large Neighborhood Search method to solve this problem. Our initial results show the proposed method is effective in finding good solutions.

2 - A New Fuzzy Modeling Approach for Joint Manufacturing Scheduling and Shipping Decisions
Can Celikbilek, PhD Candidate, Ohio University, 285 Stocker Center Ohio University, Athens, OH, 45701, United States of America, cc340609@ohio.edu, Gursel A. Suer

This study discusses a new fuzzy modeling approach for joint manufacturing scheduling and shipment decisions within a supply chain network. The aim of this study is to maximize the total net profit while minimizing the risks caused by selecting alternative transportation modes. Different transportation modes are considered in this study. This study will be unique in the sense of considering an integrated fuzzy approach with manufacturing scheduling and transportation mode selections.

3 - The Parking Time Dilemma and Chinese Postman's Revenue
Nichalin Summerfield, Full Time Lecturer, University of Massachusetts Dartmouth, 285 Old Westport Rd, North Dartmouth, MA, 02747, United States of America, nsummerfield@umassd.edu, Moshe Dror, Morris Cohen

We model an administrative activity of issuing parking tickets in a dense city street grid as a revenue collection Chinese Postman Problem. After demonstrating that our design of inspection routes maximizes the expected revenue we investigate decision rules that allow the officers to adjust online their inspection routes in response to the observed parking permits' times. A simulation study concludes that allowing the officer to selectively wait by parked cars increases the expected revenue.

4 - The Dynamic Pollution-Routing Problem with Time-dependent Travel Time
Wei Zhou, Research Assistant, University of Illinois at Chicago, 892 W Taylor St, Chicago, IL, 60607, United States of America, wzhou27@uic.edu

This paper presents the so-called Dynamic Pollution-Routing Problem, a coupling of Dynamic Vehicle Routing Problem and Pollution-Routing Problem. In urban areas, travel speed and changes drastically during the day because of congestion, thus DPRP treats the travel time functions as step functions. In this paper, mathematical models under dynamic context are presented for the time-dependent DPRP. A mixed integer linear programming approach is developed to solve the problem.

5 - A Branch-and-Price Algorithm for Vehicle Routing with Demand Allocation Considerations
Ahmed Ghoniem, Assistant Professor, Isenberg School of Management, 121 Presidents Dr., University of Massachusetts Amherst, Amherst, MA, 01003, United States of America, aghoniem@isenberg.umass.edu, Mohammad Reihaneh

We develop a branch-and-price algorithm for vehicle routing with demand allocation problems (VRDAP) which arise in food bank operations, the delivery of healthcare services in developing countries, and beyond. The VRDAP selects distribution sites, allocates "customers" to the latter, and optimizes the routes of delivery vehicles. The objective function minimizes a weighted average of the distance traveled by customers to reach distribution sites and that traveled by delivery vehichles.

■ WB27

Hilton- Union Sq 7

Logistics 2

Contributed Session

Chair: Youssef Boulaksil, Assistant Professor, UAE University, College of Business and Economics, P.O. Box 15551, Al Ain, United Arab Emirates, youssef.boulaksil@gmail.com

1 - Reliable Intermodal Freight Network Expansion: Case with Uncertain Network Disruptions
Fateme Fotuhiardakani, Research Assistant, University of South Carolina, 300 Main st, Columbia, SC, 29208, United States of America, fotuhiar@email.sc.edu, Nathan Huynh

This paper develops a robust model to improve the reliability of an intermodal network to enable it to perform well in normal and disrupted situations. The objective of the model is to identify critical links to "harden", locations to establish new terminals, and existing terminals to expand, within a given budget. We propose a Hybrid Genetic Algorithm (HGA) to solve the model. The experimental results demonstrate the efficacy and computational efficiency of the proposed HGA.

2 - A Stochastic Programming Model for Yard Storage Allocation under Uncertainty
Yue Wu, University of Southampton, School of Management, Southampton, SO17 1BJ, United Kingdom, y.wu@soton.ac.uk

This paper investigates allocation of yard space to containers under uncertainty. Two types of stacks are defined: containers with the same destination are assigned to dedicated stacks in the same block; containers in shared stacks have different destinations. A two-stage stochastic model is developed to determine an optimal storage strategy. The first-stage decision is to allocate containers to dedicated stacks and the second-stage decision is to place additional containers to shared stacks.

3 - Maintenance and Service Logistics Planning in the Maritime Sector: A Research Agenda
Ayse Sena Eruguz, Postdoc, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.s.eruguz@tue.nl, Tarkan Tan, Geert-Jan Van Houtum

Maintenance and service logistics support are required to ensure high availability and reliability for maritime assets and represent a significant part of exploitation costs. In this talk, we will present a classification of the maintenance and service logistics literature considering the specific characteristics of the maritime sector. We will discuss unexplored issues and shortcomings of existing models and suggest a research agenda.

4 - Distributing FMCG to Small Retailers in Emerging Markets
Youssef Boulaksil, Assistant Professor, UAE University, College of Business and Economics, P.O. Box 15551, Al Ain, United Arab Emirates, youssef.boulaksil@gmail.com

Distributing fast moving consumer goods to small retailers in emerging markets is a challenging task. The small retailers offer informal credits to their customers, which makes them operate with limited and uncertain availability of cash. Since distributors require payment in cash at the moment of delivery, 'empty deliveries' may result in case of insufficient amount of cash available. We conduct a simulation study to better understand empty deliveries, which reveals interesting insights.

■ WB28

Hilton- Union Sq 8

Breaking the Silos in Airline Crew Scheduling

Sponsor: Aviation Applications
Sponsored Session

Chair: Norbert Lingaya, Manager of Optimization Technologies, Ad OPT, a Division of Kronos, 3535 Queen Mary Rd, Suite 650, Montreal, QC, h3v1h8, Canada, nlingaya@Kronos.com

1 - Thinking out of the Box by Breaking the Silos
Norbert Lingaya, Manager of Optimization Technologies, Ad OPT,a Division of Kronos, 3535 Queen Mary Rd, Suite 650, Montreal, QC, h3v1h8, Canada, nlingaya@Kronos.com

"Think outside the box" is a catchphrase that has become somewhat cliché and void. In this talk we focus on "breaking the silos" as one way to think outside the box when applied to optimized Crew Planning. We present a rationale for the opportunity to break some silos, the challenges to be addressed and the expected benefits.

WB29   *INFORMS San Francisco – 2014*

2 - Integrated Crew Paring and Crew Assignment by Dynamic Constraint Aggregation

Mohammed Saddoune, Université Hassan II, Mohammedia, Casablanca, Morocco, mohammed.saddoune@gerad.ca

The crew scheduling problem is commonly decomposed into two stages which are solved sequentially. Crew pairing generates a set of pairings covering all flight legs. Crew assignment generates anonymous blocks covering all pairings. The simultaneous problem generates a set of blocks covering all flight legs. It is a large set covering problem highly degenerated. We solve it with column generation and the dynamic constraint aggregation and save up to 9% on real-life problems.

3 - Simultaneous Optimization of Crew Pairing and Personalized Monthly Schedules

Atoosa Kasirzadeh, Ecole Polytechnique de Montreal & GERAD, 2900 Boulevard Edouard-Montpetit,, Montreal, QC, H3Z 1J9, Canada, Atoosa.Kasirzadeh@gerad.ca, Francois Soumis, Mohammed Saddoune

We present a set-covering formulation and an iterative heuristic algorithm for personalized integrated cockpit pairing and assignment problems. The objective is having as much as possible similar pairings between pilots and co-pilots to increase the schedules robustness, even if pilots and co-pilots monthly schedules are different to satisfy their preferences. We use a solution approach based on column generation and numerical results are provided based on a major US carrier data set.

4 - Integrated Aircraft Routing, Maintenance Planning and Robustness for Operation

Francois Soumis, Ecole Polytechnique, Cp. 6079, Montreal, QC, H3C 3A7, Canada, francois.soumis@gerad.ca, Stephen Maher, a Division of Kronos, 3535 Queen Mary Rd, Suite 650, a Division of Kronos, 3535 Queen Mary Rd, Suite 650, Montreal, QC , h3v1h8, Canada, nlingaya@Kronos.com, Montreal, QC, h3v1h8, Canada, nlingaya@Kronos.com, Guy Desaulniers

It is common to solve the aircraft routing and maintenance planning problems many months in advance but infeasibilities appear due to perturbations in operations. We present a novel approach generating aircraft routes for a single day and ensuring a sufficient number of routes from each city going to maintenance next night. The solution is protected from disruptions by applying a recoverable robustness framework. Tests on large scale problems demonstrate significant reduction in recovery costs.

■ **WB29**

Hilton- Union Sq 9

Manufacturing 2

Contributed Session

Chair: Xi Gu, PhD Candidate, University of Michigan, 1210 H. H. Dow, 2300 Hayward Street, Ann Arbor, MI, 48109, a Division of Kronos, 3535 Queen Mary Rd, Suite 650, Montreal, Q , h3v1h8, Canada, nlingaya@Kronos.com, United States of America, xig@umich.edu

1 - Resilient Design for Manufacturing Systems

Xi Gu, Ph.D. Candidate, University of Michigan, 1210 H. H. Dow, 2300 Hayward Street, Ann Arbor, MI, 48109, United States of America, xig@umich.edu, Jun Ni, Xiaoning Jin

Resilience is regarded as a competitive advantage of manufacturing systems. A resilient system has the ability to quickly recover from faults/failures to normal conditions with no or least performance loss. The objective of this research is to model and analyze the resilience measures of manufacturing systems with unreliable machines and finite buffers. Both the steady-state and transient behavior of such systems is studied, and system design strategies are investigated.

2 - Ergonomic Risk Mapping at the Refrigerator Company

Ilgin Acar, Anadolu University, Faculty of Eng. Dept. of Industrial Eng., Eskisehir, Turkey, ipoyraz@anadolu.edu.tr, Gizem Deniz, Ozlem Urem, Ibrahim Yilmaz

As is known, there could be discomfort in almost every job due to the heavy and repetitive workload. We consider a production line at the refrigerator company that has 110 work stations to assess the ergonomic risk. NISOH, REBA and Lumbar Motion Monitor (LMM) are used to map the ergonomic risk at the work stations. Improvements are offered based on the findings of related methods.

3 - Simultaneous Line Balancing and Worker Allocation in a U-shaped Production Line

Joseph Ekong, Auburn University, 2319 Shelby Center, Auburn, AL, 36849, United States of America, jje0003@auburn.edu

An MIP model for a simultaneous U-shaped assembly line balancing and worker allocation problem is proposed. Tasks are assigned to stations and workers are assigned to the stations resulting in a global solution. The objective is to minimize deviation of operation times of workers. Impact of variability is investigated.

4 - Applying Six Sigma Techniques to Reduce Defect Rate of Deep Drawing Process for Aluminum Products

Theyab Alhwiti, Auburn University, 362 W Glenn Ave APT 104, Auburn, Al, 36830, United States of America, tza0002@auburn.edu, Nader Al Theeb

Sheet metal deep drawing is an important process to produce many products. The goal of this research is to improve this process to reduce the defective percentage rate of scratches, flange wrinkling, and earing defects appear in aluminum deep drawn products from 3% to 0.8% by adopting new mold with an excellent parameter values and control. A design of experiment phase is conducted to find the best factorial level combination of the clearness, holding force, speed, and lubricant parameters.

5 - Comparison of Simulation and Optimization Models to Support Decisions in Semiconductor at Operations

Shihui Jia, Graduate Research Assitant, The University of Texas at Austin, Graduate program in IE/OR, University of Texas at Austin, Austin, TX, 78712, United States of America, sjia@utexas.edu, Jonathan Bard

This talk presents simulation and optimization models to support machine setup and lot dispatching decisions for assembly & test operations in semiconductor manufacturing. The simulation model was built in AutoSched AP and improved by incorporating setup output from the optimization model and customizing the dispatch rules. Experiments were conducted on six datasets and results compared using the following metrics: hot lot shortages, weighted throughput, resource usage, and machine utilization.

■ **WB31**

Hilton- Union Sq 11

Applying Computational Creativity in Service Industries

Sponsor: Service Science

Sponsored Session

Chair: Ying Li, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, yingli@us.ibm.com

1 - Computational Creativity for Personalized Artifact Creation

Nan Shao, Research Staff Member, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, nanshao@us.ibm.com, Pavankumar Murali, Anshul Sheopuri

Can a computer create an artifact which is judged to be creative by a targeted group of individuals? We explore data-driven computational creativity for personalized artifact design based on two key attributes, quality and novelty. We present the methodology, comment on the available data sources, and illustrate the concept using an example in the culinary recipe creation.

2 - Intelligent Search Methods for Computational Creativity

Pavankumar Murali, Research Staff Member, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, pavanm@us.ibm.com, Nan Shao, Anshul Sheopuri

Computational creativity for designing artifacts requires searching through a combinatorially complex design space. Traditional methods resort to greedy heuristics to identify and evaluate artifacts for creativity. We present an alternative optimization framework where the evaluation metrics are used to prune the design space subject to theoretical underpinnings. We evaluate the performance of the proposed solution using public datasets on food recipes, cuisines, ingredients and chemistry.

3 - Assessing Aesthetics of Food Dishes using Computational Methods

Ying Li, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, yingli@us.ibm.com, Anshul Sheopuri

We propose and implement a novel approach to assess the aesthetics of food dishes. Our framework builds upon work in the area of color science, psychology and statistics to enable users to computationally assess whether the image of a dish is unique and visually appealing with the appropriate texture. Using Google Glass as an innovative way to interact with consumers on this application is also under active investigation, which will bring us a new dimension from wearable computing.

4 - Can Computational Creativity Produce a Commercially Successful Artificial Songwriter?

Dan Ventura, Professor, Brigham Young University, Provo, UT, 84602, United States of America, ventura@cs.byu.edu

Music is a promising domain for studying computational creativity. Music is also a huge industry, and the potential of a computational song-writing system that can produce consumable music is enticing from both a research standpoint and an economic one. We will discuss some of the challenges involved in building such a system and some approaches to their solution, including incorporation of affect, discovery of musical motifs, flexible style composition, and the combination of music with lyrics.

5 - Computational Narrative Intelligence: Opportunities and Challenges for Sense-Making with Data

Mark Riedl, Professor, Georgia Institute of Technology, 85 5th Street NW, Atlanta, GA, 30308, United States of America, riedl@cc.gatech.edu

Narrative intelligence is an entity's ability to organize, explain, and generate experiences in narrative terms. Computational story understanding and generation can be used to automatically seek familiar and novel patterns in data, create human-readable explanations of temporal changes in data, and hypothesize about occurrences in missing data.

6 - An Optimization Model for Determining Assortment of New Product at Store Level for Fashion Retailers

Dingding Lin, IBM Research - China, Building 19A, Dongbeiwang West Rd 8#, Zhongguancun Software Park, Beijing, 100193, China, ddlin@cn.ibm.com, Yongqing Xue, Ganggang Niu, Yue Tong

Store assortment is critical to help achieve retail success. However, due to highly volatile demand, short lifecycle of products, and high ratio of new styles, fast fashion retailers are facing great challenges on store assortment planning. An assortment optimization model for new products is proposed and a planning system based on this model is developed to aid fast fashion retailers in decisions of which new products to stock at store level.

■ WB32

Hilton- Union Sq 12

Operations/Service 2

Contributed Session

Chair: Zainab Al Balushi, Assistant Professor, Sultan Qaboos University, College of Economics PO BOX 20, Operations Mangement, AL Khoudh, 123, Oman, zainab.albalushi@gmail.com

1 - Optimal Dynamic Pricing of Mobile Data Plans in Wireless Communications

Xiaoyu Ma, Tsinghua University, Haidian District, Beijing, China, maxythu@gmail.com, Tianhu Deng

With smartphones sweeping the world, customers use much more data service than voice service nowadays. Because mobile data service occupies much more network capacity than voice, wireless network is frequently congested. We build a dynamic cell phone plan control model where the service provider can decide a subset of plans to open at the beginning of each period. In a case study, we analyze a large mobile service provider in Asia using 10,000 real individual-level data.

2 - Planning and Competition in Information Chain

Boyoun Choi, UCLA Anderson School, 110 Westwood Blvd, Gold Hall, Suite B-512, Los Angeles, CA, 90095, United States of America, bchoi@anderson.ucla.edu, Uday Karmarkar

We examine aspects of information chains, which process and distribute digital content in a way analogous to goods in supply chain. We consider the capacity planning problem for information content, where we decide in each period how many workers to utilize and how many items to process to make them available in the database, which is then available to customers. On competitive side, we investigate optimal release time and pricing of content such as video and model competition among vendors.

3 - Operations Management Practices in Service and Performance

Asma Al Zaidi, Assistant Professor, Sultan Qaboos University, CEPS, PO Box 20 PC123, Alkhoudh, Muscat, 123, Oman, alzidia@squ.edu.om, Zainab Al Balushi

This study proposes a model that conceptualizes the dimensions of operations management practices in managing the service quality. The model also tests the hypothesized relations between the operations management practices and performance. The results have confirmed the conceptualized model and its relations.

4 - Contract for Professional Services

Ting Luo, The University of Texas at Dallas, 7208 Fair Valley Way, Plano, TX, 75024, United States of America, ting.luo@utdallas.edu

Professional service firms turn human capital into specialized service where their clients couldn't but hope to duplicate. When they enter the contract, the client can't verify everything not because of costly observation but the disparity in expertise. The literature assumes the agent reveals true type under IC and IR constraints, but what if the principal can't understand the exact type? A principal and agent model will be presented where the principal is less knowledgeable than the agent.

5 - A Network Economic Model of a Service-Oriented Internet with Choices and Quality Competition

Sara Saberi, Isenberg School of Management, University of Massachusetts, 121 Presidents Drive, Amherst, MA, 01002, United States of America, ssaberi@som.umass.edu, Anna Nagurney, Dong Li, Tilman Wolf

A dynamic network economic model is developed for a service oriented Internet with service differentiation. We utilize variational inequality theory for formulation of Nash equilibrium. The projected dynamical systems provide a continuous-time evolution of service volumes and quality levels. We recall stability analysis results and construct a discrete-time version of the adjustment process that yields an algorithm. The algorithm is utilized to solve several examples with sensitivity analysis.

■ WB33

Hilton- Union Sq 13

New Product Development 1

Contributed Session

Chair: Niharika Garud, Postdoctoral Research Fellow, IIM Bangalore, M213 Madhav Nagar, Gwalior, MP, 474002, India, niharika.garud@gmail.com

1 - A Dynamic Model for Trade-off Analysis of New Green Products

Mohammad Reza Gholizadeh Toochaei, Student, Concordia University, 1455 De Maisonneuve Blvd. west, Montreal, QC, H3G 1M8, Canada, gholizadeh.mr@gmail.com, Nadia Bhuiyan

Companies can design their products for the environment based on different strategies. It is imperative for companies to forecast their profit at the design stage through a trade-off analysis in the new product development process. This paper is an attempt to introduce a dynamic model that considers effective factors that impact the total yearly profit based on managers' decisions regarding the level of development when products are designed for resource and energy efficiency or recyclability.

2 - Development of Customer Satisfaction Function Based on Kano's Quality Model

Daisuke Amano, student, Tokyo Metropolitan University, 6-6, Asahigaoka, Hino, 191-0065, Japan, amano_daisuke_1023@yahoo.co.jp, Yasutaka Kainuma

In this study, we suggest the way of determining which quality element by identifying the degree of importance of a product's quality element and identifying the functional relationship by conforming to the Target Planning V-model. In the analysis process, we combined the AHP and the Kano's quality model so that it can be able to grasp the weights of importance and quality model. In the synthesis process, we conduct group decision making passed through consensus building.

3 - New Product Design Evaluation and Flexibility Planning under Technological and Market Uncertainty

Amir Sanayei, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, sanayei@wayne.edu, Leslie Monplaisir

Product architecture decisions are one of the most critical decisions that are maid in early stages of the new product development with huge impact on all downstream activities and product success in the market. In this research we propose a frame work to evaluate the new product design in order to incorporate managerial flexibility into NPD projects and decrease technical and market risks, while increasing potential market value.

4 - In-depth Features of the IBM CPLEX Optimization Studio IDE

Frederic Delhoume, Software Engineer, IBM, 9 Rue de Verdun, Gentilly, 94253, France, delhoume@fr.ibm.com

We will present many features that allow IBM CPLEX Optimization Studio IDE users to accelerate their model development. Tips and tricks will be presented, related to editing models, viewing results, debugging and writing custom scripting code, profiling. This presentation will also introduce the Eclipse environment IBM CPLEX Optimization Studio is based on.

WB34   *INFORMS San Francisco – 2014*

■ **WB34**

Hilton- Union Sq 14
Session
Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Paulo Goncalves, University of Lugano, Via Giuseppe Buffi 13, Lugano, TI, 6900, Switzerland, paulo.goncalves@usi.ch

1 - Multi-preposition Decisions under Resource Constraints
José Gonçalves, U. of Porto, Rua Dr. Farias, s/n, Porto, Portugal, jfgoncal@fep.up.pt, Jarrod Goentzel, Jaime Andrés Acevedo Casta-eda

The subject of this study is a Newsstand (multi-item Newsvendor) setting under resource constraints in the context of preposition decisions. The authors explore how individuals react to different resource levels when they preposition multiple emergency supplies that differ in their cost levels, assessing thus how constrained resources affect preposition decisions.

2 - Supply Chain Optimization of the Distribution of Mosquito Nets in Ivory Coast
Paulo Gonçalves, University of Lugano, Via Giuseppe Buffi 13, Lugano TI 6900, Switzerland

The use of insecticide-treated mosquito nets is one of the most effective ways to reduce malaria deaths. To help plan UNICEF's distribution of 12 million bed-nets in Ivory Coast, we developed a model to optimize the costs from purchasing and prepositioning at Districts level, achieving 7% logistics cost reduction.

■ **WB35**

Hilton- Union Sq 15
Next Generation Decision Support for the Next Pandemic
Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Samuel V Scarpino, Omidyar Fellow, Santa Fe Insitute, 1399 Hyde Park Road, Santa Fe, NM, 87501, United States of America, scarpino@santafe.edu

1 - Detecting Epidemics using Wikipedia Article Views using Language as a Proxy for Location
Geoffrey Fairchild, Los Alamos National Laboratory, P.O. Box 1663, Mailstop P939, Los Alamos, NM, 87545, United States of America, gfairchild@lanl.gov, Sara Del Valle, Reid Priedhorsky, Nicholas Generous, Alina Deshpande

We propose an open data source previously unexplored for infectious disease surveillance: Wikipedia access logs. We demonstrate that these data feasibly support an approach that overcomes challenges traditional systems face. Specifically, our proof-of-concept yields models with r^2 up to 0.92, forecasting value up to the 28 days tested, and several pairs of models similar enough to suggest that transferring models from one location to another without re-training is feasible.

2 - An Integrative Surveillance System for Influenza-associated Hospitalizations in at Risk Populations
Samuel V Scarpino, Omidyar Fellow, Santa Fe Insitute, 1399 Hyde Park Road, Santa Fe, NM, 87501, United States of America, scarpino@santafe.edu, James Scott, Rosalind Eggo, Lauren Meyers, Nedialko Dimitrov

Influenza hospitalizations are positively associated local measures of poverty. We developed a framework for combining multiple data sources to predict influenza outbreaks in at-risk populations. The data sources considered were: emergency department visits, primary healthcare providers, and Google Flu Trends. We demonstrate that out-of-sample performance was lowest in the most at-risk zip codes, which highlights the importance of understanding the dynamics of influenza in these populations.

3 - Optimizing Vaccine Allocations for Pandemic Influenza
Bismark Singh, The University of Texas at Austin, 204 E. Dean Keeton St., Austin, TX, 78712-0292, United States of America, bismark.singh@utexas.edu, Hsin-Chan Huang, David Morton, Lauren Meyers

We develop a decision-support tool to optimize vaccine allocations during an influenza pandemic. Our allocation is proportionally fair for user-specified target populations, and we further analyze a weighted proportionally fair allocation. Using 2009 H1N1 data in the state of Texas, we show how the Texas Department of State Health Services can reserve a small percentage of doses and achieve fair coverage, while most vaccines are allocated based on healthcare provider requests.

4 - Epidemiological Consequences of An Ineffective Bordetella Pertussis Vaccine and an Option for Reducing Rising Whooping Cough Incidence
Ben Althouse, Santa Fe Institute, Santa Fe, NM, United States of America, althouse@santafe.edu, Haedi DeAngelis, Samuel V Scarpino

The recent increase in Bordetella pertussis incidence (whooping cough) presents a challenge to global health. Recent studies have called into question the effectiveness of acellular pertussis vaccination in reducing transmission. Here we examine the epidemiological consequences of an ineffective pertussis vaccine and present a cost-benefit analysis of an alternative scenario – priming individuals with one dose of the older, side effect-prone whole-cell vaccine. Using dynamic transmission models, we find that: 1) an ineffective vaccine can account for the observed increase in pertussis incidence; 2) asymptomatic infections can bias surveillance and upset situational awareness of pertussis, including obfuscating assessment of the population-level effectiveness of vaccination programs; 3) vaccinating individuals in close contact with infants too young to receive vaccine (so called "cocooning" unvaccinated children) may be ineffective; and 4) priming individuals with a single dose of whole-cell vaccine can reduce overall pertussis morbidity and may provide up to a 10-fold reduction in societal costs of pertussis infection. Our results have important implications for pertussis vaccination policy and present a complicated scenario for achieving herd immunity and pertussis eradication.

■ **WB36**

Hilton- Union Sq 16
Information Systems 4
Contributed Session

Chair: Wael Jabr, Assistant Professor, University of Calgary, 2500 University Dr NW, Calgary, AB, T2N1N4, Canada, wjabr@ucalgary.ca

1 - Firm Transition into Hybrid Systems as a Function of Exploration and Exploitation
Sukruth Suresh, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, suress@rpi.edu

IT firm offerings have transitioned from only products or services to one of a hybrid model encompassing both. This is attained by organic growth, by acquisitions or through alliances with firms that have strong service or product backgrounds. While organic growth can be seen as exploitative in nature, acquisitions or alliances are explorative. We posit that the attributes of industry concentration and firm prestige moderate the mode in which firms choose between exploration and exploitation.

2 - Hand Anthropometry: A Missing Construct in Technology Acceptance Model
Pei-Lee Teh, Senior Lecturer, Monash University, Jalan Lagoon Selatan, Bandar Sunway, Selangor, 46150, Malaysia, teh.pei.lee@monash.edu, Soon-Nyean Cheong, Emily Yim Lee Au, Wen-Jiun Yap, Pervaiz K. Ahmed, Ravindra S. Goonetilleke

Technology Acceptance Model (TAM) is regarded as a robust theoretical model for predicting technology usage. Given that more technologies are operated by gesture-based Interface, it is surprising that no study of the hand anthropometry effects on TAM has been conducted. This study examines how hand anthropometry influences user technology acceptance.

3 - Theorizing Information Systems as Technology: Might it be Fruitful?
E. Burton Swanson, Research Professor, UCLA Anderson School, 110 Westwood Plaza, Ste. D502, Los Angeles, CA, 90095, United States of America, burt.swanson@anderson.ucla.edu

Information systems scholars have struggled with the field's fundamental relationship to technology. They have debated whether the IT artifact is unwisely taken for granted and whether it lies at the field's core. Here, applying Arthur's general theory of technology,it is suggested that IS may itself be theorized as technology, opening up new avenues for research, where the unit of analysis is the technology itself and the focus is its evolution.

4 - Research on Construction & Techniques of Social Manufacturing-driven Personalized Enterprise Space
Zhen Zhao, Arizona State University, 2343 W main St, Apt 1048, Mesa, AZ, 85201, United States of America, reebokalone2001@gmail.com, Pingyu Jiang, Mei Zheng

The paper proposed personalized enterprise space (PES) which is the basic node of social manufacturing network (SMN) by 1.establishing framework of PES to illustrate its configuration and operation method; 2.discussing four key enabling technologies in detail, including role-based access control model, manufacturing capability assessment, context-based information recommendation, order generation & tracking; 3.developing a prototype platform to verify the feasibility and practicability.

■ WB37

Hilton- Union Sq 17

Big Data 3

Contributed Session

Chair: Samik Raychaudhuri, 24/7 Customer Pvt. Ltd., EGL Business Park, Off Intermediate Ring Road, Bangalore, 560071, India, samikr@gmail.com

1 - Design of Palatable Credit Scorecards as a Highly Automated Analytic Service
Gerald Fahner, FICO, 181 Metro Drive, San Jose, United States of America, ehershman@iqprinc.com

Lenders require accurate and interpretable credit scoring models. Scorecards fulfill these needs. Designing such models has remained a laborious data-guided task. With new data sources abounding and environments changing fast, lenders would like to design, update and test models, predictors and segmentation schemes frequently, objectively and cost-effectively. We propose designing scorecards as an automated analytic service.

2 - using Predictive Analytics for Customer Intent Mining
Samik Raychaudhuri, 24/7 Customer Pvt. Ltd., EGL Business Park, Off Intermediate Ring Road, Bangalore, 560071, India, samikr@gmail.com, Ravi Vijayaraghavan

In this presentation, we discuss about an emerging and niche area of application of predictive analytics with big data, known as customer intent mining. We serve millions of end customers through various channels on behalf of our clients. We provide an intuitive experience when the customers contact us by leveraging the rich interaction data that we come across through various customer touchpoints, and predicting intent in real time using machine learning models on big data.

3 - Intelligent Data Management through the Data Burst (Best Practices)
Hussain Alajmi, Team Leader, Kuwait Oil Company, Poboc 9758, Ahmadi, 61008, Kuwait, hussain@kockw.com

In KOC we achieved the better data management through different projects to overcome the data burst, which represents the main challenge in the decision making process. Our solution started with the conformance analysis to have a detailed numerical description and statistics of different data issues. The workflows nature depend on the nature of data itself and the issue.

■ WB38

Hilton- Union Sq 18

Health Care Modeling Optimization VII

Contributed Session

Chair: Steven Cohen, AHRQ, 540 Gaither Road, Rockville, MD, 20850, United States of America, steven.cohen@ahrq.hhs.gov

1 - The Impact of Misclassification and Nonresponse Errors when Oversampling Dynamic Populations
Steven Cohen, AHRQ, 540 Gaither Road, Rockville, MD, 20850, United States of America, steven.cohen@ahrq.hhs.gov

Achieving sample size targets for population subgroups that are dynamic in nature is a difficult enterprise.Attention is given to the utility of a model-based approach to oversample dynamic populations.Model performance is evaluated in terms of predictive capacity, sensitivity and specificity, assessing levels of misclassification errors inherent in alternative model specifications and its impact on precision targets and survey cost.

2 - Using Simulation to Advocate Process Improvement at a Clinical Lab
Yang Sun, Sacramento State College of Business, 6000 J St, Sacramento, United States of America, suny@csus.edu

Clinical lab testing is central to many healthcare processes. As this industry is experiencing rapid demand growth, job arrivals have reached such a high level at a large clinical lab in a southwestern state that it simply cannot process them in a timely and efficient manner. In order to gain management support on a heuristics-based process remodeling solution, simulation is used as an advocating tool to demonstrate potential benefits of the renovated design of the specimen area of the lab.

3 - Mixed Integer Programming Approaches for Two-Step Multiple Provider Practices
Hari Balasubramanian, University of Massachusetts Amherst, 160 Governors Drive Amherst MA 01003, Amherst, MA, 01002, United States of America, hbalasub@admin.umass.edu, Hyun-Jung Oh, Ana Muriel

We propose mathematical programming formulations for scheduling patient appointments in primary care with nurse and provider steps, stochastic service times at both steps, and flexibility in the nursing step.

4 - Managing Bouncebacks to a Cardiac Intensive Care Unit
Yazan F. Roumani, Assistant Professor, Oakland University, 342 Elliot Hall, Rochester, MI, 48309, United States of America, roumani@oakland.edu, Yaman Roumani, Luis Vargas

Bounce backs increase the complexity of managing ICUs. We propose a strategy to reduce the probability of bouncing back by setting a minimum required initial length of stay for patients visiting a cardiac ICU. We find no statistically significant increase in means of: time spent in hospital, immediate upstream unit and all upstream units of the intensive care unit after implementing the proposed strategy.

5 - A Novel Approach for Vascular Sounds of Arteriovenous Fistulas and Vascular Stenoses
Wheyming Song, Professor, National Tsing Hua University, 101, Sec. 2, Kuang-Fu Rd., Hsinchu, 30013, Taiwan - ROC, wheyming_song@yahoo.com

This research focuses on increasing the sensitivity and specificity of existing approaches on analyzing vascular Sounds of arteriovenous fistulas and vascular stenosis. The proposed approach is based on a series of scientific procedures, including (1) design of analysis (2) independent component analysis. Results show that the sensitivity and specificity of the proposed approach are all above 99% and 98%, respectively.

■ WB39

Hilton- Union Sq 19

HSEA - II — Spotlight on HSEA Student Research

Sponsor: Health Applications
Sponsored Session

Chair: Julie Ivy, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, United States of America, jsivy@ncsu.edu

1 - Spotlight on HSEA Student Research
Julie Ivy, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, United States of America, jsivy@ncsu.edu

This session will highlight student research in Health Systems from HSEA member institutions with a focus on undergraduate and early stage graduate research. There will be five student lead research presentations.

■ WB40

Hilton- Union Sq 20

Inverse Planning for Cancer Treatment

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, Associate Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

1 - Pareto Robust Optimality in Breast Cancer Radiation Therapy Treatment
Houra Mahmoudzadeh, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, houra@mie.utoronto.ca, Thomas G. Purdie, Timothy C. Y. Chan

We quantify the benefit of applying the concept of Pareto robust optimality to radiation therapy treatment planning of breast cancer where the uncertainty is in the patient's breathing. Pareto robust optimal solutions have the same performance as robust optimal solutions under worst-case, but may perform better under non-worst case scenarios. We apply this method for different patients and compare the results with those of robust optimization and current clinical treatment methods.

WB41   *INFORMS San Francisco – 2014*

2 - Mixed-integer Methods for Radiation Therapy with Continuous Beams
Kimia Ghobadi, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, kimia@mie.utoronto.ca, Dionne Aleman, David Jaffray

We explore exact and heuristic methods in modelling treatment planning for Gamma Knife Perfexion, where the radiation is delivered with a continuous beam instead of conventional discrete beams. We explore artificial intelligent path finding methods, and formulate mixed-integer models to find beam times for the selected path. We discuss challenges and advantages of our proposed method and explore practicality of implementing it on conventional radiation units.

3 - Inverse Planning for Focal Ablation in Liver Cancer Treatment
Shefali Kulkarni-Thaker, Graduate Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, shefali@mie.utoronto.ca, Aaron Fenster, Dionne Aleman

In focal ablation, current is passed through a needle inserted into a tumor to generate heat, killing the tumor. We develop a mathematical framework to design optimal ablation treatments. First, we obtain the needle position and orientation using optimization and geometric approximations. Next, we solve a thermal dose optimization (TDO) to obtain the treatment time for adequate thermal dose delivery. We also propose an approximation for TDO to obtain a lower bound on the treatment time.

■ WB41

Hilton- Union Sq 21

Supply Chain Management II

Contributed Session

Chair: Kai Hoberg, Kühne Logistics University, Grofler Grasbrook 17, Hamburg, 20457, Germany, kai.hoberg@the-klu.org

1 - What Drives Supplier Selection Decisions? A Firm-Level Investigation in the Automotive Industry
Kai Hoberg, Kühne Logistics University, Grofler Grasbrook 17, Hamburg, 20457, Germany, kai.hoberg@the-klu.org, Florian Badorf, Felix Papier

We empirically analyze the relationship between firm-level factors such as relationship strengths, market share, and financial stability and the probability that a supplier is selected for a sourcing project. We use empirical data from the automotive industry with more than 60,000 supplier selection decisions. We develop a regression model, test its robustness, and analyze it in different industry contexts. Furthermore, we present a prediction model for supplier selections with high accuracy.

2 - Selecting Suppliers
Serhat Yilmaz, Graduate Student, Texas State University, 902 Sagewood Trl., San Marcos, TX, 78666, United States of America, s_y29@txstate.edu

One of the most important issue that supply chain manager faces is selecting the right suppliers. This project presents the important effect of supply selection on the supply as a whole. It also presents the supplier selection criteria by reviewing and analyzing the qualitative criteria.

3 - Supply Chain Coordination under Moral Hazard
Taesu Cheong, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Blk E1A #06-25, Singapore, Singapore, taesu.cheong@outlook.com, Sang Hwa Song

We address moral hazard issues in supply chain contract. It has been discussed that risk sharing among supply chain players through contracts such as buyback contract can help coordinating a supply chain. However, we present a negative example of buyback contract in practice due to moral hazard stemming from incentive conflicts among participants in a supply chain and further discuss how well it could be possibly managed and coordinated by the base stock policy under the moral hazard problem.

4 - Optimal Procurement Strategies for Contractual Assembly System with Fluctuant Procurement Price
Yi Yang, Associate Professor, Zhejiang University, School of Management, Hangzhou, China, yangyicuhk@gmail.com

We consider a multi-component assembly system in which the assembler produces a final product in order to satisfy the one-time demand at a future time. Components can be purchased from outside suppliers with positive leadtimes under either time-inflexible or time-flexible contracts. One of the components faces an uncertainty in its procurement price.The assembler needs to determine how much to purchase and when to purchase each component. We characterize the optimal procurement strategies.

5 - Coordinating a Supply Chain when Consumers Strategically Wait for Sales
Tian Li, East China University of Science and Technology, School of Business, Shanghai, 200237, China, litian@ust.hk, Man Yu

A supply chain consists of a manufacturer and a newsvendor retailer selling a seasonal product to strategic consumers. A simple buyback contract is shown to coordinate the chain, where the aggregate demand is both price-dependent and quantity-dependent. Nevertheless, the set of coordinating buyback contractual terms shrinks as consumers are more willing to wait. The retailer gains from strategic waiting in a coordinated chain.

■ WB42

Hilton- Union Sq 22

System Dynamics in Health II

Sponsor: Health Applications
Sponsored Session

Chair: Mohammad S. Jalali, Virginia Tech / MIT, 113 Harvard St, Apt 1, Cambridge, MA, 02139, United States of America, mj@vt.edu

1 - How Will Mandated Medicare Payment Rate Reductions Affect Hospitals and Patients to 2050?
Jack Homer, Homer Consulting & MIT, 72 Station Hill Road, Barrytown, NY, 12507, United States of America, jhomer@comcast.net, Liming Cai, Gary Hirsch

The Affordable Care Act mandates permanent Medicare payment growth rate reductions to non-physician providers. Medicare's Office of the Actuary initially calculated that these reductions could cause most such providers to become unprofitable by 2040, likely leading to hospital closures and adverse impacts for patients. But this calculation was simplified and ignored several dynamic factors. OACT is using system dynamics modeling to study these factors and develop more nuanced projections.

2 - A Model of Human Growth and Body Weight Dynamics
Hazhir Rahmandad, Associate Professor, Virginia Tech / MIT, MIT Sloan School of Management, Cambridge, MA, 02139, United States of America, hazhir@vt.edu

Quantifying human weight and height dynamics due to growth, aging, and energy balance can inform clinical practice and policy analysis. I present a simulation model of dynamics of body weight, composition and height. The model replicates key trends in human growth including A) Changes in energy requirements from birth to old ages. B) Short and long-term dynamics of body weight and composition. C) Stunted growth with chronic malnutrition and potential for catch up growth.

3 - A System Dynamics Approach to Predict the Overall Impact of Interventions to Improve CKD Care
Hyojung Kang, PhD Candidate, Penn State University, 940 Stratford Ct., State College, PA, 16801, United States of America, hqk5116@psu.edu, Harriet Nembhard

Chronic kidney disease (CKD) is a growing health problem in the U.S. Patients with CKD have had critical care gaps that have perhaps led to a more rapid progression of CKD toward end stage renal disease (ESRD). In response to the need to improve CKD outcomes, we have conducted an interdisciplinary study. Using a system dynamics approach, this research aims to develop a platform for prospective planning of interventions that help slow and prevent the disease progression to ESRD.

4 - Exploring Task-shifting in Primary Care: The Case of the University of Utah Community Clinics
Andrada Tomoaia-Cotisel, PhD Candidate, London School of Hygiene & Tropical Medicine, 15-17 Tavistock Place, London, WC1H 9SH, United Kingdom, andradat@lshtm.ac.uk, Jaewhan Kim, Bernd Rechel, Michael Magill, Karl Blanchet, Jenny Neuburger, Martin McKee, Andy Haines, Samuel Allen, Debra Scammon, Timothy Farrell, Julie Day, Zaid Chalabi

A key element of the patient centered medical home lies in expanding the Medical Assistant role, or task-shifting. System dynamics was used to uncover the causal mechanisms and leverage points resulting in observed tensions and mixed outcomes at an academic medical center. Variation in physicians' estimation of time delays in team learning is hypothesized to drive variations in implementation and patient health. This research is informing management's revised implementation plan.

■ WB43

Hilton- Union Sq 23

Computational Integer Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Yan Xu, Senior Manager, SAS Insitute Inc.,
100 SAS Campus Dr., Cary, NC, 27519, United States of America,
yan.xu@sas.com

1 - Advances in Convex Quadratic Integer Optimization with Xpress
Michael Perregaard, Xpress Development, FICO, International
Square, Starley Way, Birmingham, B15 2EX, United Kingdom,
MichaelPerregaard@fico.com

We present recent advances in the solution of mixed integer quadratically
constrained programming (MIQCP) problems. We describe solution techniques
used by the FICO Xpress solver to efficiently solve various types of MIQCP
problems, including those with second-order cone constraints.

2 - New Features and Improvements in SAS/OR 13.2
Imre Polik, SAS Institute, Cary, NC, 27513,
United States of America, imre.polik@gmail.com

In this talk we present a summary of the work that went into producing the latest
release of the operations research tools in SAS. We will focus mostly on mixed-
integer linear optimization.

3 - Recent Developments in the Gurobi Optimizer
Ed Rothberg, Gurobi Optimization, Inc., Houston TX,
United States of America, rothberg@gurobi.com

This presentation will talk about new developments in the Gurobi Optimizer, with
a particular emphasis on new distributed algorithms.

4 - Recent Advances in IBM ILOG CPLEX Optimization Studio
Andrea Tramontani, CPLEX Optimization, IBM Italy,
Via Martin Luther King 38/2, Bologna, 40132, Italy,
andrea.tramontani@it.ibm.com

We will present some of the new features that have been added to CPLEX and will
give benchmark results that demonstrate the performance improvements on Mixed
Integer Linear and Mixed Integer Quadratic models in the recent CPLEX versions.

■ WB44

Hilton- Union Sq 24

The Interface between Information Systems and Operations Management

Sponsor: Information Systems
Sponsored Session

Chair: Oliver Yao, Associate Professor, Lehigh University,
621 Taylor Street, Bethlehem, 18015, United States of America,
yuy3@lehigh.edu

**1 - Influence of Organizational Design for Enacting IT
Complementarities**
Kailing Deng, University of Arkansas, WCOB217D, Information
System Department, Sam M. Walton College of Business,,
Fayetteville, United States of America, Kdeng@walton.uark.edu,
Pankaj Setia

This study unravels how organizational design influences enactment of
complementarities for capability-building. Due to different micro-level interactions,
organizational designs influence match between the use of information
technologies and business initiatives. Authors build a computational model that
uses survey data to show enactment of complementarities for building demand
management capabilities.

**2 - Does Logistics Matter in E-commerce? An Empirical Study of the
Last Mile Problem**
Jifeng Luo, Associate Professor, Shanghai Jiao Tong University,
Fahuazhen RD. 535, Shanghai, China, luojf@sjtu.edu.cn,
Huan Zheng, Ying Rong

Leading e-commerce companies are rapidly expanding their logistics networks to
deliver items faster and more reliably. This improved logistics quality drives
customers to share their positive experiences online. Using a dataset from China's
largest e-marketplace platform, we empirically explore the role of logistics services
and their effects on online consumer purchasing behaviors. We find that
consumers do consider both delivery time and WOM about logistics performance.

■ WB45

Hilton- Union Sq 25

From Deadline to Reciprocity: Assorted Topics in Behavioral Operations

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Kay-Yut Chen, University of Texas at Arlington,
Arlington, TX, United States of America, kychen@uta.edu

**1 - Is a Newsvendor More Bounded Rational Making Two Decisions
Instead of One?**
Kay-Yut Chen, University of Texas at Arlington, Arlington, TX,
United States of America, kychen@uta.edu, Shan Li

The behavior newsvendor literature focuses on scenarios of a single (but repeated)
decision. We conduct an experimental study with newsvendor making two
unrelated (managing independent stores) and related (via transshipment) decisions
simultaneously. We found non-trivial correlations between decisions across stores,
and constructed a behavioral/learning model to explain the findings.

2 - Optimizing a Reciprocal Workforce
Cipriano Santos, Deep Analytics Architect, Hewlett-Packard,
3000 Hanover St, Palo Alto, CA, 94304, United States of America,
cipriano.santos@hp.com, Alex Zhang, Kay-Yut Chen,
Claudia Marquez, Haitao Li

We study a workforce planning problem in which employees reciprocate to higher
wages by increasing productivity; we incorporate reciprocity in the form of a
productivity response function which is nonlinear. Our problem is to decide on the
wage levels and the workforce capacities to minimize the total cost.

3 - Power and Fairness
Diana Wu, University of Kansas, United States of America,
dianawu@ku.edu, Tony Cui, Paola Mallucci

Understanding what is "fair" is central to research on fairness. While different
theories have been proposed to explain how decision makers evaluate the fairness
of an outcome, one important characteristic of social interaction, power, is missing
from the picture. In this research, we offer laboratory evidence that power has
significant impact on perceptions of fairness.

**4 - An Experimental Comparison of Reserve Price Auctions and
Auctions with Renegotiation**
Lijia Tan, Xiamen University, Wang Yanan Institute for Studies,
D109, Economics Building, Xiamen, 361005, China,
ljtan.wise@gmail.com, Jason Shachat

We conduct an experimental comparison of auctioneer behavior in reserve price
auctions and post-auction decisions to engage the auction winner in ultimatum
game bargaining. Both auctions forms, when used optimally, implement the
Myerson optimal mechanism. However, subjects fail to act optimally for different
behavioral reasons in the two formats as the number of bidders change. We show
examples of how this leads to economically significant performance differences in
varying costs environments.

■ WB46

Hilton- Lombard

Advances in Mixed-integer Programming Theory

Sponsor: Optimization/Integer and Discrete Optimization
Sponsored Session

Chair: Dan Steffy, Oakland University, Dept. of Mathematics and
Statistics, 2200 N. Squirrel Road., Rochester, MI, 48309,
United States of America, steffy@oakland.edu

**1 - Optimality Certificates and Sensitivity Analysis for Mixed Integer
Programming Problems**
Babak Moazzez, Carleton University, 1125 Colonel By Drive,
Ottawa, ON, K1S 5B6, Canada, bmoazzez@math.carleton.ca

After solving a mixed integer program, a certificate can be used the check the
optimality of the solution at hand. We present generalized subadditive generator
functions which can be used as certificates of optimality and also as a tool for
sensitivity analysis for MILPs. These are subadditive dual feasible functions with
desirable properties. The certificates generated are much easier to check compared
with the time needed to solve the optimization problem.

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2 - On the Intersection of Two Mixing Sets with a Cardinality Constraint
Kevin Ryan, Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, kevin.ryan30@gmail.com, Shabbir Ahmed, Santanu Dey

Mixing sets with cardinality constraints are frequently encountered in integer programming reformulations of chance constrained optimization problems. We study an extended formulation for the polyhedron defined by the intersection of two mixing sets with a cardinality constraint.

3 - On the Complexity of Inverse Optimization Problems
Ted Ralphs, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu

Inverse optimization is the problem of determining the unknown values of certain problem parameters that are closest to given estimates and will make a given solution optimum. We show that the inverse mixed integer linear optimization problems (MILP) with unknown objective function is coNP-complete. Moreover, we generalize this result to the higher level optimization problems. We also propose a cutting plane algorithm for solving inverse MILPs for practical purposes.

4 - The L-Shape Search Method for Triobjective Integer Programming
Martin Savelsbergh, Professor, University of Newcastle, Callaghan, Newcastle, NSW2308, Australia, martin.savelsbergh@newcastle.edu.au, Hadi Charkhgard, Natashia Boland

We present a new criterion space search method, the L-shape search method, for finding all nondominated points of a triobjective integer program. The method is easy to implement, and is more efficient than existing methods. Moreover, it is intrinsically well-suited for producing high quality approximate nondominated frontiers early in the search process. An extensive computational study demonstrates its efficacy.

■ WB47

Hilton- Mason A

Monte Carlo Simulation-Based Methods for Stochastic Programming

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Güzin Bayraksan, Associate Professor, Ohio State University, 1971 Neil Ave., Columbus, OH, 43210, United States of America, bayraksan.1@osu.edu

1 - Mitigating Uncertainty via Compromise Decisions in Two-stage Stochastic Linear Programming
Yifan Liu, University of Southern California, University Park Campus, GER 240, Los Angeles, CA, 90089, United States of America, yifanl@usc.edu, Suvrajeet Sen

Stochastic Programming (SP) has long been considered as a well-justified yet computationally challenging paradigm for practical applications. For a class of two stage stochastic linear programming, we present exciting computational results with Stochastic Decomposition (SD). A new solution concept which we refer to as the compromise decision is introduced.

2 - Bias and Variance Reduction when Estimating the Optimal Value of Stochastic Programs
Burak Buke, The University of Edinburgh, School of Mathematics, JCMB King's Buildings, Edinburgh, EH9 3JZ, United Kingdom, b.buke@ed.ac.uk, Lukasz Szpruch

Monte Carlo methods are used extensively for assessing the solution quality in stochastic programs. It is known that the using sample average approximations provide us with a biased estimator of the optimal objective value. In this work, we suggest a Monte Carlo method, which relies on estimating the objective value as a telescopic sum, and discuss how it helps us reduce the bias and variance in an efficient manner.

3 - Variance Reduction Techniques for Non-Sequential and Sequential Sampling in Stochastic Programming
Rebecca Stockbridge, Assistant Professor - Research, Wayne State University, 656 W. Kirby, Detroit, MI, 48202, United States of America, rstockbridge@math.wayne.edu, Güzin Bayraksan

We apply variance reduction techniques, specifically antithetic variates and Latin hypercube sampling, to optimality gap estimators used in standalone procedures as well as sequential sampling algorithms. We discuss both theoretical and computational results on a range of test problems.

4 - Scenario Aggregation Regions for Portfolio Selection with Tail Risk Measures
Jamie Fairbrother, PhD Student, STOR-i CDT, Fylde College, Lancaster University, Lancaster, LA1 4YF, United Kingdom, j.fairbrother@lancaster.ac.uk, Stein W. Wallace

Tail risk measures, such as the conditional Value-at-Risk, are used in stochastic programming to mitigate or reduce the probability of large losses. A key observation about these is that they don't depend on the main body of the loss distribution. A ramification of this is that for scenario-based optimization problems, outcomes never incurring large losses can be aggregated, thus reducing the computational cost of their solution. We demonstrate this principle for a class of portfolio problems.

■ WB48

Hilton- Mason B

Optimization, Robust 3

Contributed Session

Chair: Giovanni Paolo Crespi, Associate Professor, University of Valle d'Aosta, Loc. Grand Chemin 73/75, Saint Christophe, 11020, Italy, g.crespi@univda.it

1 - Quasiconvexity of Set-valued Maps Assures Well-posedness of Robust Vector Optimization
Giovanni Paolo Crespi, Associate Professor, University of Valle d'Aosta, Loc. Grand Chemin 73/75, Saint Christophe, 11020, Italy, g.crespi@univda.it, Matteo Rocca, Daishi Kuroiwa

We formulate robust and the optimistic counterparts of an uncertain non-linear vector optimization problem as set optimization problems, to study well-posedness of both. We apply the embedding technique for set optimization developed by Kuroiwa and Nuriya (2006). To prove our main results we study the notion of quasiconvexity for set-valued maps. We provide a general scheme to define the notion of level sets and we study the relations among different subsequent definitions of quasi-convexity.

2 - Robust Integrated Scheduling of Crane Handling and Truck Transportation in Container Terminals
Narges Kaveshgar, PhD Candidate, University of South Carolina, 300 Main Street, Room C110, Columbia, SC, 29208, United States of America, kaveshga@email.sc.edu, Nathan Huynh

To lower the vessel turn time, the operations of quay cranes, yard cranes and yard trucks need to be coordinated. Most of the studies have optimized these operations individually and have assumed that they have deterministic task processing times. This study develops and solves a robust model that jointly schedules operations while considering non-deterministic processing times and other operational constraints such as tasks precedence relationship, blocking and quay crane interference.

3 - Robust Optimization of Gas Production with Pressure and Routing Constraints
Pelin Cay, Lehigh University, 200 W Packer Ave., Bethlehem, PA, United States of America, pec212@lehigh.edu, Luis Zuluaga, Robert Storer

We consider the problem of optimizing the production of a gas with pressure and routing constraints. In general, this problem can be formulated as a non-linear integer programming problem. We propose a methodology to obtain solutions that avoids drastic changes in production levels in response to forecasted changes in demand and/or production costs. We illustrate our results with relevant numerical experiments.

4 - Two-Stage Robust Optimization and Stochastic Programming: Drawing Parallels and Distinctions
Aldis Jakubovskis, University of Missouri - St. Louis, 229 Express Scripts Hall, One University Boulevard, St. Louis, MO, 63121, United States of America, jakubovskisa@missouri.edu, Haitao Li

A direct comparison of robust optimization (RO) to stochastic programming (SP) is not always a convenient task, as SP and RO rely on two distinct interpretations of uncertainty. A two-stage facility location and capacity planning model with random demands is used to compare RO and SP on four criteria: the type of probability distribution, the ratio of the robust interval in RO and a variability measure in SP, the magnitude of the penalty costs in SP, and the effect of correlated demands.

5 - Price Uncertainty and Robust Planning of Oil Refineries
Jens Bengtsson, Associate Professor, NMBU School of Economics and Business, P.O. Box 5003, Aas, 1432, Norway, jens.bengtsson@nmbu.no, Patrik Flisberg, Mikael Rˆnnqvist

Several studies indicate relationships between changes in product prices and crude oil prices and vice versa. It is of interest to analyze how these relationships can be formulated in terms of uncertainty constraints used in robust optimization. From there it is also of interest to analyze how different uncertainty constraints will affect the planning of an oil refinery supply chain, risk exposures and the cost of robustness.

■ **WB49**

Hilton- Powell A

Network Optimization and Its Applications

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Tachun Lin, Assistant Professor, Bradley University,
1501 W Bradley Ave, Peoria, IL, 61625, United States of America,
djlin@bradley.edu

**1 - Bus Bridging Design for Public Transportation Incident and
Event Response**
Zhili Zhou, Research Staff Member, IBM Research Collaboratory
Singapore, Singapore, Singapore, zhili@sg.ibm.com

The subway system serves as the main component of public transportation system.
In this study, bus bridging routes are designed for express buses serving for subway
incident/event impacted original-destination (OD) demands. Stochastic models are
built to handle uncertain OD demands and uncertain travel time. Column
generation based algorithm and pre-processing algorithms are proposed for routing
generation and computational complexity reduction. Real Incident scenarios are
tested.

2 - Minimum-Cost Lambda-Edge-Connected k-Subgraph Problem
Elham Sadeghi, Graduate Research Assistant, University of Arizona,
Systems and Industrial Engineering, Tucson, AZ,
United States of America, sadeghi@email.arizona.edu, Neng Fan

We propose exact algorithms based on integer programming formulations to solve
the minimum-cost lambda-edge-connected k-subgraph problem, or the
(k,lambda)- subgraph problem. This problem is to find a minimum-cost lambda-
edge-connected subgraph with at least k vertices. Numerical experiments are
performed on randomly generated graphs.

3 - Robustness of Layered Networks against Failure Probabilities
Tachun Lin, Assistant Professor, Bradley University, 1501 W Bradley
Ave, Peoria, IL, 61625, United States of America, djlin@bradley.edu

We study the design of layered networks, where the upper-layer network
maintains its connectivity against single and multiple lower-layer network failures
with various failure probabilities. We propose integer programming formulations
with the objective of guaranteeing the network connectivity with a given
probability.

■ **WB50**

Hilton- Powell B

Optimization, Integer 2

Contributed Session

Chair: Todd Easton, Associate Professor, Kansas State University,
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United States of America, teaston@ksu.edu

1 - Facets of the Latin Square Polytope
Dimitrios Magos, Professor, Technological Educational Institute of
Athens, Ag. Spyridonos Str., Egaleo, 12210, Greece,
dmagos@teiath.gr, Ioannis Mourtos

A Latin Square is an n by n matrix where in each row and column every number
between 1 and n appears exactly once. Latin squares are pertinent to planar
assignment structures. In the current work, we study the facial structure of the
polytope associated with Latin Squares. We present families of facet-defining
inequalities induced by odd holes of the related column intersection graph. We also
report computational experience of odd-hole inequalities when used as cutting
planes.

**2 - The Existence and Usefulness of Equality Cuts in the Multidemand
Multidimensional Knapsack Problem**
Todd Easton, Associate Professor, Kansas State University, 2037
Durland Hall, Manhattan, ks, 66506, United States of America,
teaston@ksu.edu, Levi Delissa

Valid equality cuts for integer programs are described. Equality cuts decrease the
dimension of a linear relaxation space by at least one. Applying the idea of equality
cuts to the multidemand multidimensional knapsack problem results in a new class
of cutting planes named anticover cover equality (ACE) cuts. ACE cuts can be
extended to an infeasibility condition. The cuts are implemented in a branch and
cut scenario, which resulted in an 11% improvement to some benchmark
instances.

3 - Modeling General Integer Programming Problems using XQX
Vijay Ramalingam, Ph.D. Student, University of Mississippi, School
of Business, University, MS, 38677, United States of America,
vramalingam@bus.olemiss.edu, Haibo Wang, Bahram Alidaee

We propose a xQx based modeling for general integer programming problems
where the constraints could be inequality, equality, or a combination of the both.

We present the detailed derivation of our general xQx model and the
implementation procedures. We apply our model and solution procedures to multi-
dimensional knapsack problems and present results from solving instances of
various sizes.

■ **WB51**

Hilton- Sutter A

Optimization, Nonlinear 1

Contributed Session

Chair: Juliane Mueller, Cornell University, CEE, 220 Hollister Hall,
Ithaca, NY, 14853-3501, United States of America,
juliane.mueller2901@gmail.com

1 - A Filter-filled Function Method for Nonlinear Global Optimization
Wei Wang, Professor, East China University of Science and
Technology, No.130, Meilong Road, Shanghai, China,
wangwei@ecust.edu.cn, Xiaoshan Zhang

This work presents a filled function method based on the filter technique for global
optimizations. Filled function method is one of effective methods for nonlinear
global optimization. Filter technique is usually applied to local optimization
methods for its excellent numerical results. In order to optimize the filled function
method, the filter method is employed for global optimization. A new filled
function is proposed in this manuscript, and the algorithm and its properties are
proved.

**2 - The Dynamic Lot-sizing Problem with Convex Economic
Production Cost**
Ramez Kian, Bilkent University, Department of Industrial
Engineering, Central Campus, Ankara, 06800, Turkey,
ramezk@bilkent.edu.tr, Emre Berk, Ulku Gurler

In this work the deterministic uncapacitated dynamic lot-sizing problem is
considered with convex production costs. We formulate the problem as a mixed
integer, non-linear programming problem and obtain structural results which are
used to construct a forward polynomial time DP algorithm. Additionally, six
heuristics with numerical study are provided.

**3 - Surrogate Model Framework for Computationally Expensive
Mixed-Integer Black-Box Global Optimization**
Juliane Mueller, Cornell University, CEE, 220 Hollister Hall,
Ithaca, NY, 14853-3501, United States of America,
juliane.mueller2901@gmail.com

We consider optimization problems that have computationally expensive objective
functions whose analytical description is not available (black-box) and that have
integer and continuous variables. We develop a class of algorithms that combines
surrogate models and evolutionary strategies to efficiently solve these problems.
We introduce a new algorithm that combines a global and a local search in order to
obtain solutions of higher accuracy.

4 - Arc Search Methods for Linearly Constrained Optimization
Nicholas Henderson, Stanford University, 3943 El Camino Real
#14, Palo Alto, CA, 94306, United States of America,
nwh@stanford.edu

We present an arc search algorithm for linearly constrained optimization. The
method constructs and searches along smooth arcs that satisfy a small set of
properties. When second derivatives are used, the method is shown to converge to
a second-order critical point. We introduce a new arc that scales to large problems,
does not require modification to the Hessian, and is rarely dependent on the
scaling of directions of negative curvature.

**5 - Analytical and Computational Study of Ibaraki\rq{}s Modified
Binary Search Algorithm**
Chong Hyun Park, Graduate Student, Purdue University,
140 Airport Rd APT 5, West Lafayette, IN, 47906,
United States of America, park456@purdue.edu

In this paper, the modified binary search (MODBIN) algorithm developed by
Ibaraki (1983) for root finding is analyzed and compared to Newton's method and
the algorithm of Pardalos and Phillips (1991). Although the MODBIN algorithm
was originally proposed for solving fractional programming problems, we study the
MODBIN algorithm as a general root finding algorithm. We develop our analysis of
the MODBIN algorithm for finding the root of monotonic, convex, and twice
differentiable functions.

■ WB52

Hilton- Sutter B

Optimization, Large Scale 1

Contributed Session

Chair: Mojtaba Maghrebi, University of New South Wales, UNSW, Sydney, Australia, maghrebi@unsw.edu.au

1 - Integrating Artificial Intelligence with Optimization for Solving Large Scale Logistic Problems

Mojtaba Maghrebi, University of New South Wales, UNSW, Sydney, Australia, maghrebi@unsw.edu.au, Travis Waller, Claude Sammut

Obtaining exact solution for large scale logistic problems is computationally intractable. Experts are hired in the industry to find practical solutions for these problems. The authors found that there is a chance to reconstruct experts' decisions by machine learning. Real data from a concrete delivery was used for testing the proposed concept. The results show that there is a potential for implementing machine learning techniques in logistic while the competitive solutions have been obtained.

2 - Challenges in Varying Fixed Parameters in a Real-World Large-Scale Army Acquisition Problem

Frank Muldoon, R&D S&E Computer Scientist, Sandia National Laboratories, P.O. Box 5800, MS 1188, Albuquerque, NM, 87185-1188, United States of America, fmmuldo@sandia.gov

Traditional MIP fleet modernization formulations involve systems with fixed parameters, e.g., cost and performance, which answers the question "When to modernize?" but not the question "What should the modernized systems be?" Given a way to define systems in terms of their parameters, we look at the challenge of parameters being variable creating bilinear terms. We consider an Army acquisition problem and explore linearization techniques for the bilinear terms and numerical instability issues.

3 - Optimizing a Class of Generalized Assignment Problems with Location/Allocation Considerations

Tulay Flamand, PhD Student, University of Massachusetts Amherst, Isenberg School of Management, 121 Presidents Drive, Amherst, MA, 01003, United States of America, varol@som.umass.edu, Mohamed Haouari, Ahmed Ghoniem

We address a novel class of generalized assignment problems with location/allocation considerations which is motivated by shelf space allocation decisions in retail stores among other applications. Exact and effective heuristic approaches, including Very Large-Scale Neighborhood Search, are discussed using computationally challenging instances.

4 - Optimal Consolidation of Air Freight for an Intercontinental Cargo Carrier

Guvenc Sahin, Associate Professor, Sabanci University, Orhanli, Tuzla, Istanbul, Turkey, guvencs@sabanciuniv.edu, Birol Yuceoglu, Gorkem Yencak

Air cargo carriers consolidate the freight in order to avoid extra handling effort and cost during transfers as consolidated freight is easier to transfer. All stations may not be equipped with consolidation capability or might have limited facilities. We study a network design problem to determine the stations to be equipped with consolidation capability and their facilities. We formulate the problem as a set-covering problem and solve it using decomposition techniques.

■ WB53

Hilton- Taylor A

Finance, Financial Engineering 2

Contributed Session

Chair: Yue Sun, University of Virginia, 151 Engineer's Way, Charlottesville, United States of America, ys6dn@virginia.edu

1 - Negativity Bias in Attention Allocation: Retail Investors' Reaction to Stock Returns

Tomas Reyes, Assistant Professor, Pontificia Universidad Catolica de Chile, Dpto Ingenierìa Industrial y Sistemas, Av. Vicuna Mackenna 4860, Macul, Santiago, RM, 7820436, Chile, threyes@ing.puc.cl, Isaac Hacamo

We argue negative stock market performance attracts more attention from retail investors than comparable positive performance. Specifically, we test and confirm the hypothesis that retail investors pay more attention to negative than positive extreme returns, using a measure of attention at the aggregate and company specific level from Google.

2 - High-frequency vs. Insider Trading

Yue Sun, University of Virginia, 151 Engineer's Way, Charlottesville, VA, United States of America, ys6dn@virginia.edu, Alfredo Garcia

In recent years, the role of high frequency trading has received increased attention. It is commonly argued that high frequency trading increases market volatility and the probability of mis-pricing. In this paper we study the effects of high frequency trading when there is also insider trading activity in the market. We find that high frequency traders play a beneficial role as they limit the extent of insider trading rents thus protecting noise traders and enhancing market liquidity.

3 - Optimal Claiming Behavior for Third-Party Auto Insurance Market in Turkey

N. Onur Bakir, Istanbul Kemerburgaz University, Mahmutbey Dilmenler Caddesi, No:26, Bagcilar, Istanbul, 34217, Turkey, onur.bakir@kemerburgaz.edu.tr, Salih Tekin, Derya Gülel

In Turkish automobile insurance market with bonus-malus system, the annual premium depends on the insured's claim experience record in addition to other factors. When a motorist has an accident, he is faced with the decision whether to pay all the cost associated with the accident himself, or claims the costs from the insurance company. Based on data obtained from a well-established company in Turkey, we analyze the optimal behavior with a risk-averse Markov decision model.

4 - The Study on Principal-agent Relationship among Venture Capitalist, Bank and Entrepreneur

Zha Bo, School of Management, Xi'an Jiao Tong University, P.O. Box 1851, Xi'an Jiao tong University, Xi'an, Shaanxi Province, 710049, China, zhabo127127@163.com

We establish principal-agent relationship among venture capitalist, bank and entrepreneur, prove that there exist the critical value of venture capitalists' supervision, and then we analyze the impact of overconfidence and supervision on the relationships among venture capitalist, bank and entrepreneur.

5 - Optimal Asset Allocation Strategies for Oil-based Sovereign Wealth Fund

Changle Lin, Princeton University, Princeton Univeristy, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, changlel@princeton.edu, John Mulvey

Oil-exporting countries face two sets of recurring decisions: asset allocation of their sovereign wealth fund, and oil extraction. This paper models these decisions in an integrated fashion via an enterprise risk management system.First, a multi-stage stochastic program optimizes the asset allocation decisions. In a second step, the continuation value of oil reserves is estimated as a real option and linked to the stochastic program.We test the methodology via a case study to show advantages.

■ WB54

Hilton- Taylor B

Control Methods in Finance

Sponsor: Financial Services Section

Sponsored Session

Chair: James Primbs, University of Texas at Dallas, Richardson, TX, United States of America, jap120030@utdallas.edu

1 - Towards Demystification of Technical Analysis: Stock Trading via Feedback Control

Shirzad Malekpour, University of Wisconsin-Madison, 1415 Engineering Dr., Madison, WI, United States of America, smalekpour@wisc.edu, B. Ross Barmish

In the finance literature, statistical analysis of historical data is often used to study the efficacy of technically-based stock-trading. This approach has been criticized due to lack of an explanatory theory for performance. In this paper we describe a new approach aimed at providing such a theory. Simple ideas based on feedback control lead to a theoretical rationale for a class of trend-following strategies. Going forward, our goal is to extend our ideas to demystify" other trading schemes.

2 - Robust Regression to Index Tracking

Jonathan Li, Assistant Professor, Telfer School of Management, 55 Laurier Avenue East Ottawa, Ottawa, Canada, jonathan.li@telfer.uottawa.ca

Constructing a portfolio that replicates the performance of a given financial index can be seen as a linear regression problem with additional constraints. In this work, we present new robust forms of regression models that have intuitive appeal to portfolio managers who intend to fully utilize the data in hand in constructing a tracking portfolio.

3 - Exploring the Dynamics of Order Book Depth
Sean Warnick, Associate Professor, Brigham Young University, 2222 TMCB, Provo, 84604, United States of America, sean.warnick@gmail.com, Scott Condie

Recent interest in high frequency trading has focused broad media attention on the dynamics of market-making and their possible susceptibility to manipulation. Here we explore NASDAQ's Totalview ITCH data, which reveals the full order book depth, and offer an introductory tutorial to the dynamics of market making and the various concerns that have received recent media attention.

4 - Asset Pricing Models with Idiosyncratic Comoments (I-COMs)
Yuji Yamada, Professor, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We propose a new framework in asset pricing models using idiosyncratic comoments (I-COMs), which provides a generalization of CAPM beta for higher order moments. First, we introduce definition of I-COMs and show that individual asset returns depend on not only CAPM beta (being given by the first order I-COM) but also higher order I-COMs. We also demonstrate risk premiums in asset returns using empirical data on Japanese stock markets and compare our framework with Fama-French 3 factor models.

■ WB55

Hilton- Van Ness

Algorithmic and Computational Aspects of Mixed-Integer Nonlinear Optimization

Sponsor: Optimization/Global Optimization & MINLP
Sponsored Session

Chair: Aida Khajavirad, Assistant Professor, University of Texas at Austin, Austin, TX, aida.khajavirad@gmail.com

1 - On Feasibility-based Bounds Tightening
Leo Liberti, Research Staff Member, IBM Research, Yorktown Heights, NY, 10598, United States of America, leoliberti@gmail.com, Sonia Cafieri, Jon Lee, Pietro Belotti

Feasibility-based Bounds Tightening (FBBT) is used to tighten the variable ranges at the nodes of spatial Branch-and-Bound (sBB) algorithms for MINLP. FBBT may not converge finitely, even in the case of linear constraints. We model FBBT by using fixed-point equations in terms of the variable ranges. This yields an auxiliary linear program, which can be solved efficiently. We demonstrate the usefulness of our approach by improving the open-source sBB solver Couenne.

2 - Systematic Diagnosis of Infeasible NLP and MINLP Models
Yash Puranik, Carnegie Mellon University, 5000 Forbes Avenue DH 4200, Pittsburgh, PA, 15213, United States of America, ypp@andrew.cmu.edu, Nick Sahinidis

We present an approach for systematic diagnosis of infeasible and nonconvex NLP and MINLP models through the isolation of an IIS (Irreducible Inconsistent Set). Our approach relies on a preprocessing algorithm which uses feasibility based reduction techniques to achieve speedups in IIS isolation. We will present computational results with our compiled library of more than 1000 infeasible models on the efficacy of the proposed preprocessing algorithm as well as comparisons with other algorithms.

3 - On Simultaneous Convexification of Multilinear Functions
Aida Khajavirad, Assistant Professor, University of Texas at Austin, Austin, TX, aida.khajavirad@gmail.com, Alberto Del Pia

We study the polyhedral convex hull of a mixed-integer set defined by a collection of multilinear equations over the unit hypercube. We define an equivalent hypergraph representation of the mixed-integer set, which enables us to derive several classes of facet-defining inequalities, structural properties, decomposition and lifting operations for its convex hull. Our theoretical developments extend several well-known results from the Boolean quadric polytope and the cut polytope literature.

4 - A Lagrangian Relaxation Approach to a Class of Mixed-integer Bilevel Program
Mahdi Hamzeei, University of Wisconsin, Madison, WI, United States of America, hamzeei@wisc.edu, James Luedtke

We study a service network design problem in which a system operator chooses which facilities to open, and the allocation of customer demands to facilities is determined as a solution of an equilibrium problem driven by facility congestion. The problem is formulated as a mixed-integer bilevel programming problem which can be reformulated to a nonconvex MINLP. We use Lagrangian relaxation to obtain a lower bound and candidate feasible solution. Promising computational results will be reported.

■ WB56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS® Global Academic
Mike Speed, Analytical Consultant, SAS Institute, 9312 Lake Forest Ct S, College Station, TX, 77845, United States of America, mike.speed@sas.com, Tom Bohannon

The tutorial will demo SAS Visual Analytics to show you that you can explore all relevant data quickly and easily. You can look at more options, uncover hidden opportunities, identify key relationships and make more precise decisions faster than ever before. Self-service, ad hoc visual data discovery and exploration put lightning-fast insights within everyone's reach.

2 - Forio - Publishing Interactive Analytics or Operations Research Models on the Web
Michael Bean, President, Forio Business Simulations, San Francisco, CA, United States of America, mbean@forio.com

Forio's web platform makes your analytic model available to hundreds of people within your organization through the browser. We will start with an introduction to the platform and example analytics applications. Then we'll divide the workshop into two parts. In the first part we will teach you how to get your analysis on a server so it can be shared. In the second part we'll focus on creating a user interface for your model.

■ WB57

Hilton- Golden Gate 1

Technology in the Classroom

Sponsor: INFORM-ED
Sponsored Session

Chair: David Czerwinski, San Jose State University, One Washington Square, San Jose, CA, 95192-0069, United States of America, david.czerwinski@sjsu.edu

1 - Incorporating Technology in Students' Professional Skills Assessment
Sadan Kulturel-Konak, Pennsylvania State University-Berks, Tulpehocken Rd. PO Box 7009, Reading, PA, United States of America, sadan@psu.edu

In this study, we introduce a web-based application, called Peer Evaluation and Assessment Resource (PEAR), to assess students' development in professional skills, namely in teamwork. PEAR has been designed based on the theory of Model of Domain Learning (MDL); hence, it can help explain the complex interactions among knowledge, interest level, and strategies with which knowledge is gained. We illustrate the workflow of PEAR and how MDL is integrated into the peer assessment process.

2 - Incorporating Technology in Classroom: A Case Study in an Engineering Course
Farnaz Ghazi Nezami, Assistant professor, Kettering University, Industrial and Manufacturing Engineering Department, 1700 University Ave.,, Flint, MI, United States of America, fghazinezami@kettering.edu, M Bayram Yildirim

This study analyzes the impact of education mode, face-to-face vs. online, on student's performance and persistence rate in Engineering Economy course. We also provide some insights about how the student's external characteristics can influence their enrollment decisions about online and face-to-face class options.

3 - POET: An Interactive Web-Based Tool for Learning Optimization Modeling Skills
Nelson Uhan, Mathematics Department, United States Naval Academy, Chauvenet Hall, Annapolis, MD, 21402, United States of America, uhan@usna.edu, Ji Soo Yi, Sung-Hee Kim, Rachael Kenney

POET is an interactive web-based tool designed to help students learn how to formulate optimization models from word problems, by establishing physical meaning for decision variables and constraints, and enabling students to test their models using concrete values for decision variables. We assessed its effectiveness with over 200 engineering students in an undergraduate optimization course over two semesters. Our studies indicate that POET helps students avoid several types of common errors.

4 - Bringing Linear Optimization to Life in the Classroom
David Czerwinski, San Jose State University, One Washington Square, San Jose, CA, 95192-0069, United States of America, david.czerwinski@sjsu.edu

We share two ways we have brought LPs to life in an undergraduate classroom. The first is a simple animation of solving an LP graphically. We discuss how to incorporate the animation in a lecture and touch on some subtle pedagogical points that can be made with it. The second is a project in which students create videos demonstrating optimization concepts. Highlights from some of the more entertaining videos will be shared, along with lessons learned about making the assignment successful.

■ WB58

Hilton- Golden Gate 2

Scheduling III
Contributed Session

Chair: Yasaman Malone, Oregon State University, 2494 NW Garryanna St, Apt. 29, Corvallis, OR, 97330, United States of America, yasaman.malone@oregonstate.edu

1 - Lower Bounding Methods for Solving a Dual Hybrid-flowshop Scheduling Problem
Yasaman Malone, Oregon State University, 2494 NW Garryanna St, Apt. 29, Corvallis, OR, 97330, United States of America, yasaman.malone@oregonstate.edu, Rasaratnam Logendran

This presentation addresses a hybrid-flow shop scheduling problem with both machine and labor as constraints in a supply chain. A linear mixed-integer mathematical programming model along with two lower bounding methods are proposed. In addition, a meta-search heuristic algorithm based on tabu search is developed in order to quickly solve the scheduling problems. The effectiveness and efficiency of the lower bounding methods and search algorithm are shown by using statistical analysis.

2 - Sequence-dependent Batch Scheduling Problem on Unrelated-parallel Machines
Rasaratnam Logendran, Professor, Oregon State University, School of MIME, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, Logen.Logendran@oregonstate.edu, Omid Shahvari

We address a batch scheduling problem on unrelated-parallel machines with the objective of minimizing the weighted sum of weighted completion time and weighted tardiness, to respect the interests of the producer and customers. A mechanism for determining a lower bound on the number of jobs in a batch within the mathematical model is proposed, and dynamic job release and machine availability times are assumed. An example is used to demonstrate the application of tabu search to solve the problem.

3 - The Precedence Properties of the Flowshop Scheduling Problem
Jin-Pin Liou, Associate Professor, I-Shou University, 11F-1, No.9, Aly. 17, Ln. 50, Lida Rd., Kaohsiung, 81356, Taiwan - ROC, jinpin@isu.edu.tw

This research studies the static n-job m-machine permutation flowshop scheduling problems to minimize the makespan. At this study, we propose two precedence properties, which can significantly improve the efficiency of the existing branch and bound algorithms to arrive the optimal solutions of the flowshop scheduling problems. The simulated results are also provided to show the efficiency of these properties.

4 - Minimizing the Number of Tardy Jobs in a Stochastic Single Machine Scheduling Problem
Hossein Soroush, Professor, Kuwait University, Dept. of Statistics & Opns Research, POB 5969, Safat, 13060, Kuwait, h.soroush@ku.edu.kw

We study the problem of scheduling a set of jobs with fixed tardiness penalties and random processing times or due-dates on a single machine. The goal is to derive the sequence that minimizes the expected weighted number of tardy jobs. Special cases of the problem are solvable optimally in polynomial time while the general cases are tackled heuristically.

5 - Scheduling with Step-improving Processing Times
Eun-Seok Kim, Middlesex University, The Burroughs, London, NW4 4BT, United Kingdom, e.kim@mdx.ac.uk, Daniel Oron

We study a single machine scheduling problem of minimizing total completion time with step-improving processing times. For step-improving processing times, job processing times reduce by a job-dependent amount after a common critical date. We show that the problem is NP-hard in general. We formulate a Mixed Integer Programming model and develop an LP-based heuristic for the problem. Finally, we perform computational experiments showing that the heuristic provides effective solutions.

■ WB59

Hilton- Golden Gate 3

Group Decisions and Negotiation
Contributed Session

Chair: Michael Chuang, State University of New York, 1 Hawk Av, New Paltz, NY, United States of America, chuangm@newpaltz.edu

1 - Strong Leadership in Entrepreneurial Firms: The Distribution of Power in Top Management Teams
Martin Peitzner, PhD Candidate, TU Dortmund, Martin-Schmeifler-Weg 12, Dortmund, 44227, Germany, martin.peitzner@tu-dortmund.de, Andreas Engelen

This study examines the relationship between Top Management Team (TMT) power distribution and performance in different markets. To address equivocal results in extant research, it argues that the Entrepreneurial Orientation (EO) of a firm greatly influences how TMT members exercise their power. Based on secondary data of 61 S&P 500 companies, it finds that the more fragmented the market is, the more positively EO moderates the relationship between unequally distributed power and performance.

2 - Personality in Computer-Mediated Communication
Michael Chuang, State University of New York, 1 Hawk Av, New Paltz, NY, United States of America, chuangm@newpaltz.edu

When a group faces a barrage of information pieces for a decision, persuasion is important for reaching a consensus. However, there is lack of related study regarding whether individuals characterized by having different personalities exhibit differences. To fill the gap, this work investigates the impacts of communication modes and personality in computer-mediated communications environments.

3 - Visualizing Alignment to Predict Group Success and Failure
Michael Taylor, Principal, SchellingPoint, 109 Cratin Lane, Suite 200, West Chester, PA, 19380, United States of America, mtaylor@schellingpoint.com

Alignment is vital in collaborative activities yet considered binary - We are aligned or We aren't. False positives cause groups to create logical but flawed plans, the flaws arising in execution. AOT measures the Alignment Index of a group. In 200 uses every group's alignment was 44 to 83 on a 100-point scale. Alignment visualization show the group's path to success and what will cause them to fail, enabling them to pinpoint their necessary conversations.

■ WB60

Hilton- Golden Gate 4

Inventory Management VI
Contributed Session

Chair: Arnab Bisi, Associate Professor of Operations Management, Indian Institute of Management Calcutta, Joka, Diamond Harbour Road, Kolkata, India, abisi@iimcal.ac.in

1 - Alternative Incentives in Inventory Management: How do Performance Metrics Affect Inventory Decision
Michael Becker-Peth, Assistant professor, University of Cologne, Albertus-Magnus-Platz, Cologne, Germany, michael.becker-peth@uni-koeln.de, Kai Hoberg, Margarita Protopapa-Sieke

We analyze the impact of alternative incentive schemes on inventory decisions and the link to the company's performance. We find analytically that commonly used performance metrics focusing on inventory levels at the fiscal year end can seriously harm the overall firm performance. Furthermore we test these incentive schemes in lab experiments and find overreactions to end-of-year incentives as end-of-year-inventory levels are typically dropped significantly below the prescriptive levels.

2 - Resetting Base Stock Levels in Unbalanced Production Systems
Nha Nghi Huynh, University of Hamburg, Von Melle Park 5, Hamburg, 20146, Germany, nha-nghi.huynh@uni-hamburg.de, Hans Daduna

We analyze monotonicity of base stock levels in inventory-production systems and study single- and multi-item systems where demand triggers production of a new unit. Standard queueing theory suggests that the base stock level should increase with the utilization in the system. However, this intuition is not easy to prove. We present a proof of this presumption utilizing stochastic orderings and consider in particular unbalanced production systems.

3 - Pricing and Assortment Decisions for Perishable Products with Price- and Stock-dependent Demand
Erhun Kundakcioglu, Ozyegin University, Faculty of Engineering, Istanbul, Turkey, erhun.kundakcioglu@ozyegin.edu.tr, Arda Yenipazarli, Mehmet Onal

We introduce a product assortment and pricing problem for perishable products. The goal is to maximize the retailer's profit under shelf-space and backroom storage capacity constraints. The demand rate is a deterministic and multivariate function of selling price and on-display stock level. The model is reformulated and a heuristic solution method is proposed. Computational experiments identify how the variation in the total profit is apportioned to changes in demand parameters.

4 - On the Interaction of Service Level and Shelf Life Agreements in Perishable-product Supply Chains
Sandra Transchel, Associate Professor of Supply Chain and Operations Management, Kuehne Logistics University - The KLU, Grofler Grasbrook 17, Hamburg, HH, 20457, Germany, sandra.transchel@the-klu.org

We study a two-stage perishable-product supply chain of a manufacturer and retailer who negotiate a contract comprising a service level and shelf life agreement (remaining shelf life guaranteed by the manufacturer). The manufacturer has an incentive to produces larger batches that negatively impacts the remaining shelf life and thus the contract agreement. We investigate the interaction of service level and shelf life agreement and its impact on the supply chain performance and efficiency.

5 - The Value of Real Time Yield Information in Multi-stage Inventory Systems
Marcus Dettenbach, University of Cologne, Albertus Magnus Platz, Cologne, Germany, marcus.dettenbach@uni-koeln.de, Ulrich Thonemann

We consider the number of defective units in an order to be random. The information on the number of defective units is available at any time. This setting is compared to a setting in which the yield is observable upon arrival of an order. We solve a dynamic program for both settings. We develop close-to-optimal heuristics with short run times and conduct various numerical experiments and identify dependencies for the value of real time yield information. An extension considers fixed order cost.

■ WB61

Hilton- Golden Gate 5

Organization Theory 2

Contributed Session

Chair: Jay Lee, California State Univ Sacramento, 6000 J St, Tahoe Hall 2079, Sacramento, CA, 95819, United States of America, jlee@csus.edu

1 - The Relationship between Career Growth and Job Performance
Hui Yang, University of Science and Technology of China, School of Management, HeFei, China, nyanghui@163.com

This paper establishes a model to interpret the relationship between career growth and job performance, empirically analyzes the impact mechanism of employees' career growth on job performance. we using correlation analysis and regression analysis methods, revealing the professional growth of job performance of paths and processes. The study found that career goals progress within the organization and professional capacity development for job performance have certain influence.

2 - Global ICT (Information, Communication & Technology) Firm's International Strategy and Performance
Jay Lee, California State Univ Sacramento, 6000 J St, Tahoe Hall 2079, Sacramento, CA, 95819, United States of America, jlee@csus.edu

This study examines the different alliance activities of major global ICT (Information, Communication & Technology) firms as they pursue an international expansion strategy in a highly competitive business environment. As in many other industries, global strategic alliances have been increasingly popular among global ICT firms all over the world. Two network characteristics - geographical scope and frequency of strategic alliances among global ICT firms - are to look at in this study.

3 - A Network-Based Approach to Organizational Learning
Mark Avnet, Assistant Professor, Texas A&M University, 4075 Emerging Technologies Building, 3131 TAMU, College Station, TX, 77843-3131, United States of America, avnet@tamu.edu

An analytical approach for measuring organizational learning is presented. Using survey data of respondents' knowledge and views about a given situation or problem, networks of shared mental models in an organization are constructed at several points in time. Structural comparisons of these networks are used to quantify learning in the organization. The approach is tested by relating organizational learning to metrics of safety performance in a major oil and gas company.

4 - The Role of Leaders in Responding to Uncertainty: Evidence from China's Largest Real Estate Company
Xiaofeng Zhang, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, Xi'an, China, xiaofeng.zh@mail.xjtu.edu.cn

Our constructing grounded theory study develops a conceptual model of leader dealing with uncertainty in China. We find that leaders search and grasp opportunity, follow policy and competition changes to respond to environmental uncertainty; promote organization evolution and mobilize resources for crisis management in the case of organizational uncertainty; consolidate position power and construct leader authority, accumulate experience and take external learning as to individual uncertainty.

■ WB62

Hilton- Plaza A

Applied Probability 2

Contributed Session

Chair: George Mytalas, NJIT, 257 86 Brooklyn, New York, United States of America, mytalas@njit.edu

1 - Multivariate Run Test for Detecting Non-Randomness in Process Control Charts
Young H. Chun, Professor of Decision Science, Louisiana State University, E. J. Ourso College of Business, 2219 Business Education Complex, Baton Rouge, LA, 70803, United States of America, prof@drchun.net

In a sequence of observations, a run is defined as a maximal subsequence of like observations. We propose a run test that checks a randomness hypothesis for a multi-valued data sequence. The randomness is tested based on the number of runs and the length of the longest run in a sequence of observations with multiple classes. The run tests can be applied to many practical situations, including the non-parametric test for statistical process control.

2 - An Efficient Decomposition Algorithm for Superquantile Regression
Dharmashankar Subramanian, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, dharmash@us.ibm.com, Pavithra Harsha, Ramesh Natarajan

A regression technique known as Superquantile regression, proposed by Rockafellar, Royset and Miranda 2013, is a method to estimate superquantile, well known as conditional value at risk, of a random variable that depends on covariates. The proposed linear program to estimate the coefficients of the regression fails to scale even for reasonably small instances. We present an efficient decomposition method to solve this problem even for very large instances with computational results.

3 - Optimal Call Center Forecasting and Staffing under Arrival Rate Uncertainty
Sihan Ding, PhD, Center for Mathematics and Computer Science, Science Park 123, Amsterdam, 1098 XG, Netherlands, S.Ding@cwi.nl, Ger Koole

We formulate the staffing problem in call centers as a new-vendor type problem, where the costs are the staffing costs. We show that under such a cost structure and the arrival rate uncertainty, the optimal staffing should occur according to a quantile of the distributional forecast, rather than the mean. It is also shown that the sum of quantile errors is asymptotically the optimal error measurement in call center forecasting. The results are validated numerically.

4 - Stochastic Enumeration for Counting SAW
Ad Ridder, Vrije University, de Boelelaan 1105, Amsterdam, 1081HV, Netherlands, ad.ridder@vu.nl, Slava Vaisman

In this talk we will consider counting the number of self-avoiding walks of length n on the 2D integer lattice. This is a so-called #P-complete counting problem. We will give a brief introduction to this complexity class and then present several randomized approximation schemes for estimating the number, including numerical results. Furthermore, we discuss the correspondence to efficient simulation algorithms for estimating rare event probabilities.

5 - An M/G/1 Queue System Subject to Disasters and Server Breakdowns
George Mytalas, NJIT, 257 86 Brooklyn, New York, United States of America, mytalas@njit.edu

We consider a M/G/1 queueing system subject to disasters and server breakdowns under N-policy. The server is turned off as soon as the system empties. When the queue length reaches or exceeds a value N (threshold), the server is turned on and begins to serve the customers. During the repair period arriving batches of customers accumulate in the queue without receiving service. Besides, the server has an exponential lifetime in addition to the catastrophe process.

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■ WB63

Hilton- Plaza B

Dynamic Programming/ Control 2

Contributed Session

Chair: Kun Zhao, University of Florida, 303 Weil Hall,
P.O. Box 116595, Gainesville, FL, 32608, United States of America,
zhaokunzk@ufl.edu

**1 - Dynamic Repairman Assignment in a Layered Queuing Network
with Correlated Queues**

Sandjai Bhulai, VU University Amsterdam, Department of
Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV,
Netherlands, s.bhulai@vu.nl, Jan-Pieter Dorsman, Maria Vlasiou

We study a machine-repair model in which the machines make products
themselves. Due to correlations of the machine downtimes, the queue lengths of
the products are correlated. We study how the repairman should allocate its repair
capacity dynamically, so as to minimize the expected total number of waiting
products. We derive several properties pertaining to the repairman's optimal
strategy. We also obtain a near optimal policy that performs nearly as well over a
wide range of parameter settings.

**2 - Inspection Scheduling of Multi-unit Systems With
Budget Constraint**

Mahmood Pariazar, American Airlines, 4333 Amon Carter Blvd,
Forth Worth, TX, United States of America,
mppv6@mail.missouri.edu, Esra Sisikoglu Sir

Consider a multi-unit system such as a multi-machine production system in which
each unit needs to be inspected/maintained under a limited budget. The budget
constraint makes it infeasible to inspect each item according to its optimal
inspection schedule. Group inspection policies become suboptimal as each item has
its own degradation probability. We use dynamic programming to determine the
optimal inspection schedule of multi-unit systems and use approximation for large
scale problem instances.

**3 - Dynamic Programming Based Inequalities for Multidimensional
Knapsack Problems**

Kun Zhao, University of Florida, 303 Weil Hall, P.O. Box 116595,
Gainesville, FL, 32608, United States of America,
zhaokunzk@ufl.edu, Joseph Hartman

Forward dynamic programming for the multidimensional knapsack problem is
used to generate inequalities for an equivalent integer programming formulation.
We illustrate the effectiveness of the approach through experimental testing.

■ WB64

Parc- Cyril Magnin I

Methods for Staffing Nonstationary Queueing Systems

Sponsor: Applied Probability Society

Sponsored Session

Chair: Jamol Pender, Cornell University, 206 Rhodes Hall, Ithaca, NY,
14850, United States of America, jjp274@cornell.edu

**1 - Optimal Allocation and Pricing of Servers under Uncertainty
with Co-sourcing**

Jeffrey Kharoufeh, Department of Industrial Engineering,
University of Pittsburgh, Pittsburgh, PA, 15261,
United States of America, jkharouf@pitt.edu, David Abdul-Malak

We consider the problem of optimally allocating servers in a multi-server queueing
system in which the arrival rate is uncertain, a quality-of-service constraint must
be satisfied, and server co-sourcing is available. Additionally, we determine the co-
sourcing contractor's profit-maximizing pricing strategy by formulating the
problem within the framework of a Stackelberg competition.

**2 - Sizing Heterogeneous Servers with Non-stationary Arrivals
for Time-stability**

Soongeol Kwon, Texas A&M University, College Station, TX, United
States of America, soongeol.kwon@gmail.com, Natarajan Gautam

We consider a set of parallel servers that could be powered on or off, and when on
run at different speeds. Requests of multiple classes arrive according to a piecewise
constant non-homogeneous Poisson process. Our objective is to make multiple
decisions including assignment of classes to servers, routing probability of requests
to servers, number of servers to be powered on, and the speed of each server. The
goal is to minimize power consumption subject to achieving time-stable
performance.

**3 - Refining Piecewise Stationary Approximation for a
Markov-Regulated Fluid Queue**

Bo Zhang, IBM T.J. Watson Research Center, 1101 Kitchawan
Road, Yorktown Heights, NY, United States of America,
bozhang@gatech.edu, Guodong Pang, Bert Zwart

We present a refinement of the Piecewise Stationary Approximation for the
stationary distribution of a Markov-regulated fluid queue. The refinement is
analytically justified. Its accuracy and utility are demonstrated.

4 - Staffing Nonstationary Queues using Transition Rates

Jamol Pender, Cornell University, 206 Rhodes Hall, Ithaca, NY,
14850, United States of America, jjp274@cornell.edu

In this talk, we will present a new way to approximate and stabilize various
performance measures of Markovian Jackson networks using the transition rates
and the Kolmogorov forward equations of the Markov process. We show that the
transition rates of the Markov process provide valuable information for
approximating and stabilizing the probability of delay, abandonment probabilities,
and the effective abandonment rate of the Jackson network.

■ WB65

Parc- Cyril Magnin II

Large-scale Stochastic Systems and Resource Allocation

Sponsor: Applied Probability Society

Sponsored Session

Chair: Kuang Xu, MIT, 77 Massachusetts Ave., Cambridge, MA,
United States of America, kuangxu@mit.edu

1 - Incentivized Optimal Advert Assignment via Utility Decomposition

Neil Walton, University of Amsterdam, Science Part 904,
Amsterdam, Netherlands, n.s.walton@uva.nl, Frank Kelly,
Peter Key

For a large-scale Ad-auction over an infinite space of random searches, we show
that a maximum aggregate utility can be solved in separate optimizations
conducted by the advertisement platform and advertisers. Here, the platform solves
an assignment problem and, on a slower time scale, each advertiser submits a bid
which matches its demand for click-throughs with supply. This simple mechanism
can incentivize truthful bidding and has a unique Nash equilibrium, which
implements our decomposition.

2 - Supply Reservation in an Inventory Model for Cloud Computing

TongHoon Suk, Graduate Student, Georgia Institute of Technology,
755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America,
tonghoons@gatech.edu, Aaron Yen, Ilyas Iyoob, Ton Dieker

Motivated by the marketplace in cloud computing, we study an inventory model
with uncertain demand for a perishable good that can be supplied at different
prices depending on the length of the contractual commitment as measured by a
lock-in period. This gives a trade-off between risk of having to buy last-minute
capacity for a high price and buying resources that end up unused. We describe a
data-driven approach to analyze this trade-off and illustrate our technique on a
representative data set.

**3 - Achievable Performance of Blind Scheduling Policies in
Heavy Traffic**

Bart Kamphorst, CWI, P.O. Box 94079, Amsterdam, 1090 GB,
Netherlands, b.kamphorst@cwi.nl, Nikhil Bansal, Bert Zwart

It is well-known that SRPT is an optimal scheduling policy for minimizing the
average sojourn time in G/G/1 queues. In practice one often does not know
individual job sizes and a blind policy is required. Scheduling literature has shown
strong bounds on the performance of blind scheduling policies in deterministic
environments when compared to SRPT. I will show how the strong bounds on
blind policies in deterministic environments can be used to obtain bounds in heavy
traffic stochastic settings.

4 - Throughput Optimal Policies in a Flexible Fork-join Network

Yuan Zhong, Columbia University, 500 West 120th Street, New
York, NY, 10027, United States of America, yz2561@columbia.edu,
Jean Walrand, Ramtin Pedarsani

We consider a flexible fork-join processing network, that models applications in
healthcare, cloud computing, manufacturing, etc. Jobs are modeled as directed
acyclic graphs of tasks with precedence constraints among them. Servers are
flexible with overlapping capabilities. In this talk, we present several throughput
optimal scheduling policies for this network, and discuss their complexity and
performance properties. We complement our results with simulations.

■ WB66

Parc- Cyril Magnin III

Predictive Modeling and Control for Additive Manufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Associate Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Shape Deviation Modeling and Compensation for Fused Deposition Modeling Processes
　　Andi Wang, HKUST, Academic Bldg 4223, HKUST, Hong Kong, Hong Kong - PRC, awangab@ust.hk, Suoyuan Song, Fugee Tsung, Qiang Huang

In this research we intend to increase the geometric accuracy for Fused Deposition Modeling (FDM) process, one of the mostly adopted additive manufacturing technologies. Based on the FDM mechanism, we analyze the process and attribute the dimensional inaccuracy to two significant error sources: extruder positioning error and processing error. We further derived a effective compensation plan through changing the product design. Experiments show the effectiveness of our method.

2 - Optimal Meniscus Planning in SL-related AM for Improvement of Surface Finish and Geometric Accuracy
　　Yayue Pan, Assistant Professor, University of Illinois at Chicago, 739 Valley Circle Dr., Apt.103, Saline, United States of America, pyy2010@gmail.com

Surface quality is a big challenge in Additive Manufacturing (AM) processes.A meniscus method has been verified for surface finish improvement.Yet without proper settings, the geometric accuracy may have no improvement or even be worse.In this paper,different manufacturing process parameters in the SL-related AM systems were examined.Systematic models for surface quality control through meniscus deposition and process characterizations were developed and verified by experiments.

3 - Unified Predictive Modeling and Compensation Approach for 3D Printed Products
　　Qiang Huang, Associate Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Sobambo Sosina, Tirthankar Dasgupta, Hadis Nouri, Kai Xu, Yong Chen

Built upon our previous optimal compensation study of 3D printed products, this work aims at an unified modeling approach to predict the quality of both cylinder and polygon shapes. Experimental investigation of polygon shapes indicates the promise of predicting and compensating a wide class of products built through 3D printing technology

■ WB67

Parc- Balboa

Data Fusion in Manufacturing Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Ran Jin, Virginia Tech, Virginia Polytechnic Institute and State, University, 111 Durham Hall,, Blacksburg, VA, 24061, United States of America, jran5@vt.edu

1 - Approximate Likelihood Inference for Multistream Count Data Monitnoring
　　Devashish Das, PhD Candidate, University of Wisconsin, Madis, Department of Industrial Engineering, 1513 University Avenue, Madison, Wi, 53706, United States of America, ddas3@wisc.edu, Shiyu Zhou

In this paper we use a Poisson-Multivariate Normal density to model multistream count data. An approximate likelihood ratio test for this model is proposed, which significantly reduces the computational cost of multi-dimensional integrals involved in the likelihood function. These approximate likelihood tests were found to be effective in detecting changes to the in-control distribution. The proposed framework is compared with existing approaches as well as on a real data case study.

2 - Within-cycle Profile Monitoring and Fault Diagnosis using Multichannel Signals
　　Weihong Guo, Ph.D. Candidate, University of Michigan - Ann Arbor, 2860 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, graceguo@umich.edu, Judy Jin, S. Jack Hu

Existing research on cyclic profile monitoring has been focusing on between-cycle detection at the end of part completion based on the entire cycle of signals. Extending from the authors' previous research on within-cycle profile monitoring for real-time defect prevention, this research develops a monitoring and diagnosis methodology to address the challenges and opportunities brought by multichannel signals for making monitoring decisions and fault diagnosis.

3 - Multiple Sensor Data Fusion in Degradation Modeling under Different Operation Conditions
　　Hao Yan, PhD Student, Georgia Institute of Technology, 755 Ferst Dr, NW, Atlanta, GA, 30332, United States of America, yanhao@gatech.edu, Kaibo Liu

System monitoring with multiple sensors in different operation conditions brings challenge to data fusion in degradation modeling. Thus, a data level fusion methodology is proposed to integrate data from multiple sensors in multiple operation conditions for accurate prediction of the remaining lifetime. The effectiveness of proposed method is demonstrated in the case study, which involves a degradation dataset of an aircraft in six different operation conditions.

4 - Dynamic Quality Models Considering Equipment Degradation in Manufacturing Systems
　　Ran Jin, Virginia Tech, Virginia Polytechnic Institute and State, University, 111 Durham Hall,, Blacksburg, VA, 24061, United States of America, jran5@vt.edu, Xinwei Deng

The reliability of manufacturing equipment plays an important role for product quality assurance. In this paper, we focus on modeling the effects of the equipment degradation to product quality. A novel dynamic model is proposed to characterize the varying effects of process variables to quality due to equipment degradation. We use both simulations and a real data set from crystal growth manufacturing to show the advantage of the proposed model.

■ WB68

Parc- Davidson

Initialization Bias and Related Problems

Sponsor: Simulation
Sponsored Session

Chair: K. Preston White, Professor, University of Virginia, 151 Engineer's Way, P.O. Box 400747, Charlottesville, VA, United States of America, kpw8h@virginia.edu

　　Co-Chair: Winfried Grassmann, Professor, University of Saskatchewan, Dept. of Computer Science, 110 Science Place, Saskatoon, SK, S7N 5C0, Canada, grassman@cs.usask.ca

1 - MSER Algorithms for the Initial Transient Problem
　　Raghu Pasupathy, Associate Professor, Purdue University, Dept. of Statistics, West Lafayette, United States of America, pasupath@vt.edu, Bruce Schmeiser

The problem of the initial transient asks how large an initial segment of a time series should be deleted before constructing the estimator of the steady state mean. The MSER family of algorithms is a popular method to address this problem; MSER's efficacy, however, is still unclear and has been the subject of ongoing debate. In this talk, we will attempt to further clarify the computational and theoretical performance of MSER. We also present two new MSER variations that have shown promise.

2 - On the Initial Transient Problem for Reflected Brownian Motion
　　Rob Wang, Ph.D. Student, Stanford University, 314M Huang Engineering Center, Department of MS&E, Stanford, CA, 94305, United States of America, robjwang@stanford.edu, Peter Glynn

We discuss the convergence to equilibrium of one-dimensional reflected Brownian motion (RBM) and related initial transient formulae. These results provide new insights into the initial transient problem for queueing systems in heavy traffic, for which RBM is an effective approximation.

3 - Choosing a Good Starting State in Discrete Event Simulation
　　Winfried Grassmann, Professor, University of Saskatchewan, Dept. of Computer Science, 110 Science Place, Saskatoon, SK, S7N 5C0, Canada, grassman@cs.usask.ca

When estimating expectations by simulation, two criteria should be used to find a good starting state: the closeness of the expectation provided by the starting state, and the drift, a concept to be discussed. Good starting states make warm-up periods redundant.

■ WB69

Parc- Fillmore

Decision Making for Holistic Sustainability Assessment

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Gokhan Egilmez, Assistant Professor, North Dakota State University, Industrial & Manufacturing Engineering, NDSU Dept. 2485, PO Box 6050, Fargo, ND, 58108, United States of America, gokhanegilmez@gmail.com

1 - Forecasting Crude Oil Prices using Machine Learning Methods
Erkam Guresen, Ph.D.Student, Turkish Military Academy, Devlet Mah., Ankara, Turkey, erkamguresen@gmail.com, Gulgun Kayakutlu

Oil price becomes an increasingly essential topic of concern to all kind of decision makers from small investors to government policy makers. In this study monthly Brent Crude Oil Prices from January 1980 to June 2013 are used. ARIMA,Exponential Smoothing, Regression, Radial Bases Function Network, Support Vector Machine, and Multi-Layer Perceptron (MLP) models are developed using SPSS software. Three additional MLP models are constructed using dynamic algorithms CA02V01, CA03V01 and CA03V02.

2 - Energy and Carbon Footprints of Alternative Vehicle Options: Inclusion of State-specific Variations
Nuri Onat, PhD Candidate, University of Central Florida, 4000 Central Florida Blvd, Orlando, United States of America, nconat@knights.ucf.edu, Omer Tatari, Murat Kucukvar

Temporal and spatial variations are quite influential when deciding which vehicle option is a better choice in terms of energy and carbon footprints. We compared electric, plug-in hybrid electric, and hybrid electric vehicles across 51 states considering state-specific electricity generation mix and driving patterns. Life cycle methodology is utilized to quantify impacts of the vehicles. This study highlights how temporal and spatial variations affect the vehicle preference at state level.

3 - Ranking Sustainability Performance of the US and Canada Metropoles: An IF-MCDM Approach
Serkan Gumus, Assistant Professor, Turkish Military Academy, Bakanliklar, Ankara, 06654, Turkey, sgumus@kho.edu.tr, Gokhan Egilmez, Murat Kucukvar

Environmental sustainability performance assessment of 27 U.S. and Canada metropoles is focused. Firstly, collecting the data and contacting experts from academia, U.S. government agencies and industry. Secondly, experts are evaluated their sustainability performance. Thirdly, IF-MCDM model is applied considering expert judgements. In the final step, the sustainability scores, rankings, results analysis and discussions, and statistical highlights about the research findings are provided.

4 - Energy-Water Nexus of Electric Vehicle Technologies in United States
Murat Kucukvar, Assistant Professor, Istanbul Sehir University, Kusbakisi Cad. No:27, Uskudar, Istanbul, 34666, Turkey, muratkucukvar@sehir.edu.tr, Nuri Onat

According to the recent statistics, we are running out of time" to take actions towards achieving sustainable vehicle transportation in the U.S. This research aims to provide new insights into the potential water consumption and withdrawals resulting from an increased use of electric vehicles in the 51 states. Four vehicles types including ICEV, HEV, PHEV, and BEV will be analyzed. Stochastic process-based life cycle assessment model will be developed to conduct well-to-wheel" analysis.

5 - Life Cycle Based Environmental Impact Intensity Assessment of National Freight Logistics
Yong Park, Ph.D. Student, North Dakota State University, Fargo, ND, 58108, United States of America, Yong.Park@my.ndsu.edu

In this study, the U.S. manufacturing and transportation industries' nexus will be addressed from life cycle perspective. The main objective of this study is to determine the environmental impact intensity scores of four transportation modes. To achieve this goal, Economic Input-Output Life-Cycle Assessment (EIO-LCA) model will be used to quantify the life cycle inventory and ton-kilometer shipment characteristics for intensity assessment purposes.

6 - Eco-efficiency Analysis of Manufacturing and Transportation Nexus in the U.S. with PCA
Gokhan Egilmez, Assistant Professor, North Dakota State University, Industrial & Manufacturing Engineering, NDSU Dept. 2485, PO Box 6050, Fargo, ND, 58108, United States of America, Gokhan.Egilmez@ndsu.edu

The relationship between the U.S. manufacturing and transportation industries is studied from a life cycle perspective. The main aim is to quantify the life cycle impacts of U.S. manufacturing in the transportation industry and perform eco-efficiency analysis. To achieve this goal, a combined application of Economic Input-Output Life-Cycle Assessment (EIO-LCA) and Principal Component Analysis (PCA) is performed.

■ WB70

Parc- Hearst

Economics (Game Theory)

Contributed Session

Chair: Rachel Chen, University of California at Davis, 3208 Gallagher Hall, Davis, CA, 95691, United States of America, rachen@ucdavis.edu

1 - Three Equilibriums of Benefit-Seeking Behavior of Consuming Weak Regenerative Resource
Shaorong Sun, professor, University of Shanghai for Science and Technology, 516 Jungong Road Shanghai 200093 CHINA, School of Management, Shanghai, 200093, China, 438878648@qq.com, Yannan Zhang

Equilibrium curve and model of common weak regenerative resource under benefit-seeking behavior are deduced based on regeneration speed model of resource and consumption model of benefit-seeking behavior. Different equilibrium points of individual irrationality, individual rationality and collective rationality are deduced. Relationships of these points are analyzed. The number of members influents the profit of benefit-seeking behavior.

2 - Free Samples, Advertisement, and Targeting Strategies
Shiming Deng, Professor, Huazhong University of Science and Technology, 1037 Luo Yu Rd, Wuhan, China, smdeng@hust.edu.cn, Lingli Wu

Customers may be uncertain about the value of a product before having any experience on it. To reduce this uncertainty, companies may offer free samples to customer evaluation. We develop models to study the effectiveness of free samples for the cases they are offered alone or jointly with other ads. Furthermore, if selective marketing are possible, we develop algorithms for choosing customers who should receive samples and/or ads. Our research provides interesting managerial insights.

3 - Opaque Distribution Channels for Competing Service Providers: Posted Price vs. NYOP Mechanisms
Rachel Chen, University of California at Davis, 3208 Gallagher Hall, Davis, CA, 95691, United States of America, rachen@ucdavis.edu, Esther Gal-Or, Paolo Roma

Opaque selling has been widely adopted by service providers to sell off leftover capacity under stochastic demand. We study the impact of different selling mechanisms, Posted Price (PP) vs. Name-Your-Own-Price (NYOP), of an opaque reseller on competing service providers. We find that providers prefer that the opaque reseller uses a posted price instead of a bidding model. Our findings are consistent with the recent trend towards more published price sales for opaque products.

4 - Principal-Agent Framework for a Revenue Generating Unit
Shuo Zeng, University of Arizona, McClelland Hall 430, 1130 East Helen Street, Tucson, AZ, 85721, United States of America, shuozeng@email.arizona.edu, Moshe Dror, Moshe Shaked

We examine the contractual relationship between a principal (revenue generating unit) and an agent (service provider) in a Markovian setting with a risk neutral principal and a risk averse agent. We identify conditions for the existence of a contract and describe the terms for a Pareto-optimal contract. For risk averse agent we adopt a novel risk representation and show that both the principal and the agent are worse off in relation to risk aversion.

■ WB71

Parc - Lombard

Auctions/ Mechanism Design 1

Contributed Session

Chair: Shivam Gupta, UT Dallas, 800 W Campbell Rd,
Richardson, TX, United States of America, sxg104920@utdallas.edu

1 - Wheat Auction with Spot Market Competing
Ruoran Chen, Department of Industrial Engineering, Tsinghua
University, 519A, Shunde Building, Tsinghua, Beijing, China,
crr11@mails.tsinghua.edu.cn, Simin Huang

Chinese governments frequently hold auctions to sell their wheat reservation
inventories. In those auctions, wheat of unknown quality is auctioned off to
bidders who have private valuations on the wheat. Meanwhile, auction sellers
compete with spot wheat market, and spot wheat has better quality which is
accessible to all. We use auction theory to analyze the interaction between wheat
auction and spot trading. We find this interaction leads to low allocation efficiency.

**2 - Re-incentivizing Discovery: Mechanisms for Partial-Progress
Sharing in Research**
Siddhartha Banerjee, Postdoc, Stanford University, 475 Via Ortega,
Stanford, Ca, 94305, United States of America, sidb@stanford.edu,
Ashish Goel, Anilesh Krishnaswamy

Partial-progress sharing (PPS) – where a researcher shares information
immediately on making a breakthrough - is essential for an efficient research
ecosystem. However there is evidence that existing rewards in research discourage
PPS. We study the problem of incentivizing information-sharing in research under
a stylized model. Under very general conditions, we give conditions to ensure PPS
is incentive-compatible for all agents, and suggest mechanisms for real-world
settings.

3 - On Virtually Efficient and Optimal Mechanisms in Procurement
Shivam Gupta, UT Dallas, 800 W Campbell Rd, Richardson,
United States of America, sxg104920@utdallas.edu,
Milind Dawande, Ganesh Janakiraman, Wei Chen

In multi-unit procurement under single-dimensional private information, we show
the following: (1) A virtually-efficient mechanism is optimal iff the production
costs of the suppliers are linear in their private types. (2) A virtual" VCG
mechanism is optimal if the revenue function of the buyer is linear in the total
amount procured, the production costs of the suppliers are linear both in their
quantity and types, and the feasibility constraints governing allocations define a
polymatroid.

■ WB72

Parc- Stockton

Data Analytics for Healthcare Applications

Sponsor: Data Mining
Sponsored Session

Chair: Talayeh Razzaghi, Postdoctoral Research Fellow,
School of Computing, Clemson University, Clemson, SC, 29634,
United States of America, trazzag@clemson.edu

**1 - Applied Partial Least Square Correlation Analysis to Brain Activity
Pattern Identification**
Yilling He, University of Central Florida, he.yiling2046@gmail.com

Previous studies have demonstrated that sleep deprivation will change human
brain activity pattern during certain tasks. Sleep deprivation may impact the
activity pattern in various ways during different tasks. By applying the partial least
square correlation analysis, we will combine behavior data and fMRI data of
subjects with regular restfullness and sleep deprivation, in order to identify the
differences of brain activity pattern between these two groups of subjects.

2 - Causal Interaction of Neural Networks in Sleep-deprived Brain
Muyuan Li, Ph.D Candidate, GRA, University of Central Florida,
University of Central Florida, P.O. Box 1, Orlando, FL, 32816,
United States of America, muyuanli2009@gmail.com

Sleep deprivation is common in modern work environment due to increasing
social and occupational demand. While its impact on performance impairment is
well studied, the patterns of neural connectivity still largely remain unknown. The
objective of this study is using granger causality analysis to reveal the inference
interactions in sleep-deprived brain networks.

3 - Are Emergency Departments Becoming the New Outpatient Units?
Sara Nourazari, PhD Candidate, Northeastern University, 360
Huntington Ave, Boston, MA, 02115, United States of America,
s.nourazari@neu.edu, James Benneyan, Rifat Sipahi, Daniel Hoch

Delayed care access in outpatient settings may result not only in poor health
outcomes and patient satisfaction but also contribute to non-urgent emergency
department visits. This work investigates correlations between poor access to
several neuro-specialties and the relative risk of scheduled or intended
appointments balking or reneging into ED visits.

**4 - Adaptive Borderline Cluster Based Oversampling Method to
Balance Imbalanced Datasets**
Iman Nekooeimehr, Presenter, University of South Florida, 14304
Wedgewood court Apt201, Tampa, Fl, 33613, United States of
America, nekooeimehr@mail.usf.edu, Susana Lai-Yuen

In reality, many of the datasets are imbalanced which means different classes have
different number of observations. This makes the classifiers fail to classify the
minority classes correctly. We have proposed an adaptive borderline cluster based
oversampling method which synthetically generates new minority instances to
balance the dataset.

■ WB73

Parc- Mission I

Multilevel Optimization Problems in Energy II

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Sauleh Siddiqui, Johns Hopkins University, Baltimore, MD,
United States of America, United States of America

1 - The Influence of the Panama Canal on Global Gas Trade
Seksun Moryade, smoryade@umd.edu, Steven A. Gabriel

The Panama Canal expansion will provide the route with shorter distances,
reducing the voyage by 7,000 nautical miles to Japan from the Gulf of Mexico.
Applying the World Gas Model from the University of Maryland, this paper
investigates the potential effects of varying Panama Canal tolls on the LNG markets
via six scenarios of possible Panama Canal tariffs. Results are compared and
examined with the focus on prices, LNG flows, and supply displacement.

**2 - Two-Level, Mixed-Integer Programming Models for
Energy Conservation Measures**
Bill Champion, Director of Asset Management Consulting/Quality
Assurance Manager of EMG, Cockeysville, MD,
United States of America, bchampion@emgcorp.com,
Steven A. Gabriel

Energy Conservation Measure selection is made difficult given real-world
constraints, limited resources to implement savings retrofits, various suppliers in
the market and project financing alternatives. The most common method of
implementation planning is suboptimal. This presentation demonstrates how two-
level mixed integer programming is used to optimize the selection of energy
conservation measures.

**3 - Joint Participation in Electric Power and Gas Markets:
A MPEC Approach**
Pablo Duenas, PhD, Comillas Pontifical University, Calle Alberto
Aguilera 23, Madrid, Spain, pablo.duenas@iit.upcomillas.es,
Sonja Wogrin

Climate change, renewable integration and abundant unconventional gas
resources have boosted the utilization of gas for electricity generation. Generation
companies with gas-fired power plants submit their hourly offers to organized
electricity markets and make use of gas system infrastructure by nominating their
planned utilized capacity on a daily basis. A MPEC problem has been developed to
considering the temporal mismatch effects. Results are compared with the single
level model.

**4 - Joint Operational Model for Smartgrid with Community Microgrids
under Carbon Emissions Control**
Felipe Feijoo, University of South Florida, 4202 E. Fowler Ave,
ENB118, Tampa, United States of America,
felipefeijoo@mail.usf.edu, Tapas Das

This research presents a model for obtaining optimal operational strategies for
microgrids subject to optimal dispatch of electricity by the smartgrid via a bi-level
mixed integer programming model. A designed experiment using the results from
the bi-level model and a Pareto analysis are used to provide policy design
guidelines for microgrids.

■ WB74

Parc- Mission II

Robust and Stochastic Modeling in Power System Operations and Planning

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Antonio J. Conejo, Professor, The Ohio State University, 286 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, conejonavarro.1@osu.edu

Co-Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, sioshansi.1@osu.edu

1 - Robust Optimization of the Self-scheduling and Market Involvement for an Electricity Producer

Ricardo Lima, Laboratorio Nacional de Energia e Geologia, Estrada do Paco do Lumiar, 22, Lisboa, 1649-038, Portugal, ricardo.lima@lneg.pt, Augusto Novais, Antonio J. Conejo

This presentation addresses the optimization of the self-scheduling, forward contracting, and pool involvement of an electricity producer operating a system that combines thermal, hydro and wind sources, and uses a two stage adaptive robust optimization approach. The wind power production and the electricity pool prices are considered to be uncertain. The solution algorithms, computational performance, scheduling results, and the impact of risk management in the results are discussed.

2 - Robust Transmission Expansion Planning

Carlos Ruiz, Universidad Carlos III de Madrid, Avda. de la Universidad, 30, Leganes, 28911, Spain, caruizm@est-econ.uc3m.es, Antonio J. Conejo

We address the problem of transmission expansion planning in an electric energy system with different sources of uncertainty. An adaptive robust optimization model, formulated as a mixed-integer three-level problem, is used to derive the investment decisions that minimize the system's costs by anticipating the worst case realization of the uncertainty. The model is efficiently solved by using a cutting plane algorithm. A realistic case study is used to illustrate the proposed technique.

3 - Toward Fully Renewable Electric Energy Systems

Ruth Dominguez, Universidad de Castilla - La Mancha, Avenida Carlos III s/n, Toledo, Spain, Ruth.Dominguez@uclm.es, Antonio J. Conejo, Miguel Carrion

Global warming and fossil-fuel depletion motivate the increasing presence of renewable sources in power systems. We present an investment model that allows planning the transition from a thermal-dominated system to a renewable-dominated design. The objective is to minimize expected investment and operating costs. The model relies on stochastic programming and allows decisions in both generation and transmission facilities. This model has been tested on a real-world system.

4 - Integration of Plug-In Electric Vehicles in Fully-Renewable Power Systems

Miguel Carrion, Universidad de Castilla - La Mancha, Avenida Carlos III s/n, Toledo, Spain, Miguel.Carrion@uclm.es, Rafael Zarate-Mi-ano

During the last years, the usage of plug-in electric vehicles (PEVs) has been strongly promoted around the world. In this context, we analyze the impact of incorporating a large number of PEVs in a fully-renewable power system. The PEVs demand is modeled considering several charging profiles and different coordination schemes between the Independent System Operator and PEVs. The proposed model is tested in a case study based on the Iberian Peninsula Power System.

5 - Concepts and Practice using Stochastic Programs for Determining Reserve Requirements

Robert Entriken, Principal Technical Leader, EPRI, 3420 Hillview Avenue, Palo Alto, CA, 94304, United States of America, rentrike@epri.com, Russ Philbrick, Edward Lo, Larsen Plano, Aidan Tuohy, Garret LaBove, Eamonn Lannoye

We describe how to appropriately determine reserve reserve requirements. A model is designed to illuminate potential procurement issues for Load Following Up (LFU) reserve products, in both deterministic and stochastic problem formulations, and to show how to leverage modern power system optimization tools to automatically select resources that address deliverability issues in an economically efficient manner. Practical experience, gained from an operational model of the WECC, is also shared.

■ WB75

Parc- Mission III

Queuing Models

Contributed Session

Chair: Rowan Wang, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, wang1075@umn.edu

1 - Individual Performance Analysis of a Discrete-time Queue Fed by a Group of DAR(1) Traffic Sources

Daniel Miao, Associate Professor, National Taiwan University of Science and Technology, 43, Keelung Road, Sec. 4, Taipei, 106, Taiwan - ROC, miao@mail.ntust.edu.tw, Xenos Lin

We study how the individual performance measures seen by a constituent traffic source are affected by other interfering sources when they are superposed into a deterministic queue. With each source modeled by a DAR(1) process, the mean and variance of the individual waiting time are derived in closed form and a recursive structure in its higher moments is established. Numerical examples are given to demonstrate the crucial role played by the autocorrelation structure among these traffic sources.

2 - Service Systems with Appointment-Driven Arrivals, Non-Punctual Customers, and No-Shows

Rowan Wang, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, wang1075@umn.edu, Oualid Jouini, Saif Benjaafar

We consider service systems where a finite number of customers arrive over time. The arrival of customers is driven by appointments. However, customers are not necessarily punctual. Customers may also not show up altogether. Customers are not homogeneous in their punctuality, show-up probabilities, and time between previous and subsequent appointments. We develop an exact analytical approach to obtain various performance measures of interest.

3 - M/ G/ Infinity with Exponentially Distributed Setup Times

Babak Haji, University of Southern California, 2553 Dearborn dr, Los Angeles, CA, 90068, United States of America, bhaji@usc.edu, Sheldon Ross

We consider an M/G/infinity model with exponentially distributed setup times. Arrivals result in an idle server setting a setup. Upon completing a setup, a server begins serving a waiting customer. Upon completing a service, with probability p the server becomes eligible to serve a waiting customer. We show, in steady state, that the number of busy servers has a Poisson distribution and is independent of the number of servers in setup.

4 - Service Systems with Uncertain Quality and Anecdote Reasoning Customers

Hang Ren, University College London, Dept of Management Science & Innovation, Gower Street, London, WC1E 6BT, United Kingdom, hang.ren.13@ucl.ac.uk, Tingliang Huang

We study service systems with random service quality and boundedly rational customers who estimate their own valuation of service quality from word of mouth. We analyze customers' equilibrium joining behavior and the influence on the firm's profit. We find that the revenue-maximizing price is increasing in the customers' rationality level when the expected service quality is high enough, and the maximized revenue is unimodal in the customers' rationality level.

5 - Between Little's Formula and Bullwhip Effect

Xiaoyue Jiang, Tulane University, Department of Computer Science, Baton Rouge, United States of America, xjiang@tulane.edu

Effort is made to bring a deterministic queuing method, Network Calculus (NetCal), back to convex analysis framework. By further interpreting the fundamental results via the notion of variability, the Bullwhip Effect (BWE) in the supply-chain field arises naturally, so does a NetCal counterpart of the Little's formula in queuing. The former reveals an additivity structure between variabilities of supply and demand, and the latter connects the worst case scenarios of two QoS metrics.

■ WB76

Parc- Embarcadero

Analytics in Bioinformatics and Healthcare

Sponsor: The Practice Track
Sponsored Session

Chair: Young Woong Park, Northwestern University,
2145 Sheridan Rd, Evanston, IL, 60208, United States of America,
ywpark@u.northwestern.edu

1 - Septic Shock Prediction for Patients with Missing Data
Joyce C. Ho, The University of Texas at Austin, 1 University Station,
C0803, Austin, TX, 78701, United States of America,
joyceho@utexas.edu, Cheng Lee, Joydeep Ghosh

Septic shock is a common and fatal condition. However, early prediction of patients
at risk for septic shock is difficult due to the wide range of potential indicators,
where missing data is a known issue. We investigate how different imputation
selection criteria and methods can overcome the missing data problem. Our
models, which use imputation methods in conjunction with predictive model,
provide a generalized approach for predicting septic shock.

2 - Algorithm for Regression Subset Selection on a Network
Diego Klabjan, Professor of Industrial Engineering and Management
Sciences Director of Master of Science in Analytics Program,
Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208,
United States of America, d-klabjan@northwestern.edu,
Sung Won Han, Judy Hua Zhong, Young Woong Park

We study a regression subset selection problem on a network, motivated from gene
network inference. The problem is to build a regression model for each attribute by
treating it as the response variable and the remaining attributes as explanatory
variables, while preserving the acyclic structure of the selected variables. We solve
the problem based on Lagrangian relaxation containing LASSO and maximum
acyclic subgraph as sub-problems. A computational study is provided.

3 - The Role of the Microbiome in Women's Health
Paul Brooks, VCU, PO Box 843083, Richmond,
United States of America, jpbrooks@vcu.edu, Greg Buck VMC

Next-generation sequencing technology facilitates conducting a DNA census of the
microbiome, including the bacteria that reside in different body habitats. In this
talk, we discuss the analysis of 16S metagenomic data generated from over 4,000
samples from female subjects. We observe differences in microbiome profiles based
on diagnosis and demographic variables.

**4 - Models for Predicting Objective Function Weights in
Prostate Cancer IMRT**
Justin J. Boutilier, University of Toronto, 5 King's College Road,
Toronto, On, M5S 3G8, Canada, j.boutilier@mail.utoronto.ca,
Timothy C. Y. Chan, Taewoo Lee, Tim Craig, Michael B. Sharpe

We demonstrate the clinical applicability of three machine learning models that
predict optimization objective function weights from patient geometry for
intensity-modulated radiation therapy of prostate cancer. Our weight prediction
methodologies can produce clinical quality treatment plans by simultaneously
predicting multiple weights and capturing trade-offs associated with sparing
multiple OARs near a prostate tumor.

■ WB77

Parc- Market Street

Joint Session Analytics/SpORts: Baseball Analytics

Sponsor: Analytics & SpORts
Sponsored Session

Chair: Sean Barnes, Assistant Professor, University of Maryland, 4352
Van Munching Hall, University of Maryland, College Park, MD,
20742, United States of America, sbarnes@rhsmith.umd.edu

1 - Minor League Scout Scheduling
Oguzhan Ozlu, Georgia Institute of Technology, School of Ind & Sys
Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30318,
United States of America, a.o.ozlu@gmail.com, Joel Sokol

An MLB team needs to schedule which scouts should see each of thousands of
minor league games over six months, subject to business constraints on travel,
baseball-related needs, time off, etc., while minimizing the overall transportation
and lodging costs. We will describe different layers of the problem and present
exact integer optimization and heuristic approaches to obtain 'good' schedules. We
will also outline the strategies for schedule recovery and handling uncertainties.

2 - Armchair Baseball Manager: Exploring Baseball Strategies
Marina Polyashuk, Associate Professor of Mathematics,
Northeastern Illinois University, 5500 N. St. Louis Ave., Chicago, IL,
60625, United States of America, m-polyashuk@neiu.edu

This presentation is focused on solving the problem of devising an optimal lineup
for a given baseball game. The problem is decomposed into two parts: one,
selecting a starting assignment of position players and two, choosing a batting
order for a given set of starters. Proposed solutions are based on multiple criteria
methods, graph theory, and statistical analyses.

**3 - The Connection between Flexible Production Networks and
Baseball Roster Construction**
Douglas Fearing, The University of Texas at Austin,
2110 Speedway, Stop B6500, Austin, TX, United States of America,
doug.fearing@mccombs.utexas.edu, Timothy C. Y. Chan

Drawing from the theory of production flexibility in manufacturing networks, we
provide the first optimization-based analysis of the value of positional flexibility
(the ability of a player to play multiple positions) for a major league baseball team
in the presence of injury risk. Using publicly available data on baseball player
performance, we derive novel baseball-related insights that can be generalized to
the manufacturing context.

**4 - Great Expectations: An Analysis of Major League Baseball Free
Agent Performance**
Sean Barnes, Assistant Professor, University of Maryland, 4352 Van
Munching Hall, University of Maryland, College Park, MD, 20742,
United States of America, sbarnes@rhsmith.umd.edu,
Margrét Bjarnadóttir

We analyze MLB player data to characterize whether players meet the expectations
set by free agent contracts. We develop two models using machine learning
techniques: one based on market valuation and one based on future performance.
We show that our second model more consistently matches previous performance
with future value.

■ WB78

Parc- Mason

Analytic Hierachy Process

Contributed Session

Chair: Orrin Cooper, University of Memphis, 332 Fogelman,
Memphis, United States of America, olcooper@memphis.edu

1 - Sensitivity Analysis for Analytic Network Models
Magda Gabriela Sava, PhD Student, Joseph M. Katz Graduate
School of Business, University of Pittsburgh, 241 Mervis Hall,
Pittsburgh, PA, 15260, United States of America,
mgsava@katz.pitt.edu, Luis Vargas, Jerrold May

We propose an extension of the sensitivity and stability analysis for analytic
network models previously developed. We study simple ANP models to understand
how preference regions are created, and characterize their boundaries as the
complexity of the network increases. We use optimization methods to find the
most suitable boundaries between the preference regions and define the
appropriate stability regions.

2 - Using Linking Pin Comparisons as Cluster Comparison Pivots
Orrin Cooper, University of Memphis, 332 Fogelman, Memphis,
United States of America, olcooper@memphis.edu

The AHP pairwise comparison process is an innovative method that relies on our
innate ability to make relative comparisons between objects. In practice, the
differences between objects being compared should not normally exceed Saaty's
1-9 scale. Herein Linking Pin comparisons are used to make the comparisons to
obtain the criteria cluster weights. This approach allows cluster weightings to
exceed the 1-9 scale without using a new scale and to reduce the cognitive burden
on the decision maker.

**3 - Determining Customers' Selection Criteria: Comparison of Turkish
Airline Companies**
Ozay Ozaydin, Assistant Professor, Dogus University, Zeamet S.
No:21 Acibadem, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr,
Mine Isik, Emel Aktas

Airlines must dynamically adapt a number of competitive strategies in order to
survive in the market and also expand their share. Criteria that customers use for
selecting an airline are investigated, and a brief comparison of the local airlines'
performances. AHP is used as a decision support system framework, combining
numerical data such as fleet size, accident history, on-time performance with
personal perception of decision makers to include all possible aspects of an airline
success.

4 - Work Load Analysis by AHP

Baris Carikci, TUBITAK, Upriselite Sitesi A1 Blok No:67 Kartal /, Kartal / Istanbul, 34403, Turkey, baris.carikci@tubitak.gov.tr

Work Load Analysis is a tool to evaluate the necessary work force for the organization. Especially it is a must after the organizational restructuring and process oriented improvements. Without such an application, the organizations might be running with adequate or inadequate work force, which eventually leads the inefficiency and unmotivated labor force. In our case, we used AHP, which focuses on the business processes, to evaluate the work force needs.

■ WB79

Parc- Powell I

Joint Session DAS/MAS: Game Theory, Decision Analysis, and Homeland Security, Part II

Sponsor: Decision Analysis & Military Applications Society

Sponsored Session

Chair: Jun Zhuang, University at Buffalo, 317 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Modeling Insurer-homeowner Interactions in Managing Natural Disaster Risk

Xiaojun Shan, Postdoctoral Research Associate, CEEEP at Rutgers University, 33 Livingston Ave, New Brunswick, NJ, 08901, United States of America, xiaojun.shan@ejb.rutgers.edu, Jamie Kruse, Yohannes Kesete, Yang Gao, Rachel Davidson, Jiazhen Peng, Linda Nozick

The system for managing natural disaster risk is problematic. Homeowners are often uninsured or underinsured while insurers often do not want to insure against these losses, which can cause an high chance of insolvency. To design an improved system for the different perspectives of the stakeholders, we develop a novel modeling framework integrating state-of-the-art hurricane loss and stochastic optimization models for decision supports to both the homeowners and insurer with governance.

2 - A Game-theoretic Model for Risk Sharing between Public and Private Sectors against Extreme Risks

Yang Zhang, Assistant Professor, Tsinghua University, Dept. of Industrial Engineering, Beijing, China, yangzhanguser@mail.tsinghua.edu.cn, Chen Wang

Public-private insurance programs can provide financial protection against catastrophic risks. We propose a sequential game with three parties, the government, an insurer, and potential policy holders, to investigate how the government can involve insurers to provide the service, while limiting their profits to avoid compromising the social welfare. We consider both natural and terrorism threats, assuming natural hazards to have considerably less ambiguity than terrorism risks.

3 - Public-private Partnerships in Disaster Management: Engaging with Multiple Private Sectors

Peiqiu Guan, Ph.D. Candidate, University at Buffalo, SUNY, 338 Bell Hall,, Department of ISE, Buffalo, NY, 14226, United States of America, peiqiugu@buffalo.edu, Jun Zhuang

Public sector would partner with multiple private sectors in different stages of disaster management to meet various needs. This research uses game-theoretical modeling, Monte Carlo Analytical Hierarchy Process, and expert opinions to study how to form optimal partnerships between the public section and multiple private sectors.

4 - Asymmetrically Prescriptive/Descriptive Game Theory with EU and PT Decision Makers

Philip Leclerc, Doctoral Student, Virginia Commonwealth University, 1501 Abelway Drive, Midlothian, VA, 23114, United States of America, philip.leclerc@gmail.com, Jason Merrick

Game theory assumes Expected Utility Theory preferences, but Prospect theory (PT) is presently the leading descriptive theory of choice under uncertainty. We study equilibria involving the full PT model for risk, and examine the impact of PT preferences on, e.g., existence and computational complexity. We develop examples illustrating that 1) each PT equilibrium may differ from the others and from NE, 2) PT equilibria may fail to exist, and 3) PT preferences can improve player welfare.

5 - Interdependent Network Performance Measures and Characteristics

Allison Reilly, Post-doctoral Researcher, Johns Hopkins University, 3400 N Charles Street, 303 Ames Hall, Baltimore, MD, 21210, United States of America, acr@jhu.edu, Andrew Samuel, Seth Guikema

Regulators are particularly concerned with predicting interdependent infrastructure system performance after a hazardous event given the threat of systemic disruption. In this work, we broaden the understanding by examining how competing network objectives impact investments and performance. We expand upon game-theoretic models of interdependent networks to ultimately aid decision-makers in setting effective regulatory strategies for encouraging efficient investments and improved performance.

■ WB80

Parc- Powell II

Infrastructure Modeling for Improved Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: Kash Barker, Assistant Professor, University of Oklahoma, 202 W Boyd St, Rm. 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Infrastructure Risk Management: Prediction and Decision-Making

Seth Guikema, Assistant Professor, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu

Infrastructure in the US is aging, suffers from a lack of funding, and is subject to a number of significant natural hazards. At the same time, it is critical for societal functioning and security. Risk-based management of infrastructure is critical. This talk presents predictive risk models for infrastructure and shows how they can be used to support infrastructure management decision-making and investment. Examples from the electric power and potable water sectors are used.

2 - Improving the Computational Efficiency of the Interdependent Network Design Problem MIP Model

Andres Gonzalez, Rice University, 6100 Main St., MS-318, Houston, TX, 77005, United States of America, andres.gonzalez@rice.edu, Leonardo Duenas-Osorio, Andrés L. Medaglia, Mauricio Sanchez-Silva

The Interdependent Network Design Problem (INDP) focuses on finding optimal recovery strategies for a set of damaged interdependent infrastructure systems. In this work, we present an application of a Benders/Danzig-Wolfe decomposition hybrid algorithm to enhance the computational efficiency of the INDP MIP model. Hence, the presented hybrid algorithm enables the INDP model to study large and realistic infrastructure networks, thus contributing to resilience quantification.

3 - Resilience-Based Decision Making for Infrastructure Networks

Kash Barker, Assistant Professor, University of Oklahoma, 202 W Boyd St, Rm. 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu, Charles Nicholson

We model network resilience as a function of vulnerability, the extent of impact after a disruption, and recoverability, the length of time required for restoration. We offer an optimization formulation to allocate resources to these two aspects of resilience, and test several heuristics for reducing the size of the network to reduce computational requirements.

4 - Resilience-Based Freight Transportation Infrastructure Network Design

Mohamad Darayi, PhD. Student, University of Oklahoma, 202 W Boyd St, Rm. 124, Norman, OK, 73019, United States of America, mdarayi@ou.edu, Kash Barker

Improving freight transportation infrastructure network design (i) by the addition of capacitated links/nodes or (ii) by increasing the capacity of current network components are explored as options to strengthen the functionality of the network and its effect on the multiple industries relying upon it. Considering different disruption scenarios, this research addresses a network completion decision making problem with respect to the network resilience, as well as multi-industry impacts.

■ WB81

Parc- Divisadero

Analytics and Energy

Sponsor: Data Mining

Sponsored Session

Chair: Theodore Trafalis, Professor, School of Industrial and Systems Engineering, University of Oklahoma, 202 W. Boyd St., Room 124, Norman, OK, 73019, United States of America, ttrafalis@ou.edu

1 - A Heuristic Algorithm to Solve the Single-facility LRP on RMS with Energy System Applications

Emre Tokgoz, Quinnipiac University, 275 Mount Carmel Ave., Hamden, CT, 06518, United States of America, emre.tokgoz-1@ou.edu, Samir Alwazzi, Theodore Trafalis

Solving LRP on Riemannian Manifold Surface (RMS) is a more realistic approach than using Euclidean surfaces because of the curved structure of the pathways on Earth with changing local RMS curvatures. In this work, we introduce a new LRP to be solved on RMS and find a heuristic algorithmic solution to this LRP. In particular, we formulate the LRP for a single facility on RMS. Applications in energy systems will be discussed in this talk.

2 - Kernel-based Regression in Natural Gas Storage Valuation

Alexander Malyscheff, malyscheff@gmail.com, Theodore Trafalis

The valuation of natural gas storage contracts has recently received significant attention in the energy management community. Least-Squares Monte Carlo (LSMC) represents one approach to value such contracts. We apply kernel-based machine learning techniques to derive the regression function required in the LSMC method.

3 - Securities Analysis of Selected Energy Companies Based on Data Mining and Machine Learning Approach

Zhen Zhang, Reserach Assistant, SCIPP, Norman, OK, United States of America, zhenzhang0217@gmail.com, Theodore Trafalis

Authors of this paper evaluate successful/failed energy moguls and aspiring new energy companies through quantitative and qualitative analysis facilitated by data mining and machine learning techniques. Quantitatively, it displays statistical superiority/inferiority based on a company's capitalization, earnings, dividends, assets, liabilities and operational data; Qualitatively, we focus on the industry, the general market, the role, the management, the prospect and the competitive advantage.

■ WB82

Parc- Haight

Multicriteria Decision Making 2

Contributed Session

Chair: Roman Slowinski, Professor, Poznan University of Technology, Pl. Marii Sklodowskiej-Curie 5, Poznan, 60-965, Poland, roman.slowinski@cs.put.poznan.pl

1 - Preference-driven Cone Contraction for Multiobjective Optimization

Roman Slowinski, Professor, Poznan University of Technology, Pl. Marii Sklodowskiej-Curie 5, Poznan, 60-965, Poland, roman.slowinski@cs.put.poznan.pl, Milosz Kadzinski

We present an interactive procedure for multiobjective optimization which involves robust ordinal regression in contraction of the preference cone in the objective space. The decision maker (DM) specifies pairwise comparisons of some non-dominated solutions from a current sample. The cone originating in a reference point is formed by all directions of isoquants of the achievement scalarizing functions compatible with the pairwise comparisons of solutions provided by the DM.

2 - MCDM and PROMETHEE Preference Functions for Crop Variety Selection

Jay Parsons, Optimal Ag Consulting, Inc., 3226 Ledgestone Ct., Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com

Wheat varieties are typically evaluated for eleven different traits in addition yield data from test plots. The PROMETHEE methodology of multi-criteria decision making is a nice fit for this type of decision problem. In this paper presentation, I propose preference functions for the twelve criteria to be evaluated when selecting a wheat variety. Furthermore, I propose a software tool for integrating this information into a multi-criteria decision support system.

3 - The Robustness Space Pareto Set Reduction Problem

Daniel Jornada, Research Engineer Associate, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, djornada@tamu.edu, V. Jorge Leon

We present a mathematical programming framework for identifying a subset of robust solutions from a given Pareto set arising from a multi-objective problem. The efficient set is mapped onto a 2-dimensional space, termed robustness space, representing model and solutions robustness with respect to uncertainties in prescribed solution values. We present theoretical properties, examples contrasting with existing Pareto set reduction approaches, and an approach for multi-objective linear programs.

4 - Bi-Objective Tabu Search for The Fleet Size and Mix Onshore Workover Rigs Scheduling Problem

Werner Soares, UFRN, UFRN - Centro de Tecnologia, Av. Sen. Salgado Filho s/n, Natal, Brazil, werner_soares@hotmail.com, Dario Aloise, Ana Paula Costa

Services on oil wells in onshore fields are performed by expensive workover rigs. A good choice of fleet size and mix and scheduling of such equipment is necessary. However, in literature, the quantities are considered fixed, a priori, and the rigs considered homogeneous. In this work, a Tabu Search heuristics is developed for obtaining a Pareto set of bi-objective solutions for a more robust version of this problem.

■ WB83

Parc- Sutro

Data Mining 2

Contributed Session

Chair: Chaojiang Wu, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, Pe, 19104, United States of America, cw578@drexel.edu

1 - Tree Based Ensemble Methods in Travel Time Prediction

Yanru Zhang, University of Maryland, University of Maryland, Dept. of Civil & Environmental Eng., college park, MD, 20740, United States of America, yrzhang@umd.edu, Ali Haghani

Ensemble based algorithms have reached a celebrity status in solving prediction problems in recent years. Within them, tree based ensemble methods are successful ones that providing interpretable results, that are able to handle different types of predictor variables, and can fit complex nonlinear relationship. In this paper, we applied a gradient boosting regression tree method to analyze and model freeway travel time to improve the prediction accuracy and model interpretability.

2 - Using Global and Local Patterns for Improving Vehicle Trajectory Prediction

William Groves, University of Minnesota, 200 Union St SE Ste 4-192, Minneapolis, Mi, 55455, United States of America, groves@cs.umn.edu, Ernesto Nunes, Maria Gini

Location data collected from taxis contains a wealth of information about daily patterns of road use. We propose a framework for prediction of in-progress vehicle trajectories using eigen-based and Markov-based methods to leverage both general and highly localized patterns. We learn the road network and travel patterns directly from a large corpus of data (10,000 taxis observed for one week in a major city) to generate short-term predictions that correspond directly to the real-world situation.

3 - Evaluation of Airlines' Web Site Via Text Mining

Feyza Gürbüz, Erciyes ‹niversites, Erciyes Universitesi Müh. Fak. Endüstri, Kayseri, 38039, Turkey, feyza@erciyes.edu.tr, Esra Kahya-Ozyirmidokuz

The websites of airlines has a critical effect on customers. These websites use a lot of data which are unstructured. In this study the web text mining (TM) approach is performed on international airlines' web site data to extract knowledge from them. TM is used to extract the keywords based on the weight calculation of Term-Frequency Inverse-Document-Frequency and uses similarity analysis and support vector machine algorithms to cluster the airline websites.

4 - Dimension Reduction in Quantile Regression

Chaojiang Wu, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, Pe, 19104, United States of America, cw578@drexel.edu, Yan Yu

To overcome the curse of dimensionality yet retain model flexibility, we propose two dimension reduction methods for modeling conditional quantiles: partially linear single-index models and partially linear additive models. The unknown univariate functions are estimated by penalized splines. Both simulations and real applications show encouraging results of the proposed estimators.

5 - Reacting in Real-time to New Malware Infections Committing Online Advertising Fraud
 Jason Shaw, Senior Data Scientist, Integral Ad Science, 37 E 18th St, Fl 7, New York, NY, 10035, United States of America, jshaw@integralads.com, Kiril Tsemekhman

Most online advertising fraud is carried out by botnets built through malware. Immediate detection of newly infected machines is critical to fully protecting advertisers, but many techniques depend on algorithms which do not allow online classification of users as clean or infected. Using locality-sensitive hashing as the basis of a recommender system, we continuously incorporate a stream of tens of thousands of ads per second. With up-to-date data, new infections can be identified in minutes.

Wednesday, 12:45pm - 2:15pm

■ WC02

Hilton- Golden Gate 7

Risk, Incentives and Cooperation in Technology Management

Sponsor: Technology, Innovation Management and Entrepreneurship
Sponsored Session

Chair: Niyazi Taneri, SUTD, 20 Dover Drive, Singapore, Singapore, niyazitaneri@sutd.edu.sg

1 - Cost-reducing Innovation and the Role of Patent Intermediaries
 Shantanu Bhattacharya, Visiting Associate Professor of Operations Management, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, Shantanu.bhattacharya@insead.edu, Sameer Hasija, Anupam Agrawal

Patent intermediaries are non-practicing entities in the innovation domain. We analyze the competition between two identical incumbents and a PI for external cost-reducing innovations. We show PIs always win IP rights for incremental innovations, and for radical innovations with significant efficiency advantages and low uncertainty about the degree of innovation.

2 - How (and When) to Encourage Cooperation in Project Portfolios
 Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, fsting@rsm.nl, Yaozhong Wu, Pascale Crama

Inspired by an innovative real-life practice, we model a project portfolio system that shapes cooperative behavior. Help is at the core of this system in which employees may mutually ask for help, while management facilitates the exchange of help. We find that the company should take a nuanced approach to help. It is striking that asymmetric resource engagement emerges as an optimal approach: cooperative behavior may lead the company to induce different efforts even for symmetrical projects.

3 - Supplier Involvement in Component Development: Commitment versus Flexibility
 Timofey Shalpegin, HEC Paris, 1 Rue de la Libération, Jouy en Josas, France, timofey.shalpegin@hec.edu, Zhixi Wan, Svenja Sommer

Manufacturers involve suppliers to develop prototypes of innovative component designs. A common practice is to set a target cost for each component design. Manufacturer can commit to a set of pre-determined cost targets or flexibly change the cost target of a design. We show that the flexible target cost scheme create benefits at the cost of provoking the supplier's strategic behavior. We examine the manufacturer's preference between the two types of target cost schemes.

■ WC04

Hilton- Continental 1

Service Operations Design and Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Sameer Hasija, Assistant Professor of Technology and Operations Management, INSEAD, 1 Ayer Rajah Avenue, Singapore, Si, 138676, Singapore, Sameer.Hasija@insead.edu

1 - Avoiding Expiration of Medical Inventory for Emergency Response
 Quan Zhou, University of Auckland, Room 6121, OGGB, 12 Grafton Road, Auckland City, Auckland, 1010, New Zealand, q.zhou@auckland.ac.nz, Tava Olsen

Even with a long shelf life, medical supplies in the national reserve for large-scale emergencies are at risk of expiration. We consider the perishability of long-life

reserve supplies, and propose to rotate them to hospitals' operational use. We derive the optimal policies for the rotation decision in combination with the hospital's ordering decision. We obtain intuitively appealing results with some surprising properties, which could provide implications for rotation operations.

2 - Contracting in Medical Equipment Maintenance Services: an Empirical Investigation
 Tian Chan, PhD, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, TianHeong.CHAN@insead.edu, Francis de Vericourt, Omar Besbes

Fixed-fee and pay-per-service contracts are two forms of maintenance service plans that structure payment between operators and service providers. Using data from 712 medical scanners, we empirically compare their effects on service outcomes. We exploit a warranty period to isolate incentive effects from adverse selection, finding (1) a pay-per-service contract leads to relatively higher reliability and lower costs, and (2) the effects are driven by both operator and service provider.

3 - Optimal Design of Co-Productive Services: Interaction and Work Allocation
 Guillaume Roels, UCLA, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu

In this paper, we develop an analytical model of joint production between a service provider and a customer and characterize how a service firm should design its co-productive system. Our analysis gives rise to a service-process framework with three archetypes of co-productive services: collaborative services, service factories, and self-services. We discuss the implications of our results for service process reengineering.

■ WC05

Hilton- Continental 2

Collaboration and Information in Supply Chains

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Hyoduk Shin, University of California-San Diego, 9500 Gilman Drive, La Jolla, CA, United States of America, hshin@rady.ucsd.edu

1 - Retailer's Forecast Capability Information and Demand Forecast Sharing in Supply Chains
 Hyoduk Shin, University of California-San Diego, 9500 Gilman Drive, La Jolla, CA, United States of America, hshin@rady.ucsd.edu, Lakshmi Nittala

Does it help to know how good the retailer is at forecasting for sharing retailer's demand forecast information with the manufacturer? We demonstrate that it can actually hurt the forecast sharing between the retailer and the manufacturer.

2 - Online Retailer Competition with a Referral Service
 Kihoon Kim, Korea University Business School, Anam-Dong, Seongbuk-Gu, Seoul, Korea, Republic of, kihoonk@gmail.com

We investigate whether two competing online retailers can be better off by adopting a referral service. When they adopt the referral service, a referral-offering online retailer faces a trade-off between generating additional revenues from referral fees and the risk of exposing its loyal consumers to the price of its referred online retailer. Our main result is that when the market shares of both retailers do not differ significantly, the referral service is likely to be adopted.

3 - Engage the Wisdom of Crowds: Structural Analysis of Dynamic User Contributions in Online Innovation
 Wei Chen, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, Wei.Chen@rady.ucsd.edu, Xiahua (Anny) Wei, Kevin Zhu

What engages users and keeps them active? This paper studies the dynamics of user contributions in an innovation community where contributions are analogous to public goods. We use a hidden Markov model to characterize the fluctuation of user contributions with two latent motivation states (active vs. inactive) and their effects on the level of participation. We find that reputational motivations and reciprocity are effective in turning inactive users into active users, and keeping them engaged.

■ WC06

Hilton- Continental 3

Service Business Models

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Jose Guajardo, University of California Berkeley, 545 Student Services Bldg #1900, Berkeley, CA, United States of America, jguajardo@haas.berkeley.edu

Co-Chair: Pnina Feldman, UC Berkeley, Haas School of Business, 2220 Piedmont Ave, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu

1 - Patient Portals in Primary Care: Impacts on Patient Health and Physician Productivity

Hessam Bavafa, Assissant Professor, Wisconsin School of Business, 975 University Ave, Madison, WI, 53706, United States of America, bavafa@wharton.upenn.edu, Christian Terwiesch, Lorin Hitt

Interest in innovative health care delivery models has increased due to measures such as the Affordable Care Act, which is designed to expand insurance coverage and contain health care costs. One innovation that has been forwarded as a low-cost alternative to office visits is e-visits," or secure messaging via patient portals. We evaluate the effect of e-visit adoption on patient health and physician productivity using a six-year panel dataset from a primary care provider in the United States.

2 - Pricing Reservations with Strategic Customers

Kate Ashley, UC Berkeley, Haas School of Business, 2220 Piedmont Ave, Berkeley, CA, 94720, United States of America, kate_ashley@haas.berkeley.edu, Pnina Feldman

Many firms offer reservations for future service, which exposes them to costly no-shows. At the time reservations are offered, customers do not know their exact valuations for service, and may vary in their probabilities of showing up. This paper analyzes three different reservation pricing schemes that address the no-show problem, characterizes optimal prices and revenues under each scheme, and discusses managerial implications.

3 - Tournaments for Service Delivery

Karan Girotra, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, karan.girotra@insead.edu, Konstantinos Stouras, Serguei Netessine

We consider contests in service delivery environments such as virtual call centers, i.e. call centers with an on-demand geographically dispersed workforce. We identify tournament design modes that trade-off tournament participation, quality of service and delivery costs.

■ WC07

Hilton- Continental 4

Supply Chain Management V

Contributed Session

Chair: Olov Isaksson, EPFL, Station 5, Lausanne, Switzerland, olov.isaksson@epfl.ch

1 - The Role of Supply Chain Complexity: An Investigation of the Thousands of Villages" Supply Network

Guanyi Lu, Assistant Professor, Oregon State University, 200 Bexell Hall, Corvallis, OR, 97331, United States of America, guanyi.lu@oregonstate.edu, Xitong Guo

Supply chain complexity has been conceptualized through the number of suppliers, the degree of differentiation among these suppliers, and the level of interrelationships among the suppliers. Our study of a large supply network suggests that two additional factors,interactions among buyers and presence of powerful third party, would also affect supply chain complexity and supply chain performance.

2 - Orders and Reciprocity in the Technology Supply Chain

Heejong Lim, PhD Student, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, limh@purdue.edu, Ananth Iyer

Motivated by the semiconductor and the LCD industry, we incorporate the reciprocal game in a dyadic (buyer-supplier) supply channel. In our model, the buyer's anticipated reciprocal behavior influences the seller's order so as to protect the seller during the oversupply period. We provide an analysis under different level of reciprocity following accepted economic models in order to explore the impact on order size and channel coordination. Insights from practice are then provided.

3 - Bullwhip Effect and Demand Uncertainty on Firms' Cost Behavior

Shilei Yang, Professor, Southwestern University of Finance and Economics, Guang Hua Chun #55, Chengdu, 610074, China, syang@swufe.edu.cn, Jing Zhu

The research is an interface study between cost accounting and supply chain management. Using the Compustat data, we find that firms with greater bullwhip effect tend to have a more flexible cost structure, but higher demand uncertainty is more likely associated with a rigid cost structure with an exception for firms in the retailing sector. In particular, firms with lower firm-level bullwhip ratio are usually more capable to withstand the stress on cost structure caused by demand uncertainty.

4 - Knowledge Spillovers in the Supply Chain: Evidence from the High Tech Sectors

Olov Isaksson, EPFL, Station 5, Lausanne, Switzerland, olov.isaksson@epfl.ch, Markus Simeth, Ralf W. Seifert

We explore knowledge spillovers in the supply chain and empirically show that buyer innovation has a strong positive impact on supplier innovation. We find that the duration of the buyer-supplier relationship positively moderates this effect, but that tie strength has a negative moderating role. The technological proximity of the two firms, however, is not found to have a significant effect on spillovers.

■ WC08

Hilton- Continental 5

Models of Human Dynamics in Social Data

Cluster: Social Media Analytics
Invited Session

Chair: Tauhid Zaman, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, MA, 02139, United States of America, zlisto@mit.edu

1 - A Billion Social Networks: What Each of Our Networks Says About Us

Lars Backstrom, Facebook, 750 N Shoreline Blvd #68, Mountain View, CA, 94043, United States of America, lars@fb.com

At Facebook, over a billion people engage with their friends each month. All this activity gives us a unique opportunity to understand real social networks. In microcosm, we can watch as new friendships turn into relationships, then engagements and finally marriages, observing effects on the rest of the network. Zooming out, we can observe the small world effect on a significant fraction of the whole world. Studying human relationships is now possible on a scale never previously imagined.

2 - The Structure and Evolution of Communities on Twitter

Gabor Szabo, Staff Data Scientist, Twitter, 1355 Market St, Suite 900, San Francisco, CA, 94103, United States of America, gabor@twitter.com, Satanjeev Banerjee

Social media services oftentimes facilitate the creation of connections among the users, based on shared interests or real-life relationships. As determined by their local network structure, most users are only linked to a very small fraction of the entire user base. In this paper we identify these dense subgraphs of the Twitter follower network as communities through a scalable algorithm, and describe their self-similar structure and temporal evolution.

3 - Tweet Time: Optimizing the Timing of Content in Twitter

Sina Modaresi, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, sim23@pitt.edu, Tauhid Zaman, Juan Pablo Vielma

In online social networks, such as Twitter, users generate content for which they wish to maximize engagement by other users. We show how one can select the time the content is posted in Twitter in order to maximize its engagement. We present a model of user behavior which combines temporal and network aspects of Twitter. Our model is fairly general and can extend to other social networks, but we focus on Twitter because the data is readily available.

4 - Twitter as a Sensor Network: Detecting Change-points in Social Signals

Arash Delijani, MIT, 404A Broadway, Cambridge, MA, 02139, United States of America, arashd@mit.edu, Tauhid Zaman

We study the problem of detecting trending events in Twitter. We model this as a change-point detection problem, and use the Cumulative Sum (CUSUM) algorithm, which is optimal for this task. We test different models of user behavior on a large amount of historical data, and use them along with CUSUM, to detect trending events and evaluate our performance on events with known starting times. We also provide theoretical bounds for the detection delay of CUSUM for various models of user behavior.

■ **WC09**

Hilton- Continental 6

E-Business/ Commerce 1

Contributed Session

Chair: ShiKui Wu, Assistant Professor, University of Windsor,
401 Sunset Ave., OB-413, Windsor, ON, N9B 3P4, Canada,
skwu@uwindsor.ca

1 - Modelling Pricing Strategies for Internet Domain Names
  Claudia Loebbecke, University of Cologne, Pohligstr. 1, Koeln,
  Germany, claudia.loebbecke@uni-koeln.de, Thies Lindenthal

Interested in buyers' and sellers' pricing strategies for Internet domain names, we
develop and empirically test a hedonic model for domain prices. We find
differences in the implicit prices for selected domain attributes across different
types of buyers, but no evidence of sellers being able to discriminate between the
different buyer types.

**2 - The Effect of Motivations on Mobile Coupon Sharing in
  Social Network Sites**
  Qing Tang, Huazhong University of Science & Technology, 1037
  Luoyu Road, Wuhan, China, tangqing0825@gmail.com, Shan Liu

This study aims to examine the possible influence of SNS users' intrinsic and
extrinsic motivations on m-coupon sharing and how users' coupon proneness
affects sharing intention. Considering the act of sharing m-coupon is special case of
viral marketing, we investigated four potential motivations: sense of self-worth and
socializing from intrinsic motivations, economic reward and reciprocity from
extrinsic motivations.

**3 - The Role of E-commerce in Cross-border Transportation:
  An Integrative View**
  ShiKui Wu, Assistant Professor, University of Windsor, 401 Sunset
  Ave., OB-413, Windsor, ON, N9B 3P4, Canada, skwu@uwindsor.ca

This study investigates the role of e-commerce in a cross-border context at two
levels: business-to-business and business-to-consumer. It examines the synergies
between offline and online channels in key business operations, and investigates
bidirectional and dynamic effects of e-commerce on transportation operations.
Using case studies and simulations this study provides insights and guidelines for e-
commerce practice in cross-border transportation.

4 - Goal-driven Analysis of Social Influencers
  Roman Vaculin, Research Staff Member, IBM Research, 1101
  Kitchawan Rd, Yorktown Heights, NY, 10598, United States of
  America, vaculin@us.ibm.com, Yosi Mass, Indrajit Bhattacharya,
  Jonathan Herzig

Definition and identification of social influencers largely depend on the purpose
and context in which influencers are used. Given different goals, such as
maximizing marketing campaign audience, maintaining brand awareness,
spreading a credible message, or maximizing speed of message spread, different
metrics achieve good results. In this work we present results of our experiments
and demonstrate effectiveness of various traditional influence metrics with respect
to given goals.

**5 - Joint Optimization of Order Sourcing Assignment and Parcel
  Delivery for Online Supermarket with a Multi-warehouse System**
  Xiangpei Hu, Dalian University of Technology, Linggong
  Road,Ganjinzi District, Dalian, China, drhxp@dlut.edu.cn, Minfang
  Huang, Yuankai Zhang

For online supermarket with multi-warehouse system and two-stage distribution
network, we develop a model for joint optimization of order sourcing assignment
and parcel delivery, which can be regarded as the solution of a special kind of
Location-Routing Problem. The model determines the assignment of order items to
each warehouse and optimal delivery schemes to customers.

■ **WC10**

Hilton- Continental 7

Supply Chain/Green I

Contributed Session

Chair: Vincent Slaugh, PhD Candidate, Carnegie Mellon University,
5000 Forbes Avenue, Pittsburgh, PA, 15213,
United States of America, vslaugh@cmu.edu

1 - Rental Inventory Management with Usage-Based Loss
  Vincent Slaugh, PhD Candidate, Carnegie Mellon University, 5000
  Forbes Avenue, Pittsburgh, PA, 15213, United States of America,
  vslaugh@cmu.edu, Bahar Biller, Sridhar Tayur

We study the operation of a discrete-time stochastic rental system over a single
selling season in which rental units may be purchased or damaged by customers.
We provide structural results related to the expected profit function and the
optimal policy for allocating rental units to meet customer demand. In an

industrial use case motivated by a high-fashion dress rental business, we show
significant value to accounting for inventory loss and using the optimal inventory
allocation policy.

2 - Product Remanufacturing in China's Projector Market
  Huanming Li, Mitsubishi Electric Air-Conditioning & Visual
  Informations Systems (Shanghai) Ltd, No.300 East Nanjing Road,
  Shanghai, Sh, 200001, China, huanming.li@mlc-cn.com, Yi Liao

The whole market size for projectors in exhibition has a dramatic rise in China?
However, one of the most important projector market's features is "declining
price". This case study addresses on how to implement collection and
remanufacturing of used products to improve environmental performance as well
as profits?

3 - Energy Efficiency Contracting in Supply Chains
  Ali Shantia, HEC Paris, 1, Rue de la liberation, Jouy-en-Josas,
  78350, France, ali.shantia@hec.edu, Sam Aflaki, Andrea Masini

Increasing energy efficiency (EE) diminishes production costs of upstream suppliers
while mitigating their environmental footprint. This study analyses the effects of
bargaining power of a downstream retailer and EE technology uncertainty on
adoption of energy efficiency technologies by a single manufacturer. Analyzing and
comparing multiple contracting arrangements currently practiced in the industry,
we study how energy service companies can affect supply chain coordination for
EE.

**4 - A Green Logistics Framework for Integrated Production-
  Distribution under Uncertainty**
  Aly Megahed, Research Staff Member, IBM Research - Almaden,
  650 Harry Road - Office D3-428, San Jose, CA, 95120,
  United States of America, aly.megahed@us.ibm.com,
  Nagham El-Berishy, Bernd Scholz-Reiter

We present a mathematical modelling framework for integrated production-
distribution of a real-world problem in the batch process industry in which we
incorporate the green aspect of carbon emissions under uncertainty. The emissions
are modeled as a function of the realized velocities at different distribution routes.
We show how such integration could achieve significant cost savings. We also
illustrate the impact of environmental regulations that governments impose on
total supply chain costs.

■ **WC11**

Hilton- Continental 8

Supply Chain, Risk Management III

Contributed Session

Chair: Bo Li, PhD Student, Texas A&M University,
4217 TAMU, 320M Wehner, College Station, TX, 77840,
United States of America, bli@mays.tamu.edu

1 - Contagion Risks in Supply Chains
  Alireza Azimian, PhD Student, WLU, Unit 103, 55 Hickory Street E,
  Waterloo, ON, n2j3j5, Canada, azim9110@mylaurier.ca,
  Hamid Noori, Kevin Hendricks

While most of the papers in the context of Supply Chain Risk Management have
addressed the threats associated with customers and suppliers, risks posed by rivals
have received little to no attention in the supply chain literature. This research fills
this gap by exploring how adverse consequences of incidents happened for a focal
firm's supply chain may spread to its industry rivals; and what factors may
contribute to significance of such contagion effect.

2 - Supply Chain Risk Mitigation using Information Sharing
  Ek Peng Chew, Associate Professor, National University of
  Singapore, 10 Kent Ridge Crescent, Singapore, 117576,
  Singapore, isecep@nus.edu.sg, Loo Hay Lee, Yi Tao

We study the impact of information sharing in a supply chain which consists of one
retailer and two suppliers, among which each individual player has profit
maximization as his primary objective. Using the game theory, we show that under
some situations, prisoner dilemma phenomenon will exist. Hence some incentive
schemes need to be implemented in order to incentivize the players in sharing the
information.

3 - Supply-Chain Management under Conditional Value-at-Risk
  Bo Li, PhD Student, Texas A&M University, 4217 TAMU, 320M
  Wehner, College Station, TX, 77840, United States of America,
  bli@mays.tamu.edu, Antonio Arreola-Risa

We consider a single item production-inventory system with stochastic demand
and production, where inventory is controlled by a base-stock policy and unfilled
demands are back-ordered. The relevant costs are inventory holding and back-
ordering, which can be significant for high-value products. We propose Conditional
Value-at-Risk (CVaR) as the decision criterion. We find the optimal base-stock level
that minimizes CVaR for various model formulations and analyze the optimal
solutions obtained.

4 - Characteristics of Risk Contagion along an Industrial Chain: Empirical Evidences from Shipbuilding
John Liu, Professor, City U of HK, Tat Chee Ave, Kowloon, Hong Kong - PRC, johnliu@cityu.edu.hk, Hui Bu, Yingfeng Wang

In this paper, we study empirical characteristics of risk contagion through an industrial chain, in the context of national shipbuilding-shipping industries, where risk contagion is referred to serially interrelated volatility triggered by uncertain events such as the global financial crisis of 2008. We develop DCC-GARCH models to estimate the conditional standard deviations and dynamic correlations of these time series.

5 - An Agriculture Feed Processing Supply Chain Modeling
Fesseha Gebremikael, Graduate Student, North Dakota State University, 253 University Village, Fargo, ND, 58102, United States of America, fesseha.gebremikael@my.ndsu.edu, Iddrisu Awudu, Khalid Bachkar

Risk management considering an agricultural firm that produces and sells transformed products. We consider a firm that has peanuts and corn as inputs. The supply chain consists of purchasing corn and peanuts, storage, transformation of the two inputs into the desired outputs, and shipping the outputs to customer destinations. A deterministic model is developed and further stochastic model is proposed. This case study is solved by using the AHP. The results indicate a good balance with buying and selling of the inputs in a hedging/risk management situation which is involves rationing.

■ WC12

Hilton- Continental 9

Supply Chain Optimization I

Contributed Session

Chair: Guoqing Zhang, Professor, University of Windsor, 401 Sunset Avenue, Windsor, Canada, gzhang@uwindsor.ca

1 - Multi-item Dual-Channel Supply Coordination for Online Shopping
Guoqing Zhang, Professor, University of Windsor, 401 Sunset Avenue, Windsor, Canada, gzhang@uwindsor.ca

We consider an e-business retailer who has a dual-channel supply network with a fulfilling center and multi-supplier for different items. The retailer can deliver the products from either the fulfilling center or the manufacturer who produces the product, depending on the geographic location of the customers and product availability. The problem is to determine the optimal order quantities in both retailer's fulfilling center and the supplier's warehouse with considering the space limitation.

2 - On the Multiple-machine Tardiness-minimization Problem with Nested Sequencing and Shared Resources
Yijun Wang, Rutgers University, 1 Washington Park, Newark, NJ, 07029, United States of America, yijun@pegasus.rutgers.edu, Lei Lei, Kangbok Lee

We consider the multiple-machine scheduling problem where a) the processing of a subset jobs involves external contracted manufacturers; and b) the starting time of internal processing depends on the availability of a shared resource. The objective is to minimize the total weighted tardiness. We define this problem as a MIP model and introduce two polynomial-time solvable cases. Examples with real data are presented.

3 - Modeling the Biofuel Supply Chain System from Dedicated Energy Crop under Uncertainty
Yuanzhe Li, PhD Student, Department of Civil and Environmental Engineering, University of California, Davis, University of California Davis, One Shields Avenue, Davis, CA, 95616, United States of America, rgli@ucdavis.edu, Yueyue Fan, Nathan Parker, Quinn Hart

A stochastic program is developed to model a complex biofuel production system using dedicated energy crop as feedstocks. By integrating agricultural land allocation and poplar adoption decisions and considering uncertainties in poplar yield, we aim to finding the optimal strategies for maximum system profit. Statistical approximation and decomposition methods are used to solve the stochastic mixed-integer programming model.

4 - A Computational Study for Common Network Design in Multi-commodity Supply Chains
Ting Wu, Nanjing University, No more22,Hankou Road, Nanjing, China, tingwu@nju.edu.cn

In this paper, we study a supply chain network design problem which consists of one external supplier, a set of potential distribution centers, and a set of retailers, each of which is faced with uncertain demands for multiple commodities.The goal is to minimize the system-wide cost. We propose a general nonlinear integer programming model for the problem and present a cutting plane approach to solve it.Computational results show that the proposed algorithm is efficiently.

5 - A Bi-level Stochastic Programming Model for Supply Chain Network Design with Assembly Line Balancing
Nima Hamta, PhD Candidate, University at Buffalo, SUNY, 437 Bell Hall, Department of ISE, University at Buffalo, SUNY, Amherst, NY, 14260, United States of America, nimahamt@buffalo.edu, Sara Behdad, Mohsen Akbarpour Shirazi, S.M.T. Fatemi Ghomi

The purpose of this paper is to integrate the strategic and tactical decisions in the supply chain network design (SCND) under demand uncertainty. The new bi-level stochastic programming model developed in this paper considers the SCND problem as a strategic decision in the upper-level model, while addressing the assembly line balancing as a tactical decision in the lower-level model. In addition, a scenario-based heuristic method is proposed to solve the developed model.

■ WC14

Imperial B

Supply Chain/Decision Analysis

Contributed Session

Chair: Gang Xie, Associate Professor, Academy of Mathematics and Systems Science, Chinese Academy of Sciences (CAS), 55 Zhongguancun East Road, Haidian Distr, Beijing, Ch, 100190, China, gxie@amss.ac.cn

1 - Combined Qualitative and Quantitative Analysis of the Thai Silk Industry
Natawat Jatuphatwarodom, University of Portsmouth, Flat 88, Fellows Court, Weymouth Terrace, London, E2 8LN, United Kingdom, natawat.jatuphatwarodom@port.ac.uk

This research is aimed at developing logistic and supply chain models that support policy decisions of the Thai Silk manufacturers' key decision makers. The constraints that restrict the expansion of the Silk industry are analysed. Supplier selection and Inventory management models were selected to be focal studies. Operational Research models (AHP/DEA/GP) were applied within the case studies.

2 - Emission-dependent Production and Policy Implications Considering Government Subsidies
Yu Jiao Zhu, University of Science and Technology of China, School of Management, Hefei, China, yujiaozh@mail.ustc.edu.cn

Based on the newsvendor model, this paper studies the impacts of government subsidies policy on emission-dependent manufacturer's decision-makings, and discusses the right way for the manufacturer to obtain emission permits. The analysis shows that after pushing the subsidy policy, the optimal production quantity of the emission-dependent manufacturer decreases.

3 - Optimal Outsourcing Strategies when Capacity is Limited
Salar Ghamat, PhD Student, Richard Ivey Business School, 1255 Western Road, London, ON, N6G 0N1, Canada, sghamat@ivey.ca, Xinghao Yan, Hubert Pun

Many Original Equipment Manufacturer (OEM) outsource some of their products' components to third-party suppliers. Some of these suppliers are competitive component manufacturers (CCM) that produce substitutable products. We consider a model where OEM has two potential suppliers: an independent supplier and a capacitated CCM. We take a game theoretic approach to find OEM's optimal outsourcing strategy. We show that, CCM may decrease its own output to satisfy the component demand of the OEM.

■ WC15

Hilton- Exec. Boardroom

Semiconductor Industry

Contributed Session

Chair: Mehmet Candas, Sr. Manager - IT Global Operations | Supply Chain, AMD, 7171 Southwest Pkwy., Austin, TX, 78735, United States of America, mfcandas@gmail.com

1 - Semiconductor Manufacturing Planning: Challenges and Solution Approaches
Mehmet Candas, Sr. Manager - IT Global Operations | Supply Chain, AMD, 7171 Southwest Pkwy., Austin, TX, 78735, United States of America, mfcandas@gmail.com, Enes Bilgin

Supply chain manufacturing planning involves many challenges, due to complexity and stochasticity of the manufacturing process, coupled with the sophisticated co-production, down-grading, and re-claiming activities. We will present our approach to handle these challenges while developing a decision support system for AMD's supply chain.

WC16   *INFORMS San Francisco – 2014*

2 - Semiconductor Supply Chain Production Planning under Uncertainty

Jon Lowe, Graduate Research Assistant, Clemson University, 103 Freeman Hall, Clemson, SC, 29631, United States of America, jjlowe@clemson.edu, Scott Mason

Due to the high risk of obsolescence due to rapid technology changes, semiconductor manufacturers are reluctant to maintain large amounts of inventory in their supply chains. However, some inventory is needed to meet forecasted demand on time. We present a master planning stochastic program for the semiconductor supply chain and demonstrate the model's ability to schedule production under uncertain yield, lead time, and demand parameters using an industrial data set.

3 - Buyer Strategies to Maintain Suppliers in Development-Intensive Supply Chains

Mericcan Usta, Stanford University, 475 Via Ortega Ste 245, Stanford, CA, 94305, United States of America, usta@stanford.edu, Warren H. Hausman, Feryal Erhun

In industries including semiconductor and defense, the prominent buyer has to simultaneously maintain a supplier base and attain ambitious R&D goals. In collaboration with Intel, we propose several strategies through game-theoretic models. Those are: egalitarian value allocation in the face of relationship decline, commitment to develop non-focal suppliers against increased supplier asymmetry, and commitment to competitive price targets to achieve synergistic benefits of supplier collaboration.

■ WC16

Hilton- Franciscan A

Empirical Studies in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Jun Li, Assistant Professor, Ross Business School, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, junwli@umich.edu

Co-Chair: Necati Tereyagoglu, Assistant Professor of Operations Management, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, Necati.Tereyagoglu@scheller.gatech.edu

1 - Multisupplier Contact in the U.S. Ketchup Industry

Necati Tereyagoglu, Assistant Professor of Operations Management, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, Necati.Tereyagoglu@scheller.gatech.edu, O. Cem Ozturk

We examine empirically the effects of multisupplier and multimarket contact on pricing decisions of retailers in the U.S. ketchup industry. We find that prices are higher in markets served by retailers with extensive contacts in others markets. Moreover, we show that prices are higher when retailers use the same suppliers.

2 - Identifying Competitors in Markets with Fixed Product Offerings

Marcelo Olivares, Assoc. Professor, Columbia University, Broadway 3027, New York, NY, United States of America, molivares@columbia.edu, Roger Lederman, Garrett van Ryzin

We develop a novel methodology to identify competitors in markets where spatial location is an important factor of differentiation. In these markets, competition is determined by the preferences of different customer segments, which we identify using variation in observable attributes that determine the size of the distinct customer segments. We apply our methodology in the hotel travel industry, where the characterization of key competitors is used in practice to benchmark hotel performance.

3 - Who Are My Competitors: Drivers of Hotel Online Competition

Jun Li, Assistant Professor, Ross Business School, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, junwli@umich.edu, Serguei Netessine, Sergei Koulayev

Hotel managers who used to identify competition set by looking across the street, are now faced with extensive competition as availability and price information are made nearly transparent online. What (and who) drives hotel competition in the new era? Using consumer click-stream data from two major online travel intermediaries, we develop a model to describe how different types of consumers search and how do these distinct search patterns influence hotel online competition.

■ WC17

Hilton- Franciscan B

Design and Control of Service Systems

Sponsor: Manufacturing & Service Operations Management/Service Operations
Sponsored Session

Chair: Serhan Ziya, Associate Professor, University of North Carolina at Chapel Hill, NC. ziya@unc.edu

1 - Routing Based on Service Rates to Incentivize Strategic Servers in Many-Server Systems

Sherwin Doroudi, Tepper School of Business; Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdoroudi@andrew.cmu.edu, Ragavendran Gopalakrishnan, Amy Ward, Adam Wierman

Traditionally, research focusing on the design of routing policies for service systems has modeled servers as having fixed, possibly heterogeneous service rates. However, service systems are often staffed by people. Then, the rate a server chooses to work is impacted by the system's routing policy. We analyze the impact of "strategic servers" on system performance in many-server systems using a novel technique of differentiating the balance equations of the underlying heterogeneous M/M/N system.

2 - Tandem Queues with Reneging

Jianfu Wang, Assistant Professor, Nanyang Business School, Block S3, 50 Nanyang Avenue, Singapore, 639798, Singapore, jianfu.wang.ntu@gmail.com, Hossein Abouee Mehrizi, Oded Berman, Opher Baron

This paper considers a two-station tandem queueing system with reneging. We develop a new technique to solve two dimensional Markov chains. We use this technique to derive the distribution of number of customers in each station. This technique can be applied to many different settings for different service level measures. We employ the method to solve a system design problem and investigate the effect of cross-trained servers.

3 - Dynamic Multi-class Kidney Allocation

Valery Pavlov, University of Auckland Business School, Private Bag 92019, Auckland, 1142, New Zealand, v.pavlov@auckland.ac.nz, Ali Vahabzadeh

In the US alone, every year several thousand people die while waiting for a kidney transplant but, at the same time, thousands of suitable donor organs are eventually discarded. Our model is aiming to provide insights about possible measures, in-line with the current policies, to reduce the waste.

4 - The Effect of Random Waits on Customer Queue Joining and Reneging Behavior: A Laboratory Experiment

Zeynep Aksin, Koc University, Sariyer, Istanbul, Turkey, ZAKSIN@ku.edu.tr, Busra Gencer, Evrim Gunes, Ozge Pala

In many service settings, customers encounter queues and have to decide between joining, balking and reneging. This study investigates customers' queue joining and reneging behaviors via a laboratory experiment in which participants experience several observable queues with different characteristics in terms of queue length (long/short) and service times (deterministic/random)and decide to join, balk or renege. We analyze the effects of random service times on joining and reneging behavior.

■ WC18

Hilton- Franciscan C

Big Data Analytics and Predictive Modeling in Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Yingying Kang, Principal Operations Research Consultant, Sabre Holdings Inc., 3150 Sabre Drive, Southlake, TX, 76092, United States of America, Yingying.Kang@sabre.com

1 - A StaticModel in Single-leg Flight Airline Revenue Management

Behrooz Pourghannad, Ph.D. Student, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48104, United States of America, behrooz@umich.edu, J.B.G. Frenk, Semih O. Sezer

We present a static single-leg airline revenue management. Requests for fare classes arrive according to independent non-homogeneous Poisson processes where cancellation and no-shows are considered. The objective is to find an optimal closing time(s) which maximizes the expected net revenue. We consider the time-dependence of the demand. Compared to dynamic continuous time models, mostly exponential time-to-cancellations, our model can be applied with arbitrary distributions for cancellations.

2 - Shaping Demand to Match Anticipated Supply
Sifeng Lin, Graduate Student, the Graduate Program of Operations Research and Industrial Engineering, the University of Texas at Austin, Austin, TX, 78712, United States of America, sifenglin@utexas.edu, Anant Balakrishnan, Yusen Xia

Firms can use dynamic pricing strategies to match anticipated demand with supply. In this paper, we develop an economic model to address these short-run demand shaping decisions for vertically differentiated products. The manufacturer must decide what prices to set for high quality and low quality products to judiciously and dynamically segment the market so as to maximize total profits. We identify properties of the optimal price and sales trajectories and the benefit of dynamic pricing.

3 - Revenue Management for Off-street Parking Lots
Manuel A. Bolìvar, Universidad de Los Andes, Cra 1 Este No 19A - 40, Edificio Mario Laserna, Bogot·, Colombia, ma.bolivar643@uniandes.edu.co, Andrés L. Medaglia, Carlos Felipe Valencia, Raha Akhavan Tabatab, Carlos Felipe Ruiz

Off-street parking lots rely on the fact that customers' needs differ from one another, encouraging the use of distinctive fares (i.e., per time-fraction and subscription) to increase the revenue. We propose a methodology to forecast demand and obtain near-optimal subscription-selling policies for new parking lots based on historical data from existing lots for a parking company in Bogot· while considering the decision makers' preferences in avoiding customer rejection.

■ WC19

Hilton- Franciscan D

Retail Operations

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Shengqi Ye, Indiana University at Bloomington, 1309 E. 10th Street, Bloomington, IN, 47405, United States of America, shye@indiana.edu

1 - The Operational Value of Social Media Information
Ruomeng Cui, Assistant Professor, Kelly School of Business, Bloomington, IN, 47405, United States of America, cuir@indiana.edu, Antonio Moreno-Garcia, Dennis Zhang, Santiago Gallino

We empirically explore how social media information helps sales forecasting. Using (1) daily sales data from an online apparel startup company that primarily advertises on Facebook, and (2) publicly available Facebook posts and the users' comments and likes data, we find a statistically significant improvement in sales forecast accuracy. We analyze the underlying mechanism—the attention effect and the word-of-mouth effect. We quantify the operational value of social media information.

2 - Campaign Earlier or Later? Sponsored Search Advertising when Customers Re-click
Shengqi Ye, Indiana University at Bloomington, 1309 E. 10th Street, Bloomington, IN, 47405, United States of America, shye@indiana.edu, Shanshan Hu, Goker Aydin

Customers might click a retailer's link and check its product multiple times before making purchasing decisions. Noting this behavior, we investigate the retailer's optimal advertising policy when selling seasonal products over a predetermined horizon. We show that the retailer may want to advertise aggressively early in the selling season.

3 - Learning Consumer Tastes from Dynamic Assortments: A Nonparametric Bayesian Model
Dorothee Honhon, Assistant Professor, University of Texas at Dallas, Naveen Jindal School of Management, Dallas, TX, 75080, United States of America, Dorothee.Honhon@utdallas.edu, Canan Ulu

We study assortment decisions of a firm learning about consumer tastes. Each period, the firm offers an assortment to maximize expected total profits given its subjective beliefs on consumer tastes. Consumers choose a product that maximizes their utility and the firm updates its beliefs after having observed sales. We develop a nonparametric Bayesian learning model using Polya tree priors. We develop upper bounds on the firm's profit and study various heuristic policies.

4 - Optimal Merchandise Testing with Limited Inventory
Zhe Wang, UNC Chapel Hill, CB 3490, Chapel Hill, NC, 27599-3490, United States of America, zhe_wang@unc.edu, Adam Mersereau, Li Chen

We consider a retailer allocating a limited inventory among its stores for a "merchandise test" to learn about demand prior to a main selling season. The key tradeoff is between spreading inventory among many stores to get more sales observations versus consolidating inventory in a few stores to avoid stockouts and demand censoring. We characterize optimal policies with identical and non-identical stores and with and without sales timing information.

■ WC20

Hilton- Yosemite A

Homeland Security Applications II

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Paul Kantor, Professor, Rutgers/CCICADA, 4 Huntington St, New Brunswick, NJ, 08901, United States of America, paul.kantor@rutgers.edu

1 - Dynamic Modeling for Arctic Resource Allocation
Richard Garrett, Ph.D. Student, Rensselaer Polytechnic Institute, 539 Congress Street, Troy, NY, 12180, United States of America, garrer3@rpi.edu, Thomas Sharkey, Martha Grabowski, William Wallace

Interest in energy prospects has increased the potential for an oil spill incident in the Alaskan Arctic. A dynamic network expansion problem with stochastic scenario considerations is proposed to assess oil spill response resource allocation policies. The focus is on addressing task lists required for all potential spills to improve the objective of weighted task completion times. Stochastic programming solution methods are employed, and observations and performance results are discussed.

2 - Aviation Resource Optimization Model for the USCG
Christie Nelson, CCICADA, Rutgers University, 4th Floor, CoRE Bldg, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States of America, christie.l.nelson.phd@gmail.com, James Wojtowicz, Paul Kantor, Thomas Rader, Chad Conrad, Endre Boros, Fred Roberts, Brian Ricks, Kevin Hanson, Brian Nakamura, Curtis McGinity

A model was created for the USCG to maximize aircraft fleet operational performance subject to budgetary constraints or to minimize fleet operational costs subject to performance targets. The model determines optimal deployment assignments, operational levels and aircraft allocation among USCG Air Stations for current infrastructure. It can also demonstrate potential efficiencies of proposed infrastructural changes and can be generalized for different types of aircraft and performance.

3 - Comparing Patron Screening Procedures at Professional Sports Stadiums
Brian Ricks, CCICADA, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, bcr50@scarletmail.rutgers.edu, Robert DeMarco, Brian Nakamura, Paul Kantor, Christie Nelson, Fred Roberts, Alisa Matlin, Cindy Hui, Holly Powell, Brian Thompson, Michael Tobia

Security officials balance difficult tradeoffs when choosing between patron screening methods. Together with NFL security personnel, we developed a novel patron screening model to contrast popular screening techniques, including walk-through magnetometers, wandings, and patdowns. We validated our model using ticket scan data and expert experience. The results helped guide the stadium in its future screen practices. Our approach is flexible enough to inform security personnel at any venue.

■ WC21

Hilton- Union Sq 1

Maintenance Problems in Transportation and Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jinwoo Lee, University of California, Berkeley, Berkeley, CA, United States of Americajinwoolee@berkeley.edu

1 - Long Term Freight Network Planning for Northern Australia using Incremental Network Flow
Leorey Marquez, Research Scientist, CSIRO, Private Bag 10, Clayton South, 3169, Australia, leorey.marquez@csiro.au, Melanie Ayre, Asef Nazari, Simon Dunstall, Andreas Ernst

Mining, agricultural and other commercial operations often require the transport of large quantities of materials between remote locations in Australia. This talk looks at the problem of deciding on investments to upgrade transportation infrastructure to meet expected future demand. The talk will present a model using a multi-period incremental network flow design, describe a matheuristic approach for solving the problem and present results demonstrating the effectiveness of the approach.

2 - Dynamic Discrete Network Design Problem – Application to Road Maintenance Planning

Pirmin Fontaine, Technische Universitat München, Arcisstrafle 21, Munich, 80331, Germany, pirmin.fontaine@tum.de, Stefan Minner

The deterioration of streets decreases the quality of road networks. Therefore, streets need to be maintained from time to time. We introduce a bilevel formulation by extending the Discrete Network Design Problem over several periods. This model is solved by a terminated Benders Decomposition approach. A numerical study shows the efficiency of this method and the quality of heuristical solutions without reaching convergence.

3 - Joint Optimization of Various Pavement Management Actions with Non-Markovian Deterioration

Jinwoo Lee, University of California, Berkeley, Berkeley, CA, United States of Americajinwoolee@berkeley.edu, Samer Madanat

We present dynamic programming solutions for the joint optimization of pavement maintenance, resurfacing and reconstruction activities. The majority of the literature does not consider reconstruction in optimization. We show that this leads to suboptimal policies. We use a non-Markovian pavement deterioration model, which is more realistic than the memoryless models.

■ WC22

Hilton- Union Sq 2

Organizational Behavior and Ethics

Sponsor: Organization Science
Sponsored Session

Chair: Emily Block, Assistant Professor of Management, University of Notre Dame, Notre Dame IN 46556, United States of America, es-block@gmail.com

1- Returns to Structural Complementarity: Roles in Entrepreneurial Teams

Brandy Aven

Abstract is not available at this time.

■ WC23

Hilton- Union Sq 3

Topics in Freight Transportation and Logistics

Sponsor: TSL/Freight Transportation & Logistics
Sponsored Session

Chair: Peng Sun, Associate Professor, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, psun@duke.edu

1 - A Deterministic Network Model for Global Thermal Coal Optimization

Ashly Arigoni, Colorado School of Mines, Golden, CO, UniteD States of America, aarigoni@mymail.mines.edu

Our objective is to minimize the cost to ship thermal coal from supply regions to fill demand while respecting import and export port capacities, ship size constraints, and coal specification requirements. The global thermal coal model allows demand nodes to incorporate different coal qualities from different sources to observe minimum heat content and maximum sulfur and ash content, as well as fulfill demand requirements, all while maintaining the overall goal of minimizing total cost.

2 - An Options-Based Pricing Scheme for a Highway Reservation System on Truck-only Lanes

Chiungryeol Lee, Purdue University, 550 Stadium Mall Drive, West Lafayette IN 47907, United States of America, lee1210@purdue.edu, Srinivas Peeta

This study explores an options-based pricing scheme for a highway reservation system for truck-only lanes that guarantees a threshold speed level. The risk for highway operators in failing to meet the promised speed is considered in the pricing process. Numerical experiments illustrate that the proposed approach can help improve reliability in the freight industry while reducing traffic congestion in the highway system.

3 - Train Dispatching Problem under Exact Travel Time Estimation

Maged Dessouky, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, United States of America, luncefu@usc.edu, Maged Dessouky

We consider the problem of dispatching trains through the railway network. Different speed limits are applied to different track segments and junctions. Travel time is obtained by accounting for the train's dynamics. This is a complex problem since the travel time on an edge depends on the entering velocity and exiting velocity. Therefore Dijkstra's algorithm doesn't guarantee optimality. We explore other heuristics and simulation is conducted to compare the proposed algorithms with Dijkstra's algorithm.

4 - Time-Dependent Pickup and Delivery TSP with Time Windows, Profits and Transfers

Peng Sun, TU/e, Pav E 17, Eindhoven 5600MB, Netherlands, P.Sun@tue.nl, Said Dabia, Tom Van Woensel

This problem is defined on a graph containing both transfers nodes and requests vertices where it is not necessary to visit all of them. Moreover, it also captures road congestion by considering time-dependent travel times. The problem consists of determining a tour that simultaneously optimize the collected profits and the total route duration. Thus, we present a time-dependent labeling algorithm to tackle this problem. The new dominance criteria is also introduced.

5 - Multi-commodity vs. Single-commodity Routing

Claudia Archetti, University of Brescia, C.da S.Chiara 50, Brescia 25122, Italy, claudia.archetti@unibs, Ann M. Campbell, M. Grazia Speranza

We study a routing problem where multiple commodities are requested by customers. We analyze the impact on transportation cost from using vehicles dedicated to a single commodity compared with using flexible vehicles capable of carrying any set of commodities. If multiple vehicles can be used, we examine when deliveries of individual commodities can be split and when they may not be split. We use worst-case and computational analysis to compare these different models.

■ WC24

Hilton- Union Sq 4

Transportation, Intelligent Systems II

Contributed Session

Chair: Qing Chuan Ye, PhD Candidate, Erasmus University Rotterdam, P.O. Box 1738, H8 Tinbergen Institute, room H7-26, Rotterdam, 3000DR, Netherlands, ye@ese.eur.nl

1 - Performance Observation in Privacy Ensured Connected Vehicle Environment using Vehicle Trajectories

Shayan Khoshmagham, University of Arizona, 1127 E. James E. Rogers, Tucson, AZ, 85721, United States of America, shkhoshmagham@email.arizona.edu, Larry Head, Mehdi Zamanipour, Yiheng Feng

This paper introduces an approach to observe the performance measures of a multi-modal transportation system in a connected vehicles environment. An Extended Tardiness Function (ETF) is deployed to guarantee that dynamic mobility applications ensure privacy. The primary purpose is to estimate performance from observations while not inferring vehicle identification.

2 - Signal Phase Allocation Algorithm in a Connected Vehicle Environment

Yiheng Feng, University of Arizona, 1127 E. James E. Rogers, Tucson, AZ, 85721, United States of America, yihengfeng@email.arizona.edu, Larry Head, Shayan Khoshmagham, Mehdi Zamanipour

A traffic signal phase allocation algorithm based on dynamic programming is proposed to optimize the signal timing in a connected vehicle (CV) environment. The algorithm considers a hierarchical structure with barriers on the upper level and phases on the lower level. Because of the low market penetration rate of CV, data from CV are processed to estimate location and speed of unequipped vehicles. Results show the proposed model has similar performance to well-tuned actuate signal control.

3 - Correcting Count-biases at Freeway Loop Detectors Based on Information from Probe Vehicles

Kwangho Kim, Postdoctoral Researcher, Institute of Transportation Studies, University of California, Berkeley, 416F McLaughlin Hall, UC Berkeley, Berkeley, 94720, United States of America, khkim@berkeley.edu

This paper proposes a new method to correct systematic biases in vehicle counts measured at freeway loop detectors by exploiting the conservation-of-vehicles principle. The proposed method is designed to compensate total count-biases, accumulated during a period, over each intervening time interval in proportion to a time-dependent correction factor, which is periodically adjusted by means of traffic information from probe vehicles. Outcomes from testing the proposed method turn out promising.

4 - An Asset Light Solution for Inter Terminal Transport at the Port of Rotterdam with Fairness

Qing Chuan Ye, PhD Candidate, Erasmus University Rotterdam, P.O. Box 1738, H8 Tinbergen Institute, room H7-26, Rotterdam, 3000DR, Netherlands, ye@ese.eur.nl, Yingqian Zhang, Rommert Dekker

Following the expansion of the Port of Rotterdam with Maasvlakte 2,there will be an increase in inter terminal transport.To accommodate this,we seek to take advantage of excess capacity of already available trucks in a so-called asset light solution by auctioning tasks to trucking companies.In order to avoid peak hours and maintain competition among companies,we do not want to have a mere optimal allocation in terms of costs,but in terms of fairness as well,which poses an interesting trade-off.

■ WC25

Hilton- Union Sq 5

Transportation, Operations I

Contributed Session

Chair: Bilge Atasoy, Postdoctoral Associate, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, batasoy@mit.edu

1 - Determining Hazardous Distractions for Teenage Drivers

Ali Mohammadhashemi, University of Tennessee-Knoxville, 1209 Clinch Avenue, Knoxville, TN, 37916, United States of America, amohamm7@utk.edu, Seyed Ahmad Niknam, Rapinder Sawhney, Robert Mee

In this research, the teenage drivers (16-19 years old) are driving in a simulation lab and the distractions are done by drivers and the severity of these distractions and their impacts on velocity, lane position , headway distance and safe headway distance is analysed. Finally the most dangerous distractions are identified and the reason why they are more important from other distractions is discussed.

2 - Regulating the Incoming Passenger Flow in Subway Systems during Emergency Situations

Qing Ye, Southwest Jiaotong University, 111 Erhuan Road Beiyiduan, Chengdu, China, qing.yeswjtu@gmail.com, Satish Ukkusuri, Qiyuan Peng

To mitigate the congestion problem in subway system during emergency situations, a control scheme for the incoming passenger flow is necessary and widely applied. In this research, a dynamic control scheme for the incoming passenger flow is proposed. A bi-level model and a sensitivity analysis-based algorithm are provided to regulate the incoming passenger flow. The effectiveness of the proposed approach has been demonstrated with a case study of Beijing subway.

3 - Optimizing the Menu of Travel Options for a Flexible Mobility on Demand System

Bilge Atasoy, Postdoctoral Associate, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, batasoy@mit.edu, Nathanael Cox, Moshe Ben-Akiva, Takuro Ikeda

We introduce a flexible mobility on demand system that provides a menu of options to passengers with the services of mini-bus, shared-taxi and taxi. For each request, a list of options is offered through an optimization framework. First, a myopic model is considered that optimizes the decisions for the current request. A set of experimental results is obtained for a network in Tokyo. Then, an extended model is studied that accounts for future demand in order to improve the quality of decisions.

4 - Stochastic ERU Allocation under Impacts of Secondary Incidents

Hyoshin Park, UMD, College Park, College Park, MD, United States of America, hyoshin0724@gmail.com

An optimal deployment of ERU depends on an incident rate and total delay as main indicators. Secondary-incident-induced delay can be estimated based on the reduced capacity considering primary and secondary incidents.The objective of the problem is to make location-allocation decisions in a way that the sum of the first-stage costs and the expected value of the second-stage costs are minimal.

5 - A Mixed Fleet Sizing Problem with the Green Alternative Fuel Vehicles

Ismail Capar, Texas A&M University, Industrial Distribution Program, College Station, United States of America, capar@tamu.edu, Mesut Yavuz

This research investigates a fleet sizing problem for an operation where a driver provides service to a number of customers at their sites. The operator would like to determine the optimal fleet mix consisting of alternative fuel vehicles (AFVs) with limited driving range and refueling capabilities and internal combustion vehicles without such limitations. We analyze the problem under a stochastic environment and evaluate the impact of route splitting and intraday refueling strategies for AFVs.

■ WC26

Hilton- Union Sq 6

Vehicle Routing III

Contributed Session

Chair: Gu Pang, Newcastle University Business School, 5 Barrack Road, Newcastle upon Tyne, United Kingdom, gu.pang@ncl.ac.uk

1 - Multiple Visits Model for Ready Mixed Concrete Delivery

David Rey, The University of New South Wales, UNSW, Sydney, 2052, Australia, d.rey@unsw.edu.au, Mojtaba Maghrebi, Travis Waller

Unlike most vehicle routing formulations, the delivery of Ready Mixed Concrete (RMC) often requires that a customer be visited multiple times in a given time period. Therefore conventional vehicle routing approaches cannot be simply adapted to RMC delivery and new models are required to account for such routing patterns. We introduce a mathematical programming model for the RMC delivery problem that is able to account for multiple customer visits through integer variables.

2 - Inventory Routing and the Optimal Levels of Postponement

Gu Pang, Newcastle University Business School, 5 Barrack Road, Newcastle upon Tyne, United Kingdom, gu.pang@ncl.ac.uk, Luc Muyldermans

We study Inventory-Routing Problems (IRPs). Our aim is to determine the parameter-dependent 'optimal' level of postponement (or accumulation times) when both routing and inventory holding costs are minimised. We carry out the computational experiments by applying the Continuous Approximation models. Our results reveal the 'optimal' accumulation times are dependent on client demand rates, client locations, client service requirements, and service regions.

3 - An Column-Generation Approach to the Public Transit Routing and Network Design Problem

Ran Zhang, University of South Florida, 4202 E Fowler Ave, Tampa, FL, 33620, United States of America, ranzhang@mail.usf.edu

The paper aims to rerouting the passenger paths in an existing public transit network with large passenger flow in China, in order to minimize the total costs of both passengers and operator. A new multi-commodity flow model is proposed and the bus lines can be generated dynamically. A Column Generation algorithm is introduced to solve this problem more efficiently.

4 - Value of Spatial Decision Support in Operations Research

Avijit Sarkar, Associate Professor, University of Redlands, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, avijit_sarkar@redlands.edu, Hindupur Ramakrishna

Spatial decision support systems combine operations research (OR) and geotechnology to obtain elegant, efficient solutions for complex problems in routing, location, supply chain and logistics optimization. We provide taxonomy of spatial decision support in OR with focus on the value added by integrating OR with geotechnology in a unified framework.

5 - Branch and Price for the Vehicle Routing Problem with Time Windows and Driving Regulations

Said Dabia, TU/e, Pav F 19, Eindhoven, Ne, 5600MB, Netherlands, s.dabia@tue.nl, Emrah Demir, Maryam SteadieSeifi, Nico Dellaert, Tom Van Woensel

In this presentation, we show an exact algorithm for the vehicle routing problem with time windows considering drivers working and driving hours regulations. The exact algorithm is based on branch and price. The master problem is a standard set partitioning that can be solved by means of column generation. We show how we can handle working and driving hours regulations in the pricing problem of the column generation.

■ WC27

Hilton- Union Sq 7

Logistics 3

Contributed Session

Chair: Marcus Ang, Assistant Professor (Education), Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, marcusang@smu.edu.sg

1 - Truck Dispatch Optimization on a Large-Scale Logistics Network
Bo Zhang, Staff Researcher, IBM Research - China, Diamond Building 19-A, ZGC Software Park, Beijing, China, bozbo@cn.ibm.com, Yue Tong, Xin Shi, Hongbo Li

Timelessness of service is among the most important competencies of a logistics service provider nowadays. In our research, we propose a new method to optimize truck dispatching plan that reduces the freight transit times on a logistics network. Numerical experiments are conducted on real-world sized sample networks, the results of which demonstrate the effectiveness and efficiency of our method. Managerial insights are drawn for practitioners in transportation industry.

2 - Green Purchasing: A Mathematical Programming Perspective
Xin Ma, PhD Candidate, Hong Kong Polytechnic University, EF403, Hung Hom, Kowloon, Hong Kong - PRC, maxinstu@gmail.com, Ping JI, Cheng-hu Yang

Game processes between suppliers and manufacturers are presented by using a mathematical programming model. This model not only focuses on the issue of green supplier selection, but also solves the lot sizing issue based on capabilities of selected suppliers. Environmental factors are integrated into the model to study green purchasing.

3 - A Distribution Center where Robots" Pick Orders
Nima Zaerpour, Assistant Professor, VU University Amsterdam, De Boelelaan 1105, Rotterdam, 1081 HV, Netherlands, nzaerpour@rsm.nl

We consider a distribution center, which uses mobile-robotic fulfillment system eliminating walking. In such a system, the robots pick up an entire storage pod and bring it to a pick station, from where the products on the pod are distributed over customer bins. We study the retrieval sequencing and location assignment of storage pods leading to minimum robot's travel time. We propose a simple heuristic, which can substantially reduce the retrieval time.

4 - Optimizing Storage-Class Formation in Unit-Load Warehouses
Marcus Ang, Assistant Professor (Education), Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, marcusang@smu.edu.sg, Yun Fong Lim

We propose a new approach to form optimal storage classes for a unit-load warehouse. Under this approach, we determine the frequency of visits to each storage location based on a linear programming model that considers the warehouse's layout and the arrivals and mean demands of products. We use this frequency of visits to evaluate the "attractiveness" of each storage location. We compare our frequency-based class formation method with a cost-based method and a grid-based method.

■ WC28

Hilton- Union Sq 8

Measuring and Managing Delay through Trajectory Analysis

Sponsor: Aviation Applications
Sponsored Session

Chair: Heng Chen, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu

1 - Design and Analysis of a Large-Scale Database for Assessing Weather Impact on Passenger Aviation
Brian Lemay, University Of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor MI 48109-2117, United States of America, blemay@umich.edu, Amy Cohn, Ji Wang

To better understand the system-based and propagating impacts of weather-based disruptions, we have developed a large scale database of roughly 70 million flight records and 50 million weather records. We present insights from the design of this database and preliminary analysis.

2 - Optimal Airline Actions during Collaborative Trajectory Options Programs
John-Paul Clarke, Associate Professor, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu, Tim Niznik, Billy Wang, Balaji Nagarajan, Bosung Kim

Collaborative Trajectory Options Programs are designed to reduce en route congestion by rationing capacity. Optimal airline actions during CTOPs are determined via a two-stage algorithm. In stage one, the optimal set of trajectory options to submit is determined given available capacity, FAA rules, and possible actions by other airlines. In stage two, flights are optimally re-assigned to the slots obtained in stage one. Numerical results indicate significant reductions in operations costs.

3 - Optimal Metering Point Locations for Optimized Profile Descent Operations at Airports
Heng Chen, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu, Senay Solak

We consider Optimized Profile Descent (OPD) implementations at airports, and develop models to increase potential savings through optimal metering policies, which include identification of the number and locations for metering points. We present an algorithmic framework based on a stochastic dynamic program and a nonlinear stochastic integer program to identify best metering point configurations, and present some numerical results based on actual traffic information at a major U.S. airport.

4 - Vertical Trajectory Optimization to Minimize the Environmental Impact of Terminal Area Operations
Sang Gyun Park, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332, United States of America, sanggyun.park@gatech.edu, John-Paul Clarke

En route descent from a point along the cruise segment to a metering fix at a lower altitude is optimized in the presence of altitude dependent winds. The optimal control problem is formulated with both mixed and pure state inequality constraints for flight envelope protection and passenger comfort, and timing constraints at meter fixes for capacity constraints. The vertical area navigation mode sequence that minimizes the environmental impact is derived from the optimal solution.

■ WC29

Hilton- Union Sq 9

Manufacturing 3

Contributed Session

Chair: Paolo Letizia, Assistant Professor of Operations Management, Rotterdam School of Management/Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, letizia@rsm.nl

1 - Two Types of Learning Effects on Maintenance Activities
Hakan Tarakci, Assistant Professor, University of North Texas, Box 305249, Denton, 76203, United States of America, hakan.tarakci@unt.edu

In this paper, we study a manufacturing system which is prone to failure. We consider two types of maintenance activities: Preventive (PM) and Corrective (CM). We assume that the repetitive nature of PM enables learning to occur and subsequent PMs take less time and cost less. In addition, the system is also able to learn from its failures in such a fashion that the number of failures in a previous cycle decreases the failure rate in the next cycle.

2 - On the Economic Lot-Size Scheduling and Pricing for Multiple Products
Alireza Kabirian, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States of America, akabirian@csun.edu

In this paper, the economic production quantity problem for multiple products on a single-machine system is extended. It is assumed that annual demands of the products are functions of prices set by manufacturer. This extension considers an objective function comprised of sales revenues, inventory and setup costs as well as the costs of production. Non-linear programming methods are investigated for solving the models obtained.

3 - Achieving Zero Accident Facility
Mohammad Ali Asudegi, RA, University of Tennessee, 301 Woodlawn Pike Apt C6, Knoxville, TN, 37920, United States of America, aliasudegi@gmail.com, Rapinder Sawhney

Achieving Zero Accident approach has been the focus of many manufacturing companies for a while. The ultimate goal of this study is to develop a structure for a medium size manufacturing company to become a Zero Accident facility using statistical methods. Implementing the proposed guideline is found to be beneficial in preventing incidents in the workplaces.

4 - Quality Control in an Export Processing System

Paolo Letizia, Assistant Professor of Operations Management, Rotterdam School of Management/Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, letizia@rsm.nl, Long Gao

Export-processing is offshored production from developed countries. The majority of procurement contracts that are adopted for export-processing are flexible and do not specify product quality. Through contract theory we show that flexible contracts are preferred by the manufacturer when the product quality cannot be effectively communicated between the parties.

■ WC30

Hilton- Union Sq 10

Operations Management/Marketing Interface III

Contributed Session

Chair: Abhishek Shinde, Doctoral Student, Indian Institute of Management Calcutta, India, Room No C 203 Lake View Hostel, IIM Calcutta, Joka, DH Road, Kolkata, Wb, 700104, India, abhishekjs11@iimcal.ac.in

1 - Cash Conversion Cycle Consideration in Resource Constrained Supply Chain

Abhishek Shinde, Doctoral Student, Indian Institute of Management Calcutta, India, Room No C 203 Lake View Hostel, IIM Calcutta, Joka, DH Road, Kolkata, Wb, 700104, India, abhishekjs11@iimcal.ac.in, Nishant Kumar Verma

Often in marketing 'cash-to-cash-cycle' - ability of an organization to handle operating capital and meet operating expenses-is ignored, which can ultimately result in series of payment crisis and question the survivability of the organization . In our research paper we have discussed the importance of 'cash-to-cash-cycle' consideration in cash strapped channel partner and developed a model to prioritize the products to optimize cash-to-cash-cycle period.

2 - Channel Strategy Considering Store Brand Introduction: The Robinson-Patman Act Actually Helps

Yannan Jin, School of Management, Fudan University, No. 670, Guoshun Road, Yangpu District, Shanghai, China, jinyannan61@gmail.com, Xiaole Wu, Qiying Hu

Motivated by the prevalent phenomenon of store brand entry in the retailing market, this paper studies a manufacturer's channel strategy taking into account retailers' potential store brand introduction under two scenarios: in the presence and absence of the Robinson-Patman Act. The impacts of three factors on firms' decisions are investigated: the store brand base demand, the competition between national brand and store brand, and the cross-store national brand competition.

3 - Production and Sales Management for Successive Generations of New Products under Supply Constraints

Ashkan Negahban, PhD Student, Auburn University, 3301 Shelby Center, Auburn, AL, 36849, United States of America, anegahban@auburn.edu, Jeffrey Smith

Various real-world case studies show that an incorrect production and sales plan for the launch of a new product can lead to huge financial losses for companies. In this work, we study how a firm should manage its production and inventory before launching a new generation of a new product into the market. We use optimal control theory to establish the optimal sales policy and derive closed-form expressions for the demand and sales dynamics of the second generation of the product.

4 - Optimal Inventory and Demand Management through Dynamic Bundling and Pricing

Sang Jo Kim, PhD Candidate, MIT-Zaragoza International Logistics Program, Calle Bari 55, Edificio Nayade 5, Zaragoza, 50197, Spain, sjkim@zlc.edu.es, Youyi Feng

We investigate an optimal decision-making for a manufacturer that makes and sells two distinguishable products. To maximize its revenue, the firm often bundles products for stimulating sales. Optimal joint decisions on inventory replenishment, bundling/unbundling and pricing of the products show certain effective structures and draw significant managerial insights.

5 - Should Marketing Care About Supply Chain Management? On the Moderating Role of SCM on Advertising

Kristoph Ullrich, Ph.D. Candidate Supply Chain and Operations Management, Kuehne Logistics University - The KLU, Grofler Grasbrook 17, Hamburg, HH, 20457, Germany, kristoph.ullrich@the-klu.org, Sandra Transchel

Based on COMPUSTAT data we empirically investigate the impact of supply chain management capabilities on the association between advertise spending and stock returns. To capture the implications of complex feedback loops we employ vector autoregressive models and reveal (among other things) that the effect of advertise spending on abnormal stock returns depends on supply chain competencies.

■ WC31

Hilton- Union Sq 11

Incorporated Models in Business Processes Optimization

Sponsor: Service Science
Sponsored Session

Chair: Tulia Plumettaz, Xerox Corporation, 800 Phillips Rd, Bldg 128-257F, Webster, 14580, United States of America, Tulia.Plumettaz@xerox.com

1 - Planning Inventories in a Multi-Echelon On-line Retail Fulfillment System

Juan Li, Research Scientist, Xerox Corporation, 800 Phillips Road, Webster, NY, 14580, United States of America, Juan.Li@xerox.com, John Muckstadt

When designing and operating an order fulfillment system for an on-line retailer, many factors must be taken into account. We present a model and a computationally tractable method for planning procurements and allocating stock among warehouses. Our model is based on taking advantage of the length of time between when a customer places an order and when it must be fulfilled. We will demonstrate the effect of the percentage of demand that must be filled immediately on the total system inventories.

2 - A Multidisciplinary Approach to Model Child Support Services Business Processes

Bo Hu, Research Scientist, Xerox Corporation, 128/29E, 800 Phillips Road, Webster, NY, 14580, United States of America, bo.hu@xerox.com, Bryan Dolan, Patricia Wall, Maryann Fuhrmann, Kirk Ocke, Yasmine Charif

A multidisciplinary team of ethnographic researchers, business process modelers and data analysts was formed to study the processes and practices of several Child Support Services departments across the U.S. We will describe our methodology for collecting data and modeling key work processes. We will also discuss our recommendations for improving workflow, including new opportunities to increase stipulated child support orders and compliance.

3 - Optimization Models in Advertising: Paid Search

Aya Wallwater, PhD Candidate, Columbia University, Rm. 329, School of Engineering, 500 West 120th Street, New York, NY, 10027, United States of America, aw2589@columbia.edu

Modern advertising is heavily based on digital media. It consists with different marketing channel and typically the channel that drives the most traffic to a vendor's website is called Paid or Sponsored Search. Paid search is auction-based method to place online advertisements on webpages that shows results from search engine queries. Motivated by the importance of paid search within a digital campaign we will describe an optimal decision process to determine the daily bids on search keywords.

4 - Instability of Sharing Systems in the Presence of Retransmissions

Evangelia Skiani, PhD Candidate, Columbia University, New York, NY, es3009@columbia.edu, Predrag Jelenkovic

Retransmissions represent a primary failure recovery mechanism on all layers of communication network architecture. Similarly, fair sharing, e.g. Processor Sharing (PS), is a widely accepted approach to resource allocation among multiple users. Recent work has shown that retransmissions in failure-prone systems can lead to heavy-tailed delays. Here, we discover that PS-based scheduling induces complete instability in the presence of retransmissions regardless of the job size or the traffic load.

■ WC32

Hilton- Union Sq 12

Supply Chain, Game Theory & Combinatorial Auctions

Contributed Session

Chair: Ahmet Camci, Yasar University, Universite Caddesi, No:35-37, Agacli Yol, Izmir, 35100, Turkey, ahmet.camci@yasar.edu.tr

1 - On Group-Buying Pricing in B2B Systems

Wenxi Gu, PhD candidate, The Chinese University of Hong Kong, Dept of Systems Engineering, CUHK, Shatin, N.T., Hong Kong, Hong Kong - PRC, wxgu@se.cuhk.edu.hk, Xiaoqiang Cai

We explore the feasibility of group-buying pricing for a monopolist supplier who sells a single product to multiple independent Newsvendor-type retailers. The problem is analyzed as a Stackelberg game in which the supplier acts as the leader by announcing its pricing scheme first and the retailers act as followers by choosing their order quantities accordingly. We argue that group-buying pricing, if designed properly, can be a win-win solution for B2B systems.

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2 - The Role of Transaction-specific Investment and Switching Costs in Customer Involvement
Yi Li, Xi'an Jiaotong University, School of Management, Xianning West Road No.28, Xi'an, 710049, China, yiyifirst@foxmail.com, Taiwen Feng, Gang Li

First, the empirical study demonstrates that trust and commitment have positive effects on customer involvement. Second, trust would indirectly impact on commitment through transaction-specific investment. Moreover, switching costs play widely distinct roles in different stages of customer relationship. Switching costs negatively moderate the relationship between trust and customer involvement, while positively moderate the relation of commitment to customer involvement.

3 - Solving the Wine Bottling Plant Lot-sizing Problem under Uncertainty and using Postponement
Sergio Maturana, Professor, Pontificia Universidad Catölica de Chile, Industrial and Systems Engineering Dept, Santiago, Chile, smaturan@ing.puc.cl, Mauricio Varas

Planning the wine bottling and labeling operations is difficult, especially if labeling postponement is allowed. We present a MIP model for lot sizing multiple production lines with decoupled bottling and labeling stages. This capacitated lot sizing model with set-up times was tested on a rolling horizon framework with error-prone demand forecasts against a benchmark model. We developed lagrangian decomposition and fix-and-relax heuristics using commercial solvers. The results are presented.

4 - Robust Optimization Model for Scheduling the Bottling Line of a Large Winery
Alejandro Mac Cawley, Assitant Profesor, Pontificia Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, amac@uc.cl

We present a model that produces solutions for the wine bottling lot sizing and scheduling problem with sequence dependent setup times, in an adequate time-frame, which can be implemented by large wineries. The model incorporates particular aspects of the problem such as: major/minor setups, sequence dependent setup times, crewing limitations and finally, sanitation and traceability constraints. We introduce a robust schedule approach and we implemented an effective decomposition algorithm.

■ **WC33**

Hilton- Union Sq 13

New Product Development 2

Contributed Session

Chair: Debasish Mallick, Associate Professor, University of St. Thomas, 1000 La Salle Avenue #SCH 435, Minneapolis, MN, 55403, United States of America, dnmallick@stthomas.edu

1 - A SA-based Approach for the Feedback-length Minimization Problem
Weihao Huang, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, h.w.h.1989@stu.xjtu.edu.cn, Yanjun Qian, Jun Lin

Finding an appropriate sequence of many interrelated activities becomes a key issue. One important objective of scheduling is to find an activity sequence with minimum total feedback length. This study first proposes two rules for reducing total feedback lengths. Then we combine these two rules with simulated annealing (SA) to provide a heuristic algorithm.

2 - A Framework Based on Quasi-Jackson Network for Evaluating the Complex Collaborative Design
Wen Su, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, China, suw12@mails.tsinghua.edu.cn, Li Zheng

This paper presents a queueing network model to evaluate complex collaborative design (CCD) performance. The network based on quasi-Jackson theorem considers multiple design teams, stochastic task duration, rework and some other characteristics of design process. Using this model, we are able to analyze throughput, iteration times, and time delay of CCD. Some numerical examples are used to illustrate the proposed framework.

3 - Identifying SMEs-Oriented Technology using Patent Bibliographic Information
Keeeun Lee, Dongguk university-Seoul, E440, 26, Pil-dong 3-ga, Chung-gu, Seoul, Korea, Republic of, kelee@dongguk.edu, Byungun Yoon, Daeun Go, Inchae Park

This research aims to propose a systematic method that identifies SMEs-oriented technology in win-win innovation on the SMEs and Large firms. These technology fields are identified by factors, such as a difference in technology cycle time, applying a Hidden markov model based approach and value chains regarding technology. For this, patent bibliographic data is collected and then, considering innovation factors, technologies are matched to each firm type: large and small-sized enterprises.

4 - Spare Parts Demand under Fleet Expansion with Uncertain Product Customization
Tongdan Jin, Associate Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu

Prior studies on after-sales service often assume the demand for spare parts is stationary. We analyze a spares inventory system confronted with a non-stationary demand process due to a growing installed base upon the new product introduction. The spare parts forecasting becomes more involved when the configuration of shipped products randomly changes. We synthesize renewal theory with computational analytics to tackle this challenging, yet quite realistic issue.

■ **WC34**

Hilton- Union Sq 14

Performance Measurement 1

Contributed Session

Chair: Ekaterina Koromyslova, Assistant Professor, South Dakota State University, Box 2223, Solberg Hall 206, Brookings, SD, 57007, United States of America, Ekaterina.Koromyslova@sdstate.edu

1 - De-Risking Business Decisions through Experimentation
Callyn Giese, Marketing Coordinator, Applied Predictive Technologies, 901 North Stuart Street, Suite 1000, Arlington, VA, 22203, United States of America, cgiese@predictiveTechnologies.com

APT is the world's largest purely cloud-based predictive analytics software company. APT's Test & Learn software is revolutionizing the way Global 2000 companies harness their Big Data to accurately measure the profit impact of advertising, marketing, pricing, merchandising, operations and capital initiatives, tailoring investments in these areas to maximize ROI.

2 - An Empirical Examination: Leadership and Dynamic Capabilities Influence on Performance
Zhe Yu Zhang, University of Science and Technology of China, School of Management, Hefei, China, zhufeng@mail.ustc.edu.cn

The article elaborates the process influence mechanism of firm performance output and sum up the regularity, which based on the two perspectives of dynamic capabilities and leadership. Though factorial analysis and structural equation modeling test the relationship among leadership, dynamic capabilities and firm performance; multiple group structural equation modeling verify life cycle and dynamic environment have controlling and moderating effects between these path relationships.

3 - Applied Activity-Based Budgeting Model for a University Department within Decentralized Budgeting
Ekaterina Koromyslova, Assistant Professor, South Dakota State University, Box 2223, Solberg Hall 206, Brookings, SD, 57007, United States of America, Ekaterina.Koromyslova@sdstate.edu, Gary Hatfield

Nowadays, universities strive to remain cost effective in the face of increasing expenses and diminishing support. An applied activity-based budgeting and cost management model for budgeting, strategic planning, and operational analytics allows administrators to be better informed about the effectiveness of the department's business activities while decreasing time and effort in transition towards a new decentralized budgeting and cost management system.

4 - Predictive Cost Analysis Model for Buildings:
A Decision-Making Tool

Basima Abdulrahman, Graduate Assistant, Auburn University, 238 Harbet Engineering Center, Auburn University, Auburn, AL, 36849, United States of America, haa0003@auburn.edu, Haitham Eletrabi

The bills of quantities of the construction materials and the related budget have been a major headache for Civil Engineers for a long time. In this paper, we offer an innovative and simple technique for civil engineers and house owners to accurately estimate the construction costs. The proposed model use specific demographics and design related factors to calculate a detailed bill of quantities and construction budget that streamlines the decision making process in the construction industry.

5 - A Game Theoretical Approach to Modeling Energy Consumption
with Consumer Preference

Guangyang Xu, University of Louisville, 2727 Riedling Dr Apt 7, Louisville, KY, 40206, United States of America, guangyang.xu@louisville.edu, Lihui Bai, Qipeng Zheng

We propose a new game theoretical equilibrium model to analyze residential users' electricity consumption behavior in smart grid where energy usage and price data are exchanged between users and utilities via advanced communication. Consideration is given to users' possible preference on convenience over cost-saving under the real-time pricing in smart grid, and each user is assumed to have a preferred time window for using a particular appliance.

■ WC35

Hilton- Union Sq 15

Fire and Emergency Medical Services

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Laura McLay, Associate Professor, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, lmclay@wisc.edu

1 - A Stochastic Approach for Modeling Wildfire Propagation

Mohammad Hajian, Northeastern University, Dept. of Mechanical and Industrial Eng., Northeastern University, Boston, MA, 02115, United States of America, mhajian@coe.neu.edu, Peter Kubat, Emanuel Melachrinoudis

Wildfires can have significant economic and social impact. Predicting the fire propagation enables fighting the fire effectively and in a timely manner. In this research, a stochastic approach for modeling surface wildfire propagation is presented. Two different methodologies are developed to (a) find the probability distribution of the fire arrival time to a point of interest and (b) find the fire forefront stochastic contours.

2 - Allocation Models for Competition among Ambulance Services

Lavanya Marla, University of Illinois at Urbana- Champaign, Champaign, IL, United States of Americalavanyam@illinois.edu, Praveen Tumuluri

We consider a setting where multiple ambulance services compete to serve a population. Such settings have been observed in emerging economies where 911-type services are just being set up, which compete with existing ad-hoc services; as well as in cities like New York, where multiple EMS services exist. We demonstrate the opportunity costs occurring due to competition, and discuss game-theoretic models for better ambulance utilization. We conclude with results from a real-world case study.

3 - Spatial Analysis of Cardiac Arrests

Derya Demirtas, University of Toronto, 5 King's College Rd., Toronto, On, M5S 3G9, Canada, demirtas@mie.utoronto.ca, Roy H. Kwon, Timothy C. Y. Chan

Sudden cardiac arrest is a major public health problem. In this talk, we discuss statistical approaches such as intra-class correlation and kernel density estimation to analyze the stability of cardiac arrests in time and space, and estimate a spatial distribution of cardiac arrests. The resulting risk map provides insights on resource allocation decisions such as identifying the most appropriate areas for community CPR training or determining the placement of AEDs.

4 - A Budgeted Maximal Covering Problem for Reducing
Cyber-security Vulnerabilities

Kaiyue Zheng, University of Wisconsin-Madison, Madison, Wi, 53706, United States of America, kzheng23@wisc.edu, Laura McLay

This talk will discuss a cyber-security planning application for securing global information technology (IT) supply chain from the myriad of cyber-security risks and vulnerabilities that exist. We propose a budgeted maximal covering problem for selecting cyber-security mitigations and will introduce integer programming models and greedy approximation algorithms for identifying optimal and near-optimal solutions.

■ WC36

Hilton- Union Sq 16

Humanitarian Operations in a Response Supply Chain

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Aruna Apte, Associate Professor, Naval Postgraduate School, 555 Dyer Road, Monterey, CA, 93940, United States of America, auapte@nps.edu

1 - Model of Supply Chain Vulnerability for Fresh Produce

Cameron MacKenzie, Assistant Professor, Naval Postgraduate School, 699 Dyer Rd., Bldg 234, Monterey, CA, 93940, United States of America, camacken@nps.edu, Aruna Apte

Fresh produce supply chains are highly vulnerable to contamination. Factors that influence the vulnerability of these supply chains include the perishability of the product, the supply chain structure, possible exposure to contamination, the ability to trace the source of contamination within the supply chain, and communication. We model these factors to explore how the interplay of these factors impacts vulnerability.

2 - Decision Model for Planning of Pilot Training Supply Chain

Uday Apte, Professor, Naval Postgraduate School, GSBPP, 555 Dyer Road, Monterey, CA, 93943, United States of America, umapte@nps.edu, John Khawam, Murat Mise

The pilot training process in the U.S. Department of Defense is structurally similar to a physical supply chain; each step serves as the supplier of partially trained pilots to the next step. By combining a LP model, a Markovian forecast and a new performance metric, we develop a decision model that balances cost with readiness in planning for pilot training supply Chain. We illustrate the proposed decision model using the training supply chain for F-16 pilots.

3 - The Self-sufficient Marine Problem

Aruna Apte, Associate Professor, Naval Postgraduate School, 555 Dyer Road, Monterey, CA, 93940, United States of America, auapte@nps.edu, Jay Simon, Eva Regnier

Marines engage in a wide variety of expeditionary operations, and must function without logistical support for long stretches of time. They face many constraints, including the amount they can physically carry, mission requirements, resources needed for sustainment, and the extent to which resources can be shared. In this work, we develop an optimization model for the self-sufficient Marine problem and examine the impacts of reducing the needed amounts of certain resources.

4 - Avoiding Tropical Cyclones in Automated Naval Logistics Planning

Walt DeGrange, CDR, Naval Postgraduate School, wcdegran@nps.edu, Steven Lantz, Eva Regnier

The US Navy's Combat Logistics Force (CLF) provides at-sea resupply to US and allied vessels throughout the world. The CLF scheduling system anticipates demand and schedules 45 days in advance to meet demand. Tropical cyclones (TCs) frequently disrupt these plans, requiring diversions, and inefficient steaming speeds. We evaluate the impact of using TC forecasts in operational planning, and the best lead time and geographic extent of severe weather to use in optimizing CLF operational planning.

■ WC39

Hilton- Union Sq 19

Operations Research Methods for Cancer Care

Sponsor: Health Applications
Sponsored Session

Chair: Christine Barnett, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, United States of America, clbarnet@umich.edu

1 - Developing Optimal Biomarker-Based Screening Policies using
Reinforcement Learning

Christine Barnett, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, United States of America, clbarnet@umich.edu, Scott Tomlins, Todd Morgan, James Montie, John Wei, Brian Denton

Recent advances in the development of new biomarker tests, which physicians use for the early detection of cancer, have the potential to improve patient survival by catching cancer at an early stage. Q-learning methods were used to develop optimal screening policies, in terms of patient outcomes, for new prostate cancer biomarker tests. Numerical results based on a large clinical dataset will be used to draw insights about optimal screening policies.

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2 - Health and Economic Outcomes of Alternative Follow-up Strategies in Lung Cancer Screening
Ayca Erdogan, University of Southern California, Los Angeles, CA, United States of Americaserdogan@usc.edu

USPSTF recently recommended that heavy-smokers between ages 55 and 80 to be screened annually with CT for lung cancer early detection. However, there are no guidelines on decisions to be made following a positive screening exam. Previous guidelines on nodule follow-up strategies were made before the screening recommendations, thus, need to be renewed. Using a validated micro-simulation model, we aim to analyze the impact of different follow-up strategies on health and economic outcomes.

3 - Individualized Decision Analysis for Prostate Cancer Treatments in the Genomic Era
Jennifer Mason, Assistant Professor, University of Virginia, 1300 Jefferson Park Avenue, Charlottesville, VA, 22908, United States of America, jem4yb@virginia.edu, Timothy Showalter

We present a decision analysis model to evaluate the effectiveness of a genomic classifier of risk of cancer progression as a determinant of decisions for post-prostatectomy prostate cancer treatments, compared to decisions in the absence of the genomic test. We use Monte Carlo simulation to estimate life years, quality-adjusted life years, and 5 and 10 year estimates of cancer progression outcomes for a cohort of patients using individual genomics-based cancer progression risk estimates.

4 - Optimizing Public Health Spending for Cancer Screening with a Focus on Health Outcomes
David Cornejo, North Carolina State University, Raleigh, NC, United States of America, dacornej@ncsu.edu, Maria Mayorga, Kristen Hassmiller Lich

For colorectal cancer and other chronic diseases, health outcomes may be improved through improved screening behavior. Health officials need to choose how to allocate limited public health budget to interventions that change individuals' choice to screen. We develop methods to optimize the allocation of a fixed public health budget across individuals' life course. This allocation accounts for the time-varying dynamics of disease as represented by a simulation model of colorectal cancer.

■ **WC40**

Hilton- Union Sq 20

New Models of Health Care Delivery: Reengineering for Efficient, Effective Care

Sponsor: Health Applications
Sponsored Session

Chair: David Hopkins, Senior Advisor, Pacific Business Group on Health, 575 Market St., Suite 600, San Francisco, CA, 94105, United States of America, dhopkins@pbgh.org

Co-Chair: Feryal Erhun, Stanford University, CERC, Stanford, CA, United States of America, ferhun@stanford.edu

1 - Transforming Ambulatory Surgical Care: Triple-R Model
Feryal Erhun, Stanford University, CERC, Stanford, CA, United States of America, ferhun@stanford.edu, Kimberly Brayton, Maziyar Kalani, Christine Nguyen

We present our Triple-R ambulatory surgical care model, which is designed to lower costs associated with ambulatory surgery in the United States, a sector experiencing one of the fastest growth rates and accounting for 8% of the 2.3 Trillion in domestic healthcare spending. We outline the current challenges that contribute to excessive spending, suggest our solutions to those challenges, and report our cost impact projections of these solutions.

2 - Reducing Wait Times for New Patient Chemotherapy Consults
Martin Puterman, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, martin.puterman@sauder.ubc.ca, Scott Tyldesley, Emma Liu, Claire Ma, Leah Weber, Antoine Sauré, Marianne Taylor

We describe our study of the impact of scheduling rules and oncologist capacity on wait times for new patient consults. We show that in a highly capacitated system scheduling rules have little impact on service levels. In view of this, we determine the number of additional new patient consults needed by specialty to achieve target service levels. Furthermore, we describe models for investigating the impact of new patient consults on downstream oncologist workload and panel size.

3 - Surgical Care in United States vs. India
Dhruv Kazi, UCSF. University of California, San Francisco, CA, United States of Americakazi@ucsf.edu

Coronary Artery Bypass Grafting (CABG) is believed to cost the most efficient U.S. hospitals about $30,000 to produce. The same operation reportedly costs Narayana Hospital in India under $2,000. In this talk, we discuss the underlying reasons of this cost difference. We also share how learnings from India can be used to develop new surgical care models to decrease U.S. health spending and improve surgical outcomes.

■ **WC41**

Hilton- Union Sq 21

Supply Chain Management IV

Contributed Session

Chair: Kurt Masten, PhD Candidate, Drexel University, Gerri C Lebow Hall, 3220 Market Street, Philadelphia, PA, 19104, United States of America, kam478@drexel.edu

1 - Exploration versus Exploitation of Trust: Strategic Behavior in Cooperative Relationships
Maryam Razeghian Jahromi, Doctoral Assistant, EPFL, EPFL CDM MTEI OES, ODY 4 16 (Odyssea) Station 5, Lausanne, 1015, Switzerland, maryam.razeghianjahromi@epfl.ch, Thomas Weber

This paper sheds light on the dynamics of trust in repeated bilateral interactions. At each time period, a decision maker learns about the cooperative behavior of a business partner and decides whether or not to continue the relationship based on her updated beliefs about the counterparty's objectives. We analyze how the duration of the relationship changes when the business partner anticipates and strategically distorts the informational consequences of his actions.

2 - Supply Chain Coordination under Asymmetric Information and Demand Updates
James Cao, University of Saskatchewan, 215 209 Willis Crescent, Saskatoon, SK, S7T0L8, Canada, cao@edwards.usask.ca

We explore the role of forecast updating in a supply chain with asymmetric demand information. A supplier sells to a downstream retailer who benefits from demand updates each period. Although the supplier is higher up on the supply chain and therefore unable to observe demand in each period, it is possible for the supplier to infer the state of demand through the retailer's ordering activity. We show that it is in the best interests of the retailer to not share her information.

3 - An Inventory-Production System Subject to Production Constraints and Variable Target Inventory
Mohammadreza Parsanejad, PhD Candidate, Keio University, Department of Administration Engineering, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Kanagawa, Yokohama, 223-8522, Japan, parsanejad2011@gmail.com, Hiroaki Matsukawa

In Inventory and Order Based Production Control System (IOBPCS) there is no limitation for manufacturing line to produce items while in the real world there are production constraints. The extended version of IOBPCS subject to production constraints with fixed target inventory has been analyzed in recent years. In this paper we aim to analyze the nonlinear IOBPCS which is called NIOBPCS with production constraints for variable target inventory levels.

4 - The Value of Dual-sourcing in a Supply Chain
Isik Bicer, Mr., University of Lausanne, Quartier UNIL-Dorigny, Batiment Anthropole, Lausanne, 1015, Switzerland, isik.bicer@unil.ch, Suzanne De Treville, Valerie Chavez

We consider a dual-sourcing model where a buyer purchases its products from two different suppliers. We apply extreme-value theory and analyze the effects of tail behavior of demand distribution on the optimal sourcing policy. Combining product-flexibility and dual-sourcing models, we develop a framework that shows effective sourcing strategies for different product characteristics.

5 - The Case for 3rd Party Supply Chain Coordination
Kurt Masten, PhD Candidate, Drexel University, Gerri C Lebow Hall, 3220 Market Street, Philadelphia, PA, 19104, United States of America, kam478@drexel.edu, Seung-Lae Kim

Supply chain coordination (SCC) has been an area of intense interest from multiple perspectives. Some focus on coordination mechanisms while others explore methodology and experience. Little research has attempted to bridge these separate streams of research in a meaningful way. A proposal is made to use an independent and neutral third party to address the low application rates of the many techniques available in the literature. A model is developed and payment options explored.

■ WC42

Hilton- Union Sq 22

HSEA - III - Undergraduate Student Research Presentation

Sponsor: Health Applications
Sponsored Session

Chair: Andy Banerjee, Texas A&M University, 3131 TAMUS, College Station, TX, 77843, United States of America, banerjee@tamu.edu

1 - HSEA undergraduate Student Research Presentation
Andy Banerjee, Texas A&M University, 3131 TAMUS, College Station, TX, 77843, United States of America, banerjee@tamu.edu

This session provides a forum for undergraduates and masters student to present the results of their applied research in healthcare applications of operations research and management science. The focus is on problem definition and scoping, data analysis, modeling, and ñ where appropriate ñ lessons learned from piloted implementations.

■ WC43

Hilton- Union Sq 23

Constraint Programming

Sponsor: Computing Society
Sponsored Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

1 - Scheduling Home Health Care with Separating Benders Cuts in Decision Diagrams
John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, United States of America, jh38@andrew.cmu.edu, Andre Augusto Cire

We schedule home health care delivery with a logic-based Benders method in which the master problem is a decision diagram and the subproblem is a constraint programming problem. Benders cuts are implemented with a novel separation algorithm for the decision diagram.

2 - Insights into Parallelism with Intensive Knowledge Sharing
Horst Samulowitz, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, United States of America, samulowitz@us.ibm.com, Ashish Sabharwal

Novel search space splitting techniques have recently been successfully exploited in parallelizing Constraint Programming and MIP solvers. We use universal hashing to extend existing approaches to a generalized setting. We show that such static splitting approaches are not as effective when intensively sharing knowledge. Finally, there exists a surprising tradeoff between communication cost for knowledge sharing across nodes and cost incurred by the computational load per node.

3 - A CP-Based Branch-and-Price-and-Cut Approach for Operating Room Planning and Scheduling
Louis-Martin Rousseau, Professor, CIRRELT - Polytechnique Montréal, CP 6079 Succ Centre-Ville, Montréal, QC, H3C 3A7, Canada, Louis-Martin.rousseau@polymtl.ca, Seyed Hossein Hashemi Doulabi, Gilles Pesant

We study integrated planning and scheduling of operating rooms. The problem is formulated as a mathematical programming model and a branch-and-price-and-cut algorithm is developed based on a constraint programming model to solve the subproblem. Some dominance rules and a fast infeasibility checking criterion based on a multidimensional knapsack problem are also developed which effectively improve the efficiency of the constraint programming model.

4 - Integrating CP, MIP and Decision Diagrams for the Time-Dependent TSP
Joris Kinable, KU Leuven, Gebroeders de Smetstraat 1, Gent, 9000, Belgium, joris.kinable@kuleuven.be, Andre Cire, Willem-Jan van Hoeve

The Time-Dependent Traveling Salesman Problem (TD-TSP), is a generalization of the well-known TSP where the travel times between cities are dependent on the order or time the cities are visited. This work presents an integrated solution procedure for the TD-TSP, thereby unifying Constraint Programming (CP), Mixed Integer Programming (MIP) and Decision Diagrams into a single framework. Experimental results indicate significant performance improvements over dedicated MIP or CP approaches.

■ WC44

Hilton- Union Sq 24

IT in Healthcare and Education

Sponsor: Information Systems
Sponsored Session

Chair: Rohit Aggarwal, Assistant Professor, University of Utah, 221 B Connor Road, Salt Lake City, UT, 84113, United States of America, Rohit.Aggarwal@business.utah.edu

1 - What Drives Quality Academic Exchanges in the Online Classroom?
Aravinda Garimella, PhD Student, University of Washington, 350 Mackenzie Hall, Seattle, WA, 98105, United States of America, aravinda@uw.edu, Ming Fan

The pedagogical benefits of academic dialogue amongst students have long been acknowledged in the collaborative learning literature. With the advent of massive open online courses (MOOCs), there has been debate on whether MOOCs can achieve deep and meaningful interaction as effectively as brick-and-mortar classrooms do. We empirically investigate the mechanics of academic exchange between students learning mathematics via micro-lectures on one of the pioneer websites in the K-12 MOOC space.

2 - Adverse Drug Effects and Drug Effectiveness: Mining Social Media to Predict Perceived Effectiveness
Michael Lee, Doctoral student, University of Utah, 1182 West 200 North, Unit #b415, Centerville, UT, 84014, United States of America, michael.lee@business.utah.edu, Olivia Sheng

Each year, Adverse Drug Events (ADEs) cause thousands of fatalities and billions of dollars costs. Research suggests that patient education is key. The most accessible way for patients to get drug and ADE information is social media / online drug review sites. Social media can provide insights to patients' perceptions of ADEs and drug effectiveness. This research evaluates patients' perceptions of drug effectiveness using text mining, and sentiment analysis techniques of social media posts.

3 - Investments-adjusted Cost Sensitive Learning for Medical Decision Making
Yuanyuan Gao, Doctoral student, University of Utah, 131 South 1000 East, Apt 18, Salt Lake City, UT, 84102, United States of America, yuanyuan.gao@business.utah.edu, Xiao Fang, Paul Hu

This study designed an Investment adjusted cost sensitive learning (IACSL) method to reduce the total misclassification costs. We tested our method empirically on the weaning problem. The weaning has been proven to be a very challenging problem in ICU intensive care.Our results demonstrated that integrated with appropriate investments and reasonable reduction in costs, IACSL could achieve a better classification solution with lower costs.

■ WC45

Hilton- Union Sq 25

Behavioral Operations 1

Contributed Session

Chair: Jeannette Brosig-Koch, Universitat Duisburg-Essen, Universitatsstrafle 12, Essen, 45117, Germany, jeannette.brosig-koch@ibes.uni-due.de

1 - Promises and Social Distance in Buyer-Determined Procurement Auctions
Timo Heinrich, Universitat Duisburg-Essen, Forsthausweg 2, Duisburg, 47057, Germany, timo.heinrich@ibes.uni-due.de, Jeannette Brosig-Koch

This study explores the effects of communication and its interaction with reputation information in buyer-determined procurement auctions with moral hazard. The results of our laboratory experiment demonstrate that ñ in contrast to reputation information ñ communication only slightly increases market efficiency. Buyers' choice of a bidder is influenced by both, reputation information and communication. In the field we find a choice pattern that is consistent with our lab data.

2 - Running Behavioral Operations Experiments in Online Labor Markets

Yong Won Seo, Associate Professor, Chung-Ang University, 84 Heukseok-Ro, Dongjak-Gu, Seoul, Korea, Republic of, seoyw@cau.ac.kr, Yun Shin Lee

Online labor markets provide an ideal platform for conducting behavioral experiments because experimental results can be produced more quickly, cheaply, and easily. We review recent research about online labor markets and demonstrate the validity of online experiments in the field of behavioral operations. To this end, we replicate the seminal newsvendor experiment using Amazon's Mechanical Turk (MTurk) and show that online subjects on MTurk behave similarly to subjects in physical laboratories.

3 - Cognition versus Computational Power in High-volume Store Replenishment Decisions

Antti Tenhiala, IE Business School, Calle de Maria de Molina 12, 5, Madrid, 28006, Spain, antti.tenhiala@ie.edu, Shivom Aggarwal

Using longitudinal data from a multi-site implementation of automatic store replenishment (ASR) software in a retail supply chain, this study investigates the factors that explain the performance effects of human decisions to deviate from the recommendations of the ASR software. For practitioners, the results show when to restrain and when to encourage deviations. For the theory, the results elaborate the relative strengths and weaknesses of cognition and computational power in decision making.

4 - An Experimental Study of Posted Prices

Seungbeom Kim, University of Southern California, 950 South Flower Street #706, Los angeles, CA, 90015, United States of America, seungbek@usc.edu, Sriram Dasu

We use laboratory experiments to gain insights into how customers make purchase decisions. We find that the quantal response model provides a more accurate description of customers' decisions. If decision making is consistent with our experimental findings, then pricing models that are based on the assumption that customers are rational expected utility maximizers can result in significant loss in profitability. We also study how customers learn in these types of settings.

■ WC46

Hilton- Lombard

Advances in Theory and Computation of Integer Programming

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: Kiavash Kianfar, Texas A&M University, College Station, TX, United States of America, kianfar@iemail.tamu.edu

1 - Power Grid Visualization by Means of Optimization

Mingyang Di, Northwestern University, 2145 Sheridan Road, C210, Evanston, IL, 60208, United States of America, mingyangdi2012@u.northwestern.edu, Diego Klabjan, Esa Rantanen

The operators in electric power system control centers play a crucial role in ensuring the integrity of the nation's electric grid. Thus, the task to optimize the layout of visual elements on the display interface is of vital importance. To this end, algorithms using several optimization techniques are proposed to make the interface less cluttered subject to human perceptual and cognitive capabilities. We report our findings based on a real-world power grid in US.

2 - A Few Strong Knapsack Facets

Sangho Shim, Research Associate, Kellogg School of Management, 2001 Sheridan Road, Suite 548, Evanston, IL, 60208, United States of America, shim@kellogg.northwestern.edu, Sunil Chopra, Wenwei Cao

We perform the worst case analysis for the knapsack facets with coefficients equal to multiples of $1/k$. The worst case analysis shows that a few facets of small k are strongest and facets of larger k are weaker. We define the $1/k$-facets up to k equal to 4.

3 - Continuous n-mixing: A Unified Framework for Lot-sizing, Facility Location & Network Design Problems

Manish Bansal, Ph.D. Candidate, Department of Industrial and Systems Engineering, Texas A&M University, 3131 TAMU, Texas A&M University, College Station, TX, 77843-3131, United States of America, bansal@tamu.edu, Kiavash Kianfar

We present facets of continuous n-mixing set with(out) bounded integer variables which we then utilize to develop new valid inequalities for multi-module lot-sizing, facility location, and network design problems. This research generalizes several existing concepts in cutting plane theory along with various well-known families of cuts for the aforementioned problems. We also present our computational results which show that our cuts (applied using our separation algorithm) are very effective.

4 - Improving the Tractability of a Nuclear Waste Disposal Optimization Problem

Benjamin Johnson, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, bebjohns@mines.edu, Alexandra M. Newman, Jeffrey King

We formulate an integer program that determines a methodical way to dispose of nuclear waste within a repository, using Yucca Mountain as a case study. We exploit the underlying network structure of the problem, address symmetry concerns, and eliminate unnecessary variables to expedite solutions for the objective: minimize the total weighted heat load of all 3x3 waste packages. We present results for this objective and extensions for two other objectives to reduce heat load hot spots.

■ WC47

Hilton- Mason A

Stochastic Optimization in a Data-Driven Context

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Ruiwei Jiang, University of Arizona, Engineering Building 310, University of Arizona, Tucson, AZ, 85721, United States of America, ruiweijiang@email.arizona.edu

1 - Robust SAA

Nathan Kallus, MIT, 77 Massachusetts Ave., E40-149, Cambridge, MA, 02139, United States of America, kallus@mit.edu, Dimitris Bertsimas, Vishal Gupta

We propose a tractable methodology for data-driven optimization, which enjoys strong asymptotic as well as finite-sample performance guarantees. The key to this is new theory that links sample average approximation of stochastic optimization, distributionally robust optimization, and statistical hypothesis testing. This also characterizes the asymptotic and finite-sample guarantees of existing data-driven procedures. We demonstrate numerically that our approach outperforms existing approaches.

2 - Distributionally Robust Discrete Optimization with Entropic Value-at-Risk

Daniel Zhuoyu Long, The Chinese University of Hong Kong, The CUHK, Hong Kong, Hong Kong - PRC, zylong@se.cuhk.edu.hk, Jin Qi

We study the discrete optimization problem under the distributionally robust framework. We optimize the Entropic Value-at-Risk, which is a coherent risk measure and is also known as Bernstein approximation for the chance constraint. We propose an efficient approximation algorithm to resolve the problem via solving a sequence of nominal problems. The computational results show that the number of nominal problems required to be solved is small under various distributional information sets.

3 - A Practically Efficient Framework for Distributional Robust Linear Optimization

Melvyn Sim, Professor, National University of Singapore, Singapore, Singapore, melvynsim@nus.edu.sg, Dimitris Bertsimas, Melin Zhang

We developed a modular framework to obtain exact and approximate solutions to a class of linear optimization problems with recourse with the goal to minimize the worst-case expected objective over a probability distributions or ambiguity set. We propose an approach to lift the original ambiguity set to an extended one by introducing additional auxiliary random variables.

4 - Risk-averse Two-Stage Stochastic Program with Distributional Ambiguity

Ruiwei Jiang, University of Arizona, Engineering Building 310, University of Arizona, Tucson, AZ, 85721, United States of America, ruiweijiang@email.arizona.edu, Yongpei Guan

We develop a risk-averse two-stage stochastic program (RTSP) taking into account the distributional ambiguity. We derive an equivalent reformulation for RTSP that applies to both discrete and continuous distributions. Also, the reformulation reflects its linkage with a full spectrum of coherent risk measures under varying data availability.

■ WC48

Hilton- Mason B

Optimization, Stochastic 1

Contributed Session

Chair: Majid Taghavi, McMaster University, 1280 Main St. W, Hamilton, L8S 4L8, Canada, taghavm@mcmaster.ca

1 - Optimal Policy for Attracting FDI: Investment Cost Subsidy versus Tax Rate Reduction
Yuan Tian, Ryukoku University, 67 Tsukamoto-cho, Fukakusa, Fushimi-ku, Kyoto, Japan, tian@econ.ryukoku.ac.jp

We examine two policies for a host government to attract FDI: investment cost subsidy and tax rate reduction. Taking into consideration the strategic interaction between foreign firms and the host government through value functions, we demonstrate that there exists a critical level of the growth rate (or volatility) of the profits: when the growth rate (or volatility) of the profits is lower than the critical level, investment cost subsidy is optimal; otherwise, tax rate reduction is optimal.

2 - A Stochastic Programming Approach to Satellite Ground Station Placement
Aaron Hoskins, Graduate Student, Mississippi State University, Industrial & Systems Engineering, Starkville, MS, United States of America, abh318@msstate.edu

Ground stations are needed for satellites to be able to download data. If the satellite's mission is to collect data after a natural disaster, then the optimal ground station location(s) will not be known before the disaster occurs. A stochastic programming approach is applied to find the optimal ground station placement when the ground stations must be built before the disaster site is known.

3 - Resolving MDP Problems with Misspecified Transition Matrices
Hao Jiang, University of Illinois at Urbana-Champaign, 117 TB 104 S. Mathews Ave., Urbana, United States of America, jiang23@illinois.edu, Uday Shanbhag

We consider a Markov decision process with no knowledge of the transition matrix. Our goal is to obtain the optimal value function and policy while simultaneously learning the misspecified transition matrix. Learning-enhanced value and policy iteration schemes are shown to be convergent. Finite-time error statements and preliminary comparisons are provided with Q-learning.

4 - Single Resource Stochastic Capacity Expansion with Multiple Sources of Capacity
Majid Taghavi, McMaster University, 1280 Main St. W, Hamilton, L8S 4L8, Canada, taghavm@mcmaster.ca, Kai Huang

We consider the multi-period single resource stochastic capacity expansion problem with spot market and permanent capacity available to the decision maker. The problem is modeled as a multi-stage stochastic integer program. We show the totally unimodularity property of the model and develop polynomial-time primal and dual algorithms to solve it.

■ WC49

Hilton- Powell A

3Rs of Networks: Restoration, Risk, and Replenishment

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Sarah Nurre, Assistant Professor, Graduate School of Engineering & Management, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, Sarah.Nurre@afit.edu

Co-Chair: Brian Lunday, Assistant Professor, Graduate School of Engineering & Management, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, brian.lunday@afit.edu

1 - Applying Ranking and Selection Procedures to Mitigation for Improved Infrastructure Restoration
Emily Heath, Rensselaer Polytechnic Institute, Department of Mathematical Sciences, Troy, NY, United States of America, heathe@rpi.edu, Thomas Sharkey, John Mitchell

We seek to determine for a network the single arc mitigation plan that contributes the most to the expected restoration of the network over different damage scenarios using ranking and selection (R&S) procedures. We find that R&S procedures are competitive with standard statistical tests in terms of the level of confidence achieved and often reduce the required computational effort. Current and future research examines how these methods can be scaled for multiple-arc plans.

2 - Risk-based Decision Support for Mass Casualty Incident Response
Behrooz Kamali, PhD Candidate, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, kamali@vt.edu, Douglas Bish

In this research, we systematically coordinate the response to a mass-casualty incident using optimization. Using our optimization models, we analyze the structure of the optimal response. We then structure the model to allow large problems to be solved in an operational timescale. The solutions we develop are response plans that reduce casualty risk by effectively using regional resources (e.g., emergency vehicles and hospitals) to transport and treat casualties.

3 - Information-Sharing in Interdependent Network Restoration
Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Instittute, 110 8th Street CII 5108, Troy, NY, 12180, United States of America, sharkt@rpi.edu, Burak Cavdaroglu, Huy Nguyen, Jon Holman, John Mitchell, William Wallace

We consider the problem of restoring multiple disrupted infrastructure networks after an extreme event. Each network has its own restoration resources that will repair damage done to its components in order to bring services back online. This work analyzes the loss in restoration effectiveness resulting from decentralized restoration efforts across networks and how information-sharing can reduce this loss. Computational results based on realistic damage scenarios to networks are presented.

4 - The Aircraft Network Routing Problem with Aerial Refueling Requirements
Brian Lunday, Assistant Professor, Graduate School of Engineering & Management, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, brian.lunday@afit.edu, Sarah Nurre, Tanya Kannon, Raymond Hill

We present three formulations to solve the aircraft routing problem with aerial refueling: two MINLPs and an MILP. We discuss the formulations' equivalence using transformations to the underlying network structure and/or a separation of routing decisions via their temporal sequence, as well as the formulations' relative sizes, and we analyze their performance in solving a battery of tests instances representing combinations of network size and frequency of aerial refueling point availability.

■ WC50

Hilton- Powell B

Optimization, Integer 3

Contributed Session

Chair: Marco Luebbecke, Professor, RWTH Aachen University, Operations Research, Kackertstrafle 7, Aachen, 52072, Germany, marco.luebbecke@rwth-aachen.de

1 - A New Metric for Parental Selection in Plant Breeding
Ye Han, Iowa State University, 235 Sinclair Ave, Unit 211, Ames, IA, 50014, United States of America, yeh@iastate.edu, William D. Beavis, John N Cameron, Lizhi Wang

With the application of operations research, we developed a new metric, parental breeding value (PBV), based on application of conditional probability distribution and integer programming to help to solve the parental selection problem to accelerate the process of plant breeding and save resources at the same time. From the results of simulations, the PBV metric is demonstrated to shorten the plant breeding process and decrease the resources costs.

2 - Multi Objective Branch and Bound Algorithm
Ozgu Turgut, OR Scientist, Wayne State Uni., 1230 Wisteria Drive Apt 321, A321, Ann Arbor, MI, 48104, United States of America, ozgu.turgut@gmail.com, Alper Murat

This algorithm can be used in order to obtain full Pareto front as well as a representative set generation algorithm for multi-objective integer optimization type of problems(MOIP). Branching is performed on solution points on objective space. Standard concepts of B&B has been investigated and explained within the multi objective optimization context such as fathoming, node selection, heuristics, as well as MOIP specific concepts like filtering, non-domination probability, parallel running.

3 - Separation of Generic Cutting Planes in Branch-and-Price using a Basis
Marco Luebbecke, Professor, RWTH Aachen University, Operations Research, Kackertstrafle 7, Aachen, 52072, Germany, marco.luebbecke@rwth-aachen.de, Jonas Witt

Dantzig-Wolfe reformulation on an integer program may lead to stronger relaxations. A fractional solution to the reformulated program translates to the original program, but usually does not constitute a basic solution. This hinders us from separating cutting planes like Gomory mixed integer cuts which rely on a basis. We check what the literature offers for this defect and propose remedies. We give computational experience with our implementation, which is the first of this kind.

4 - Bilevel Optimization for Capacity Expansion with Rational Markets
Pablo Garcia-Herreros, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, pgarciah@andrew.cmu.edu, Pratik Misra, Erdem Arslan, Sanjay Mehta, Ignacio E. Grossmann

Capacity expansion is usually formulated without considering the influence of markets or the role of providers. We formulate the problem as a mixed-integer bilevel LP that models the rational behavior of markets. The upper level maximizes profit by establishing the expansion plan; the lower level is an LP that minimizes total market cost. A single-level reformulation is obtained using strong duality of the lower level LP. An example from the industrial gas industry is used for illustration.

■ WC51

Hilton- Sutter A

Game Theory 1

Contributed Session

Chair: Vyacheslav V. Kalashnikov, Associate Professor, Dr., Tecnologico de Monterrey (ITESM), Campus Monterrey, 2501 Av, Eugenio Garza Sada South, Monterrey, NL, 64849, Mexico, slavkamx@gmail.com

1 - Co-development of Tests for New Drugs with Risk Averse and Risk Seeking Agents
Jianbo Qian, Ivey, Western University, London, Canada, jqian42@uwo.ca

We study optimal contract structures between a pharmaceutical company and a companion diagnostics company to co-develop a new test. We use a principal/agent framework, where the pharmaceutical company is the principal and invest in the development, and the companion diagnostics company is the agent and supplies effort. We use a general form for the utility function to investigate the cases risk-neutral/averse/seeking agents.

2 - Strategic Behavior in Limited Price Auctions
Xiaodong Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, xzhangas@ust.hk, Qi Qi, Zhou Chen

Vickrey auction has been a favourite among market makers for its simplicity and truthfulness. There are, however, other considerations in various markets that change the requirements. We discuss fairness and equilibrium in those markets beyond the simple setting of an auction.

3 - Dual-licensing Strategy for Software Companies
Ying Liu, Xi'an Jiaotong University, No. 28, Xianning Road, Beiling District, Xi'an, China, liuyingleyna@stu.xjtu.edu.cn, Xiuwu Liao

Open source software brings new business models while posing a great threat to commercial software. To leverage innovation benefits from community and make profits at the same time, some companies adopt dual-licensing strategy which means software is licensed under both open source and commercial license. When the software is used for profit, users have to pay for the commercial license; otherwise they don't. The paper studies when it's profitable to adopt this strategy and how to employ it.

4 - Consistent Conjectures in Oligopoly are Optimal Cournot-Nash Strategies in the Upper Level Game
Vyacheslav V. Kalashnikov, Associate Professor, Dr., Tecnologico de Monterrey (ITESM), Campus Monterrey, 2501 Av, Eugenio Garza Sada South, Monterrey, NL, 64849, Mexico, slavkamx@gmail.com, Vladimir A. Bulavsky, Nataliya I. Kalashnykova

Properties of consistent conjectural variations equilibrium developed for oligopolistic markets of a single commodity are examined. In general, consistent conjectures are distinct from those of Cournot-Nash. Now define an upper level game with the same agents as in the original oligopoly but with the conjectures playing the role of the agents' strategies. Then the consistent conjectures of the lower level (original) game provide for the Cournot-Nash optimal strategies for the upper level game.

■ WC52

Hilton- Sutter B

Optimization, Linear Programming 1

Contributed Session

Chair: Davood Shamsi, Stanford University, 469 Ruthven Ave, Apt B, Palo Alto, CA, 94301, United States of America, davood@stanford.edu

1 - A Parametric Programming Approach to Consensus Clustering Gene Expression Profile Data
Victoria Ellison, Ph.D. Student, North Carolina State University, 2500 Stinson Drive, Raleigh, NC, 27695, United States of America, vmelliso@ncsu.edu, Yahya Fathi, Amy Langville

A new method of consensus clustering is proposed and applied to gene expression analysis. Resembling hierarchical clustering methods and based on parametric linear programming and sensitivity analysis, the approach offers a method for discovering clustering results of different cluster sizes. It also provides a metric of closeness between objects and clusters. A new algorithm is also proposed to more efficiently solve problems parametric programming problems with redundant constraints.

2 - Online Resource Allocation in Display Advertising
Davood Shamsi, Stanford University, 469 Ruthven Ave, Apt B, Palo Alto, CA, 94301, United States of America, davood@stanford.edu, Yinyu Ye

We study online impression allocation in display advertising using a real data set. At the first step, allocation algorithm is guided by the estimated dual prices. Next, we propose a risk minimization framework for updating dual prices on the fly. As impressions arrive, they are allocated to advertisers such that a risk measure is minimized. Using a real data set with 700 advertisers and millions of impressions, we show enforcing an exponential penalty function results in a higher revenue.

3 - The Unit Commitment Model for Power Interruption Contracts
Lakshmi Palaparambil Dinesh, Graduate Assitant, The University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221, United States of America, lakshmi603@gmail.com, Jeffrey Camm

The term unit commitment implies which generating units within an electric power plant should be operational during a particular time period. One of the costs involved in power generation and distribution is the cost the supplier will have to incur by signing up for an interruption contract with the customers. The model aims to understand when the power interruption contacts should be executed by the supplier and how they could lead to overall cost minimization.

4 - Production Scheduling Considering Energy Consumption
Mostafa Ghafoorivarzaneh, Student, University of Tennessee - Department of Industrial and Systems Eng., 610 Sutherland View Way, Apt# 735, Knoxville, Te, 37919, United States of America, mghafoor@utk.edu, Rapinder Sawhney

A considerable part in production cost is energy cost, but in most of production scheduling optimizations this part has been disregarded. In this study in addition to traditional scheduling terms, the following energy parts have been considered: Energy consumption for producing each item, Energy consumption for start-up, Idle energy consumption, Energy consumption for changing setup between production types. The cost has been minimized considering hourly fluctuations of electricity cost.

5 - Optimizing Boat Hull and Deck Mold Storage Scheduling with Linear Programming Based on the Production
Tron Dareing, Student, University of Tennessee - Department of Industrial and Systems Eng., 512 John D. Tickle Building, 851 Neyland Drive, Knoxville, Te, 37996, United States of America, tdareing@utk.edu, Rapinder Sawhney, Mostafa Ghafoorivarzaneh

This research has been done on linking the production schedule with hull and deck mold storing using bi-level optimization. In this case, there was a limited amount of space to store boat molds inside. Outside storage will result in more damages and more frequent repair times. In order to decrease the non-value added time of the maintenance and transportation, a linear model was developed which synced the mold storage with the production schedule.

■ WC53

Hilton- Taylor A

Finance

Contributed Session

Chair: Sandeep Juneja, Professor, Tata Institute of Fundamental Research, HB Road, Colaba, Mumbai, 400005, India, juneja@tifr.res.in

1 - Financial Market Risk over a Period of Time and its Indicator

Chunhui Xu, Professor, Chiba Institute of Technology, Tsudanuma 2-17-1, Narashino, 275-0016, Japan, joh.haruki@gmail.com

Risk indicators for financial market risk had been focused on the risk at a certain future time spot, the risk over a period of time has not been reflected. This talk will introduce our study aiming at filling this gap. I will introduce the notion of period value at risk(PVaR), which was proposed for measuring the risk during a period of time, and the methods we proposed for computing PVaR of an investment.

2 - Multi Armed Bandit Sampling in Nested Portfolio Risk Measurement

Sandeep Juneja, Professor, Tata Institute of Fundamental Research, HB Road, Colaba, Mumbai, 400005, India, juneja@tifr.res.in, Ankush Agarwal, Nahum Shimkin

We consider estimating probability that portfolio loss exceeds a large threshold within a time horizon when the portfolio comprises of diverse financial securities and its value at any state-time is a conditional expectation that needs simulation estimation. We develop a multi armed bandit based sampling method to determine whether at any time loss exceeds specified threshold. For this we also develop computation lower bounds and show that proposed method matches them up to the first order.

3 - Nonparametric Models for Predicting Credit Default Swap Prices: Empirical Study

Youngdoo Son, Dept. of Industrial Eng./Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, 151-744, Korea, Republic of, hand02@snu.ac.kr, Jaewook Lee, HyeongMin Byun

In this study, we investigate the out-of-sample prediction performance of non-parametric machine learning models for credit default swap (CDS) prices. The comparisons were performed on the real market CDS prices including the period of global financial crisis. Also to verify the statistical performance of various models, we compared the statistical differences between the compared methods and tested the predictive performance of several time step ahead forecasting of time series.

4 - Discrete-Event Simulation of Financial Market Dynamics

Vitali Volovoi, Independent Contractor, 505 Birchington Close, Alpharetta, GA, 30022, United States of America, vitali@volovoi.com

Quality of the financial markets is analyzed by means of discrete-event simulations. Model construction and visualization is performed using a new framework, Abridged Petri Nets (APNs). The focus of the presented models is on understanding the underlying market dynamics and on the relationship among the various market quality measures. In particular, impacts of various types of traders on the market liquidity and the market's resilience to external shocks are investigated.

■ WC54

Hilton- Taylor B

Financial Regulation and Risk Management

Sponsor: Financial Services Section

Sponsored Session

Chair: Xianhua Peng, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, maxhpeng@ust.hk

1 - Network Effects on Risk and Asset Prices

John Birge, Jerry W. and Carol Lee Levin Professor of Operations Management, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, john.birge@chicagobooth.edu, Jing Wu

The structure of firm connections has direct effects on their exposure to systematic risk. This talk will present a model of this form of risk propagation in supply chain networks and show how this impacts asset prices.

2 - Rank Dependent Utility and Risk Taking in Complete Markets

Xuedong He, Assistant Professor, Columbia University, 316 Mudd, 500 W. 120th street, New York, NY, 10027, United States of America, xh2140@columbia.edu, Xunyu Zhou, Roy Kouwenberg

We analyze the portfolio choice problem of investors who maximize rank dependent utility in a single-period complete market. We propose a new notion of less risk taking: choosing optimal terminal wealth that pays off more in bad states and less in good states of the economy. We prove that investors with a less risk averse preference relation in general choose more risky terminal wealth, receiving a risk premium in return for accepting conditional-zero-mean noise (more risk).

3 - Risk Analysis and Hedging of Parisian Options

Kyoung-Kuk Kim, Associate Professor, Korean Advanced Institute of Science and Technology, 291 Daehak-ro, Yuseong-gu, Industrial and Systems Engineering,KAIST, Daejeon, Ch, 305-701, Korea, Republic of, catenoid@kaist.ac.kr, Dong-Young Lim

A Parisian option is an option such that a specified amount of time below/above a barrier is a trigger. We study its greeks via Laplace transform and conduct risk analysis, showing that theta is important to understand the behaviors of Parisian options and how it can make dynamic hedging fail. Instead, we propose a quasi-static hedging strategy by decomposing the option into other derivatives that are statically hedged. Numerical comparisons of dynamic and static hedging are reported.

4 - On the Measurement of Economic Tail Risk

Xianhua Peng, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, maxhpeng@ust.hk

We show that the only tail risk measure that satisfies a set of economic axioms proposed by Schmeidler (Econometrica, 1989) and the statistical property of elicitability (i.e. there exists an objective function such that minimizing the expected objective function yields the risk measure; see Gneiting (J. Amer. Stat. Assoc., 2011)) is median shortfall, the median of tail loss distribution. Elicitability is important for backtesting. We also extend the result to incorporate multiple scenarios.

■ WC55

Hilton- Van Ness

Global Optimization in Graphs/Networks

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Sergiy Butenko, Texas A&M University, 4037 ETB, TAMU-3131, College Station, TX, 77843, United States of America, butenko@tamu.edu

1 - A Global Optimization Approach for the Maximum Quasi-clique Problem

Zhuqi Miao, PhD Student, Oklahoma State University, 322 Engineering North, Oklahoma State Un, Stillwater, OK, 74078, United States of America, zhuqi.miao@okstate.edu, Baski Balasundaram, Eduardo Pasiliao

The maximum quasi-clique problem (MQCP) can be formulated as a {0,1}-program with a linear objective function and a single quadratic constraint. Motivated by the MQCP, this research investigates Lagrangian based upper-bound, and embeds this upper-bound in a branch-and-bound algorithm for the MQCP. The effectiveness of this approach is studied by solving the MQCP on DIMACS benchmark instances.

2 - Optimization Approach for Analysis of Neuronal Connectivity Network

Alla Kammerdiner, Assistant Professor, New Mexico State University, PO Box 30001, MSC 4230, Las Cruces, NM, 88003, United States of America, alla@nmsu.edu

We present a new approach for analyzing integrity of white matter in the brain. First the network model is constructed from a diffusion tensor image by single linkage clustering to signify the integrity of fiber bundles. The nodes into specified regions of interests denote the sink and source nodes of our model. By solving the maximum flow problem, the maximum flow is obtained for a given image. Finally, the solutions are used in image comparisons. Our approach is illustrated on simulated data.

3 - Metaheuristic Framework for Detecting Robust Cliques in Networks Subject to Uncertain Edge Failures

Oleksandra Yezerska, Texas A&M University, College Station, TX, United States of America, yaleksa@tamu.edu, Sergiy Butenko, Vladimir Boginski

We develop and compare several heuristic approaches for detecting robust cliques in graphs subject to uncertain edge failures. A clique is robust if it satisfies certain risk requirements modeled using the CVaR concept. The proposed heuristics employ techniques borrowed from the well-known tabu search and GRASP metaheuristics.

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■ WC57

Hilton- Golden Gate 1

Academic Projects and Cases Using Real-world Data and Scenarios to Prepare Students for the Workforce

Sponsor: INFORM-ED

Sponsored Session

Chair: Wendy Swenson-Roth, Associate Professor, Georgia State University, 6230 Forest Park Dr, Signal Mountain, TN, 37377, United States of America, wroth@gsu.edu

1 - Industry and Academia Partner to Provide Real-World Data and Issues to Learn Complex Systems Design

Michael Ogle, Assistant Professor and Undergraduate Director, UNC Charlotte, 9201 University City Blvd., CARC 220, Charlotte, NC, 28223, United States of America, Mike.Ogle@uncc.edu

An industry trade association and its college-industry council organization have partnered for twenty years to offer an annual design competition focused on real-world data and marketplace challenges, creating an intensive five-week design experience. This session focuses on how that industry-university collaboration is structured and how it can provide a model for other industries to partner with academia to grow the next generation of educated customers and solution providers.

2 - Teaching Sustainability from an Optimization and Analytics Perspective

Iddrisu Awudu, NDSU, 26 University Village, Fargo, ND, United States of America, Iddrisu.Awudu@my.ndsu.edu

This paper presents a discussion on teaching sustainability by considering optimization and analytics methods. A decision for corporate social responsibility is made by combining a stochastic optimization model using Sample Average Approximation (SAA) algorithm and principal component analysis. A case study is presented based on an ethanol plant in the mid-west.

3 - Mathematical Modeling to Reduce Waste of Compounded Sterile Products in Hospital Pharmacies

Vera Tilson, Simon School, University of Rochester, Rochester, NY, United States of Americavera.tilson@simon.rochester.edu, Greg Dobson

In recent years, many U.S. hospitals embarked on lean" projects to reduce waste. Thoughtful analysis of the data captured by operational systems allows the modeling of many potential process options. Such models permit the evaluation of likely waste reductions and financial savings before actual process changes are made. We present an operations management case based on a student project.

4 - Methods of using the Internet and Laptops in the Classroom with the Goal of Improving Student's Preparation for the Workforce

Wendy Swenson-Roth, Associate Professor, Georgia State University, 6230 Forest Park Dr, Signal Mountain, TN, 37377, United States of America, wroth@gsu.edu

The information students will need and the problems they will receive when they enter the workforce are different from what they are exposed to in many courses. Students receive a substantial amount of course Information through lectures and textbooks. In addition, problems often come with a well-organized data set and a clearly defined problem. Methods are presented to help prepare students to transition from homework problems, where the data and model are clearly laid out, to an end of the semester group project where students are responsible for the entire Decision Making Process.

■ WC58

Hilton- Golden Gate 2

Scheduling IV

Contributed Session

Chair: Cong Zhao, University of Wisconsin Madison, 1513 University Ave, Room 3235, Madison, WI, 53706, United States of America, czhao27@wisc.edu

1 - Analysis of Multi-product Manufacturing Systems with Setup States

Cong Zhao, University of Wisconsin Madison, 1513 University Ave, Room 3235, Madison, WI, 53706, United States of America, czhao27@wisc.edu, Jingshan Li, Ningjian Huang

An analytic model for manufacturing systems with unreliable machines, finite buffers and setup states is developed. Solutions for two-machine are derived and aggregation procedure for longer lines are proposed. Extensive simulation shows this method has high accuracy. This provides a quantitative tool to study the impact of flexibility of manufacturing operations and derive managerial insights.

2 - Scheduling: Agreement Graph vs Resource Constraints

Mourad Boudhar, USTHB University, BP 32, El-Alia, Algiers, Algeria, mboudhar@yahoo.fr, Mohamed Bendraouche, Ammar Oulamara

We consider two problems. The first is scheduling with agreements (SWA) that consists in scheduling jobs non-preemptively on identical machines in a minimum time, subject to constraints that only some specific jobs can be scheduled concurrently. These constraints are represented by a graph. We definitely close the complexity status of SWA on 2 machines with 2 fixed processing times. The second problem is the resource-constrained scheduling. We deduce new complexity results for the latter.

3 - A Subcubic Algorithm to Propagate the Energy Reasoning for the Cumulative Constraint

Nicolas Bonifas, École Polytechnique & IBM, Route de Saclay, Palaiseau, 91128, France, nicolas.bonifas@polytechnique.edu

In the field of constraint-based scheduling, we present an algorithm to propagate the energy reasoning of Lopez in subcubic time, compared to the cubic time needed for the original algorithm. This is a result of great practical significance since energy reasoning is stronger than both timetabling and edge-finding to propagate the cumulative constraint. This new result is based on new properties of the energy reasoning and on new data structures.

4 - Particle Swarm Optimization for Scheduling Flexible Flow Line

Parastoo Amiri, Clemson University, 250 Elm St. # 423, Clemson, SC, 29631, United States of America, pamiri@clemson.edu, Mary Elizabeth Kurz

Previous research on scheduling flexible flow lines (FFL) to minimize makespan has utilized approaches such as branch and bound, integer programming, or heuristics. Particle swarm optimization (PSO) is a population-based metaheuristic method which finds a solution based on the analogy of sharing useful information among individuals. The effectiveness of a discrete PSO in FFL scheduling is compared to genetic algorithms. Methods to avoid premature convergence are evaluated.

■ WC59

Hilton- Golden Gate 3

Operations Management

Contributed Session

Chair: Maria Emilia Camargo, Professor, University of Santa Cruz do Sul, Av. João Machado Soares, 3199, Santa Maria, Brazil, kamargo@terra.com.br

1 - Role of Communication in a Collaborative Supply Chain: An Empirical Analysis

Qingyu Zhang, Professor, Shenzhen University, College of Management, Shenzhen, China, q.yu.zhang@gmail.com, Mei Cao

The objective of the study is to explore the mediating role of communications in the relationships among collectivism, goal congruence, and process efficiency in a supply chain. Data was collected through a Web survey of U.S. manufacturing firms. The results and implications are discussed.

2 - Optimality of Base Stock List Price Policy for Dynamic and Nonstationary Inventory-Pricing Control

Sirong Luo, Associate Professor, Shanghai University of Finance and Economics, School of Statistics and Managment, Guoding Road 777, Yan, Shanghai, 200433, China, luo.sirong@mail.shufe.edu.cn

We study a dynamic inventory-pricing control problem. Demand are two parameter nonlinear, nonstationary and nonadditive model. Using a decision variable transformation approach, we show that the BSLP policy is optimal and the optimality conditions depend only on the location and scale parameters of demand as functions of price. Our results complement the existing results for both backorder and lost sale models in this area.

3 - Applying Cuscore Statistic to Process Control

Maria Emilia Camargo, Professor, University of Santa Cruz do Sul, Av. João Machado Soares, 3199, Santa Maria, Brazil, kamargo@terra.com.br, Suzana Russo, Ivonne Maria Gassen, Marcia Adriana de Oliveira Cerezer

This paper present the study about the statistics CuScore, using the real data (Textile Industry Oeste Ltda in the State of Santa Catarina, Brazil) to investigate the behaviour this statistics in decteting the changes in the process. Also present the comparation between the statistics CuScore with the technics of Exponentially Weighted Moving Average (EWMA). The combination of the ajustament system (EPC) with to monitoring system (SPC) showed best results than only the ajustament system.

4 - Data-Driven Modeling to Improve Elementary School External Resource Acquisition

Samantha Meyer, Graduate Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, samanthameyer2011@u.northwestern.edu

Using interview and survey data we collected from nine urban elementary schools, we develop a series of optimization models to improve school resource acquisition. We explore trade-offs across multiple resource dimensions (knowledge, human, and financial resources) and objectives (equity, effectiveness, and efficiency). Lastly, we discuss implications of this study for organizations that wish to strategically form external partnerships to improve access to scarce resources.

■ WC60

Hilton- Golden Gate 4

Inventory Management VII

Contributed Session

Chair: Kemal Gursoy, Instructor, Rutgers University, 100 Rockafeller Road, Room 5146, Dept. of MSIS, Piscataway, NJ, 08854, United States of America, kgursoy@rci.rutgers.edu

1 - Optimal Procurement: Case of a Cost Conscious Manufacturer

Kemal Gursoy, Instructor, Rutgers University, 100 Rockafeller Road, Room 5146, Dept. of MSIS, Piscataway, NJ, 08854, United States of America, kgursoy@rci.rutgers.edu, Melike Baykal-Gursoy, Sicong Hou

We consider a manufacturer who uses an expensive raw material to produce products for a stable market. The raw material price is subject to unknown market conditions, and thus it is random and may not be stationary. There are opportunities to make profitable spot purchases, or making long term purchasing commitments. The objective of procurement policy is to minimize mainly the purchasing cost and secondarily the inventory holding costs. We also present a case study.

2 - The Profit and Pricing Effect of Item-level Inventory Management

Fang Fang, Associate Professor, California State University at San Marcos, 333 S Twin Oaks Valley Rd, San Marcos, CA, 92127, United States of America, fangfang@csusm.edu, Xiaohui Xu

This research studies the strategic decisions when online retailers are able to dynamically track item-level inventories. The decision is on whether to release the inventory level to the consumers, especially when the inventory is low; and how the prices can be dynamically adjusted to improve profitability. Our preliminary results show that the online retailers shall be able to improve profits by adopting a contingency inventory-revealing plan when inventory drops to a certain threshold.

3 - The Stochastic Lot Sizing Problem with Remanufacturing

Onur A. Kilic, Hacettepe University, Institute of Population Studies, Ankara, Turkey, onuralp@hacettepe.edu.tr, Huseyin Tunc, S. Armagan Tarim

We study the stochastic lot sizing problem with remanufacturing under customer service level constraints. The problem is a stochastic extension of the classical lot sizing problem where demand can be met via two alternative sources: manufacturing new products and remanufacturing returned products. It is known that even the deterministic version of this problem is NP-hard. We propose a mixed integer programming based heuristic for the problem building on the static-dynamic uncertainty strategy.

4 - Multi-period Inventory Management with Bounds on Cumulative Commitment and Demand Forecast

Na Zhang, Student, Huazhong University of Science and Technology, School of Management, Wuhan, Hubei, 430074, China, m201373374@hust.edu.cn, Zhe Yin, Fei Lv

We propose a retailer's inventory replenishment policy to cooperate with a supplier in a periodic review. The retailer shares an advanced replenishment plan based on demand forecast with the supplier and commits total order quantity of several periods within range of a lower and upper percentage of the planned quantity. Using a year sales data from a retail chain store in China, we examine the effects of this policy on retailer's inventory turnover performance by the method of simulation.

5 - Fixed-Interval Order-up-to Policies for Serial Systems

Guangyu Wan, PhD candidate, Nanyang Business School, NBS PhD Office, Block S3-01B-73, Nanyang Technological University, Singapore, 639798, Singapore, wang0699@e.ntu.edu.sg, Qinan Wang

This paper studies an echelon fixed-interval order-up-to policy for a serial system, in which related cost are evaluated continuously. We provide:(1) a simple recursive approach to evaluate the exact system cost;(2) a complete characterization of an optimal ordering policy by equating the marginal echelon inventory related cost to the inventory holding cost at the upstream stage. An optimal ordering policy for a given replenishment schedule can be identified by a simple bottom-up procedure.

■ WC61

Hilton- Golden Gate 5

Military Application 2

Contributed Session

Chair: Ramzi Mirshak, Defence R&D Canada, 101 Colonel By Drive, Ottawa, ON, Canada, ramzi.mirshak@drdc-rddc.gc.ca

1 - Multi-objective Crew and Fleet Scheduling using an GA/IP Hybrid

Ramzi Mirshak, Defence R&D Canada, 101 Colonel By Drive, Ottawa, ON, Canada, ramzi.mirshak@drdc-rddc.gc.ca, Matt Smart

We present a problem that involves scheduling fleets and crews that are dispatched from two bases and must fulfill three distinct mission sets. We optimize crew and fleet objective functions through a hybrid GA/IP, where aspects of the fleet maintenance profile are pre-allocated in the GA. This approach permits us to estimate the Pareto front for the multi-objective problem of optimizing fleet maintenance and minimizing the crew-swaps between assets while meeting the mission sets.

2 - Mitigation Methods and Techniques for Enhancing Sonar Operational Confidence

Mark Gammon, Defence Scientist, Defence R&D Canada - Atlantic, 9 Grove Street, Dartmouth, NS, B2Y 3Z7, Canada, mark.gammon@drdc-rddc.gc.ca

There are numerous challenges to effectively model sonar performance given variability in ocean acoustic parameters. It is well recognized by the operational community that it is challenging to accurately predict the performance of a sonar system. Numerous initiatives are required to harmoniously provide a level of confidence to operators for sonar prediction. Simulation tools that are being utilized include the NATO Multi-Static Tactical Planning Aid and the Environmental Modelling Manager.

3 - A Continuous-Time Model for Airlift Scheduling at the United States Transportation Command

Allison Chang, Technical Staff, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420, United States of America, aachang@mit.edu

USTRANSCOM is responsible for providing the Department of Defense with global mobility. Current research efforts to assign resources to requirements typically discretize time into intervals. This type of model scales with the granularity of the time horizon, and thus becomes prohibitively large. We introduce a continuous-time scheduling model that removes the dependence of the model size on how finely the horizon is divided. We demonstrate the performance of this model on several test datasets.

4 - Time-Dependent Portfolio of Systems Optimization using GAs with Gradient-Directed Mutations

Stephen Henry, Senior Member Technical Staff, Sandia National Labs, 1515 Eubank Ave, Albuquerque, NM, 87123, United States of America, smhenry@sandia.gov, John Eddy, Mark Smith

Long-range business or military planning often requires portfolio optimization of integer system counts over many time periods. Genetic Algorithms (GAs) are an attractive approach due to their ability to optimize over multiple non-linear objectives. However, random GA mutations have difficulty with the inherent coordination in year-to-year investment levels. This work uses objective function gradients to direct mutations in a coordinated fashion, giving impressive speedups over zeroth-order GAs.

■ WC62

Hilton- Plaza A

Homeland Security

Contributed Session

Chair: Daniel Faissol, Group Leader, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, 94550, United States of America, faissol1@llnl.gov

1 - Modeling, Simulation and Optimization to Guide Radiological and Nuclear Searches

Daniel Faissol, Group Leader, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, 94550, United States of America, faissol1@llnl.gov, Richard Wheeler, Thomas Edmunds, Claudio Santiago

We present a prototype modeling, simulation, and optimization tool to support operational planning of radiological or nuclear search missions in an urban environment. The tool includes a 3-dimensional simulation model of an urban scene to estimate the expected background radiation and attenuation of the radiation through building walls. We then solve a non-linear optimization problem and demonstrate that optimized searches can perform 3-30 better than unguided strategies.

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2 - DDDAMS-based System for Surveillance and Crowd Control via UAVs and UGVs
Amirreza M. Khaleghi, Research Assistant, University of Arizona, 1127 James E. Rogers Way, Tucson, AZ, 85721, United States of America, amirreza@email.arizona.edu, Dong Xu, Mingyang Li, Jyh-Ming Lien, Sara Minaeian, Yifei Yuan, Christopher Vo, Arsalan Mousavian, Jian Liu, Young-Jun Son

A dynamic data driven adaptive multi-scale simulation (DDDAMS) based planning and control framework is presented for surveillance and crowd control via teams of UAVs and UGVs. Various issues are discussed such as enabling algorithms (detection, tracking, motion planning), control architectures, and team formation/coordination policies. An agent-based hardware-in-the-loop simulation testbed is constructed, where the modeling fidelity can be adjusted according to the observations and performance.

3 - Quantifying Difficulty in Transporting Illicit Radiological and Nuclear Materials
Samrat Chatterjee, Pacific Northwest National Laboratory, 902 Battelle Blvd, Richland, WA, 99354, United States of America, samrat.chatterjee@pnnl.gov, Robert Brigantic, Casey Perkins

Varying levels of information may be available to an analyst for the quantification of illicit radiological and nuclear transport difficulty along a path. In this study, the characterization of difficulty is explored using ordinal rankings, probability distributions, and intervals. A systems-approach is then adopted to investigate the propagation of difficulty.

4 - Modeling the National Oceanic and Atmospheric Administration's (NOAA) Observing Portfolio
David Helms, National Oceanic and Atmospheric Administration (NOAA), 1335 East West Hwy, Silver Spring, MD, 20910, United States of America, David.helms@noaa.gov

Since 2005, NOAA has developed a large-scale portfolio analysis (PA) model to support investment decisions across its complex mission-space and portfolio of 100+ observing systems (e.g. satellites, ships, aircraft, and surface-based). The model is very large and detailed, employs advanced data elicitation and modeling capabilities; and informs NOAA's investment decisions. It is also a PA proving ground for other federal agencies involved in planning and conducting national earth observations.

■ **WC63**

Hilton- Plaza B

Decision Analysis 3

Contributed Session

Chair: Shital Thekdi, Assistant Professor, University of Richmond, 1 Gateway Rd., Richmond, VA, 23103, United States of America, sthekdi@richmond.edu

1 - Scenario-Based Input-Output Inoperability Modeling for Risk Management of Port Disruptions
Shital Thekdi, Assistant Professor, University of Richmond, 1 Gateway Rd., Richmond, VA, 23103, United States of America, sthekdi@richmond.edu, Joost Santos

Disruptions to maritime port operations have potential to propagate economic losses across supply chains. Risk management should anticipate the impact of disruptions and guide protective investments. This presentation will: (1) Describe a scenario-based interdependency model to identify sectors vulnerable to disruptions, and (2) Prioritize risk management policy investments. The methods will be demonstrated on a United States port responsible for handling $36.1 billion of cargo annually.

2 - Enhanced Techno-economic Analysis for Advanced Biofuel Production
Qi Li, Iowa State University, 0076 Black Engineering, Ames, IA, 50010, United States of America, qili@iastate.edu, Guiping Hu

We will increase the complexity of the traditional techno-economic analysis of commercial biorefinery by considering the practical logistic settings and constraints. At the same time, new uncertainty analysis such as Monte-Carlo simulation and regression analysis could be performed to test the uncertainty in technical data (e.g., reactor performance, product yields), facility size, and capital costs.

3 - Understanding the Channels of Contagion: A Game between Borrower and Lender Countries
Jonathan Welburn, PhD Student, University of Wisconsin - Madison, 1513 University Ave, 3237 Mechanical Engineering Building, Madison, WI, 53706, United States of America, welburn@wisc.edu, Vicki Bier, Kjell Hausken

The process by which crises spread across countries and regions, known as contagion, causes risk to economic stability. We use a multi-agent model of borrower and lender countries to capture the transmission of shocks through trade and debt channels of contagion by strategic interaction. We also explore the possibility of common-cause shocks that lead to crises without propagation. Simulation and sensitivity analysis explain how negative events in trade and debt can lead to a crisis.

4 - Decision-Making under Uncertainty: A Decision-Analytic Typology of Emotion, Logic and Dynamics
Ursula Ott, Associate Professor, Loughborough University, School of Business and Economics, Ashby Road, Loughborough, LE11 3TU, United Kingdom, U.F.Ott@lboro.ac.uk

We use a decision-analytic mechanism to show the impact of emotion, logic and dynamics for managerial players. In a complex globalized world, managers have adapted to their organizations and have learnt to make decisions in an uncertain environment. The dynamics of their behavior is driven by emotion, logic and dynamics. We show the paths of decision-making from three angles and come up with a typology of ELD for managerial decision-making.

5 - How to Use Regression Correctly
Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

Forecasting is a critical tool for making sound futuristic decisions. Forecasters can use timeseries or regression to forecast. Using a method, one must follow the required rules of the method to make an accurate forecast. Some forecasters do not know the rules, ignore the rules, or implement them partially. Thus, most forecasts are inaccurate. My paper discusses the required rules associated with regression and shows the consequences of ignoring, violating, or partially implementing them.

■ **WC64**

Parc- Cyril Magnin I

Probability Theory and Combinatorial Optimization

Sponsor: Applied Probability Society

Sponsored Session

Chair: Alessandro Arlotto, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, alessandro.arlotto@duke.edu

1 - When Exactly is Long Chain Optimal?
Antoine Desir, PhD Candidate, Columbia University, New York, NY, United States of America, ad2918@columbia.edu, Yehua Wei, Vineet Goyal, Jiawei Zhang

The long chain process flexibility design has been an important concept in the design of flexible sparse configurations. We show that in a system with n supply and n demand nodes, long chain is optimal among the class of connected networks with at most 2n arcs. Our proof is based on a combinatorial analysis of the structure of augmenting paths and maximum flow in directed graphs. Surprisingly, the result does not hold for disconnected networks and we present a counterexample.

2 - Incorporating Correlation in Rounding LP Relaxations
Arash Asadpour, New York University, 44 W 4th St, New York NY aasadpou@stern.nyu.edu

We investigate linear optimization problems in the presence of combinatorial structures. We show how one can incorporate appropriate concentration inequalities in order to round the solution of the LP relaxation of the problem.

3 - Online Stochastic Bin Packing
Varun Gupta, Assistant Professor, University of Chicago, 5807 S Woodlawn Avenue, Chicago, IL, 60637, United States of America, varun.gupta@chicagobooth.edu, Ana Radovanovic

In one-dimensional online stochastic bin packing, n items with sizes sampled i.i.d. from an unknown distribution arrive as a stream and must be packed on arrival to minimize the number of non-empty bins. We present the first truly distribution-agnostic bin packing heuristic that achieves additive $O(\sqrt{n})$ waste compared to OPT for all discrete distributions. We also present results on stochastic online bin packing with item departures for which are heuristic extends as-is.

4 - Beardwood-Halton-Hammersley Theorem for Stationary Ergodic Sequences: A Counterexample
J. Michael Steele, University of Pennsylvania, Philadelphia, PA, United States of America, steele@wharton.upenn.edu, Alessandro Arlotto

We construct a stationary ergodic process { X_1, X_2, X_3, ... } such that each X_t, has the uniform distribution on the unit square and the length of the shortest path through { X_1, X_2, ...,X_n } is not asymptotic to a constant times the square root of n. In other words, we show that the Beardwood-Halton-Hammersley theorem does not extend from the case of independent uniformly distributed random variables to the case of stationary ergodic sequences with the uniform stationary distribution.

■ WC65

Parc- Cyril Magnin II

Optimal Control in Queueing Networks
Sponsor: Applied Probability Society
Sponsored Session

Chair: Jim Dai, Cornell University, 226 Rhodes Hall, Cornell University, 136 Hoy Road, Ithaca, NY, 14853, United States of America, jd694@cornell.edu

Co-Chair: Shuangchi He, National University of Singapore, 1 Engineering Drive 2, Singapore, 117576, Singapore, heshuangchi@nus.edu.sg

1 - Diffusion Approximation for Multidimensional Reflecting Processes via their Stationary Equations
Masakiyo Miyazawa, Professor, Tokyo University of Science, Yamazaki 2641, Noda, 278-8510, Japan, miyazawa@is.noda.tus.ac.jp

We consider diffusion approximations of the stationary distributions of multidimensional reflecting processes. Such a diffusion limit is usually studied through a scaling limit of processes. We here directly consider a limit of stationary equations. This may not guarantee the weak convergence of the stationary distributions. Nevertheless, it will be useful when charcateristics are obtainable from the stationary equations and when a process limit is hard to get. We present such examples.

2 - Optimal Stock Allocation for Production-Inventory Systems with Multiple Impatient Customer Classes
Yasar Levent Kocaga, Assistant Professor of Operations Management, Yeshiva University, Belfer Hall 403/A, 2495 Amsterdam Avenue, New York, NY, 10033, United States of America, kocaga@yu.edu, Yen-Ming Lee

We address the production and inventory control of a make-to-stock system with multiple impatient customer classes. We assume Poisson demand and exponential production times. Demand not satisfied immediately is backordered; but waits only up to an exponentially distributed amount of time, and is cancelled if not satisfied within this time. We show that the threshold inventory rationing policy is still optimal under certain conditions including a requirement on the order of abandonment rates.

3 - Staffing Service Systems with Unknown Arrival Rates Restricted by Partial Distributional Information
Ying Chen, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, lesleycy@utexas.edu, John Hasenbein

We study the staffing level minimization problem in a large-scale queueing system with a QoS constraint on the probability that a customer waits in a queue. We consider an Erlang-C model where the arrival rates follow an uncertain discrete distribution with partial information. We explore two cases: in the first one, the constraint has to be satisfied by every possible distribution, while in the second case, the constraint is enforced only on the overall delay probability.

4 - Routing and Scheduling in a Gurvich Network
Arda Sisbot, Graduate Research Assistant, University of Texas at Austin, Department of Mechanical Engineering, Austin, TX, 78712-1063, United States of America, arda@utexas.edu, John Hasenbein

We focus on a two-class parallel queueing network with a flexible server having a faster rate of service for the class with higher holding cost. Under Poisson arrivals, our model jointly considers incoming job routing and flexible server assignment to one of the classes. Through the associated fluid model we determine a near-optimal discrete policy. The asymptotic behavior of the policy is then analyzed. Numerical experiments are performed to assess the performance of the proposed policy.

■ WC66

Parc- Cyril Magnin III

Sensor-based System Informatics and Control
Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Co-Chair: Ran Jin, Virginia Tech, Virginia Polytechnic Institute and State, University, 111 Durham Hall,, Blacksburg, VA, 24061, United States of America, jran5@vt.edu

1 - Evaluating the Microstructure of A206 Metal Matrix Nanocomposites using Ultrasonic Attenuation
Jianguo Wu, University of Wisconsin-Madison, 1513 University Ave, Industrial and Systems Engineering, Madison, WI, 53706, United States of America, wu45@wisc.edu, Shiyu Zhou, Xiaochun Li

A206-Al2O3 MMNCs are promising high performance materials with potential applications in various industries. The Al2O3 nanoparticles dispersed using ultrasonic cavitation technique can enhance the nucleation of intermetallic phases and reduce grain sizes.This paper investigated the relationship between the ultrasonic attenuation and the microstructures. The results provide useful guidelines on the developmemt of the new quality inspection technique for A206-Al2O3 nanocomposites.

2 - Estimating Length of Nanorods using Dynamic Light Scattering Data
Xin Li, Florida State University, 2525 Pottsdamer Street, Tallahassee, FL, United States of America, xl12d@my.fsu.edu, Chiwoo Park

We present a new approach for estimating length distribution of nanorods with dynamic light scattering (DLS) data. The conventional approach uses the CONTIN procedure and it involves numerical inverse Laplace transform which has some numerical issues and is computationally expensive. Our method avoids the numerical inversion by reformulating the problem into a regression setting with physics-based basis functions. Our method outperforms the CONTIN in terms of accuracy and computation.

3 - Joint Modeling of Quantitative and Qualitative Responses in Additive Manufacturing
Hongyue Sun, Virginia Tech, Virginia Polytechnic Institute and State, University, 112 Durham Hall,, Blacksburg, VA, 24061, United States of America, hongyue@vt.edu, Prahalad Rao, Ran Jin, Xinwei Deng, Zhenyu Kong

This paper focuses on modeling the product quality in a fused deposition modeling (FDM) additive manufacturing process. During such a process, both quantitative and qualitative (QQ) types of responses are used to quantify the product quality. The in situ process variables are also included in the QQ model to predict the QQ responses with functional predictors. Both numerical simulations and experimental studies are conducted to evaluate the modeling performance.

4 - Weighted-Likelihood Based Control Chart for Monitoring Censored Weilbull Lifetimes
Chi Zhang, PhD Candidate, HKUST, Room 4223, Academic Building, HKUST,, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, czhangaf@ust.hk, Fugee Tsung

Lifetime experiments are widely seen in modern industrial/medical applications. And process monitoring for lifetime observations has received increasing attention in recent years. This work applies the recent developed weighted likelihood scheme to monitor lifetime data. The proposed control chart is not only able to present desirable In Control (IC) performance, but also robust under various scenarios. Numerical simulations have demonstrated the effectiveness of our method.

5 - Heterogeneous Recurrence Monitoring and Control of Nonlinear Stochastic Processes
Yun Chen, USF, 14219 Les Palms Circle, Apt. 101, Tampa, FL, 33613, United States of America, yunchen@mail.usf.edu, Hui Yang

Process monitoring of dynamic transitions in complex systems is more concerned with heterogeneous recurrence variations. However, little has been done to investigate heterogeneous recurrence variations and link with process monitoring. This paper presents a novel approach of heterogeneous recurrence analysis of nonlinear stochastic processes. Experimental results show that this research provides an effective scheme for monitoring and control of nonlinear dynamic transitions of complex systems.

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■ WC67

Parc- Balboa

Data Fusion for Process Monitoring and Diagnosis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, WI, United States of America, kliu8@wisc.edu

1 - Imbalanced Classification by Hidden Structure Learning

Yang Zhao, PhD Student, City University of Hong Kong, 83 Tat Chee Ave, Kowloon, Hong Kong - PRC, yangzhao9-c@my.cityu.edu.hk, Kwok Leung Tsui, Abhishek Shrivastava

We propose a decomposition based approach to two-class imbalanced classification problem. This approach works by first decomposing the majority class using an unsupervised learning algorithm. The base classifier is then constructed on each sub-problem. The ensemble is tuned to increase the sensitivity towards the minority class. We also provide a metric for estimating the stability of the decomposition. We demonstrate the performance of the proposed approach through various real datasets.

2 - Phasor Measurement Uncertainty Quantification in Voltage Stability Analysis

Jianhui Wang, Decision and Information Sciences Division/Argonne National Laboratory, 9700 S. Cass Avenue, Bldg. 221, Argoone, IL, 60439, United States of America, jianhui.wang@anl.gov, Chen Chen

We present an uncertainty quantification method for phasor measurement units (PMUs) in voltage stability assessment. The effect of local phasor measurement uncertainty on the bus impedance and the Thevenin equivalent impedance used for voltage stability analysis is quantified analytically.

3 - Online Steady-State Detection using Sequential Monte Carlo Methods

Yuxing Hou, University of Iowa, Ames, IA, United States of America, yuxing-hou@uiowa.edu, Yong Chen

We propose an efficient on-line steady-state detection algorithm using a multiple change-point model and sequential Monte Carlo methods. The proposed algorithm is a Rao-Blackwellized version of the particle filter change-point detection algorithm.

4 - An Automatic Nonlinear Profile Monitoring Method using RP in Progressive Stamping Processes

Xi Zhang, Assistant Professor, Peking University, Haidian, Beijing, China, xi.zhang@pku.edu.cn, Kaibo Liu, Cheng Zhou

This research proposed a nonlinear profile monitoring method by using the recurrence plot for monitoring the progressive stamping processes. We investigated the relationship between the faulty patterns in RP and the changes in nonlinear profiles due to missing parts. A parameter learning algorithm was developed to determine the critical parameters involved in RP, and the selected features from RP were embedded into the support vector machine to identify those faulty process conditions.

■ WC68

Parc- Davidson

Simulation Applications of Supply Chain and Reverse Logistics

Sponsor: Simulation

Sponsored Session

Chair: Suman Niranjan, Assistant Professor for Operations Management, Savannah State University, 209 Jordan Bldg,COBA, 219 College St, Savannah, GA, 31404, United States of America, niranjans@savannahstate.edu

1 - Capacity Management in a Pre-Admission Testing Center

Sal Agnihothri, Professor, Binghamton University, SUNY, School of Management, Binghamton, NY, 13902-6000, United States of America, agni@binghamton.edu, Anu Banerjee

A Pre-Admission Testing Center (PATC) is a hospital unit to gather important patient information and perform procedure-specific tests to get the patients ready for surgery in the Operating Room (OR) on the surgery date. We consider a PATC where patients can either walk-in or schedule an appointment in advance to get the service. In this talk, we explain the efforts to determine the bottleneck and increase capacity to reduce patient waiting time. We analyze the system using a simulation model.

2 - A Simulation Approach to Modeling Lumpiness in Spare Parts Demands

Frank Ciarallo, Associate Professor, Wright State University, 3640 Col Glenn Hwy, Dayton, OH, 45435, United States of America, frank.ciarallo@wright.edu, Albert Lowas

Demand for spare parts in many supply chains has been characterized as lumpy: having the characteristic of high quantity variability as well as high timing variability. Using a simulation-based methodology, this talk explores the underlying characteristics that drive lumpy demand for spare parts from fleets of aircraft. These findings demonstrate that a significant portion of variability that has historically been considered random can be accounted for by deterministic patterns.

3 - A Simulation Analysis of Collection and Processing of End-of-Life Garments

Kai Huang, Dr., McMaster University, 1280 Main St. W, Hamilton, ON, L8S 4L8, Canada, khuang@mcmaster.ca, Suman Niranjan

We analyze a collection and sorting process of end-of-life garments, which can be re-manufactured or recycled. The supply of the garments and the demand for re-manufactured items are stochastic and price-sensitive. We develop a discrete-event simulation to determine the near-optimal acquisition price of garments and selling prices of re-manufactured items.

4 - Optimal Queue Length Based Server Sharing Decisions in Field Services

Suman Niranjan, Assistant Professor for Operations Management, Savannah State University, 209 Jordan Bldg,COBA,Savannah State Univ, 3219 College St, Savannah, GA, 31404, United States of America, niranjans@savannahstate.edu, Sal Agnihothri

We consider a field service system with equipment located in a geographic area. The area is divided into two territories, each with a single server who provides onsite service. The objective of this paper is to investigate the conditions for server sharing between the two service territories. In particular, we use simulation to explore the impact of additional travel time and server utilization on server sharing decisions between two territories.

■ WC69

Parc- Fillmore

Expert Elicitation, Climate, and Energy Technologies

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Max Henrion, CEO, Lumina Decision Systems, 26010 Highland Way, Los Gatos, Ca, 95033, United States of America, henrion@lumina.com

1 - An Elicitation of Expert Assessments of Current and Future Li-ion Battery Costs and Designs for EVs

Apurba Sakti, Massachusetts Institute of Technology, Cambridge, MA, United States of America, sakti@mit.edu

In this elicitation, battery manufacturers, car OEMs, and consultants assessed Li-ion battery cost and design developments for a PHEV10, a PHEV40, a BEV100 as well as for specific designs similar to the Ford C-Max Energi and the Nissan Leaf in 2013 and 2018.

2 - Consumer Cost Effectiveness of CO2 Mitigation Policies in Restructured Electricity Markets

Jared Moore, PhD Candidate, Carnegie Mellon University, 5620 Hempstead Rd., #10, Pittsburgh, PA, 15217, United States of America, jaredmoo@andrew.cmu.edu, Jay Apt

We examine the cost to consumers per tonne of carbon offset of a carbon price and renewable portfolio standards in the restructured markets of PJM, ERCOT, and MISO. We find consumers' costs are strongly dependent on the price of natural gas and on the characteristics of the generators in the dispatch stack. We find that both policies have consequences in capacity markets and that the RPS can only be more cost effective if existing capacity supply remains adequate and gas prices increase.

3 - The Value of Integrated Production Planning in Aluminum Recycling

Jiyoun Chang, Student, MIT, 77 Massachusetts Ave., E38-435, Cambridge, MA, 02139, United States of America, jiyoun@mit.edu, Elsa Olivetti, Randolph Kirchain

Recycling low-quality scrap and byproducts is of great interest in the aluminum industry due to its economic and environmental benefit but requires two stage processing. This work includes developing models for two-stage blending operations to maximize incorporation of secondary raw materials. The analysis quantifies the opportunities associated with integrated production planning given a complex operational environment including variation in demand and raw materials availability.

■ **WC70**

Parc- Hearst

Economics- Policy

Contributed Session

Chair: Lorena Berumen, Head of Academic Area in Operations Management, Universidad Panamericana, Augusto Rodin 498, Ciudad de México, Mexico, laberumen@up.edu.mx

1 - understanding the Effects of Policy Designs for the Future of the US Light-duty Vehicle Fleet
Alan Jenn, PhD, Carnegie Mellon University, 3621 Childs Street, Pittsburgh, PA, 15213, United States of America, ajenn@andrew.cmu.edu, Ines Azevedo

We assess the effects of vehicle policies on the design/composition of the US fleet. We incorporate consumer demand by measuring responsiveness to changes in vehicle attributes by calibrating a logit model to sales of vehicles. We maximize the profits of manufacturers in an iterative NLP, by changing design decisions of vehicles sold (fuel economy and vehicle prices). We find that manufacturers face higher incremental costs and have dynamic pricing strategies in the presence of policies.

2 - Do Government R&D Subsidies Serve as a Signal for External Investors? Evidence from China
Yanhui Gao, Xi'an Hi-tech Development Zone, 1 Jinye Road, Xi'an, China, yhgaoxjtu@aliyun.com

Using the data on China's high-tech industry during the period 1998-2008, we find that government subsidies have positive effect on external finance and it is more significant in non-state owned sectors and the areas with worse external market conditions. The results are very important for alleviating financial constraints of non-state owned industries and improving the efficiency of allocation of capital.

3 - Encouraging Long-Shot Investments: Regulatory Options for Orphan Drug Development
Anjali Nursimulu, Visiting Risk Fellow, International Risk Governance Council, EPFL IRGC CM 1516, CP 99, Lausanne, 1015, Switzerland, anjali.nursimulu@irgc.org, Thomas Weber

By granting market exclusivity for new orphan drugs a regulator can promote research on treatments for rare diseases. For given effectiveness thresholds and terms of exclusivity, as well as the structure of the disease spectrum and the various expected payoffs for successful drugs, firms can enter an R&D race head-on or diversify their efforts. In a game-theoretic setting, we identify regulatory policies that maximize welfare by both encouraging R&D investments and realizing treatment benefits.

4 - Impact of Insecurity on the Manufacturing Sector, Panel Data Model: Mexican Case
Lorena Berumen, Head of Academic Area in Operations Management, Universidad Panamericana, Augusto Rodin 498, Ciudad de México, Mexico, laberumen@up.edu.mx, Margarita Hurtado, Jen ai de la Cruz, Gilberto Gonzalez

Insecurity adversely affect economic development, particularly economic performance of enterprises and hinders the formation of value chains. In this work the impact of violence in Mexico on manufacturing activity was measured from a panel data model, which includes information from manufacturing of Mexico between 2007 and 2011. It was found that the main factors limiting the development of the manufacturing industry are insecurity conditions.

■ **WC71**

Parc - Lombard

Auctions/ Mechanism Design 2

Contributed Session

Chair: Christina Lee, Massachusetts Institute of Technology, 216 Harvard St, Apt #1, Cambridge, MA, 02139, United States of America, celee@mit.edu

1 - Strategic Outsourcing under Dynamic Information Asymmetry
Long Gao, University of California, School of Business Administration, Riverside, CA, United States of America, long.gao@ucr.edu, Elodie Adida

We study a procurement problem where the supplier's private capability is dynamically evolving. The buyer commits to a long-term contract for profit-maximizing. We show that the optimal contract spreads out the needed distortions over time to limit information rents. The contract is asymptotically efficient and easy to implement.

2 - Heuristic Algorithms to Solve the Course Allocation Problem
Hoda Atef Yekta, PhD Candidate, University of Connecticut, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, Hoda.AtefYekta@business.uconn.edu, Robert Day

This research formulates the course allocation problem as a multi-objective mathematical model considering both efficiency and measures of fairness. Results of four proposed heuristic algorithms are compared with existing mechanisms and we show that our new algorithms can improve both efficiency and fairness of the results.

3 - Modeling of Emergency Cooperation of Urban Extreme Storm Floods Based on Strong Reciprocity
Liu Gaofeng, Hohai University, No.200, North Jinling Road, Xinbei Distr, Changzhou, 213022, China, gaofengliu@hhu.edu.cn, Huimin Wang

Strong reciprocity theory is applied into emergency management of Urban extreme storm floods, and a model of emergency cooperation mechanisms is set up,which is performed in Jingdezhen city.The results show that the government strong reciprocity helps to promote emergency cooperation. Besides, rewards and punishment, strong ability of acquiring and processing information, extensive publicity and education can all improve emergency cooperation efficiency and effectiveness.

■ **WC72**

Parc- Stockton

Energy VI

Contributed Session

Chair: Thomas Yeung, Associate Professor, Ecole des Mines de Nantes, 4 Rue Alfred Kastler, BP20722, Nantes, 44000, France, thomas.yeung@emn.fr

1 - Optimizing Maintenance & Operation Policies for Offshore Wind Farms with Stochastic Wind Conditions
Thomas Yeung, Associate Professor, Ecole des Mines de Nantes, 4 Rue Alfred Kastler, BP20722, Nantes, 44000, France, thomas.yeung@emn.fr, Bruno Castanier, Canan Pehlivan

Offshore wind power is an emerging source of sustainable energy via wind turbine farms located in bodies of water off coasts. They present maintenance challenges due to their harsh environment and accessibility issues. We propose a Markov decision process to determine the optimal subset of wind turbines to maintain as well as the braking speed to reduce deterioration while considering short and long term stochastic wind conditions. A numerical example and analysis is presented.

2 - Multi-criteria Decision Support for Transmission and Generation Expansion Planning in Power Systems
Valentin Bertsch, Karlsruhe Institute of Technology (KIT), Hertzstr. 16, Karlsruhe, 76187, Germany, Viktor Slednev, Wolf Fichtner

The energy sector continues to undergo substantial structural changes. Currently, the expansion of renewable energy sources and the decentralisation of energy supply lead to new players entering the market who pursue different objectives and have different preferences. Thus, multiple, conflicting targets need to be considered. As a result, decision processes grow more complex at all levels. We therefore propose an approach combining multi-criteria decision analysis and energy systems modelling.

3 - On the Use of Fritz-John Optimality Conditions to Represent Optimal Power Flow Solutions
Katia Almeida, Professor, Universidade Federal de Santa Catarina, Dep. de Engenharia Elétrica, UFSC, Florianöpolis, 88040-900, Brazil, katia@labspot.ufsc.br

Computer programs that solve the optimal power flow (OPF) problem are important tools for the analysis of electric power systems. They should provide the system optimal operating point for a variety of network topologies and consumption levels. Depending on the scenario being analyzed, OPF solutions are close to non regular points of the constraint set. This work investigates the use of normalized Fritz-John optimality conditions, together with interior point methods, to solve the OPF problem.

4 - Corrective Switching with AC Feasibility
Paula Lipka, UC Berkeley, 450 Sutardja Dai Hall, 2594 Hearst Ave, Berkeley, CA, United States of America, plipka@berkeley.edu, Richard O'Neill, Shmuel Oren

Corrective switching can be used to correct a voltage violation or line overload problem caused by a line or generator contingency. Here, we examine using corrective switching with a sequential linear program that approximates the alternating-current optimal power flow problem to quickly solve for a feasible switching sequence that minimizes load shed.

WC73   *INFORMS San Francisco – 2014*

5 - California Assembly Bill 2514 Energy Storage Purchase Requirements: An Innovation-Diffusion Approach
   Mohammed Osman, Dept. of Technology & Society, Stony Brook University, 16 Hessian Ct., Centereach, NE, 11720, United States of America, mohammed.osman@stonybrook.edu

California Assembly Bill 2514 is a first-in-the-nation policy requiring that utilities purchase energy storage technology. AB 2514 implements a buying schedule for grid scale electricity storage on the three largest California utilities by RPS 33% by 2020 deadline. It mandates 1,325 MW of storage capacity or ~2% of projected peak 2020 summer demand to be added to the grid. We look at the policy's assumptions, expectations, and critical response from utilities using Innovation-Diffusion theory.

■ **WC73**

Parc- Mission I

Optimization for Distributed Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Chen Chen, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg. 221, Argonne, IL, 60439, United States of America, morningchen@anl.gov

1 - Enhancing Demand Bidding in Electricity Markets
   Hamed Mohsenian-Rad, University of California at Riverside, 900 University Ave, Riverside, CA, United States of America, hamed@ee.ucr.edu

A brief analysis of existing electricity market data suggests that demand side market participation is not as efficient as supply side market participation. This can affect price competitiveness and potentially create concerns about market power and supplier collusion. Accordingly, in this talk, we examine different methods to exploit flexible loads and other resources to enhance demand biding in deregulating electricity markets.

2 - A Mixed-integer Nonlinear Program for the Optimal Design and Dispatch of Remote Hybrid Power Systems
   Mike Scioletti, PhD Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, mikescio@gmail.com, Alexandra M. Newman

We present a design and dispatch strategy for the integration of renewable energies, specifically solar photovoltaic cells combined with battery storage and diesel generators at Forward Operating Bases (FOBs). This problem is a non-convex, mixed-integer nonlinear programming (MINLP) problem. Given the difficulties associated with solving large, non-convex MINLPs to global optimality, we present convex underestimation and linearization techniques to bound and solve the problem.

3 - Demand Charge Reduction with Battery Energy Storage System
   Fang Chen, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, fac210@lehigh.edu, Lawrence V. Snyder

In an electricity network, large power consumers are charged for their peak demand. A battery energy storage systems (BESS) may be employed to perform peak shaving tasks in order to reduce the demand charge. We introduce two optimization algorithms to properly dispatch battery power assuming demand is stochastic. We then develop a real time planning algorithm, where the load forecast is obtained from a real time predictor. Simulation results show that the system can achieve substantial saving.

4 - Design and Control Decision Model for Distributed Green Energy Generation
   Alireza Ghalebani, PhD Student in Industrial Engineering, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, alireza@mail.usf.edu, Tapas Das

We studied optimal design and control strategy customized for distributed green energy generation systems. A MIP decision model is developed for regions with net-metering policy and time varying price of electricity. It considers inputs such as characteristics of the power system components, micro-grid's demand pattern, reliability requirement, system maintenance, local incentives and regulations, and weather data.

■ **WC74**

Parc- Mission II

Modelings in Electricity Markets for Policy Insights

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Xiaojun Shan, Postdoctoral Research Associate, CEEEP at Rutgers University, 33 Livingston Ave, New Brunswick, NJ, 08901, United States of America, xiaojun.shan@ejb.rutgers.edu

1 - Energy Technology Allocation for Distributed Energy Resources: A Strategic Technology-Policy Model
   Sreekanth Mallikarjun, Stony Brook University, Department of Technology and Society, Stony Brook, NE, United States of America, sreekanth.mallikarjun@stonybrook.edu, Herbert Lewis

We present a two-stage multi-objective strategic technology-policy framework. The first stage utilizes a production possibility frontier model to evaluate the performance of each energy technology based on economic, technical, and environmental objectives. The second stage incorporates factor efficiencies from the first stage, energy capacity limitations, dispatchability, and renewable energy penetration, and energy end-use demands into a bottleneck multi-criteria decision model.

2 - Grid Planning using Multistage Stochastic Programming: Benefits of Additional Decision Stages
   Saamrat Kasina, Johns Hopkins University, Baltimore, MD, United States of America, bkasina1@jhu.edu, Pearl Donohoo-Vallett, Ben Hobbs

Planning models must accurately capture market forces, incentives, and planning time-lines while giving planners the maximum flexibility possible. We analyze how the number of times the operator is allowed to delay or modify investment decisions or exercise options i.e., the number of decision stages affects the timing and location of generation and transmission decisions, and expected system cost. Numerical test cases are used to quantify this effect.

3 - Game-theoretic Model for Electric Distribution Reliability from a Multiple Stakeholder Perspective
   Frank Felder, Research Associate Professor, CEEEP at Rutgers University, 33 Livingston Ave, New Brunswick, NJ, United States of America, ffelder@rutgers.edu, David Coit, Xiaojun Shan

We build and solve two games where either factory or utility decides first on whether to buy Combined heat power plant or harden. We also study government intervention (eg, mandating utility not to harden its distribution and factory to buy a Combined Heat Power with blackstart capability). We illustrate with notional data and show that under some conditions, investing in a Combined Heat Power Plant with blackstart capability could be optimal while the utility does not harden its distribution.

■ **WC75**

Parc- Mission III

Simulation I

Contributed Session

Chair: Kaan Kuzu, University of Wisconsin-Milwaukee, 3202 N. Maryland Ave, Milwaukee, WI, 53201, United States of America, kuzu@uwm.edu

1 - Comparison of Perceptions and Behavior in Ticket and Physical Queues
   Kaan Kuzu, University of Wisconsin-Milwaukee, 3202 N. Maryland Ave, Milwaukee, WI, 53201, United States of America, kuzu@uwm.edu

We designed an empirical study to obtain insights into participant perceptions of and behavior within different queuing arrangements. We specifically focused on the decision making process before and during waits in ticket and physical queue arrangements, and examined how participants adjust their willingness to wait. Using the empirical study results, we tested the impact of changes in customers' willingness to wait on system performance measures.

2 - Internal versus External Complexity: How Organizations React
   Bizhan Jamshidnezhad, Lecturer, APIC, 55 Regent St., Chippendale, Sydney, NS, 2008, Australia, bizhan@apicollege.edu.au

This paper investigates the effects of environmental complexity on organizational performance by means of computational modeling. The results of the model show counter-intuitively that the complexity of environmental requirements has positive effects on performance. Also, the results demonstrate that the internal complexity is detrimental to the organizational performance. As regards learning memory, it is seen that shorter memory cycles as defined in this work improve organizational learning.

3 - A Simulation Approach to Airline Maintenance Cost
Massoud Bazargan, Professor, Embry Riddle Aeronautical
University, College of Business, 600 S. Clyde - Morris Blvd.,
Daytona Beach, FL, 32114, United States of America,
bazargam@erau.edu

In the past few years airlines in the United States have been using third party
companies to do their maintenance operations. This study introduces a simulation
approach to help airlines decide if they need to conduct maintenance of their
aircraft in-house or outsourced purely from financial aspects. The simulation
models incorporate the exciting fleet of an airline and attempt to determine the
costs associated with each strategy.

4 - A System for Teaching Simulation to College Students
Ingolf Stahl, Professor Emeritus, Stockholm School of Economics,
Box 6501, Stockholm, SE 11383, Sweden, ingolf.stahl@hhs.se

The paper discusses what system is most suitable to use in a one-semester course in
simulation in which the focus is on modeling of business decisions and having the
students do a simulation project of value in a company. Less than twenty class
room hours can be spent on teaching the software. The paper is based on the
experience from teaching over ten thousand business students during three
decades.

■ WC76

Parc- Embarcadero

Multi-Channel Attribution Modeling

Sponsor: The Practice Track
Sponsored Session

Chair: George Roumeliotis, Senior Data Scientist, Intuit, 2623 Marine
Way, Mountain View, CA, 94043, United States of America,
George_Roumeliotis@intuit.com

**1 - B2B Marketing Multi-touch Attribution/close Loop of Attribution
and Contribution**
May Xu, LinkedIn, 2029 Stierlin Court, Mountain View, CA, 94043,
United States of America, mxu@linkedin.com, Neethi Thomas

Attribution is a process that links marketing activities with an outcome and to
determine which activities receive credit for a sale which ensures proper budget
allocation for ROI. A weighting technique (based on effectiveness of each
campaign and recency) is discussed. In addition, we will discuss how to close the
loop of marketing attribution and contribution, the two distinctive questions facing
CMOs.

2 - Marketing Attribution on the Front Line
Kevin Potcner, Principal, Exsilon Analytics, 149A Hartford Street,
Sasn Francisco, CA, 94114, United States of America,
kevin.potcner@exsilondata.com

Implementing a marketing attribution initiative is complex and met with myriad
challenges. The effort requires alignment from teams within and outside the
organization, each bringing differing expectations, needs, and biases. Influencing
marketing leaders to provide the models" with an important seat-at-the-table
begins long before the models are built. The presenter will outline specific steps
that the project team can take to facilitate important buy-in, support, and
credibility.

3 - Current State of Attribution Modeling
George Roumeliotis, Senior Data Scientist, Intuit, 2623 Marine
Way, Mountain View, CA, 94043, United States of America,
George_Roumeliotis@intuit.com

This talk will review the state-of-the-art of attribution modeling, comparing the
performance of various methodologies on a real-world data set.

4 - Digital Attribution is Only a Down Payment
John Wallace, DataSong, 234 Front St, San Francisco,
United States of America, jwallace@datasong.com

Most attribution exercises begin with a focus on understanding the effects of digital
marketing. Yet for most large advertisers, digital spend is only a fraction of their
overall budget, and as difficult as it is for some marketers to accept, there are other,
outside factors that explain why their customers buy. Attribution models need to
incorporate a variety of non-marketing data such as loyalty program information,
service events, and product reviews.

■ WC77

Parc- Market Street

Theory and Applications of Analytics and Big Data

Sponsor: Analytics
Sponsored Session

Chair: Felipe Aros-Vera, Rensselaer Polytechnic Institute, 110 8th St,
Troy, NY, 12180, United States of America, arosvm@rpi.edu

1 - A Survey on the Big Data Analytics and its Applications
Amir Gandomi, Ryerson University, 350 Victoria Street, Toronto,
ON, M5B 2K3, Canada, agandomi@ryerson.ca, Murtaza Haider

This study establishes a definition for the term "big data". Big data analytics is
discussed as one of the two sub-processes of extracting insights from big data.
Specifically, a literature review is presented on text analytics, audio analytics, video
analytics, social media analytics and predictive analytics.

2 - Surveying Predictive Models for Diabetes Disease Complications
Saeed Piri, PhD Student, Oklahoma State University, IEM
department, 322 Engineering North, Stillwater, OK, 74078,
United States of America, saeed.piri@okstate.edu, Tieming Liu

One of the most important applications of analytics is in healthcare. Diabetes is a
chronic illness requiring continuous care with multifactorial risk reduction
strategies beyond glycemic control. Diabetes has several complications including
heart disease, neuropathy, nephropathy, etc. In this study we try to survey
predictive models that predict the diabetes complications ahead of time and as
result patients can apply intervention strategies to stop or even reverse the progress
of the disease.

**3 - Hawkes Point Processes as a Big Data Analytics Tool for Social
Media Management**
Amir Hassan Zadeh, PhD Student, Oklahoma State University,
Spears School of Business, Stillwater, OK, 74078, United States of
America, amir.zadeh@okstate.edu, Ramesh Sharda

Online social networks (OSNs) generate a huge volume of content and clickstream
data over time as a result of continuous social interactions between users. Because
these interactions are not fully observable, the mining of such social streams is
more challenging than traditional data streams. Point processes as a promising
approach can be used to unravel latent network structure of OSNs and particularly
understand human interactions and collective behavior within the social networks.

■ WC78

Parc- Mason

Decision Support Systems 1

Contributed Session

Chair: Dilek Onkal, Bilkent University, Faculty of Business
Administration, Ankara, 06800, Turkey, dilekon@gmail.com

**1 - Does Acceptance of Forecast Advice Depend on
Scenario Optimism?**
Dilek Onkal, Bilkent University, Faculty of Business Administration,
Ankara, 06800, Turkey, dilekon@gmail.com, K.Zeynep Sayim,
M.Sinan Gonul

Scenarios constitute effective tools for information sharing by depicting alternative
storylines of possible futures.Recent research suggests that decision makers
effectively utilize optimistic/pessimistic scenarios as channels of forecasting
advice.However, the scenarios used in these studies are not only
optimistic/pessimistic in tone and content, but are also labeled as such.Current
work focuses on exploring whether the effects of scenarios originate from their
content or from framing.

**2 - Risk-informed Regulatory Compliance Enforcement Model for
Technical Systems and Products**
Lency Mulamootil, Decision Analysis Advisor, Technical Standards
and Safety Authority, 3300 Bloor Street West, Toronto, ON, M8X
2X4, Canada, lmulamootil@tssa.org, Srikanth Mangalam,
Arun Veeramany, David Witt, Rene Karavas

A typical mandate of regulatory authorities that have oversight of public safety is to
identify non-compliances with regulated systems and products. A key parameter in
this critical process is the determination of a permissible time duration within
which a non-compliance must be rectified. This paper proposes a risk-informed
decision process to assign a time duration for a given regulatory non-compliance
and describes how it can be adapted and implemented for a given regulated sector.

3 - A Context Representation Model for Real-time Vehicle Routing in the Distribution of Product Oil
Lijun Sun, Dalian University of Technology, Linggong Road, Ganjingzi District, Dalian, China, slj@dlut.edu.cn, Xiangpei Hu

In China, the urban distribution of product oil is realized by multi-compartment vehicles of several types. Moreover, the types of sources of urban demands vary greatly, including gas stations and some third-industry companies. Constructing a mathematical model for real-time vehicle routing cannot totally reflect and solve this complicated distribution problem, a context representation model is presented to complement it.

4 - Appraising Investments in Integrated and Interdependent Complex Systems: The Case of Smart Cities
Sebastian Maier, Imperial College London, Skempton Building - South Kensington Cam, London, SW7 2AZ, United Kingdom, s.maier13@imperial.ac.uk, John Polak, David Gann, Aruna Sivakumar

Cities require massive capital investment in new infrastructures and services. However, traditional methods of investment appraisal are widely considered as inadequate. To overcome their limitations, this research presents a new appraisal framework that aims at valuing smart city investments while taking into account multiple interdependencies among different investments and the major uncertainties inherent in the investments' underlying technologies, thus supporting long term strategic planning.

■ WC79

Parc- Powell I

OR Models in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Victor Richmond Jose, Georgetown University, McDonough School of Business, 544 Hariri Building, Washington, DC, 20057, United States of America, vrj2@georgetown.edu

1 - When to Issue an Offer and What Deadline to Set When Both Parties Have Outside Options
Sasa Zorc, PhD Student, INSEAD, Ayer Rajah Avenue 1, Singapore, 138676, Singapore, sasa.zorc@insead.edu, Ilia Tsetlin

We model a finite-horizon setting where two agents could make a deal but also are searching for other alternatives. Key decision variables are time to make an offer and the deadline. We explore different settings and show, in particular, that a) issuing all offers as exploding offers is the dominant strategy and b) revealing information about your own search improves equilibrium outcomes for all agents.

2 - Impact of Bayesian Learning and Externality on Strategic Investment
Wenxin Xu, University of Illinois, Chicago, IL, United States of America, wxu9@illinois.edu, Dharma Kwon, Anupam Agrawal, Suresh Muthulingam

We investigate the impact of the interplay between learning effects and externalities on competitive investments with uncertain returns. Our model reduces to a war of attrition under certain conditions, and the interplay between externality and learning has counter- intuitive effects on investment strategies and payoffs.

3 - Inequity-averse Optimization in Operational Research
Ozlem Karsu, Bilkent University, Bilkent, Ankara, Turkey, ozlemkarsu@yahoo.co.uk, Alec Morton

In this paper we review the operational research (OR) literature on inequity-averse optimisation. We discuss two equity related concerns, namely equitability and balance, which are distinguished based on whether anonymity holds. We review applications involving these concerns and discuss alternative ways to incorporate such concerns into OR models. We discuss the pros and cons of different approaches and provide some future research directions.

4 - Expert Elicitation for Production Planning: Theory and Implementation
Saurabh Bansal, The Pennsylvania State University, Business Building, University Park, PA, United States of America, sub32@psu.edu, Genaro Gutierrez

We first present some new results for the determination of probability distributions from subjectively elicited limited information from an expert, and then discuss the application of results at a large firm for a $800 million decision. The technical development specifically allows for incorporating expert's biases and inconsistencies during the deduction of distribution parameters.

■ WC80

Parc- Powell II

Joint Session DAS/ENRE: Energy Infrastructure: Decisions and Models

Sponsor: Decision Analysis & Energy Natural Resources and the Environment
Sponsored Session

Chair: Seth Guikema, Assistant Professor, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu

1 - Robust Portfolio Planning of Offshore Wind Farms
Alexana Cranmer, University of Massachusetts, 120B Marston, 160 Governors Drive, Amherst, MA, 01002, United States of America, acranmer@umass.edu, Erin Baker

We apply a spatial version of robust portfolio analysis to wind siting, to help us better understand the value of each project in the context of the full portfolio of projects. Wind farm sites are generally considered one at a time and current approaches do not account for any interactions between the qualities of the sites. Sites may interact with each other through wake effects, profit potential, and wildlife impacts.

2 - Long-Term Hurricane Impact on U.S. Power Systems
Andrea Staid, PhD Student, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, astaid@gmail.com, Seth Guikema, Roshanak Nateghi, Steven Quiring, Michael Gao

Climate change may impact hurricane behavior. The electric power distribution system is particularly vulnerable to hurricane damage. Hurricanes may change in intensity, annual frequency, or geographical location. We simulate the hurricane impact to power systems under plausible climate scenarios. We assess the long-term impacts of hurricanes on U.S. power system infrastructure, and the results can be used to inform decisions regarding improvements in grid reliability, resilience, and robustness.

3 - Evaluating Risk Mitigation Investments in Coastal Power Systems that are Prone to Hurricane Impacts
Roshanak Nateghi, NSF SEES Postdoctoral Fellow, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, roshanak.nateghi@gmail.com, Seth Guikema

The US power systems are repeatedly stressed by hurricanes. They cause widespread outages that lead to huge economic losses. Research shows that tree-trimming practices of utility companies are an important factor in the extent of hurricane damage. In this talk, we describe the results of our decision analysis model used to assess the costs and benefits associated with investing in vegetation management for power networks and discuss further studies needed to address this research question.

4 - Manipulation of Day-ahead Electricity Prices through Virtual Bidding in the U.S.
Chiara Lo Prete, Assistant Professor of Energy Economics, The Pennsylvania State University, John and Willie Leone Family Department, of Energy and Mineral Engineering, University Park PA 16802, United States of America, chiaraloprete@psu.edu, William Hogan
Enforcement actions of the Federal Energy Regulatory Commission in regard to allegations of price manipulation in electricity markets have recently been in the spotlight. We focus on one type of market manipulation strategy considered by FERC (placing unprofitable virtual bids to enhance the value of related FTR positions) and construct examples of equilibrium manipulation in the context of Kumar and Seppi (1992).

■ WC82

Parc- Haight

Data Mining 6

Contributed Session

Chair: Qi Zhang, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qz@andrew.cmu.edu

1 - Data-driven Construction of Convex Region Surrogate Models
Qi Zhang, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qz@andrew.cmu.edu, Ignacio E. Grossmann, Arul Sundaramoorthy, Jose M. Pinto

There is an increasing demand for process models that are sufficiently accurate as well as computationally efficient. In this work, we develop an algorithm for the

data-driven construction of a type of surrogate models that can be formulated as MILPs yet still provide good approximations of nonlinearities and nonconvexities. In the surrogate model, the feasible region is given by the union of polytopes and for each region, the objective function can be approximated by a linear function.

2 - Patent Pool Analysis in Bibliometrics

Hiroko Nakamura, The University of Tokyo, 7-3-1 Hongo, Bunkyoku, Tokyo, Japan, techhn@mail.ecc.u-tokyo.ac.jp, Yuya Kajikawa

Taking statistics and bibliometrics approach, we investigate charactoristcs of patents in the patent pools managed by Mpeg LA. While previous research compare patents in a patent pool and patents, which is not in a patent pool but applied by the same applicant and in the same IPC category, we compare patents in a patent pool with patents, which cited same patents.

3 - A Hybrid Generating Rules Method for Identifying Financial Distress

Ching-Hsue Cheng, Professor, National Yunlin University of Sci. & Tech., 123 University Road, Section 3,Douliou, Yunlin, Taiwan - ROC

This study employed six attribute selection methods to reduce high dimension data. After attribute selection, this study utilized rough set classifier to find the rules of financial distress. In verification, the TEJ dataset was employed as experimental data in Type I, Type II error, and accuracy criteria. The experimental results show that the logistic regression and chi- square attribute selection method combined with rough set classifier outperform the listing methods.

4 - Temporal Analysis of Origin-destination Matrices Estimation based on Passenger Cars Traffic Counts

Carlos Gonzalez-Calderon, Postdoctoral Research Associate, Rensselaer Polytechnic Institute, 110 8th St, JEC 4037, Troy, NY, 12180, United States of America, gonzac8@rpi.edu, Susana Restrepo Morantes, John Jairo Posada Henao, Catalina Osorio

This research introduces an entropy maximization demand model to estimate origin-destination matrices for passenger vehicles on the basis of traffic counts for different years. The performing of the formulation for the different time periods (2001-2008) is tested in the Medellin, Colombia network.

■ WC83

Parc- Sutro

Data Mining 3

Contributed Session

Chair: James Wilson, Department of Statistics and Operations Research, UNC Chapel Hill, Chapel Hill, NC, United States of America, jdwilson1212@gmail.com

1 - Extraction of Statistically Significant Communities in Multilayer Networks

James Wilson, Department of Statistics and Operations Research, UNC Chapel Hill, Chapel Hill, NC, United States of America, jdwilson1212@gmail.com

Community detection is an important problem in the study of complex networks. We consider community detection in the context of multilayer networks where the observed data is a collection of networks on the same vertex set. We propose and investigate a novel testing based community extraction procedure that identifies statistically significant community-layer pairs. We investigate the potential use of our method through analysis of a gene expression dataset from the cancer genome atlas.

2 - Feature Selection in Relational Data Mining

Michele Samorani, University of Alberta, Edmonton, AB, Canada samorani@ualberta.ca, Ivor Cribben

Traditional data mining and statistical techniques require a single table as input; by contrast, we tackle the problem of findings patterns in a relational database. This is possible by automatically exploring the database and generating new attributes using information from all tables. However, doing so results in a large set of attributes that may be correlated with one another. In this talk, we show the benefits of this approach and discuss how to select the most important features.

3 - Study on City-Production Integration of High-tech Industrial Park Based on Fuzzy AHP

Lin Su, PhD, Tongji University, School of Economic and Management, Siping Road, Yangpu District, Shanghai, China, yjshsl@163.com, Xia Wang, Bing Guo, Xin Zheng

City-production integration is fully interpreted but barely evaluated. In this paper, the building of Evaluation Index System comprehensively evaluates the degree of city-production integration of Shanghai High-tech industrial park by applying the fuzzy AHP to that case. We finally found certain factors actively promoting the integration of city-production and put forward policy recommendations.

4 - Longitudinal Service Repurchasing Models and Their Financial Effects

Yoko Norose, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, 305-8573, Japan, norose@aclab.esys.tsukuba.ac.jp, Yukihiko Okada, Yukie Sano, Yuji Takano

The purpose of this research is to build longitudinal service repurchasing models for estimating their long-term revenue contributions empirically. We identify remarkable step-up / step-down repurchasing behaviors based on 2.9 million purchasing records (about 1 million individuals) for the past 18 years of TAC school, a biggest educational service company in Japan.

5 - Temporal Skeletonization on Sequential Data: Patterns, Categorization, and Visualization

Chuanren Liu, PhD Student, Rutgers Business School, 1 Washington Street, Room 1003C, Newark, NJ, 07102, United States of America, chuanren.liu@rutgers.edu

We propose "temporal skeletonization" to proactively reduce the representation of sequences to uncover hidden temporal structures. The key idea is to summarize the temporal correlations in an undirected graph. Then, the embedding topology of the graph allows us to translate the rich temporal content into a metric space. This opens up new possibilities to explore, quantify, and visualize sequential data. Our approach can effectively discover critical buying paths from noisy customer event data.

Wednesday, 2:45pm - 4:15pm

■ WD01

Hilton- Golden Gate 6

MAS Tutorial Session. The State of Operations Research in the US Military: A 75th Anniversary Perspective

Sponsor: Military Applications Society
Sponsored Session

Chair: Greg Parlier, Past President, MAS of INFORMS, 255 Avian Lane, Madison, AL, 35758, United States of America, gparlier@knology.net

1 - The State of Operations Research in the US Military: A 75th Anniversary Perspective

Greg Parlier, Past President, MAS of INFORMS, 255 Avian Lane, Madison, AL, 35758, United States of America, gparlier@knology.net

This extended presentation offers perspectives on the past, present, and future of Operations Research in the US Department of Defense with emphasis on the Army. The need for a critical review is argued, and a framework for a comprehensive assessment is developed. Enduring principles are suggested, and new concepts are presented, including both strategic and transformational analytics.

■ WD02

Hilton- Golden Gate 7

Product Development and Process Development in Pharmaceutical Industry

Sponsor: Technology, Innovation Management and Entrepreneurship
Sponsored Session

Chair: Zhili Tian, Assistant Professor, Florida International University, 11200 SW 8th Street, Miami, FL, 33199, United States of America, ztian@fiu.edu

1 - Production Planning Models for Biopharmaceutical Perfusion Production

Phil Kaminsky, Professor, University of California, Berkeley, IEOR Dept., 4141 Etcheverry Hall, Berkeley, Ca, 94720-1777, United States of America, kaminsky@ieor.berkeley.edu, Dan Bu

Perfusion production technologies are increasingly used in Biopharmaceutical production, and introduce a variety of scheduling and planning challenges. Motivated by these challenges, we introduce several novel lot-sizing and planning models, analyze these models, and develop heuristic approaches to solving them.

2 - Technology Investment on Improving Environmental Performance

Derek Wang, McGill University, Montreal, QC, Canada derek.wang@mcgill.ca, Shanling Li, Toshiyuki Sueyoshi

We investigate empirically the linkage between firms' environmental technology adoption decisions and firms' characteristics using data from U.S. companies in

WD03

INFORMS San Francisco – 2014

2011-2013. This study shows the determinants that lead companies to invest in different types of technologies, and how the choice of technology affects the companies' market performance.

3 - Optimal Investment in Phase II and III New Drug Development
Zhili Tian, Assistant Professor, Florida International University, 11200 SW 8th Street, Miami, FL, 33199, United States of America, ztian@fiu.edu

Firms conduct Phase II and/or III drug trials by enrolling and treating thousands of patients. Finding these patients is expensive and time consuming, with uncertainty. We consider how firms should determine their investment policy. This must be done recognizing that there is also uncertainty in the outcome of a trial.

4 - Financing Drug Discovery for Orphan Diseases
David Fagnan, PhD Candidate, MIT, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, dfagnan@mit.edu, Andrew Lo, Roger Stein

Recently proposed 'megafund' financing methods for funding translational medicine require billions of dollars in capital to de-risk the drug discovery process enough to issue long-term bonds. We demonstrate that the same financing methods can be applied to orphan drug development but, because of the unique nature of orphan diseases and therapeutics (lower development costs, faster FDA approval times, and lower failure rates) the amount of capital needed to de-risk such portfolios is much lower.

■ WD03

Hilton- Golden Gate 7

Electronic Markets and Mechanisms

Sponsor: eBusiness

Sponsored Session

Chair: Yifan Dou, Assistant Professor, Beihang University, 37# Xueyuan Road, Haidian District, Beijing, China, dou@buaa.edu.cn

1 - Online Reputation and Pricing Strategies in E-markets
Min Xu, Harbin Institute of Technology, 92 Xidazhi street, School of Management,, Harbin, He, 150001, China, xuminivy@gmail.com, Wen Shi, Qiang Ye

This paper explores the relationship of sellers' online reputation and their pricing strategies in E-markets. Empirical results suggest that sellers' reputation has a positive impact on price. Meanwhile, the number of competitors will moderate the relationship between reputation and price. Generally, sellers with higher reputation will charge higher price, but their positive correlation will be weakened when there are more competitors in the E-markets.

2 - Dual-sourcing Auctions under Supply Risks
He Huang, School of Economics and Business Administration, Chongqing University, Chongqing, China, huanghecqu@gmail.com, Hongyan Xu

This paper examines unit-price dual-sourcing auctions when the buyer faces multiple suppliers with random yields and privately informed costs. We analyze and compare three widely used auction mechanisms: i) a generalized second-price (GSP) open auction; ii) a generalized first-price (GFP) sealed-bid auction with quantity commitments; and iii) a hybrid auction which selects two winners with an open-descending auction and then allocates quantities with a simplified version of ii).

■ WD04

Hilton- Continental 1

Topics in Supply Chain Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: S. Alex Yang, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, sayang@london.edu

1 - Inventory Pooling under Heavy-Tailed Demand
Mihalis Markakis, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, Spain, mihalis.markakis@upf.edu, Kostas Bimpikis

We consider a single-period multi-location newsvendor model with independent demands. We show both analytically and numerically that the benefits to inventory pooling (in terms of both the inventory levels and the expected costs) in the presence of ``heavy-tailed'' demand uncertainty are much more modest than what Eppen's celebrated result predicts (for the case of Normal distributions). We also discuss various extensions of these results.

2 - Financial Pooling in Supply Chain
Qu Qian, Assistant Professor, Shanghai University of Finance and Econo, School of International Business Adminis, 100 Wudong Road, Shanghai, China, qian.qu@mail.shufe.edu.cn, Ming Hu, S. Alex Yang

We show that one possible role trade credit plays is to pool the liquidity buffers between suppliers and retailers. Due to this pooling effect, even as the supplier's cost of capital is high, the retailer should still demand for trade credit. However, this role is not without costs. As an innovative financial scheme, supply chain finance increases the efficiency of this pooling effect, and as a result reduces the overall supply chain financing cost.

3 - The Impact of Supplier Competition on Supply Chain Responsiveness
Ruixue Guo, Stanford University, 63 Abrams Ct, Apt 313, Stanford, CA, 94305, United States of America, rguo@stanford.edu, Robert Swinney

We study a model with two types of suppliers "efficient and responsive" competing for the business of a single manufacturer. We find that competition between the suppliers reduces the advantage of responsive supplier, compared to a model exogenous procurement costs from the two suppliers. We also demonstrate how the manufacturer's power in establishing contract price affects its incentives to source from a responsive supplier.

4 - Integrative Management of Transfer Pricing and Global Sourcing Decision in a Multinational Firm
Vernon Hsu, Professor, The Chinese University of Hong Kong, Room 1502, Cheng Yu Tung Building,CUHK, Hong Kong, Hong Kong - PRC, vhsu@cuhk.edu.hk, Kaijie Zhu, Xiaopeng Zhang

We exam integrative management of a multinational firm's transfer pricing (TP) and global sourcing decisions to take advantage of different tax rates across subsidiaries and to maximize the firm's global after-tax profits. With various decision timelines (ex-ante and ex-post TP decisions) and structures (centralized and decentralized sourcing decisions), we characterize optimal TP and sourcing decisions in various scenarios. Several new and important managerial insights are derived.

■ WD05

Hilton- Continental 2

Multichannel Retailing

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Santiago Gallino, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, santiago.gallino@tuck.dartmouth.edu

1 - The Drivers of Consumer Latency in Online Retailing
Vishal Gaur, Cornell University, Johnson School, Ithaca, NY, United States of America, vg77@cornell.edu, Nikolay Osadchiy

Consumer latency is the time from the first click by a customer on a website until the time to purchase. We develop an econometric model to assess the drivers of consumer latency using data from an online retailer.

2 - Channel Integration & Sales Concentration: Empirical Evidence
Ioannis Stamatopoulos, PhD Student, Northwestern University, 829 Foster St, Evanston, IL, 60201, United States of America, i-stamatopoulos@kellogg.northwestern.edu, Santiago Gallino, Antonio Moreno-Garcia

Competing for an increasingly demanding customer pool, retailers progressively integrate their B&M and Online channels. In this paper, using a proprietory dataset coming from the implementation of a Ship to Store (StS) capability of a large US housewares retailer, we find that StS causes a statistically and economically significant drop in sales concentration.

3 - Need for Speed: The Value of Delivery Lead-Time in Online Retailing
Jiaqi (Joseph) Xu, PhD Student, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Phialdelphia, PA, 19104, United States of America, jiaqixu@wharton.upenn.edu, Marshall Fisher, Santiago Gallino

We explore the relationship between online retail sales and service quality in terms of delivery speed by analyzing a quasi-natural experiment from an apparel retailer. The retailer improved service quality for a subpopulation of its customers by opening a new distribution center (DC) in western US. We establish a causal link between delivery time reduction and sales, and show that sales was 3.88% higher in western US compared to eastern US after opening of the new DC.

4 - How Can I Help You? Improving Retail Store Execution through Online Learning
>   Santiago Gallino, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, santiago.gallino@tuck.dartmouth.edu, Marshall Fisher, Serguei Netessine

Converting demand into sales in today's retail environment is not a trivial task. When retailers fail on their store execution, customers walking into the store will leave empty-handed or carrying fewer bags than they might have otherwise. But, is it true that more-engaged associates perform better? Is it the case that employees who became more knowledgeable about the products they are selling improve their sales performance? And if so, by how much?

■ **WD06**

Hilton- Continental 3

Humanitarian-Driven Inventory Management: Pre-positioning and Responses

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Fang Liu, Nanyang Technological University, 50 Nanyang Drive, Singapore, Singapore, Liu_Fang@ntu.edu.sg

Co-Chair: Yulan Wang, Asst Prof, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, yulan.wang@polyu.edu.hk

1 - A Stochastic Location-Routing Model for Prepositioning and Distributing Emergency Supplies
>   Xiaofeng Nie, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, xiaofengnie@ntu.edu.sg, Yidong Zhang, Aakil Caunhye, Mingzhe Li

We model post-disaster situations as scenarios and propose a two-stage stochastic programming model to preposition and distribute emergency supplies. In the first stage, the model decides where to locate warehouses and how many quantities to stock for prepositioning purposes. In the second stage, the model decides how many quantities to transport to demand sites and the corresponding routing. Furthermore, the issue of equitability is taken into consideration when distributing emergency supplies.

2 - An Integrated Inventory Management Framework for Emergency Operations
>   Eren Ozguven, Assistant Professor, Florida State University, 2525 Pottsdamer Street, Tallahassee, FL, 32310, United States of America, eozguven@fsu.edu, Kaan Ozbay

This research describes the steps required to develop a novel and comprehensive framework for the development of a humanitarian emergency inventory management framework that enables the real-time tracking of emergency supplies/demands through the integration of emerging technologies such as Radio Frequency Identification Devices (RFID) for commodity tracking and logistics.

3 - Optimal Allocation of Resources Bases on Social Costs
>   Jose Holguin-Veras, William H. Hart Professor, RPI, 110 8th St JEC 4030, Troy, NY, United States of America, jhv@rpi.edu

This talk discusses the policy implications of allocating scarce resources under post-disaster conditions using the concept of social cost.

4 - Optimal Deployment of Emergency Supply Inventory with a Humanitarian Relief Objective
>   Yulan Wang, Asst Prof, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, yulan.wang@polyu.edu.hk, Fang Liu, Pengfei Guo

We consider the optimal pre-positioning of emergency supply inventory (ESI) that are used for recurring disasters with an objective of minimizing the total expected number of casualties. We derive the expected casualty number and develop two algorithms to find the optimal ESI allocation. We extend the problem to the scenario where the pre-positioned ESI may be partially destroyed, the transportation infrastructure may be destroyed, and the disaster may occur at more than one location.

■ **WD07**

Hilton- Continental 4

Supply Chain Management VII

Contributed Session

Chair: Sunantha Teyarachakul, Dr., MacEwan University, 10700-104 Avenue NW, Edmonton, AB, T5J 4S2, Canada, teyarachukals@macewan.ca

1 - Commodity Hedging in a Competitive Supply Chain
>   Ehsan Bolandifar, Assistant Professor, Chinese University of Hong Kong, 1 Chak Cheung Street, Cheng Yu Tung Bld. R 922, Hong Kong, Hong Kong - ROC, ehsan@baf.cuhk.edu.hk

We study optimal hedging policy in a competitive market where a retailer procures two substitutable commodities from two processors. We show that how market competition and commodity price correlation affect optimal hedging policies of the producers in a supply chain setting.

2 - Optimality of Operations and Marketing Coordination Mechanisms in a Two-level Supply Chain
>   Chirag Surti, Assitant Professor, UOIT, 2000 Simcoe Street North, Oshawa, ON, L1H7K4, Canada, chirag.surti@uoit.ca, Salma Karray

Research on supply chain coordination relies on the assumption that manufacturers incentivize the retailer by offering a single coordination mechanism. Most manufacturers offer multiple incentives to the retailer in order to coordinate the channel. This paper relaxes this central assumption and investigates the optimal mix of manufacturer's coordination mechanisms. The main finding suggests that the preference for the type(s) of coordination depends on the demand and marketing effort parameters.

3 - Financing the Capital-Constrained Newsvendor with Trade Credit in the Presence of Bankruptcy Cost
>   Shuang Xiao, Huazhong University of Science and Technology, Luoyu Road 1037, Hongshan District, Wuhan, China, 996719696@qq.com

We consider a two-level supply chain with a supplier and a capital-constrained retailer. The retailer is facing bankruptcy risks and failure of loan repayment leads to a costly bankruptcy. We model the interaction between the supplier and retailer as a Stackelberg game with the supplier as the leader, and try to find the best financing structure among the bank, supplier and retailer, from different perspectives.

■ **WD08**

Hilton- Continental 5

Supply Chain Management VII

Contributed Session

Chair: Jinfeng Yue, Professor at MTSU, Dean and Professor at SHUFE, Middle Tennessee State University (MTSU) and, Shanghai University of Finance and Econ, Murfreesboro, TN, 37132, United States of America, jinfeng.yue@mtsu.edu

1 - Optimal Inventory Policy and Disposition Decision for Supply Chain with Stochastic Returned Products
>   Sajjad Farahani, University of Wisconsin, Milwaukee, Industrial Engineering Department, Milwaukee, WI, 53211, United States of America, farahani@uwm.edu, Farshid Zandi

This paper consider an analytical queuing model for a two echelon supply chain; including inventory system and remanufacturing system with stochastic returns. High congestion of return product at remanufacturing facility causes considerable delays and consequently remarketing value losses for time-sensitive products and high-tech products with short life cycles. We propose a model for admission decision that decides about acceptance of return products and maximum capacity of inventory system.

2 - The Effects of Knowledge Management, Cooperative Norms and Joint-action on Supplier's Innovation
>   Zainab Al Balushi, Assistant Professor, Sultan Qaboos University, College of Economics PO BOX 20, Operations Mangement, AL Khoudh, 123, Oman, zainab.albalushi@gmail.com, Asma Al Zaidi

Inter-firm knowledge management enables effective utilization of competencies. This paper examines the effects of inter-firm knowledge absorptive capacity on supplier's innovation and how joint action between exchange partners fosters this outcome. Also it examines the moderating role of cooperative norms that exists in the exchange relation. Dynamic capability view was used as theoretical lens. A survey was conducted on manufacturing firms in the Arabian Gulf countries and analyzed using SEM

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3 - Coordination Conditions in Supply Chain Contracts
Jinfeng Yue, Professor at MTSU, Dean and Professor at SHUFE, Middle Tennessee State University (MTSU) and, Shanghai University of Finance and Econ, Murfreesboro, TN, 37132, United States of America, jinfeng.yue@mtsu.edu

This research uses distribution free approach to study the coordination conditions in different supply chain contracts. It is shown that coordination is achievable for any supply chain contract if some general conditions can be satisfied. The managerial insights are discussed with recommended managerial approaches which provide practical solutions to coordinate supply chain by any preferred contract.

4 - Impact of Customization Postponement on Delivery Lead Time Agreement
Xiao Zhang, UT Dallas, 5657 Amesbury Dr, Apt 1402, Dallas, TX, 75206, United States of America, xiao.zhang@utdallas.edu, Ozalp Ozer, Holly Lutze

A manufacturer (M) produces a batch of common intermediate products, customizes into multiple end products, and delivers them to two retailers (Rs) with different cost parameters. Delivery lead times determine three parties' inventory levels and costs. M minimizes its cost by offering a portfolio of lead times and corresponding payments, from which Rs choose their best options. We derive the explicit form of the optimal lead time agreement. Customization postponement leads to faster delivery.

■ WD09

Hilton- Continental 6

E-Business/ Commerce 2
Contributed Session

Chair: Rajhans Mishra, Assistant Professor, Indian Institute of Management Indore, Faculty Block B First Floor, IIM Indore, Rau, Indore, 453331, India, rajhans111@gmail.com

1 - Web Analytics for Customer Profiling and Segmentation for e-Commerce using Sequential Information
Rajhans Mishra, Assistant Professor, Indian Institute of Management Indore, Faculty Block B First Floor, IIM Indore, Rau, Indore, 453331, India, rajhans111@gmail.com, Siddhartha Rastogi

Web analytics can be used to suggest right products to right customers at right time. It will help e-commerce organizations to increase the probability of purchase of products. We propose a scheme of customer profiling and segmentation using a web recommendation system, which considers sequential navigational information of users for the generation of recommendations.

2 - A Restaurant Recommendation System using Collaborative Filtering
Brian Piper, Data Scientist, Forio, 1159 Howard Street, San Francisco, CA, 94103, United States of America, bpiper@forio.com

A recommendation system with a web-based UI is demonstrated that allows users to explore items and their relationships. Strength of similarity among items is displayed as an interactive visualization. The visualization enables users to understand how recommendations are obtained and explore alternatives and select between different items. The approach is demonstrated using restaurant data provided by Yelp for Phoenix, AZ.

3 - The Power of the Like Button Social Media Effect on Internet Financing
Chao Ding, Assistant Professor, University of Hong Kong, School of Business, Pokfulam Rd, Hong Kong, Hong Kong - PRC, chaoding@hku.hk, Yang Duan, Yong Jin

Using data collected from Kickstarter and Facebook, this paper examines the power of the "like" button on Internet financing. Our empirical results show that the social media has a significantly positive impact. One more click of the Facebook "like" button leads to a 0.15% greater chance of success for Kickstater projects. Surprisingly, it has little influence on expediting the fundraising process. We also find the crowdfunding contributors have a stronger preference for technology projects.

4 - Understanding the Virtual Activities in an Online Game and their Impacts on Real Money Spending
Gwangjae Jung, Singapore Management University, 80 Stamford Road, Singapore, 178902, Singapore, gwangjaejung@smu.edu.sg, Youngsoo Kim

We examine the relationship between online activities and real money spending in an online game. We collected users' log data in an online game from February to August 2010. Our analyses show that virtual money and real money basically complement each other in playing an online game. Another interesting finding is that users can save real money by accomplishing a task with other users together. We also find the impacts of virtual activities vary depending on the purpose of real money spending.

■ WD11

Hilton- Continental 8

Supply Chain, Managing Disruptions I
Contributed Session

Chair: Amirhossein Khosrojerdi, University of Oklahoma, 1021 East Brooks St Apt F, Norman, Ok, 73071, United States of America, akhosrojerdi@ou.edu

1 - A Location-inventory Model under the Risk of Supply Disruptions with Facility Fortifications
Ehsan Jafari Shirazi, West Virginia University, Moprgantown, WV, United States of America, ejafaris@mix.wvu.edu, Wafik Iskander

The interest in reliable facility location models has recently been growing fast, triggered by recent high-profile disruptions. It has also been shown in the literature that failing to incorporate long term decisions on location and short term decisions on inventory may result in suboptimality (Daskin et al. 2002, Shen et al. 2003). In this study, a location-inventory model with facility fortifications for improving the reliability of facilities is proposed.

2 - Coordinated Selection of Supply Portfolio and Scheduling of Customer Orders under Major Disruptions
Tadeusz Sawik, Professor and Chair, AGH University of Science and Technology, Al. Mickiewicza 30, Krakow, Poland, ghsawik@cyf-kr.edu.pl

Coordinated supplier selection and customer order scheduling under major disruptions is studied for different sourcing strategies. The suppliers are located in different regions and the supplies are subject to local and regional disruptions. New MIP formulations are proposed to minimize expected worst-case cost or maximize expected worst-case customer service level.

3 - Supply Chain Disruption and Quality
Rebecca Clemons, Doctoral Candidate, Cleveland State University, Monte Ahuja College of Business, 1860 E. 18th Street, Cleveland, OH, 44115, United States of America, clemonsbec@gmail.com, Walter Rom, Susan A. Slotnick

A manufacturer has two suppliers. The old supplier experiences random disruption with acceptable quality. The new supplier is reliable with unacceptable quality. A simulation study examines the impact of policy decisions for a given level of disruption while considering cost of supplier development, appraisal, purchasing, holding and backorder costs.

4 - An Assessment of Disruption Mitigation Strategies: Inventory, Backup Suppliers and Supplier Protect
Masoud Kamalahmadi, Student, North Carolina A&T State University, 1601 E Market Street, Greensboro, NC, 27411, United States of America, Mkamalah@aggies.ncat.edu, Mahour Parast

The purpose of this paper is to develop an assessment to examine the impacts of three disruption mitigation strategies (Pre-positioning Inventory, Backup Suppliers, Suppliers Protection) on supplier selection and allocation. A two stage mixed integer programming model with three extensions are developed. Each model suggests contingency plans for each scenario and provides proper supplier selection and allocation to meet customer demand during disruptions in suppliers and/or regions.

5 - A Controllable Structural Network Design for a Resilient Supply Chain
Amirhossein Khosrojerdi, University of Oklahoma, 1021 East Brooks St Apt F, Norman, Ok, 73071, United States of America, akhosrojerdi@ou.edu, Janet Allen, Krishnaiya Thulasiraman, Farrokh Mistree

A method is proposed for designing expandable supply chains that are resilient to natural or human induced extreme events. The proposed method is based on designing controllable structures for supply chains when locating control nodes in the network structure brings flexible restoration plans. Our focus is also on the development of efficient restoration strategies that aid the supply chain in recovering from a disruption, thereby limiting the impact on its customers.

■ WD12

Hilton- Continental 9

Supply Chain Optimization II

Contributed Session

Chair: Jian Zhang, Postdoc Fellow, McGill University, Frank Dawson
Adams Building, Room 110, 3450 University Street, Montreal, QC,
H3A0E8, Canada, jian.zhang9@mail.mcgill.ca

1 - Mining Supply Chain Planning with Dynamic Recovery Rate and Market Uncertainty

Jian Zhang, Postdoc Fellow, McGill University, Frank Dawson
Adams Building, Room 110, 3450 University Street, Montreal, QC,
H3A0E8, Canada, jian.zhang9@mail.mcgill.ca, Roussos
Dimitrakopoulos

A mining complex's strategic and tactical plans for production and transportation
are optimized using a stochastic mixed-integer-nonlinear program in consideration
of both contracted customers and the spot market. A heuristic is developed to deal
with the complexity caused by the dynamic recovery rate in each processing plant.
The proposed model and heuristic can be employed before signing a long-period
sales contract to reduce risk due to the resource and market uncertainties.

2 - The Two-Phase Stochastic Lotsizing Problem with Optimal Timing of Additional Review

Dina Smirnov, Technion - Israel Institute of Technology, Faculty of
Industrial Engineering, Haifa, 32000, Israel, kadina7@gmail.com,
Yale T. Herer

We study a single-location problem with Poisson demand and a finite planning
horizon. Additional inventory review and production are allowed during the
period. The additional review timing is a decision variable whose value is selected
before the sales period starts. We use analytical tools to develop algorithms for
finding the optimal initial production quantity, the optimal timing of the additional
review, and the optimal decision at the time of the additional review.

3 - The Impact of Information Visibility on Supply Chain Coordination in a Food Industry

Wenbo Zhang, Xi'an Jiaotong University, No. 28 at Xianning West
Road, Xi'an, China, wenbozhang@stu.xjtu.edu.cn

With various food safety crisis worldwide especially in China recently, supply
chains involved have attracted much closer attentions than food manufacturers.
Information visibility(IV) is believed a most effective safety practice. We study a
food supply chain consisting of one supplier and one manufacturer. IV is derived
from both players, and the market demand is price and IV sensitive. Models and
examples are used to illustrate how IV influence the supply chain coordination
strategies.

■ WD14

Imperial B

Retail Management I

Contributed Session

Chair: Ameera Ibrahim, University of Massachusetts Amherst,
Isenberg School Of Management, 121 Presidents Drive, Amherst,
MA, 01003, United States of America, ameera@som.umass.edu

1 - Assortment Planning in the Presence of Variety Seeking

Yanzhi David Li, Department of Manament Science, City University
of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, Hong
Kong, Hong Kong - PRC, yanzhili@cityu.edu.hk, Di Xu,
Zhaowei Miao, Huiqiang Mao

This paper explores the optimal assortment planning when the customers have the
variety seeking preference, i.e., the utility of a customer is decreased for the
product purchased on the previous purchase occasion. Through myopic and
strategic planning, we show how the assortment planning under this context can
be different.

2 - New Science of Retail - Digitized Offline Store Case Study

Shin Woong Sung, PhD Candidate, KAIST, 291 Daehak-ro,
Yuseong-gu, Daejeon, Korea, Republic of, sw.sung@kaist.ac.kr,
Juyeong Lee, Young Jae Jang

We introduce the concept of the digital offline store that utilizes various advanced
digital technologies to sense the customer behaviors in selecting and buying
products in the store. The case study conducted with the biggest sports outdoor
brand in Korea is introduced to illustrate the concept and to show how the concept
is applied to the actual distribution and inventory management.

3 - Distribution Center Design to Support Business Processes Involved in the Management of Retail Store

Germ·n Klee Rebolledo, Universidad de La Frontera- MGSIC
Programm, Ir`n 01830, Temuco, Chile, german.klee.r@gmail.com,
Jaime Bustos

A model of joint procurement processes and delivery to showroom, enabling
substantial improvements in commercial operation and sales targets of the
company is presented. Sales targets in retail management materialize through
selling products to achieve the highest volume, margin and frequency in order to
ensure profitability, while promoting sustainability. Linking procurement processes,
offices and shop supplies give the starting point for a successful sales process.

4 - A Multi-category Assortment Packing Problem under Cross-Selling and Cannibalization Effects

Ameera Ibrahim, University of Massachusetts Amherst, Isenberg
School Of Management, 121 Presidents Drive, Amherst, MA,
01003, United States of America, ameera@som.umass.edu,
Ahmed Ghoniem, Bacel Maddah

We examine the problem of optimizing the release times of substitutable and
complementary products that belong to different categories over a multi-period
horizon. Products have a longevity over which their attractiveness decays (e.g.,
electronics or fashion products), while being positively or negatively impacted by
the specific mix of products that have been introduced. Using a 0-1 fractional
program with an attraction demand model, we discuss managerial insights from
our computational study.

■ WD15

Hilton- Exec. Boardroom

Procurement and Purchasing Management 1

Contributed Session

Chair: Vahid Ganji, University of tennessee, 511A John D. Tickle
Engineering Building, 851 Neyland Drive, Knoxville, TN, 37996-
2315, United States of America, vganjili@utk.edu

1 - Combined Method for Buyer-Supplier Negotiations – Qualitative and Quantitative Data

Vahid Ganji, University of Tennessee, 511A John D. Tickle
Engineering Building, 851 Neyland Drive, Knoxville, TN, 37996-
2315, United States of America, vganjili@utk.edu, John E. Bell,
Rapinder Sawhney

To model buyer-supplier negotiations and identify effective negotiation strategies in
changing business conditions, an integrated model using fuzzy AHP, fuzzy TOPSIS
(Technique for Order Preference by Similarity to Ideal Solution) and inverse DEA
(data envelopment analysis) methods is proposed. The model handles multi-inputs
(values offered by buyer) and multi-outputs (values offered by suppliers) and both
quantitative and qualitative data forms.

2 - Integrated Spot and Auction Procurement of Wheat Millers

Wenhao Li, Tsinghua University, Room 408, Apartment #14,
Tsinghua University, Beijing, 100084, China,
wenhaoli111@gmail.com, Ruoran Chen, Simin Huang

This paper analyzes the optimal procurement and production of wheat millers with
two procurement options—spot and auction. The objective is to satisfy demand
and quality requirements at minimum costs under spot price and auction
uncertainty. Compared with the current sequential decision making, our proposed
model significantly increases expected profit. Moreover, it effectively hedges
procurement risks. This paper elucidates for the first time the value of auction for
wheat millers.

3 - Procurement Negotiation with Two-sided Private Information

Cheng Qian, University of Sydney, 11/115 Garden Street,
Maroubra, NS, 2035, Australia, c.qian@econ.usyd.edu.au

We consider a procurement negotiation process where a buyer and a supplier
negotiate on price and quality under two-sided uncertainty. The buyer has private
information on valuation, and the supplier has private cost information. We
characterize the equilibrium outcome and analyse the amount of information each
player should reveal.

4 - Supply Contract Competition: The Role of Subcontracting and Single-Sourcing Commitment

Lusheng Shao, University of Sydney, 91 Darlington Road,
Sydney, Australia, l.shao@econ.usyd.edu.au

We consider a situation where two suppliers compete for a buyer's purchase
business. Two procurement mechanisms are studied: Splitting Mechanism where
the suppliers each bid a supply function which maps quantities to payments and
the buyer may split her order; Commitment Mechanism where the buyer commits
to sole-source before bidding and the winning supplier can subcontract with the
losing supplier after bidding. We characterize equilibrium for each mechanism and
make a comparison between them.

WD16   *INFORMS San Francisco – 2014*

5 - Joint Emergency Procurement under Supply Disruptions and Price Competition
   Sobhan Asian, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, sobhan1@e.ntu.edu.sg, Xiaofeng Nie

We study two competing retailers who differ in their market bases, each basically sourcing from its main supplier that is subject to disruptions. To cope with supply risk, the retailers use a common emergency source, which is perfectly reliable but more expensive. The retailers' equilibrium solutions are obtained under different emergency strategies, separate buying (SB) and joint procurement (JP). We show that the higher the main sources' disruption risks, the higher the attractiveness of JP.

■ WD16

Hilton- Franciscan A

Joint Session RMP/BOM: New Results on Strategic Consumer Behavior in RM

Sponsor: Revenue Management & Pricing & Behavioral Operations Management
Sponsored Session

Chair: Anton Ovchinnikov, Assistant Professor, University of Virginia, 100 Darden Blvd, Charlottesville, VA, United States of America, AOvchinnikov@darden.virginia.edu

1 - Experimental Studies on Purchasing Scarce Products under Dynamic Pricing
   Vincent Mak, Cambridge Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, v.mak@jbs.cam.ac.uk, Jiaojie Han, Eyran Gisches, Amnon Rapoport

We experimentally tested a two-period dynamic pricing model in which a firm sells a good under exogenous inventory constraints to a market of buyers. In one experiment, human buyers purchased from an automated seller; in another, both seller and buyers were human subjects. Equilibrium predictions assuming fully strategic buyers largely accounted for aggregate behavior in both experiments, but there were also nuanced deviations from equilibrium that had profit and pricing implications.

2 - Strategic Consumers, Myopic Retailers
   Anton Ovchinnikov, Assistant Professor, University of Virginia, 100 Darden Blvd, Charlottesville, VA, United States of America, AOvchinnikov@darden.virginia.edu, Mirko Kremer, Benny Mantin

We investigate the behavior of retailers who sell a fixed inventory of products over a two period horizon (main selling season followed by a markdown period) to a mixture of myopic and strategic consumers. We present a stylized model and an experimental study. Our main result is that retailers exhibit a significant degree of myopia when facing consumers who are strategic. We quantify the degree of myopia and explore how it depends on various demand and supply factors.

3 - Behavioral Anomalies in Consumer Wait-or-Buy Decisions and Their Implications for Revenue Management
   Nikolay Osadchiy, Assistant Professor, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30309, United States of America, nikolay.osadchiy@emory.edu, Manel Baucells, Anton Ovchinnikov

We propose a model that incorporates behavioral anomalies in consumer wait or buy decisions, and analytically solve the consumer wait-or-buy problem in a retail markdown setting. Through a behavioral study we estimate the model parameters and numerically show that accounting for the behavioral anomalies a firm would offer larger markdowns yet generate higher revenue compared to the current literature's predictions.

■ WD17

Hilton- Franciscan B

Customer Differentiation in Services

Sponsor: Manufacturing & Service Operations Management/Service Operations
Sponsored Session

Chair: Mojtaba Araghi, Rotman School of Management, University of Toronto, 105 St. George Street,, Toronto, ON, Canada, Mojtaba.Araghi08@Rotman.Utoronto.Ca

1 - Multi-period Lead Time and Stocking Decisions for a Dual-channel Retailer
   Nevin Mutlu, PhD Candidate, Virginia Tech, 607 Clay St. Apt 10., Blacksburg, VA, 24060, United States of America, nmutlu@vt.edu, Ebru Bish, Erick Wikum

As traditional brick-and-mortar retailers expand their sales channels to online, mobile, and catalog orders, the consumer adoption rates of these emerging channels is increasing as a function of time. The dynamic change of demand across channels has important implications for retailers' operational decisions. We develop a novel, dynamic demand model, and show that the retailers' optimal decisions in this dynamic environment differ significantly from those under static demand.

2 - Customer Acquisition and Service Quality for a Call Center with Time-Varying Demand Response
   Mojtaba Araghi, Rotman School of Management, University of Toronto, 105 St. George Street,, Toronto, ON, Canada, Mojtaba.Araghi08@Rotman.Utoronto.Ca, Philipp Aféche, Opher Baron

This paper proposes and analyzes a novel call center model that accounts for customer lifetime value and the impact of service quality on customer acquisition and retention under time-varying demand response. We provide prescriptions on the optimal ad-hoc and periodic advertisement policies, along with the optimal staffing and priority plans for managing the call center operations.

3 - Threshold Policy for Call Centers with Time Dependent Arrival Rate
   Benjamin Legros, Ecole Centrale Paris, Grande Voie des Vignes, Chatenay Malabry, France, belegros@laposte.net, Ger Koole, Oualid Jouini

In the context of multi-channel call centers with inbound calls and emails, we consider a threshold policy on the reservation of agents for the inbound calls. The optimization problem consists of maximizing the throughput of emails under a constraint on the waiting time of calls. We propose an efficient adaptive threshold policy). This scheduling policy is evaluated both in the stationary and the non-stationary case.

4 - Staffing Shift Planning for a Hospital Call Center with Inbound and Outbound Calls Blending
   Yanli Zhao, Wayne State University, 630 Merrick St Apt 810, Detroit, Mi, 48202, United States of America, ee0086@wayne.edu, Susan Yu, Kai Yang

This research considers the staffing shift planning for a hospital call center with a single kind of inbound calls and multiple kinds of outbound calls. A mathematical programming model is developed with the objective of minimizing the labor cost, by deciding the shift setting and workload allocation. The service level and staffing utilization are taken into consideration in the constraints. Numerical experiments based on actual operational data are included to show the optimization results.

■ WD18

Hilton- Franciscan C

New Topics in RM: Demand Learning, Strategic Consumers, and Behavioral Issues

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Bora Keskin, The University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

1 - Price Differentiation: A Machine Learning Approach
   David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Room 1-171, Cambridge, MA, 02139, United States of America, dslevi@mit.edu, Clark Pixton, Zachary Owen

We propose the use of machine learning classifiers for the task of consumer segmentation for price discrimination. We quantify the effect of classification errors on expected revenue, and we develop lower bounds on the performance of

machine learning revenue management policies for worst-case demand functions. These bounds show that such policies can outperform single-price policies even with significant classification error. We also formulate price selection as a tractable integer program.

2 - Revenue Management using Thompson Sampling

David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave, Room 1-171, Cambridge, MA, 02139, United States of America, dslevi@mit.edu, Kris Johnson, He Wang

We consider the dynamic pricing problem of a retailer facing limited inventory. The retailer has no prior assumption of demand and must learn expected demand for each price throughout the season. Thompson sampling is a randomized strategy that balances exploration to learn demand and exploitation to maximize revenue. We use Thompson sampling to develop a dynamic pricing strategy and compare the algorithm's revenue to the optimal revenue given known demand.

3 - Innovative Dynamic Pricing: The Potential Benefits of Early-Purchase Reward Programs

Mike Wei, Assistant Professor, University at Buffalo, 326 Jacobs Hall, Buffalo, NY, 14260, United States of America, mcwei@buffalo.edu, Yossi Aviv

To mitigate the negative influence of strategic consumer behavior, we use stylized scientific model to seek for the optimal form of a reward program that should be offered to strategic consumers if they made early purchase decisions. Such program is identified among all possible functional forms that specify a reward to consumers that is contingent of future markdowns and sales realizations. We will share our findings in this presentation.

4 - Consistency between Prospect Theory and the Newsvendor Pull-to-Center Effect

Bhavani Shanker Uppari, PhD Student, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, BhavaniShanker.UPPARI@insead.edu, Sameer Hasija

This paper revisits the role of Prospect Theory (PT) in explaining the newsvendor Pull-to-Center (PTC) effect. Our results contrast with the existing literature that uses zero profit as a reference point in the PT model. We use the extant literature to establish the saliency of the mean demand as a decision and show that, with the outcome associated with this decision as the reference point, PT cannot be ruled out as a potential explanation for the PTC effect.

■ WD19

Hilton- Franciscan D

Revenue Optimization in Retail and Services II

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Thunyarat Amornpetchkul, Lecturer, NIDA Business School, Boonchana-Autthakorn Bldg., 8th fl, 118 Seri-Thai Rd. Khlong Chan, Bangkapi, Bangkok, Thailand, thunyarat.a@nida.ac.th

1 - Pricing Strategy for Theater Seats with Various Quality Levels in the Movie Industry

Ling-Chieh Kung, Assistant Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei, 10617, Taiwan - ROC, lckung@ntu.edu.tw, Chia-Yin Hsieh

Nowadays, seats in a cinema hall are typically charged the same price regardless of their locations. This uniform pricing strategy not only deviates from the common practice for most performance goods but also conflicts with the screening literature for revenue maximization. With a stylized model, we find that uniform pricing intensifies the competition among consumers, induce early purchase, and thus may be revenue-maximizing in several scenarios.

2 - Strategic Use of Uncertainty through Mystery Discounts

Thunyarat Amornpetchkul, Lecturer, NIDA Business School, Boonchana-Autthakorn Bldg., 8th fl, 118 Seri-Thai Rd. Khlong Chan, Bangkapi, Bangkok, Thailand, thunyarat.a@nida.ac.th

Recently, several retailers have experimented with offering mystery discount" where multiple discount levels are distributed among consumers. Under a mystery discount, consumers may discover the acquired discount prior to making purchase decisions, or at the point of purchase. Furthermore, consumers may or may not be informed about the actual distribution of different discount levels. This paper investigates how mystery discounts affect consumer purchase behavior and the seller's profitability.

3 - Effect of Cyclic Pricing on Inventory Costs

Yifan Feng, PhD Student, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, fengx233@umn.edu, Zizhuo Wang

We consider a monopolist selling a product to patient customers. Cyclic pricing policy has been shown to achieve optimal revenue in several studies. However, as price affects the demands, inventory costs are also changed when one uses a cyclic pricing policy. In this talk, we study the inventory cost of cyclic pricing policies compared to static ones. We identify two opposite effects ñ a pooling effect and a cost accumulation effect and give conditions under which each strategy has a lower cost.

4 - The Influence of Risk Preferences on Rebate Effectiveness

Ozgun Caliskan Demirag, Penn State Erie, 5101 Jordan Road Burke 259, Erie, PA, 16563, United States of America, ozc1@psu.edu

We study how the performance of rebate promotions is affected by the risk preferences of end customers and firms offering the rebates. Focusing on risk-averse and risk-neutral behaviors, we analyze the optimal values of production/order quantity, retail price, and rebate amount in a channel facing demand uncertainty and price sensitivity.

■ WD21

Hilton- Union Sq 1

Supply Chain and Transportation

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Zhaodong Wang, University of Illinois, Urbana, IL, United States of America, zwang137@illinois.edu

1 - Coordinated Inventory Replenishment and Outsourced Transportation Operations

Osman Alp, TED University, Endustri Muhendisligi Bolumu, TED Universitesi, Ankara, 06440, Turkey, osman.alp@tedu.edu.tr, Ulku Gurler, Nasuh Cagdas Buyukkaramikli

We consider a one-warehouse-N-retailer supply chain with stochastic demand. Inventory is managed in-house whereas transportation is outsourced to a 3PL provider. We develop operating characteristics under periodic and continuous joint replenishment policies. We identify settings where a periodic review policy is comparable to a continuous review one. We compare the overall performance of the outsourced transportation strategy under a contract to that of operating with in-house fleet of vehicles.

2 - Modeling the Petroleum Supply Chain under Disruption and Mitigation Strategies

Yasaman Kazemi, North Dakota State University, 1225 10th St, N, Apt 1, Fargo, ND, 58102, United States of America, yasaman.kazemi@ndsu.edu, Joseph Szmerekovsky

In this research, a three echelon supply chain model for the downstream petroleum industry is proposed to study the problem of facility failures due to a specific disruption and select appropriate mitigation and coping strategies to handle the effects of the disruptive event. A two stage stochastic mixed integer linear programming model (SMILP) is developed, and Geographic Information Systems (GIS) was used to locate facilities, obtain realistic transportation data, and to visualize the process.

3 - Bullwhip Effect in Supply Chains under Nonlinear Ordering Policies

Zhaodong Wang, University of Illinois, Urbana, IL, United States of America, zwang137@illinois.edu, Yanfeng Ouyang

This paper analyzes the bullwhip effect in multi-echelon supply chains under nonlinear ordering policies (such as base-stock policies). A describing-function approach is used to derive closed-form formulas to predict amplification of order fluctuations. The analytical results are verified by simulations and hold promise to explain empirical observations.

■ WD22

Hilton – Union Sq 2

Historical and Microfoundation of Strategy

Sponsor: Organization Science
Sponsored Session

Chair: Emily Block, Assistant Progessor of Management, University of Notre Dame, Notre Dame, IN, 46556, United States of America, es-block@gmail.com

1 - Frontiers of Strategy Research on Time Horizon,
   University of Connecticut
      Greg, Reilly, Rebecca Ranucci, David Souder

Abstract is not available at this time.

2 - Moving Opportunism to the Back Seat: Bounded Rationality,
   Costly Conflict, and Hierarchical Forms
      Libby Weber

Abstract is not available at this time.

3 - Do Accelerators Accelerate? A Study of Venture Accelerators as a
   Path to Success
      Bemajmin Hallen, Chris Bingham, Susan Cohen

Abstract is not available at this time.

4 - The Well of the Past: The Historical Boundedness of Absorptive
   Capacity, University of Arizona
      Eugene Paik

Most research on absorptive capacity suggests that more of it is universally better for organizations. Breaking from that tradition, this study examines that organizations' absorptive capacity can mislead them to avoid new technology despite its potential opportunities. I specifically argue that the adoption may be delayed when absorptive capacity is shaped by negative experience with prior, then-new technologies. I test this proposition by examining the record-labels' album releases in MP3 format as a function of the extent to which their earlier releases suffered from piracy.

5 - Spinning Off onto Shaky Ground: Executive Mobility in an
   Uncertain Task Environment, University of Texas at Austin
      Y. Sekou Bermiss

Abstract is not available at this time.

■ WD23

Hilton- Union Sq 3

Traffic Management I

Contributed Session

Chair: Masoud Hamedi, Research Scientist, University of Maryland, Department of Civil & Environmental Eng, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, masoud@umd.edu

1 - Dynamic Structural Learning of a Bayesian Network for
   Drivers' Behaviors
      Sojung Kim, The University of Arizona, 1127 E. James E. Rogers Way Room 162, Tucson, AZ, United States of America, sojungkim@email.arizona.edu, Sung Joong Kim, Young-Jun Son

The goal of this work is to introduce a dynamic structural learning approach for a Bayesian network to represent evolution of drivers' reasoning behaviors at an intersection. The proposed approach considers three assumptions: 1) a limited memory of a driver, 2) partial observation of the road environment, and 3) non-stationary road environment. The proposed approach is demonstrated with real drivers' behavioral responses obtained from experiments conducted in a virtual reality driving simulator.

2 - A Pattern Recognition Approach for Measuring Performance of
   High Occupancy Vehicle Lanes
      Masoud Hamedi, Research Scientist, University of Maryland, Department of Civil & Environmental Eng, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, masoud@umd.edu, Ali Haghani, yanru zhang

Making more efficient use of existing road system through HOV lanes is a cost-effective solution to improve mobility.Continuous monitoring of the system performance is key to a success implementation. A framework for fusing traffic data from several sources to estimate key HOV indicators is introduced. Motivated by advancements in travel time measurement technologies, a pattern recognition algorithm for separating travel time on HOV and regular lanes collected by Bluetooth sensors is developed.

3 - A Traffic Signal Priority Control Model for Multi-Modal Users
      Mehdi Zamanipour, Research Assistant, University of Arizona, 1127 E. James E. Rogers, Tucson, AZ, 85721, United States of America, zamanipour@email.arizona.edu, Yiheng Feng, Shayan Khoshmagham, Larry Head

The opportunity to manage multi-modal transportation systems has become possible with the advent of connected vehicle systems. We present a mathematical model to implement traffic signal control for multiple traffic modes based on an N-level importance hierarchy. The model allows decision makers to establish a priority policy for different modes.

4 - Dynamic Origin-Destination Demand Estimation for Congested
   Traffic Networks
      Ala Alnawaiseh, Post Doctor, Southern Methodist University, 3101 Dyer St, Room 203, Dallas, TX, 75205, United States of America, aalnawai@smu.edu, Hossein Hashemi, Khaled Abdelghany

A methodology for time-dependent origin-destination demand estimation in congested urban transportation networks is presented. The methodology utilizes time-varying traffic density and flow observations to estimate a demand pattern that replicates the observed flow breakdown at bottleneck locations. The problem is formulated in the form of a linear mathematical program. The results of experiments that illustrate the performance of the new methodology are presented.

■ WD24

Hilton- Union Sq 4

Disaster and Emergency Management 1

Contributed Session

Chair: Reza Zanjirani Farahani, Kingston University London, KHBS 215, Kingston Business School, Kingston Hill, Kingston Upon Thames, United Kingdom, zanjiranireza@gmail.com

1 - A Study on the Arrangement Method of Relief Supplies in a Depot
   Immediately after a Disaster
      Zhao Jie, Tokyo University of Marine Science and Technology, 2-1-6, Etchujima, Koto-ku, Tokyo, Japan, zhaojie6111@gmail.com, Kurokawa Hisayuki

Relief supplies were sent to the depot from all over the country soon after The Great East Japan Earthquake. However, the problem is that the many of relief supplies still have not reached the victim after the natural disaster occurred. One of the reasons of the cause was delayed sorting process of the material. Consequently, in this study, we report the result of the arrangement method of relief supplies in a depot by "operations research (OR)".

2 - Quantifying Resilience in Cyber-Physical Systems
      Igor Linkov, Risk and Decision Science Focus Area Lead, US Army Corps of Engineers, 696 Virginia Rd, Concord, MA, 01742, United States of America, Igor.Linkov@usace.army.mil

Security in the face of increasingly pervasive and costly cyber attacks has prompted the call for enhanced resilience. We argue that resilience can be understood as a property of a networked system, and two approaches are discussed in which to develop resilience metrics: a MCDA matrix-based approach, and network science tools. The use of these approaches for strengthening system resilience and ensuring the continuity of the critical functions of cyber-physical systems will be discussed.

3 - An Empirical Analysis of Disaster Operations Management and a
   Research Agenda
      Niratcha Grace Tungtisanont, PhD Student, Clemson University, 100 Sirrine Hall, Clemson, SC, 29634, United States of America, ntungti@g.clemson.edu, Aleda Roth, Yann Ferrand

We first motivate the need for a humanitarian operations agenda, describing the operations management gaps and future research directions. We then conceptualize humanitarian and disaster operations in multiple ways, including the four phases of the disaster cycle, a typology of natural disasters, the stakeholders in disaster management, and the magnitude, frequency, and time duration of disasters. Finally, we perform an econometrics analysis to study the losses resulting from natural disasters.

4 - Identifying Points of Supply Consolidation for Relief Provision
   using Uncongested Transport Links
      Guven Ince, UMass Amherst, 990 N Pleasant St, Apt E14, Amherst, MA, 01002, United States of America, gince@som.umass.edu, Agha Iqbal Ali

We make use of optimization methodology to reveal the dependence of timely provision of relief to populations in rehabilitation sites on the selection of points of supply consolidation. The optimization framework is demonstrated for the provision of supplies to affected populations in the aftermath of a catastrophic earthquake in Istanbul.

**5 - Rapid Flow Path Network Design: Properties and Two
       Exact Algorithms**
   Reza Zanjirani Farahani, Kingston University London, KHBS 215,
   Kingston Business School, Kingston Hill, Kingston Upon Thames,
   United Kingdom, zanjiranireza@gmail.com

I introduce rapid flow path network design problem (RFPNDP) which has
applications such police patrolling and quick and temporary road network repair
after disasters. RFPNDP makes decisions which are made rapidly as there is not
sufficient time, generates many feasible solutions rather than only one optimal and
consider handmade solutions as computer systems may have already been
collapsed. We extract some properties of RFPNDP analytically and develop two
algorithms to solve it in special cases.

■ **WD25**

Hilton- Union Sq 5

Transportation, Operations II
Contributed Session

Chair: Mesut Yavuz, University of Alabama at Tuscaloosa, Tuscaloosa,
Tuscaloosa, AL, United States of America, myavuz@cba.ua.edu

**1 - LNG Inventory Routing with Pickup Contracts and
       Origin-destination Clauses**
   Marielle Christiansen, Professor, Norwegian University of Science
   and Technology, Alfred Getz vei 3, Trondheim, Norway,
   marielle.christiansen@iot.ntnu.no, Sondre Thorvaldsen,
   Henrik Andersson, Kristian Emanuelsen

We consider an LNG supply chain problem where an energy actor is responsible for
the routing and scheduling of LNG ships and the inventory management at the
regasification terminals. At the liquefaction plants there exist purchase agreements
with upstream suppliers containing issues regarding the total pickup volume,
prices, loading regularity and origin-destination restrictions. Three models are
developed and compared. Computational studies based on real-world instances
show promising results.

**2 - Balance vs. Efficiency Trade-off in Mixed-fleet Green
       Vehicle Routing**
   Mesut Yavuz, University of Alabama at Tuscaloosa, Tuscaloosa,
   Tuscaloosa, AL, United States of America, myavuz@cba.ua.edu,
   Ismail Capar

Minimization of total vehicle miles traveled (VMT) is commonly adopted as the
objective function in vehicle routing. When a mixed-fleet consisting of gasoline or
diesel and alternative-fuel vehicles is considered, a weighted VMT objective better
represents efficiency. Balance among vehicle routes is measured in terms of total
tardiness and maximum tardiness. In this talk we present trade-offs between
efficiency and balance via a computational experiment in a mixed-fleet setting.

3 - Dynamic Traffic Control Interventions for Enhanced Mobility
   SeyedBehzad Aghdashi, Post-Doc, ITRE, 803 Essex Forest Dr #,
   Cary, NC, 27518, United States of America, saghdas@ncsu.edu

This research is intended to develop efficient (optimized) methods that dynamically
evaluate the current traffic system performance, propose interventions that can
ameliorate the performance as needed, and implement and re-evaluate the
effectiveness of the intervention. To enable real progress in this arena, the focus
will be on active traffic management techniques and their application on freeway
facilities.

**4 - Parcel Distribution Timetabling Problem with Incomplete
       Hub Network**
   Omar Ben-Ayed, Professor, Qatar University, College of Business
   and Economics, PO Box 2713, Doha, 2713, Qatar,
   omar.benayed@qu.edu.qa, Salem Hamzaoui, Faiza Zalila,
   Belaid Aouni

Parcel distribution timetabling problem optimizes the movements of parcels in
their journey from their pickup to their delivery. The minimization of the time
spent in this journey is a common objective for this problem. We provide a
comprehensive presentation of this problem that emphasizes its practical aspects.
The proposed mixed integer program addresses the common case of incomplete
hub network where the volume between two hubs is not large enough to justify
the use of a dedicated transport.

■ **WD26**

Hilton- Union Sq 6

Vehicle Routing IV
Contributed Session

Chair: Mohammad Yousef Maknoon, Ecole Polytechnique Montreal,
2900 Boulevard Edouard-Montpetit, Montreal, Canada,
mohammad-yousef.maknoon@polymtl.ca

**1 - A Parallel Route Construction Algorithm for the Vehicle Routing
       Problem with Soft Time Windows**
   Sezgin Kaplan, Asst. Professor, Turkish Air Force Academy,
   Hava Harp Okulu, Yesilyurt, Istanbul, 34149, Turkey,
   skaplan@hho.edu.tr, Ahmet Herekoglu

A novel parallel route construction algorithm is developed for the vehicle routing
problem with soft time windows (VRPSTW). The Apparent Tardiness Cost rule,
which is a good composite dispatching rule for the parallel machine scheduling
problem with total weighted tardiness, is adapted to the VRPSTW by considering
the slack factors for the time windows. Computational results are compared with
the alternative heuristic algorithms for the set of benchmark problems by
Balakrishnan (1993).

2 - Vehicle Routing with Cross-dock Selection
   Mohammad Yousef Maknoon, Ecole Polytechnique Montreal,
   2900 Boulevard Edouard-Montpetit, Montreal, Canada,
   mohammad-yousef.maknoon@polymtl.ca, Gilbert Laporte,
   Pierre Baptiste

Vehicle routing problem with cross-dock selection is a variant of the vehicle
routing problem containing spatial and load synchronization constraints by which
products are transferred and processed via at least one cross-dock. In this
presentation, we investigate this problem and demonstrate the challenges in
finding the optimal solution. Finally, we represent a heuristic methodology to
handle practical problems.

**3 - Multiple Partial Dominance for the Elementary Shortest Path
       Problem with Resource Constraints**
   Troels Martin Range, Associate Professor, Department of Business
   and Economics, University of Southern Denmark, Campusvej 55,
   Odense, 5230, Denmark, tra@sam.sdu.dk

We present a new dominance criterion for dynamic programming used in the
Elementary Shortest Path Problem with Resource Constraints. The criterion is
based on the observation that a state can be partially dominated by another state
and that we can combine the partial dominance of several states to fully dominate
a given state. By using this criterion we can eliminate states earlier in the solution
process which may be worthwhile, when the problems become difficult.

**4 - A Study on Indian Rice and Wheat Food Supply Chain –
       Select Modeling Insights**
   Lohithaksha M Maiyar, Research Scholar, Indian Institute of
   Technology Kharagpur, Industrial and Systems Engineering Dept.,
   IIT Kharagpur, Kharagpur, WB, 721302, India,
   lohit10.maiyar@gmail.com, Jitesh J Thakkar

Over the recent times the major global concern is to ensure food security to the
growing population. In line with this concern, this paper discusses the issues and
challenges faced in efficient supply of rice and wheat in Indian context with the
help of a specific network diagram. Finally few mathematical models for the rice
and wheat distribution system have been presented which can be taken as an input
for further analyzing and improving the current state of Indian food distribution
system.

5 - Minimum Cost Path Problem for Plug-in Hybrid Electric Vehicles
   Okan Arslan, PhD Candidate, Bilkent University, Department of
   Industrial Engineering, Bilkent University, Ankara, 06800, Turkey,
   okan.arslan@bilkent.edu.tr, Baris Yildiz, Oya Karasan

We investigate the minimum-cost path problem for plug-in hybrid electric vehicles.
The objective is to find a minimum-cost path between given departure and
destination points in a transportation network and to determine the refueling and
battery switching policies. We show that the problem is NP-complete and propose
two solution techniques: a mixed integer quadratically constrained program and a
dynamic programming based heuristic.

WD27   *INFORMS San Francisco – 2014*

■ WD27

Hilton- Union Sq 7

Aviation

Contributed Session

Chair: Rodrigo Scarpel, Instituto Tecnolögico de Aeronautica, Praca Marechal Eduardo Gomes, 50, ITA - IEM , sala 2311, São José dos Campos, SP, 12228900, Brazil, rodrigo@ita.br

Co-Chair: Alexander Yemelyanov, Professor, Georgia Southwestern State University, 800 GSW University Drive, Americus, GA, 31709, United States of America, alexander.yemelyanov@gsw.edu

1 - A Data Mining Approach for Early Identification of Potential Disruptive Scenarios
Rodrigo Scarpel, Instituto Tecnolögico de Aeronautica, Praca Marechal Eduardo Gomes, 50, ITA - IEM , sala 2311, São José dos Campos, SP, 12228900, Brazil, rodrigo@ita.br

On disruption management, the philosophy of robust optimization is to generate an operational plan that is "good" for most scenarios and acceptable for the worst scenario. Thus, in oder to employ the robust optimization all potential disruptive scenarios must be specified. The objective of this work is to make use of a data mining approach for early identification of such disruptive scenarios for the São Paulo International Airport (Brazil).

2 - Global Air Jet Medical Network Design
Wei Chen, University of Pittsburgh, 241 Mevis Hall, Pittsburgh, PA, 15260, United States of America, raul.weichen@gmail.com, Jennifer Shang

Given current international health care demand unbalance situation and considering all air medical transport's characteristics, this research designs a global network structure for an air medical transport firm. The objective of the research is to maximize firm's global service coverage in a cost effective way.

3 - Optimization of Performance Shaping Factors Analysis in Safety Databases
Alexander Yemelyanov, Professor, Georgia Southwestern State University, 800 GSW University Drive, Americus, GA, 31709, United States of America, alexander.yemelyanov@gsw.edu, Alla Yemelyanov

The existing databases on accident/incident reports such as NTSB, NASA-ASRS, etc. are suitable mostly for statistical analysis of predetermined error categories rather than for the analysis of underlying causal factors. We present an error modeling method with classification algorithms and verbal decision analysis that allow to collect cognitive PSFs at the stage of accident investigation and provide further analysis of these data to determine repeated factors and error-provoking situations.

4 - Optimizing AMAN-SMAN-DMAN at Hamburg and Arlanda Airport
Carlo Mannino, Professor, SINTEF ICT, Forskningsveien 1, OSLO, Norway, carlo.mannino@sintef.no, Dag Kjenstad, Patrick Schittekat

Air Traffic Management controls movement of airplanes at airports, a complex task divided into Arrival, Surface and Departure Management problems. Airports handle them independently preventing good solutions to be found. We developed an integrated optimization approach that showed remarkable improvements compared to expert controllers for Hamburg airport. Embedded in an ATM system developed with SAAB and THALES, it will be officially validated by the Swedish air traffic control in October 2014.

■ WD28

Hilton- Union Sq 8

Data Mining and Optimization for Air Traffic Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: Aude Marzuoli, Georgia Institute of Technology, 270 Ferst Drive, School of Aerospace, Atlanta, GA, 30332-0150, United States of America, amarzuoli3@gatech.edu

1 - Multimodal Impact Analysis of an Airside Catastrophic Event
Alexandre Bayen, University of California at Berkeley, Berkeley, CA, United States of America, bayen@berkeley.edu, Aude Marzuoli, Eric Feron, Emmanuel Boidot, Alexis Ucko, Mark Hansen, Paul van Erp

The present project aims at performing a data-driven analysis of multimodal (air, rail, road) transportation efficiency through the case study of a large-scale disruption in the San Francisco Bay Area. The study provides an overview of the impact of the disruption on the air side and the ground side, and highlights the coupling between transportation modes. This analysis stresses the importance of further data-driven research on interdependent infrastructure networks to improve their resilience.

2 - Regression Models of Aircraft Engine Fuel Burn and Emissions
Yashovardhan Chati, MIT, Boston, MA, United States of America yschati@mit.edu, Hamsa Balakrishnan

The Flight Data Recorder collects aircraft and engine parameters during the course of a flight. In this talk, we propose statistical models for different aircraft types that predict engine fuel flow rates, total fuel burn and emissions of various pollutant species, given observations of trajectory variables (such as position and speed). The results can be used to refine fuel burn and emissions inventories, in order to better reflect the impacts of actual aircraft operations.

3 - Airport Ground Delay Planning using Markov Decision Processes
Jonathan Cox, Stanford, 496 Lomita Mall, Stanford, CA, United States of America, joncox@stanford.edu, Mykel Kochenderfer

We present a solution to the single airport ground hold problem that outperforms existing solution techniques by a considerable margin. The approach uses Monte Carlo tree search to find an approximate solution to a Markov decision process model of the system dynamics. Performance is demonstrated by comparison to existing techniques using historical data from San Francisco International Airport.

4 - Message Clustering and Targeting for Throughput-Limited Communication
Joseph Rios, Research Aerospace Engineer, NASA, Ames Research Center, Mail Stop 210-15, Moffett Field, CA, 94035, United States of America, joseph.l.rios@nasa.gov, Avijit Mukherjee

In certain communication environments, efficient use of throughput is paramount. For example, sending messages via satellite wherein the cost is related to the target area of the broadcast and the message length, one needs to efficiently compose and bundle messages based on their payloads. We developed models for clustering multiple payloads with varying target locations that minimize the total broadcast cost. We demonstrate the utility of the model with an aviation application for Alaska.

■ WD29

Hilton- Union Sq 9

Operations Management/others

Contributed Session

Chair: Kai Luo, Kedge Business School, France, Toulon, France, kai.luo@kedgebs.com

1 - Tacit Knowledge Management Methods
Kai Luo, Kedge Business School, France, Toulon, France, kai.luo@kedgebs.com

In the knowledge economy, knowledge is the strategic resource for enhancing competitive advantage of organizations. This paper addresses two different strategies based on the distinction between tacit and explicit knowledge. We provide theoretical results for both linear and non-linear models. Managerial insights are also provided via numerical examples.

2 - Critical Influencing Factors and Paths of Leader's Global Mindset
Haixin Zhang, University of Science and Technology of China, Jin Zhai Road 96, Hefei, China, z_h_x606@139.com

Based on literature research and grounded theory, explore the deep-seated factors that affect the leader's global mindset.

3 - Inspection, Traceability and Recall Cost Sharing Contracts
Shengnan Sun, Southeast University, School of Economics and Management, Sipailou 2, Nanjing, 210096, China, sun.shengnan@seu.edu.cn, Xinping Wang

Traceability and inspection are different policy mechanisms for firms to improve food quality and safety with their supply chain. The two mechanisms are not independent in terms of their influence on firm behavior and food safety. In this paper, we discuss contractual agreements by which food product recall costs can be shared between a manufacture and a supplier to induce traceability improvement effort, and analyze the impact of inspection policy on contracts.

■ WD30

Hilton- Union Sq 10

Operations Management/Marketing Interface IV

Contributed Session

Chair: Changseung Yoo, UT Austin, 2110 Speedway Stop B6500, CBA 5.202, Austin, TX, 78712-1277, United States of America, Changseung.Yoo@phd.mccombs.utexas.edu

1 - On Pricing and Composition of Multiple Bundles offered in Multiple Market Segments

Juan-Carlos Ferrer, Associate Professor, P. Universidad Catölica de Chile, Casilla 306 Correo 22 Santiago Chile, Santiago, Chile, jferrer@ing.puc.cl, Alejandro Cataldo

We study the problem facing a company that should determine the optimal composition and price for multiple bundles offering across multiple market segments, where it will compete with other bundles offered by the competition. We consider that competitors will not react in the short term, and we assume that consumers are rational (maximize their utility function). The problem is modeled as a mixed nonlinear program, and we propose heuristic methods to solve it.

2 - A Two-product Inventory System with a Probabilistic Good

Xiaoya Xu, University of Macau, Macau, Taipa, China, yb27003@umac.mo, QI FU, Zhaotong Lian

We investigate the impact of offering a probabilistic good in a single period two-item inventory planning system. The optimal inventory decisions for the two regular products are analyzed. This probabilistic selling strategy can help firms effectively pool the excess stocks to better match supply with demand and thus enhance profitability. We also explore the pricing decision of the probabilistic good using both additive and multiplicative demand functions when there is demand cannibalization.

3 - Price, Quality and Advertising Decisions Considering Reference Price Effects

Qinglong Gou, Associate Professor, University of Science and Technology of China, Jinzhai Road 96, Hefei, 230026, China, tslg@ustc.edu.cn, Zhimin Huang, Yanyan He

A change from the B2C e-commerce is that a consumer cannot observe a product's quality directly. Thus, an online consumer makes his decision mainly based on his own expectation, i.e., the reference quality. In this paper we incorporate reference effect into a firm's joint decision on quality, advertising and pricing under a dual channel framework. Our study provides a new perspective of investigating the influence of B2C e-commerce.

4 - Consumer Intention to Purchase Remanufactured Product: An Experimental Analysis of Product Knowledge

Yacan Wang, Beijing Jiaotong University, No.3 Shangyuan Road, Xizhimen Wai, Haidian District, Beijing, China, ycwang@bjtu.edu.cn, Benjamin Hazen

This paper develops a research model to describe consumers' intention to purchase remanufactured products. Using a 2x2x2 inter-group experiment, we examine how knowledge of remanufactured products in terms of cost, quality, and green benefits affects consumers' perception of both risk and value associated with purchasing remanufactured products, and how these perceptions subsequently affect consumers' purchase intentions.

5 - Competitive Pricing and Advertising in Dynamic Oligopoly Markets

Changseung Yoo, UT Austin, 2110 Speedway Stop B6500, CBA 5.202, Austin, TX, 78712-1277, United States of America, Changseung.Yoo@phd.mccombs.utexas.edu, Genaro Gutierrez

We analyze a multi-firms pricing and advertising model in a dynamic oligopoly market. We show that, under mild assumptions, the value functions of the firms in equilibrium exhibit strategic complementarities and that the equilibrium is increasing in brand awareness. To this end, we compare existing dynamic advertising models by designing a Kalman filter to estimate the models with actual market data, and show that there are many models that satisfy our assumptions. For those that violate our assumptions, we show that our choice of advertising models perform just as good as them.

■ WD31

Hilton- Union Sq 11

Innovation and Quality in Service Delivery

Sponsor: Service Science
Sponsored Session

Chair: Nilanjan Chattopadhyay, Dean Executive Education, Manipal University, Dubai International Academic City, Dubai, United Arab Emirates, nchattopadhyay@gmail.com

1 - An Investigation of Firm Performance and Country-of-Origin Effect in Adoption of Innovation

Jiyoon An, Texas Tech University, Rawls College of Business, Lubbock, TX, 79409, United States of America, jiyoon.an@ttu.edu

This paper examines the influence of a supplier firm's performance and country-of-origin effect on a buyer firm's willingness to adopt a supplier firm's product innovation. Specifically, a buyer firm's perceived importance of purchasing product and entrepreneurial orientation affect their willingness to accept a product innovation, which is moderated by a supplier firm's performance and country-of-origin effect from a network innovation perspective.

2 - Incentives for Quantitative and Qualitative Quality in Service Outsourcing Contracts

Zhi Ouyang, School of Management, Xi'an Jiaotong University, No. 28 at Xianning West Road of Xi'an, Xi'an, China, ouyangzhi1987@stu.xjtu.edu.cn

As to the poor service quality in outsourcing practice, we introduce qualitative quality into conventional outsourcing contacting. Based on the contract theory, we analyze the optimal quality for service outsourcing and investigate the reward and punishment mechanism for qualitative quality changes. We show optimal quantitative quality need to be modified to fit with feasible qualitative one; thus, service requirements with modified quality metrics can improve the outsourcing performance.

3 - Eco-labels and Their Contribution to Company Profit

Xu Yang, Assistant Professor, San Jose State University, Dept of Marketing and Decision Sciences, San Jose State University, San Jose, CA, United States of America, xu.yang@sjsu.edu, Amy Xia

In this research we study how an industry designs the eco-label to promote green products in the market. The research questions we address include: how to design the eco-labeling mechanism, does it bring any profit to pursue the eco-label, how to price the green product to stay profitable? The main contribution of the research is to prove the positive effect of eco-label to company profit.

4 - Shipping Cost Optimization for an E commerce Retail Company

Mrinalini Shah, Professor, Institute of Management Technology, Raj Nagar, Hapur Road, Ghaziabad, 201001, India, shahmrinalini@gmail.com, Nilanjan Chattopadhyay

An Indian online sports equipment retail company was facing huge loss due to fixed shipping charge of Rs 70 from its customers whereas courier companies were charging on the basis of volumetric weight. The challenge was 10,000+ products and 150+ cities as destination.The objectives was to decide the shipping charge from customers which should not exceed 15% of the price of the product and should be at least higher then what courier company charge to them while earning 7% overall profit margin.

5 - The Role of E-service Offerings, Customer Ratings, and Reviews in Enhancing Customer Demand

Xun Xu, PhD Candidate, Washington State University, Department of Finance and Management, Science, Washington State University, Pullman, WA, 99163, United States of America, xun.xu@email.wsu.edu, Charles Munson

Using the largest C2C online shopping website in China, we collected data for 200 online sellers for each of 40 products (8000 observations) pertaining to the sellers' respective customer ratings and reviews, relative popularity, history, price, and e-service offerings (e.g., fast shipping, refund opportunities, and purchase security). We examine the extent to which these activities and characteristics influence customer demand. Implications for online selling strategies are discussed.

6 - Strategic Balancing between Service Quality and Innovation: Evidence from Banking Industry

Nilanjan Chattopadhyay, Dean Executive Education, Manipal University, Dubai International Academic City, Dubai, United Arab Emirates, nchattopadhyay@gmail.com, Mrinalini Shah

Objective of this paper is to discuss the eternal problem faced by service providers while adopting a sustainable strategy to balance service quality and innovation, and therefore, cost. Analysis of data on multiple firms operating in different geographies lead to conclusion that fostering inter-functional collaboration can lead to service enhancement and quality through innovation.

■ WD32

Hilton- Union Sq 12

Supply Chain/Competition

Contributed Session

Chair: Dong Xu, Research Assistant, University of Arizona, 1127 E. James E. Rogers Way, Rm 111, Old Engr Bldg, Tucson, AZ, 85721, United States of America, dongxu@email.arizona.edu

1 - Is Online Channel a Counterstrategy to the Store Brand by the National Brand?

Xiaomeng Luo, PhD candidate, Department of Marketing, City University of Hong Kong, Rm 709, Hall 7, Student Residence, Kowloon, Hong Kong, Hong Kong - PRC, xiaomeng.sissi.luo@gmail.com, Jianbin Li, Ling Ge, Liwen Chen

We consider a supply chain with a national brand manufacturer distributing his products both through a retailer and an online channel. The retailer is also capable of introducing her own store brand. We use a two-stage game-theoretic model to capture the strategic interaction between the online channel and the store brand.

2 - Vertical Competiton in a Decentralized Supply Chain under Supply Uncertainty

Shaoxuan Liu, Associate Professor, Shanghai Jiao Tong University, ACEM, Shanghai, China, liusx@sjtu.edu.cn, Rick So, Fuqiang Zhang

We study a two-stage decentralized supply chain in which a manufacturer sells a product to a retailer who in turn sells the product to consumers.The supply process of the supply chain is uncertain and customer demand is determined by the retailer's endogenous sales effort decision. We study the impacts of supply uncertainty on the firms' optimal decisions, their profits and the supply chain efficiency.

3 - Pollution Control, Bilateral Duopoly, Double Marginalization, Dynamic Games

Fouad el Ouardighi, Professor, ESSEC Business School, Bp 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr, Bowon Kim

The literature on pollution control has pointed out the improper internalization of pollution externalities in a horizontal setting (i.e., with two producers) involving no price competition. We design a bilateral duopolistic price competition differential game and compare whether supply chain coordination would be more efficient than horizontal coordination to reduce pollution.

4 - An Integrated Simulation and Game Theoretic Framework for Analysis of Supply Chain Competitions

Dong Xu, Research Assistant, University of Arizona, 1127 E. James E. Rogers Way, Rm 111, Old Engr Bldg, Tucson, AZ, 85721, United States of America, dongxu@email.arizona.edu, Young-Jun Son

An integrated simulation and game-theoretic approach is presented to study the multi-echelon, multi-period newsvendor competition. We will first discuss an innovative simulation-based game platform involving agent-based and systems dynamics modeling, which can be utilized in both the repeated matrix game and stochastic game settings. The game solving procedures are further developed, with the equilibrium existence, uniqueness, and algorithm convergence in the considered supply chain experiments.

■ WD33

Hilton- Union Sq 13

Research and Development

Contributed Session

Chair: Xiang He, University of Cambridge, Emmanuel College, Saint Andrews Street, Cambridge, CB2 3AP, United Kingdom, xh232@cam.ac.uk

Co-Chair: Mohammad Quasem, mohammadquasem@gmail.com

1 - Effect of R&D Diversification on Alliance Outcomes

Xiang He, University of Cambridge, Emmanuel College, Saint Andrews Street, Cambridge, CB2 3AP, United Kingdom, xh232@cam.ac.uk

We examine the effect of R&D alliance choices on innovation quality and innovation output. In particular, We find that a firms' existing R&D diversification is a strong moderating variable, in that it affects a firm's tendency to commit to any particular R&D alliance. We use a novel instrumental variable to remove endogeneities rising from partner selection.

2 - Best Practices using the CPLEX Python API

Ryan Kersh, Software Developer, IBM, 355 Goodpasture Island Rd., Eugene, OR, 97405, United States of America, rkersh@us.ibm.com

Python is a popular programming language that has been gaining traction in the scientific community. The CPLEX Python API allows users to access the CPLEX optimization engine from Python. When writing programs to solve LP problems using the CPLEX Python API there are several best practices which can prevent errors, improve performance, and enhance readability. Using real examples, a tour of the CPLEX Python API, and best practices for writing programs in this environment will be given.

3 - Integrated Pricing Strategies of Remanufactured Products with Replacement Purchase

Lei Jing, National University of Singapore, E1-07-26, Computing Lab, Kent Ridge 10, Singapore, 117576, Singapore, jinglei@nus.edu.sg, Boray Huang

For remanufacturing business in highly saturated markets, many product sales come from replacement purchase. Pricing strategies are usually adopted by remanufacturing companies to balance supply and demand. In this study, the joint decision of acquisition, trade-in and selling price is considered. It is shown that a remanufacturing firm should offer higher rebates to replacement customers when this customer segment has high return quality and high price sensitivity.

4 - The Influence of Dr. Deming's Philosophy in Quality Improvement

Mohammad Quasem, mohammadquasem@gmail.com

PDSA (plan-do-study-act cycle), also known as the Deming Wheel, is an important factor of processes and systems development, which are the keys to improving quality. This along with his famous 14 points is a critical element in organizational development, leading him to be granted the title as the father of quality improvement. Deming believed that defective products were produced due to the carelessness of management. Over the last 60 years Dr. Deming has been the most important contributor in improving quality. This study has shown how his philosophy of quality improvement has influenced nearly every field.

■ WD34

Hilton- Union Sq 14

Performance Measurement 2

Contributed Session

Chair: Arne S. Drud, ARKI Consulting & Development, Bagsvaerdvej 246A, Bagsvaerd, 2880, Denmark, adrud@arki.dk

1 - A Study on Connectivity-Electrical Conductivity Relationship of Carbon Nanotube Networks

Min-Yang Li, Florida State University/High-Performance Materials Institute, 2005 Levy Ave, Tallahassee, FL, 32310, United States of America, minyangli@gmail.com, Richard Liang, Andrew Moench, Brian Wiesner

Although experimental and theoretical studies have identified some factors that affect the electrical conductivity of CNT films, the effect of CNT network topology on the electrical conductivity remains unclear. We present an image analysis approach to extract the CNT network topology information directly from a scanning electron microscope (SEM) image of a CNT film, and use the result to study the relationship between the network topology and the electrical conductivity.

2 - Performance Impacts of Plant Level Production Improvement Programs

Markku Kuula, Professor, Aalto University School of Business, Runeberginkatu 22-24, Helsinki, Finland, Markku.Kuula@aalto.fi, Katri Kauppi

With increased competition, manufacturing organizations are forced to launch new activities to develop their operations. The aim of this paper is to analyze how production improvement activities and product development efforts affect plants' performance. The analyses are made using data from the International Manufacturing Strategy Survey 6th edition. The data set consist of manufacturing five industry sectors and over 800 responses across 15 countries.

3 - From CONOPT3 to CONOPT4

Arne S. Drud, ARKI Consulting & Development, Bagsvaerdvej 246A, Bagsvaerd, 2880, Denmark, adrud@arki.dk

The presentation gives an overview over the major changes in CONOPT between version 3 and 4: Improved preprocessor; Separation between user model and various internal sub-models; Improved sub-algorithms with selection based on up-to-date model information; Stability improving basis selection. Emphasis is on reliability and large scale. Efficiency comparison of old vs. new version will be provided.

4 - Mining Process Metrics from Project Tracking Tools for Software Development Teams
Ryan Panos, Arizona State University, 3243 Guillermo Pl, Hayward, CA, 94542, United States of America, rpanos@asu.edu

I have pursued statistical relationships between policy choices and environmental factors in software development teams by mining time related data from project tracking tools. Ideally, these dependent and independent variables will also be correlated with indicators of productivity levels. In support of the movement to agile methodologies, we also are attempting to measure how agile a team might be relative to others and in contrast to traditional waterfall based teams.

5 - Contextual Managment in China's Local NGOs and Social Enterprises
Husheng Xu, University of Science and Technology of China, School of Public Affairs, Hefei, China, hsxu@mail.ustc.edu.cn, Liang Gao

NGOs and Social Enterprises management in China context are attracting increasing attention. Theory and practice of this field are creating social value to improve societal development. 54 and 47 non profit organizations and potential social enterprises were fully surveyed in 2011 and 2013. All these groups were local grass organizations from inner area of central China which acquire specific attention. With respect, China's unique contextual management characters were considered in this study.

■ WD35

Hilton- Union Sq 15

Dynamic and Stochastic Models in Emergency Response and Preparedness

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Sibel Salman, Associate Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, Turkey, ssalman@ku.edu.tr

1 - Modeling for Pre-planning of Resources for Emergency Situations
Shaligram Pokharel, Professor, Qatar University, P.O. Box 2713, Doha, Qatar, shaligram@qu.edu.qa, Rojee Pradhananga, Fatih Mutlu, Jose Holguin-Veras

A two-stage stochastic resource allocation and distribution model is presented for prepositioning of resources to meet demand at an emergency (post-disaster stage) situation. Supply deficit in the post disaster stage is met with shipments from the suppliers. The problem is to obtain optimal resource allocations and choice of suppliers and distribution centers for pre and post disaster situation. Application of the model on a case study and analysis of cost and service trade-off are discussed. (This research is funded through Qatar/QNRF/NPRP Project: 5-200-5-027)

2 - A Heterogeneous Fleet of Vehicles for Automated Humanitarian Missions
Enes Bilgin, Advanced Micro Devices, 13509 Lamplight Village Ave, Austin, TX, 78727, United States of America, enes1988@gmail.com, David Escobar Sanabria, Pieter Mosterman, Kun Zhang, Justyna Zander

An automated emergency response system responds to dynamic and heterogeneous pick-up and delivery requests submitted in the aftermath of a disaster. Autonomous fixed wing aircraft is used for reconnaissance, autonomous trucks serve as depots and the requested items are delivered via autonomous quadcopters. The system aims to respond to high priority requests in minimum time, for which p-median and tabu search algorithms are utilized.

3 - Dynamic Vehicle Routing by Incorporating Social Data in Disaster Relief
Emre Kirac, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ekirac@uark.edu, Ashlea Milburn

Decision makers in disaster response community have faced challenges whether to take social data streams into consideration to identify needs in a shorter amount of time. However, needs identified through social media initially have not been verified. Confidence in requests changes with time based on verification inputs. A wide variety of decision policies are defined to represent a broad range of emergency manager preferences. These policies are compared across a variety of demand scenarios.

4 - Impact of Information Sharing on Relief Distribution During Disasters
Huguette Tran, University of North Texas, 1155 Union Circle, 311396, Denton, TX, 76203, United States of America, huguette.tran@unt.edu, Cigdem Kochan, David R. Nowicki

This study evaluates the impact of demand information sharing on relief distribution during a disaster. A mathematical model is developed to determine the optimal relief quantities when there is full and partial information sharing. The results show that full information sharing improves the accuracy of the relief quantities.

■ WD36

Hilton- Union Sq 16

Sports & Entertainment I

Contributed Session

Chair: Stephen Hill, Assistant Professor, UNC Wilmington, 601 South College Road, Wilmington, NC, 28403-5611, United States of America, hills@uncw.edu

1 - Building Perfect Tournament Brackets with Data Analytics
Christopher Hagmann, Purdue University, 480 Stadium Mall Dr., West Lafayette, IN. United States of America, chagmann@purdue.edu, Nan Kong

The NCAA men's basketball tournament highlights data analytics to the everyday person as they look for help building their brackets. In this talk, a k-Nearest Neighbors algorithm is proposed to compare new opponents to previously played teams. A distance between teams is calculated to determine the most similar teams and to weight the value of each win or loss to the teams. The value of k is determined from previous years and applied to 2014. Results are compared to other predictions for 2014.

2 - Down - Set - Punt? Evaluating a Late-Game Strategy in Canadian Football
Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca, Kent Kostuk

In several respects, Canadian football is unlike the American version of the sport. One particular difference involves kicking strategies. Canadian teams can earn a single point by punting the ball through the end zone. During the final moments of a tied game, a team may prefer punting for a single point rather than attempting a field goal. We build a decision analysis model for this scenario and use it to evaluate actual decisions made during a 2010 Canadian football game

3 - Learning to Dance: Conference Tournament Design for Maximum Financial Benefit
Stephen Hill, Assistant Professor, UNC Wilmington, 601 South College Road, Wilmington, NC, 28403-5611, United States of America, hills@uncw.edu

NCAA basketball conferences hold tournaments to determine their champions. The champions then receive automatic bids to the NCAA Tournament. For some conferences, the tournament champion is likely to be the conference's only participant in the NCAA Tournament. We analyze whether it is in a conference's financial interest to ensure that its best team receives the automatic bid. We discuss the implications that this analysis could have on the structuring of tournaments.

4 - Analyzing and Forecasting Attendance at FIFA Soccer World Cups
Ghaith Rabadi, Associate Professor, Engineering Management and Systems Engineering, 5115 Hampton Blvd, Old Dominion University, Norfolk, VA, 23529, United States of America, grabadi@odu.edu, Ahmed Ghoniem, Agha Iqbal Ali, Mohammed Al-Salem

Abstract: The FIFA World Cup is among the most popular international sport events. This paper analyzes historical data on attendance at FIFA World Cups over the last two decades. Key factors that influence attendance are identified and their relative importance is discussed. This analysis can be used within a forecasting framework to predict attendance at future events.

■ WC37

Hilton- Union Sq 17

Marketing 1

Contributed Session

Chair: Shaobo Li, University of Cincinnati, 2925 Campus Green Dr., Cincinnati, OH, 45221, United States of America, lishaobo413@gmail.com

1 - Product Strategy under Smartphone Competition
Siddhartha Sharma, Indian School of Business, AC 6121, Gachibowli, Hyderbad, AP, 500032, India, siddhartha_sharma@isb.edu, Amit Mehra

We observe an unusual phenomenon of Nexus 5 having a much lower price tag than other phones of comparable quality like iPhone 5S and Galaxy S4. Using a game-theoretic model, we show that the usual result of high quality-high price can be overturned in the case of smartphone competition. This happens because introduction of Nexus allows for increased revenue for Google since it does not share the ad and app revenue from Android phones as it has to do on the earnings from iPhones.

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2 - Non-Monetary and Monetary Rewards for Product Review Contribution in a Connected Community
Xiaojing Dong, Santa Clara University, 500 El Camino Real, Lucas Hall, Marketing, Santa Clara, CA, 95053, United States of America, xdong1@scu.edu, Yacheng Sun

We empirically demonstrate that monetary reward can sometimes decrease product review contributions in a community. Using a HB model, we examine individual-level contributions before/after the introduction of monetary reward. We find that with the reward, consumers with more friends decreased their contributions by 90%; while those with fewer or no friends increased their contributions by 1400%. They suggest that there is a significant conflict between monetary rewards and non-monetary rewards.

3 - The Pricing Strategy of Multinational Enterprises
Mei-Wen Chao, Assistant Professor, Kao-Yuan University, No. 1821, Chung-Shan Rd, Lu-Chu district, Kaohsiung, Taiwan - ROC, t80149@cc.kyu.edu.tw

Multinational Enterprise (MNE) has been studied extensively across countries and companies. While the emerging globalization of market pressures MNEs to consolidate operations, price always remains a key point of international differentiation for most products. This paper consider the pricing strategy by taking into consideration of entry mode, product life cycle and outsourcing. Salient results and practical issues involved in this unique problem are discussed in detail in this paper.

4 - In Search of Models for Stock Return Forecasts
Shaobo Li, University of Cincinnati, 2925 Campus Green Dr., Cincinnati, OH, 45221, United States of America, lishaobo413@gmail.com, Yan Yu

We attempt to investigate forecastability of US stock market return by using a set of information. Given the high dynamicity of stock return, we propose to develop Bayesian Dynamic Linear Model (DLMs), which assumes model coefficients to be time-varying. Model Averaging technique is applied to improve the forecasting accuracy. We compare our developed DLMs model with previously established models in terms of out-of-sample R square.

5 - Causality and Time: A Longitudinal Model for the Impact of Digital Advertising
Daniel Hill, Senior Data Scientist, Integral Ad Science, 95 Morton St., Floor 8, New York, NY, 10014, United States of America, dhill@integralads.com, Gijs Joost Brouwer, Kiril Tsemekhman, Alan Hubbard

Ad networks target people who are inclined to buy the product being advertised. Do their ads cause users to convert or would they have converted regardless? Previous studies have applied the tools of causal analysis to address this question. However, their static models did not capture the dynamic interplay between user and advertiser. We developed a longitudinal event-driven causal framework for the analysis of ad campaigns. Our method generalizes to any intervention on online behavior.

■ **WD38**

Hilton- Union Sq 18

Health Care, Process 1
Contributed Session

Chair: Anu Banerjee, PhD Student, Binghamton University, SUNY, Vestal Parkway East, Binghamton, NY, 13902, United States of America, banerjee@binghamton.edu

1 - Correcting Systematic Errors in Clinical Laboratories
Chin Hon Tan, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, isetch@nus.edu.sg

Analyzers in clinical laboratories are tested periodically to ensure that readings are within acceptable levels of accuracy. When a systematic error (e.g., contamination of reagent) occurs, readings may deviate significantly from their true values. Therefore, the laboratory should retest all affected patient samples. However, the onset of error is often unknown. We propose a Bayesian approach, which sequentially updates the distribution for the time of error, in tackling this problem.

2 - EHR and its Impact on Healthcare
Anu Banerjee, Ph.D. Student, Binghamton University, SUNY, Vestal Parkway East, Binghamton, NY, 13902, United States of America, banerjee@binghamton.edu, Sal Agnihothri

An Electronic Health Record (EHR) is a systematic collection of health information in digital format to capture a patient health status. It allows patient history to be viewed and shared across different healthcare settings. Implementing EHR system could reduce costs and increase quality of care. Recently the U.S. Govt. provided incentives to drive adoption of EHRs. The objective of this paper is to examine EHR and its impact on healthcare operations in general and patient health in particular.

3 - The Effect of Organizational Practices on Outcomes of Cardiothoracic Surgery
Jingyun Li, PhD Student, The University of Texas at Dallas, 7740 McCallum Blvd. Apt. 321, Dallas, TX, 75252, United States of America, jxl097620@utdallas.edu, Indranil Bardhan, Steve Ring

Coronary Bypass Artery Grafting (CABG) patients experience significant variations in healthcare outcomes after surgery. We study hospital- and surgeon-specific organizational practices related to cardiac surgeries on a large panel of CABG patients, using archival and survey data collected across 26 hospitals in North Texas, and their impact on patient outcomes.

4 - Process Issues of Patient Safety and Home Care for Healthcare Delivery Systems in Japan
Masato Takanokura, Kanagawa University, 3-27-1 Rokkakubashi, Kanagawa-ku, Yokohama, Japan, takanokura@kanagawa-u.ac.jp, Masaru Kawakami, Keiou Ishiguro, Tomokazu Muto, Seiko Taki, Tetsuo Yamada

Healthcare delivery systems in Japan should be improved urgently to enhance their quality of service and to reduce social security costs simultaneously. The consumption tax increased this spring in Japan to supplement the lack of social security costs. The aim of this study is to identify processes in healthcare delivery systems especially for patient safety and home care in hospitals and nursing homes in Japan. Possible alternative solutions are discussed under the constraints in Japan.

5 - Supply and Demand Alignment at Primary Care Facilities
Sina Faridimehr, Graduate Research Assistant, Wayne State University, Wayne State University, Detroit, MI, United States of America, fb1562@wayne.edu, Seung Yup Lee, Azade Tabaie, Alper Murat, Qingyu Yang, Ratna Babu Chinnam, Evrim Dalkiran, Hakimuddin Neemuchwala, Michael Lederle

We propose statistical models to improve timely access for patients while maintaining clinic capacity utilization in primary care facilities. The models leverage correlations between scheduling practice, panel size management, appointment slot grid design and access performance. Results from VA facilities are promising.

■ **WD39**

Hilton- Union Sq 19

Optimization in Radiation Therapy
Sponsor: Health Applications
Sponsored Session

Chair: Jagdish Ramakrishnan, Post-doctoral Scholar, University of Wisconsin-Madison, Wisconsin Institute for Discovery, Madison, WI, 53715, United States of America, jramakrishn2@wisc.edu

1 - Spatio-temporally Optimized Radiation Therapy
Minsun Kim, University of Washington, Radiation Oncology, Seattle, WA, 98195, United States of America, mk688@uw.edu, Fatemeh Saberian, Archis Ghate

Adaptive radiotherapy utilizes mid-treatment, anatomical images to re-evaluate tumor volume to modify treatment plans accordingly. We propose a stochastic control formalism framework for spatio-temporally optimized radiotherapy, where mid-treatment functional images provide clinicians with a chance to adapt the plan to biological changes of tumors in response to radiation. Potential benefits of spatio-temporal approach over current adaptive therapy will be demonstrated by numerical simulations.

2 - Optimization Problems in Proton Therapy Treatment Planning
Gino Lim, Department Chair, Hari and Anjali Agrawal Faculty Fellow, Associate Professor, University of Houston, E206 Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, Wenhua Cao

Radiation therapy treatment planning for cancer patients provides many challenging optimization problems. Unlike conventional photon based radiation therapies, the new intensity modulated proton therapy (IMPT) is highly sensitive to uncertainties and its optimization involves very large data sets. Therefore, we will present uncertainty incorporated models and efficient solution algorithms for choosing IMPT treatment beam angles, selecting proton energy levels, and determining intensity profiles.

3 - Simultaneous Beam Sampling and Aperture Shape Optimization for SPORT
Masoud Zarepisheh, Stanford University, Department of Radiation Oncology, Stanford, CA, United States of America, masoudzp@stanford.edu, Ruijiang Li, Yinyu Ye, Lei Xing

We build a mathematical model whose decision variables are beam angles and aperture shapes. We solve the resulting large scale optimization problem by integrating three optimization techniques: column generation, the subgradient method, and pattern search. Column generation adds the most beneficial stations (aperture shapes, beam angles, and corresponding intensities) sequentially. Then, the subgradient method and pattern search improve the selected stations locally and globally.

4 - Biological Planning for High-dose Rate (HDR) Brachytherapy and Applications to Cervical Cancer
Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & Healthcare, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

This work is joint with Rush University. HDR treatment preserves organ functionalities. Major challenges involve determining the best seed type, their spatial configuration, and dwell time. PET imaging facilitates design of treatment that target at cancer cells. We present an advanced planning system to simultaneously optimize the radiation source while at the same time escalating dose to the PET-identified cancer pockets. Results for cervical cancer patients treated will be discussed.

■ WD40

Hilton- Union Sq 20

Center for Systems Engineering in Health
Sponsor: Health Applications
Sponsored Session

Chair: Sean Barnes, Assistant Professor, University of Maryland, 4352 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, sbarnes@rhsmith.umd.edu

1 - A Multiobjective Optimization Technique for CRNA Staffing
Sauleh Siddiqui, Assistant Professor, Johns Hopkins University, 3400 N Charles St, Baltimore, MD, 21218, United States of America, siddiqui@jhu.edu, Robert Greenberg, Scott Levin, Claro Pio Roda

Staffing in hospital operating rooms (OR) require scheduling Certified Registered Nurse Anesthetists (CRNAs). Due to uncertainty in patient demand, creating an efficient schedule is not straightforward, and requires balancing surgical caseload, staff satisfaction, and costs. We present a multiobjective optimization technique that takes operating room patient flow data as input and creates a CRNA scheduling tool. As a case study, we implement this technique at the OR at Johns Hopkins Hospital.

2 - Outcomes-Based Emergency Department Triage
Scott Levin, Associate Professor, Johns Hopkins School of Medicine, 5801 Smith Ave, Baltimore, MD, 21209, United States of America, slevin33@jhmi.edu, Andrea Dugas, Matthew Toerper, Tom Kirsch

Our novel emergency department (ED) triage tool, HopScore, aims to support outcomes-based differentiation of patients addressing deficiencies in the current standard, Emergency Severity Index (ESI). The tool uses easily obtained patient demographic and clinical information commonly collected at triage to predict patients' risk for critical outcomes.

3 - PACER Surge Application
Matthew Toerper, Senior Software Engineer, Johns Hopkins University, 5801 Smith Avenue, Baltimore, MD, 21209, United States of America, mtoerper@jhu.edu, Gabe Kelen, Scott Levin, Lauren Sauer, Jamil Bayram, Christina Catlett

The National Center for the Study of Preparedness and Catastrophic Event Response (PACER) Surge application is a scalable, internet-based tool that allows hospital planners to simulate strategies in response to heightened population care needs during disasters. The tool determines the effects of these strategies on hospital surge capacity.

4 - Application of Supervised Machine Learning Methods to Predict Daily Hospital Discharges
Sean Barnes, Assistant Professor, University of Maryland, 4352 Van Munching Hall, College Park, MD, 20742, United States of America, sbarnes@rhsmith.umd.edu, Eric Hamrock, Matthew Toerper, Sauleh Siddiqui, Scott Levin

We apply supervised machine learning methods to predict patients likely to be discharged each day in a single hospital unit. We compare the predictive performance for logistic regression, decision trees, and ensemble learning approaches, and compare these results to clinician predictions.

■ WD41

Hilton- Union Sq 21

Supply Chain Management VI
Contributed Session

Chair: Byeong-Yun Chang, Ajou University, San 5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, bychang@ajou.ac.kr

1 - The Impact of Supply Chain and Business Process Managements on Firm Performance
Byeong-Yun Chang, Ajou University, San 5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, bychang@ajou.ac.kr

This research is to develop an integrated framework of SCM and BPM and to test their joint impact on firms' competitive advantage as well as economic and operational performance. In doing so, this paper will be a pioneer for both researchers and practitioners by giving empirical evidence on how SCM and BPM are interrelated each other and how they contribute to firms' effort in building their competitiveness and economic achievement.

2 - Effects of Demand Information Sharing on Service Level in Supplier Collaboration
Ki-Seok Choi, Hankuk University of Foreign Studies, 81 Oedae-ro, Yongin, 449-791, Korea, Republic of, kchoi@hufs.ac.kr, Kyungsik Lee

Buyer and supplier can benefit from collaboration in which buyer shares customer demand information with supplier. Shared demand information helps supplier reduce backorders and improve service level. We analyze the impact supplier collaboration has on service level by focusing on how early demand information is shared.

3 - A Study of Factor and Measurement of Supply Chain Resilience on the Buyer's and Seller's Perspective
Xiaowei Ji, Huazhong University of Science & Technology, Luo Yu Road No. 1037, Wuhan, 730074, China, Jixw@hust.edu.cn

Through empirical research, we identify the elements of supply chain resilience, analyze their influence on the competitiveness of supply chain and the mechanism of this course.On this basis, we use empirical methods to analyze the measurement of an enterprise's supply chain resilience.

4 - Blood Distribution Game
Harshal Lowalekar, Assistant Professor, Indian Institute of Management Indore, Prabandh-Shikhar, Rau-Pithampur Road, Indore, MP, 453331, India, harshal@iimidr.ac.in, Raghu Santanam, Ajay Vinze

We present a business game which models the problem of blood distribution from a regional blood bank to hospital blood banks. The computer-based multi-player game demonstrates the effects of constrained supply and stochastic demand on the performance of various stakeholders in the supply-chain of perishables like blood.

5 - Outsourced Parts Clustering for Supplier Quality Assurance
Venkat Venkateswaran, Professor of Practice, Rensselaer Polytechnic Institute, Room 725, 275 Windsor Street, Hartford, CT, 06120, United States of America, venkav3@rpi.edu, Steven Webster, Daniel Dillon

A supplier for the aerospace industry may be responsible for several hundred complex parts of small runs each. The quality protocol at the contracting aerospace company requires that process capability for each part manufactured at the supplier be certified, audited and continually monitored. A natural way to attack this complexity is to group parts into clusters and treat them as blocks. We describe our special purpose clustering algorithm to accomplish this.

■ WD42

Hilton- Union Sq 22

HSEA -IV- Undergraduate Projects in Healthcare Engineering
Sponsor: Health Applications
Sponsored Session

Chair: Jose Zayas-Castro, University of South Florida, 4202 E. Fowler Ave., ENB 118, Tampa, FL, 33620-5350, United States of America, josezaya@usf.edu

1 - HSEA Healthcare Team Based Projects
Jose Zayas-Castro, University of South Florida, 4202 E. Fowler Ave., ENB 118, Tampa, FL, 33620-5350, United States of America, josezaya@usf.edu

The panelists will address the status and progress of the curricular developments and education of health systems engineering. They will share their views, address barriers, requirements and ideas for the path forward. The panelists will address questions from the audience.

■ WD43

Hilton- Union Sq 23

Network Flow Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Martin Takac, Lehigh University, 27 Memorial Drive West, Bethlehem, PA, United States of America, martin.taki@gmail.com

1 - Moment-Based Relaxations of Optimal Power Flow Problems
Daniel Molzahn, Dow Postdoctoral Fellow, University of Michigan, 1301 Beal Avenue, Room 4234A, Ann Arbor, MI, 48109, United States of America, dan.molzahn@gmail.com, Ian Hiskens

Optimal power flow (OPF) is the key problem in operating electric power systems. A hierarchy of moment-based" convex relaxations globally solves many non-convex OPF problems for which existing relaxations fail. Comparing the feasible spaces of the low-order relaxations illustrates the capabilities of the moment relaxations. Exploiting sparsity and selectively applying the higher-order relaxation enables global solution of larger problems.

2 - Elementary Estimators for High-Dimensional Statistical Models
Pradeep Ravikumar, University of Texas at Austin, 2317 Speedway, Stop D9500, Austin, TX, 78712, United States of America, pradeepr@cs.utexas.edu, Eunho Yang, Aurelie Lozano

State of the art statistical estimators of structurally constrained high-dimensional statistical models are based on solving regularized convex programs, which are typically non-smooth non-strongly convex programs. An ongoing but strong line of research has focused on developing efficient and scalable optimization methods to solve these programs. Here, we address this scaling issue at the source, and develop *closed-form statistical estimators*, that yet come with strong statistical guarantees.

■ WD44

Hilton- Union Sq 24

Strategy/Strategic Planning I

Contributed Session

Chair: Jiulin Teng, HEC Paris, 1 Rue de la Liberation, Dept of Strategy and Business Policy, Jouy-en-Josas, 78350, France, jiulin.teng@hec.edu

1 - Empirical Study on the Relationships between Manufacturing Strategy and Competitive Performance
James Ang, Associate Professor of Decision Sciences, National University of Singapore, Mochtar Riady Building, BIZ 1, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizangsk@nus.edu.sg, Tomoaki Shimada, Eugene Lim, Ser-Aik Quek

We conducted non-linear regression analysis on the relationships between manufacturing strategy and competitive performance using data from the High Performance Manufacturing Project. We showed that data on established and emerging manufacturing countries should not be mixed for the purpose of data analysis, and found different characteristics in established and emerging manufacturing countries.

2 - Analysis of Prefabricated Urban Housing Constructions on Freight Transport Systems
Panagiotis Angeloudis, Lecturer, Imperial College London, Department of Civil & Environmental Eng, South Kensington Campus, London, SW7 2AZ, United Kingdom, p.angeloudis@imperial.ac.uk, Bani Anvari, Washington Y. Ochieng

Prefabricated buildings have become the choice of many construction teams as they offer time, cost, quality and environmental benefits compared to traditional on-site construction. We have explored the effects of prefabricated urban constructions on freight transport systems and identified cost-efficient logistics strategies using genetic algorithm. Our results will be beneficial for the Construction Method Selection Model which advises to what extent building components should be prefabricated.

3 - Contractual Negotiation and Ex Ante Economizing
Jiulin Teng, HEC Paris, 1 rue de la Liberation, Dept of Strategy and Business Policy, Jouy-en-Josas, 78350, France, jiulin.teng@hec.edu

We enrich the study of contracts with the ex ante cost aspect. Using a bargaining theoretic model with strategic reaction, we provide a view of contractual negotiation as a means to economizing bargaining cost, information cost, and monitoring cost. We thereby extend the lens of contract beyond the dichotomy of ex ante incentive alignment and ex post economizing. Further, we show ex ante cost aspect is both theoretical and practical antecedents of ex post cost and ex ante incentive aspects.

4 - Myopia in Strategy Making: Evidence from a Laboratory Study
Daniella Laureiro-Martinez, Senior Fellow, ETH Zurich, Weinbergstrasse 56-58, Zurich, Pl, 8092, Switzerland, dlaureiro@ethz.ch, Stefano Brusoni, Maurizio Zollo, Amulya Tata

This study explains differences in decision making performance on the basis of the choice patterns implemented by individuals while playing a four armed bandit task. We develop a procedure to identify and cluster strategies. We observe the emergence of strategies which differ in terms of content, myopia and performance. Our results extend current research by operationalizing the concept of myopia, and showing that the different levels of myopia in choice strategies reliably predict performance.

5 - Alignment between Business Strategy and Operations: Implications for Managerial Decisions
Kalinga Jagoda, Associate Professor, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, T3E 7N9, Canada, kjagoda@mtroyal.ca, Senevi Kiridena

The current research on operations strategy has almost exclusively focused on businesses operating in the manufacturing sector. Using the empirical data collected from more than 400 firms in the Canadian oil and gas industry, this paper examines the linkages between the alternative forms operations strategy and organizational performance.

■ WD45

Hilton- Union Sq 25

Behavioral Operations 2

Contributed Session

Chair: Nico Laya, University of Auckland Business School, Private Bag 92019, Auckland, 1142, New Zealand, nhio001@aucklanduni.ac.nz

1 - Using the Newsvendor Game as a New Research Environment for Behavioral OM and Marketing
Tong Wu, University of Rochester, 201 Conant Road, Apt B, Rochester, NY, 14623, United States of America, tong.wu@simon.rochester.edu, Abraham Seidmann

The newsvendor problem represents a fundamental question in supply chain management. There is a growing body of empirical research that points at the various cognitive biases that misdirect managers under uncertainty. In this talk, we will discuss the research and teaching role of a new experimental system called the Newsvendor game, and present some preliminary research results of those newsvendor games under the tournament competitive environment. Significantly gender difference is observed.

2 - Team Decision-making and Individual Learning in the Newsvendor Problem
Valery Pavlov, University of Auckland Business School, Private Bag 92019, Auckland, 1142, New Zealand, v.pavlov@auckland.ac.nz, Nico Laya

The study investigates group decision-making in the Newsvendor problem using a laboratory experiment. The key observations are (i) that flat teams (as opposed to hierarchical) promote better individual performance at the post-team stage, and (ii) exposure to working with an expert on team may not remove decision biases of non-experts but is likely to replace them with other biases.

3 - Behavioral Study of Supplier Switching Decision Making
Hyejeong Gwon, PhD Candidate, Korea University, 408 LG-Posco Hall, KUBS, 145 Anam-ro Seongbuk-ku, Seoul, Korea, Republic of, 11ku11@korea.ac.kr, Daeki Kim

According to psychological theories, humans use heuristics rather than logical thinking especially when the decision is complicated. The firm level's decision maker is a human being and the decision is usually associated with plenty of factors. This study proposes a behavioral model of supplier switching decision making. Regulatory focus theory is implied to reflect the effect of individual characteristics on decision making process.

4 - Imprecise Skill Level Affecting Dynamic Operator Assignment
Corey Kiassat, Assistant Professor of Industrial Engineering, Quinnipiac University, 275 Mt. Carmel Avenue, Hamden, CT, 06518, United States of America, corey.kiassat@quinnipiac.edu, Nima Safaei

Our novel methodology measures skill level in a dynamic operator assignment problem under an imprecise environment. Operator skill is assessed by an expert whose belief reflects environmental, personal, and social effects. Expert belief is characterized using Accuracy (skill level with highest degree of belief) and Confidence (the spread of belief degrees on skill levels around accuracy). Fuzzy logic's membership function is used to model confidence and accuracy as dimensions of expert knowledge

■ WD46

Hilton- Lombard

Complexity and Algorithmic Aspects in Linear and Nonlinear Optimization

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: Amitabh Basu, Johns Hopkins University, 3400 N. Charles St., Baltimore, MD, 21231, United States of America, basu.amitabh@jhu.edu

1 - How Good Are Sparse Cutting-Planes?
Marco Molinaro, Georgia Tech, Ferst Drive, Atlanta, GA, United States of America, marco.molinaro@isye.gatech.edu, Qianyi Wang, Santanu Dey

Sparse cutting-planes are often the ones used in MIP solving. But how well do they approximate the IP hull? We abstract this question as the approximation of arbitrary polytopes (e.g. the IP hull) by sparse valid inequalities. We will discuss recent results, such as matching upper/lower bounds on the approximation error, and an analysis showing that for a class of hard packing IPs, sparse cutting-planes do not approximate the integer hull well.

2 - Recent Developments on the Oracle Complexity of Convex Optimization
Cristobal Guzman, Georgia Tech, 755 Ferst Drive NW, Atlanta, United States of America, cguzman@gatech.edu, Sebastian Pokutta, Gabor Braun, Arkadi Nemirovski

We study lower bounds for oracle-based algorithms in convex optimization. First, we prove new lower bounds for smooth optimization over non-Euclidean domains, deriving nearly-optimal lower bounds for ℓ^p balls, where $p\in[1,\infty]$. Second, we extend oracle complexity to the distributional setting, where the distribution of instances is part of the algorithm input. This model can be analyzed by information-theoretic arguments, unifying known lower bounds for the nonsmooth case.

3 - Reverse Split Rank
Alberto Del Pia, Assistant Professor, University of Wisconsin-Madison, Madison, WI, United States of America, delpia@wisc.edu, Michele Conforti, Marco Di Summa, Yuri Faenza

The reverse split rank" of an integral polyhedron P is defined as the supremum of the split ranks of all rational polyhedra whose integer hull is P. Already in R^3 there exist polyhedra with infinite reverse split rank. We give a geometric characterization of the integral polyhedra in R^n with infinite reverse split rank.

4 - Submodular Knapsack Polytope
Avinash Bhardwaj, University of California at Berkeley, 450/60 Sutardja Dai Hall, University of California Berkeley, Berkeley, CA, 94720-1758, United States of America, avinash.bhardwaj@berkeley.edu, Alper Atamturk

We define new inequalities for the level set of of an arbitrary submodular function. This work generalizes earlier studies on monotone submodular functions. Application to stochastic network design with correlations is provided.

■ WD47

Hilton- Mason A

Topics in Stochastic Programming

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Yongpei Guan, University of Florida, Weil 413, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Data-Driven Risk-Averse Two-Stage Stochastic Program
Chaoyue Zhao, University of Florida, Weil 413, Gainesville, FL, United States of Americacherryzhao09@ufl.edu, Yongpei Guan

In this project, we investigate the data-driven risk-averse two-stage stochastic program with a new class of probability metrics. We reformulate the problem as a traditional two-stage robust optimization problem for the discrete distribution case and develop a sampling approach for the continuous distribution case. We prove that the risk-averse problem converges to the risk-neutral problem with an exponential rate.

2 - A Stochastic Trust Region Algorithm for Mixed Logit and Latent Class Logit Type Problems
Anton Kleywegt, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332-0205, United States of America, anton@isye.gatech.edu

We consider mixed logit and latent class logit type problems. We propose a trust region type algorithm that controls sampling from the set of observations as well as the sample size for each observation. We provide convergence results, and demonstrate the algorithm with numerical results for the estimation of mixed logit and latent class logit discrete choice models, using airline data.

3 - Two-stage Portfolio Optimization with Higher-order Conditional Measures of Risk
Sitki Gulten, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, sgulten@business.rutgers.edu, Andrzej Ruszczynski

We describe a study of novel risk modeling and optimization techniques to daily portfolio management. First, we develop specialized methods for scenario generation and scenario tree construction. Second, we construct a two-stage stochastic program with conditional measures of risk, which is used to re-balance the portfolio on a rolling horizon basis, transaction costs included in the model. Third, we present an extensive simulation study with different risk measures on real world data.

4 - Recent Progress on Stochastic Unit Commitment Problems
Yongpei Guan, University of Florida, Weil 413, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

In this talk, we review the research progress on recent studies for stochastic unit commitment problems. We discuss the motivation, algorithm developments, and computational experiment results.

■ WD48

Hilton- Mason B

Optimization, Stochastic 2

Contributed Session

Chair: Khatibi Arash, University of Illinois, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, khatibi2@illinois.edu

1 - A Two-stage Stochastic PDE-constrained Optimization Model for Control of Smart Mechanical Structures
Dmitry Chernikov, The University of Iowa, 418 Brown St. Apt 19, Iowa City, IA, 52245, United States of America, dmitry-chernikov@uiowa.edu, Pavlo Krokhmal, Olesya Zhupanska

We consider the problem of optimization of "smart", or "multifunctional" mechanical structures under uncertainty. In particular, a PDE-constrained optimization model for vibration control of a composite plate due to an impact load through an application of electromagnetic field is presented. To account for uncertainty in the impact load, a two-stage stochastic PDE-constrained programming problem is formulated. A solution method is presented, and the results of computational study are discussed.

2 - Doubly Stochastic Sequential Assignment Problem
Khatibi Arash, University of Illinois, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, khatibi2@illinois.edu, Golshid Baharian, Sheldon Jacobson

This paper introduces the Doubly Stochastic Sequential Assignment Problem (DSSAP), an extension of the Sequential Stochastic Assignment Problem where sequentially arriving tasks are assigned to workers with random success rates. The best secretary problem is used to find the optimal policy for the DSSAP with IID random success rates. An optimal assignment algorithm is presented that achieves the maximum total expected reward for the DSSAP with any given success rate distribution.

WD49   *INFORMS San Francisco – 2014*

■ WD49

Hilton- Powell A

Network Analytics

Sponsor: Optimization/Network Optimization
Sponsored Session

Chair: Sangho Shim, Research Associate, Kellogg School of
Management, 2001 Sheridan Road, Suite 548, Evanston, IL, 60208,
United States of America, shim@kellogg.northwestern.edu

1 - Steiner Tree Inequalities for Clustering Problems
Kangbok Lee, Assistant Professor, York College, CUNY, 94-20 Guy
Brewer Bldv., Jamaica, NY, 11451, United States of America,
klee5@york.cuny.edu, Sangho Shim, Sunil Chopra

Inequalities from node minimum Steiner trees are strong valid inequalities for
constrained partition into connected components. They are added to Chopra-Rao
system for the partition problem which is completely described in tree case by Lee,
Chopra and Shim (2013) and speed up branch-and-cut for constrained tree
partitioning into sub-trees.

**2 - Tabu Search for Solving the Black-and-White Travelling
Salesman Problem**
Haitao Li, Associate Professor, College of Business Administration,
229 ESH, One University Blvd, St. Louis, MO, 63121-4400,
United States of America, lihait@umsl.edu, Bahram Alidaee

The black-and-white traveling salesman problem (BWTSP) is an extension to the
well-known TSP and has various applications in logistics and telecommunication
networks design. We develop several tabu search (TS) heuristics for solving the
BWTSP. Extensive computational experiment on both benchmark and randomly
generated instances shows effectiveness and efficiency of our algorithms.

3 - New Heuristic Approaches for Parts Clustering and Layout Design
Mohammad Moshref-Javadi, Purdue University, 315 N. Grant St.,
Purdue University, West Lafayette, IN, 47907,
United States of America, moshref@purdue.edu, Mark Lehto

This paper considers minimization of transportation in warehouses. To achieve this,
parts which are more frequently ordered together are grouped together. Then
family groups are located in the layout. In addition, interactions between parts in
different groups are also taken into account. We used Principal Component
Analysis to group parts into part families. Also, several heuristics were used to
locate part families. The results indicate 40% reduction in transportation.

4 - Large Scale Mixed Integer Programming for Feature Selection
Younghoon Kim, PhD Student, Korea University, Anam-Dong,
Seongbuk-Gu, Seoul 136-713, Seoul, Korea, Republic of,
younghoon.kim11@gmail.com, Sangho Shim, Seoung Bum Kim

We propose a feature selection algorithm based on a large-scale mixed integer
programming. The proposed method minimizes the least square error subject to
the number of selected feature being equal to a constant integer specified by users.
Consequently, the number of features selected can be equal to the constant value
that users specified. We will present the formulation and algorithm to solve this
model.

■ WD50

Hilton- Powell B

Optimization, Integer 4

Contributed Session

Chair: Kalpana Dahiya, Senior Assistant Professor, Panjab University,
UIET, Chandigarh, 160014, India, kalpanas@pu.ac.in

1 - A Traveling Salesman Problem with Budget and Time Constraints
Elham Kookhahi, Wichita State University, Wichita, KS, 67220,
United States of America, exkookhahi@wichita.edu,
M Bayram Yildirim

In this paper, a mathematical model is presented for a travelling salesman problem
in which a sub tour of a set of cities can be visited to maximize the number of
customers that can be served with a limited budget and time. The problem is solved
using a genetic algorithm and numerical results are presented.

**2 - An Iterative Algorithm for Two-stage Time Minimization
Assignment Problem**
Kalpana Dahiya, Senior Assistant Professor, Panjab University,
UIET, Chandigarh, 160014, India, kalpanas@pu.ac.in

An iterative algorithm has been proposed to solve a two-stage bottleneck
assignment problem, in which jobs are performed in two-stages. The objective is to
find that set of m agents performing the primary jobs in Stage-I for which the sum
of the overall completion times of jobs in Stage-I and the corresponding optimal
completion time of the secondary jobs in Stage-II by the remaining (n-m) agents is
the minimum.

3 - Benders Decomposition for Coils Allocation and Shuffling Problem
Yuan Yuan, The Logistics Institute, Northeastern University of
China, NO. 3-11, Wenhua Road, Heping District, Shenyang, China,
yyuan.tli@gmail.com, Lixin Tang

We propose a hybrid approach combining Benders decomposition and cut
generation to solve a coil allocation and shuffling problem. The problem is
formulated as a 0-1 linear model. In the approach Benders decomposition acts as
the main frame and employs cut generation to deal with its integer subproblem.
Numerical experiments show the competitiveness of the approach.

**4 - Optimization Models and Methods for University
Course Timetabling**
Antony Phillips, Department of Engineering Science, University of
Auckland, Auckland, New Zealand, aphi038@aucklanduni.ac.nz,
Cameron Walker, Matthias Ehrgott, David Ryan

University course timetabling is a large resource allocation problem, in which both
times and rooms are determined for each class meeting. We present a novel
approach for course timetabling based on mathematical optimisation. By
decomposing the problem into a timetable generation, followed by a room
assignment, integer programming becomes viable even for large practical problems.
Computational results on data from the University of Auckland will be presented.

■ WD51

Hilton- Sutter A

Game Theory 2

Contributed Session

Chair: Nelson Uhan, Mathematics Department, United States Naval
Academy, Chauvenet Hall, Annapolis, MD, 21402, United States of
America, uhan@usna.edu

**1 - Impacts of Human Behaviors' Diffusion in an Epidemic Model
Based on Spatial Game**
Songnian Zhao, PhD Candidate, Kansas State University, 1600
Hillcrest Drive APT 4, Manhattan, KS, 66502, United States of
America, songnian@ksu.edu, Yan Kuang, David Ben-Arieh,
Chih-Hang Wu

In this paper, a new behavior-based SIR model using spatial evolutionary game is
constructed to predict the spread of infectious disease. Information transmission,
contact structure and changes of human behaviors are emphasized in modeling the
dynamics of infectious diseases,and people make decisions based on the
information available to them during the game, by balancing their own benefits
and costs. Equilibrium analysis and numerical simulation results will be shown in
the end.

**2 - The Strategic Effect of In-Store Medium under Product
Line Competition**
Haruki Kobayashi, Keio University, 3-14-1 Hiyoshi Kohokuku,
Yokohama, Japan, 151e0423@gmail.com, Nobuo Matsubayashi

Manufacturer's competitive actions of enhancing their product lines result in
increasing consumers' burden of selecting products. In particular, communicating
to consumers about the product differences from the rival's products is a harder
task for manufacturers. We consider a retailer's service model of in-store
advertising, where the retailer neutrality provides product information to
consumers for free, whereas he charges manufacturers. We explore the optimal
tariff design for this service.

**3 - A Game-theoretic Procedure for Bridge Construction
Cost Allocation**
Saurav Kumar Dubey, PhD Student-Department of Industrial and
Systems Engineering, University of Tennessee at Knoxville, 1615
Laurel Avenue, Knoxville, TN, 37916, United States of America,
skumardu@utk.edu, Dongju Lee, Alberto Garcia-Diaz

The proposed method integrates traffic capacity and load requirements to allocate
bridge costs among vehicle classes, using two game-theoretic criteria known as
Aumann-Shapley value and Shapley value, and an incremental allocation
procedure.Players are defined as vehicle classes, axle load applications, or lanes.The
gross-weight based incremental procedure determines marginal costs.

**4 - Dynamic Allocations for Cooperative Games under Uncertainty
with Risk-averse Players**
Nelson Uhan, Mathematics Department, United States Naval
Academy, Chauvenet Hall, Annapolis, MD, 21402,
United States of America, uhan@usna.edu, Alejandro Toriello

We consider a class of cooperative games in which the costs of cooperation are
uncertain and evolve over time, and the players are risk averse. These games
generalize the classic linear production game, and as a result, model a variety of
cooperative settings. We give sufficient conditions for the existence of an allocation
in the strong sequential core - the set of allocations that distribute costs as they are
incurred and are stable against coalitional defections at any point in time.

■ **WD52**

Hilton- Sutter B

Optimization, Linear Programming 2
Contributed Session

Chair: Gene Coffman, Technical Leader, Ford Motor Company, Manufacturing Development Center, 6100 Mercury Drive, Dearborn, MI, 48126, United States of America, gcoffman@ford.com

1 - The New Approach to Diet Problem
Fariborz Partovi, Professor, Drexel University, Gerri Lebow Hall. Room 726, 3220 Market Street, Philadelphia, PA, 19104, United States of America, Partovi@drexel.edu

Over the years many researchers have contributed to updating, extension, and new methodologies for solving the diet problem. However the problem with the classical models is based on lack of proper presentation of food preferences. For many people, especially when they are eating outside their home, the taste of the food may be as important as the nutrition values. In this paper we propose a new method for designing foods that are more desirable to customers and cost less to the producers.

2 - Fuzzification of the Special Simplex Method for the Transportation Problem
Gene Coffman, Technical Leader, Ford Motor Company, Manufacturing Development Center, 6100 Mercury Drive, Dearborn, MI, 48126, United States of America, gcoffman@ford.com, Stephany Coffman-Wolph

The framework for the fuzzification of algorithms can be applied to a wide variety of problems including the widely recognized transportation problem from the field of Linear Programming. This deterministic transportation problem algorithm will undergo the fuzzification process to become a fuzzy algorithm (i.e., fuzzified transportation problem). It will be demonstrated that an optimal solution to the original problem is contained within the alternative optima of the fuzzified problem.

3 - Polyhedral Results for 2-sided Stable Matchings and Ordinal Transportation
Pavlos Eirinakis, Athens University of Economics and Business, Patission 76, Athens, 10434, Greece, peir@aueb.gr, Ioannis Mourtos, Dimitrios Magos

We establish the dimension of the many-to-many stable matching (MM) polytope and its minimal equation system and facets. We utilize this analysis to provide a minimal description of the Stable Admissions (SA) polytope and the polyhedral correspondence of the known MM and SA constraints. Further, we derive an upper and a lower bound for the diameter of the Stable Marriage polytope. Finally, we provide an implicit linear representation for the ordinal transportation problem.

4 - Accounting for Risk and Pillar Recovery in MILP Room and Pillar Production Sequencing Models
Angelina Anani, Missouri University of Science and Technology, 407 E12th Street, Rolla, MO, 65401, United States of America, akakc2@mail.mst.edu, Kwame Awuah-Offei

The goal of this work is to formulate a mixed integer linear programming (MILP) model of room and pillar production sequencing that incorporates pillar recovery and project risks. The model maximizes the project's net present value and minimizing project risks while meeting all constraints.The model is solved with CPLEX using the MATLAB API. The model has been validated with a realistic mine sequencing problem. Future work will use branch-and-bound solution algorithms to solve this problem.

5 - Analytically Solving a Customer Scheduling Problem with Customer Mix Restrictions
Ridvan Gedik, Visiting Assistant Professor, Mississippi State University, 260 McCain Hall, Mississippi State, MS, 39762, United States of America, gedik@ise.msstate.edu, Chase Rainwater, Edwin Romeijn

This research examines the impact of incorporating long term customer mix preferences and operational capacity constraints on customer scheduling decisions in a facility. We propose an algorithm which generates efficient frontiers by utilizing the key concepts of post-optimality sensitivity analysis and parametric right hand side perturbation principles.

■ **WD53**

Hilton- Taylor A

Finance Theory and Empirics
Contributed Session

Chair: Fernando Moreira, Assistant Professor, University of Edinburgh, 29 Buccleuch Place, Edinburgh, United Kingdom, fernando.moreira@ed.ac.uk

1 - SEO Returns and the Japanese Law Reforms
Yasunori Katsurayama, Waseda University, 1-6-1 Nishi-Waseda, shinjuku-ku, Tokyo, Japan, yasunori@cf.socs.waseda.ac.jp, Keiji Abe

After 2000, book building became a familiar pricing tool for the SEO in the Japanese Market. The SEO price is determined in two weeks after the SEO announcement. Investors might be able to make profit by selling short the SEO shares in this period. As they can close their short position, after SEO, using SEO stock whose price was got cheaper by short selling. Closing of the short position using the SEO shares was prohibited in 2011. We report the CAR around the law reforms.

2 - Regulatory Capital Charges for Too-connected-to-fail Institutions: A Copula Approach
Fernando Moreira, Assistant Professor, University of Edinburgh, 29 Buccleuch Place, Edinburgh, United Kingdom, fernando.moreira@ed.ac.uk

We propose two copula-based approaches to support the calculation of regulatory capital concerning systemic risk. The main advantage of our methods over some traditional approaches is the possibility of capturing potential asymmetric and/or tail dependence across the performance of institutions. We illustrate the application of our models in the case of the largest UK financial institutions (in terms of assets) by using daily data from 2008 to 2012.

3 - Optimal Stopping Of A Credit Lending Process With Multiple Disorders
Xiaoxuan Zhang, JP Morgan, 277 Park Ave, New York, NY, 10172, United States of America, zhangxiaoxuan@live.com

We study an optimal stopping time problem that arises from the risk management of a credit lending process. The loss is driven by the borrower's credit status where multiple disorder is possible. The goal of the lender is to find a stopping strategy to maximize the expected profit, which are at risk of no payment recovery when the borrower defaults. We show that optimal stopping times forms a threshold type policy. Application in responsive energy load scheduling is also discussed.

4 - Market Adoption of Reverse Factoring
Matthew Reindorp, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, M.J.Reindorp@tue.nl, Nico Dellaert, Umberto Dello Iacono

Existing research on Supply Chain Finance (SCF) arrangements such as reverse factoring almost exclusively considers a static context, where market factors take fixed, known values. Our study links the direct benefits of reverse factoring to dynamic, interacting market factors: competition, interest rates, receivables volumes, and firms' working capital goals. We utilize System Dynamics to show that a comprehensive assessment of reverse factoring cannot neglect the evolutionary perspective.

5 - Binomial and Multinomial Tree Monte Carlo Methods for Pricing Options on Multiple Assets
Dirk Sierag, CWI, Science Park 123, Amsterdam, Netherlands, D.D.Sierag@cwi.nl, Bernard Hanzon

We propose an effective method for pricing multi-asset options by combining the efficiency of Monte Carlo simulation with the accuracy of multinomial trees. The latter are generalised from binomial trees in two directions: 1) the structure of the tree, from Pascal's triangle to Pascal's simplex; 2) the probability vector of the successor-nodes, this is a free parameter. We evaluate accurate multi-asset option prices by generating random probability vectors and corresponding multinomial trees.

■ WD54

Hilton- Taylor B

Modeling and Computations in Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: Ning Cai, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, ningcai@ust.hk

1 - Lifecycle Consumption and Investment with Illiquid Housing and Voluntary Retirement

Min Dai, National University of Singapore, Singapore, 117546, Singapore, matdm@nus.edu.sg, Hong Liu, Yingshan Chen

We consider the joint decisions of housing, stock investment, daily consumption, and voluntary retirement. We show that the investor is more aggressive in investing in both stock and house before retirement than after retirement. In the presence of shortsale constraints for stocks, our model can help explain the well known stock market nonparticipation puzzle. Furthermore our model predicts that stock investment, daily consumption rate and housing choice all jump at retirement date.

2 - The Pricing of European-type Options under Time-inhomogeneous Diffusion Processes

Yingda Song, National University of Singapore, Centre for Quantitative Finance, Block S16, 6 Science Drive 2, Singapore, 117546, Singapore, matsy@nus.edu.sg

This paper proposes a series expansion formula for European-type options under time-inhomogeneous diffusion processes. Its convergence is proved rigorously under some regularity conditions. Numerical results demonstrate that our series representation method is accurate and efficient.

3 - Optimal VWAP Tracking

Daniel Mitchell, Assistant Professor, Singapore University of Technology and Design, 20 Dover Drive, Singapore, Singapore, dan.mitchell@utexas.edu, Jedrzej Bialkowski, Stathis Tompaidis

We consider the problem of finding a strategy that tracks the volume weighted average price (VWAP) of a stock, a key measure of execution quality for large orders used by institutional investors. We obtain the optimal, dynamic, VWAP tracking strategy in closed form in a model with general price and volume dynamics. We build a model of intraday volume using the Trade and Quote dataset to empirically test the strategy.

4 - Central Bank's Intervention of Interest Rates: An Impulse Control Approach

Haolin Feng, Assistant Professor, Lingnan College, Sun Yat-sen University, 135 Xin Gang Xi Road, Sun Yat-sen University, Guangzhou, 510275, China, fenghaol@mail.sysu.edu.cn, Daniel Mitchell, Kumar Muthuraman

We model the central bank's intervention of short rate as a stochastic control problem on a general class of processes. We consider fixed as well as variable intervention costs, and we develop an algorithm to numerically solve the resulted impulse control problem. We then study the effect of the intervention on longer term interest rate securities. The method developed here can be applied to a very wide range of impulse control problems beyond the realm of interest rate models.

■ WD55

Hilton- Van Ness

Chance, Inference and Robustness

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Leo Liberti, Research Staff Member, IBM Research, Yorktown Heights, NY, 10598, United States of America, leoliberti@gmail.com

1 - An Improved Lagrangian Relaxation Approach for Nonconvex Two-stage Stochastic Programs with Recourse

Paul Barton, Lammot du Pont Professor of Chemical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Ave, 66-470b, Cambridge, MA, 02139, United States of America, pib@mit.edu, Rohit Kannan

In this work, an improved Lagrangian relaxation approach, which dualizes the non-anticipativity constraints of only the continuous first-stage variables and solves the corresponding Lagrangian dual problems using nonconvex generalized Benders decomposition in a branch-and-bound framework, is proposed. An efficient implementation is outlined, and the effectiveness of the proposed decomposition approach is demonstrated through case studies.

2 - MINLP Problems in Inference of Chemical Reaction Networks

Emilio Carrizosa, Universidad de Sevilla, F. Matem·ticas, Avd. Reina Mercedes s/n, Sevilla, 41012, Spain, ecarrizosa@us.es, M Asuncion Jimenez-Cordero, Bogl·rka G Tóth, Rafael Blanquero

We address the problem of finding the stoichiometric matrix and the reaction rates that best fit to the empirical concentrations given. The coefficients of the matrix are integer numbers, and the reaction rates are non negative continuous values, so the proposed optimization program is a MINLP with linear constraints, whose objective function is nonconvex and contains an ordinary differential equation term.

3 - Tight Relaxations of Non-Convex Quadratic Programs in Robust Sensitivity Analysis

Guanglin Xu, PhD Candidate, University of Iowa, S221 John Pappajohn Business Building, Iowa CIty, IA, 52242-1994, United States of America, guanglin-xu@uiowa.edu, Samuel Burer

Abstract: We study robust sensitivity analysis in LP problems where general perturbations in parameters including objective coefficients, right-hand sides, and constraint matrix entries are considered. This generality leads to non-convex quadratic programs (QPs) that are NP-hard in general. We investigate tight convex relaxations of these QPs and present preliminary computational results.

■ WD58

Hilton- Golden Gate 2

Scheduling V

Contributed Session

Chair: Hakan Gultekin, TOBB University of Economics and Technology, Sogutozu Cad. No:43, Sogutozu, Ankara, Turkey, hgultekin@etu.edu.tr

1 - Balancing Assembly Lines with Material Handling Robots

Hakan Gultekin, TOBB University of Economics and Technology, Sogutozu Cad. No:43, Sogutozu, Ankara, Turkey, hgultekin@etu.edu.tr, Burak Can Yildiz

An assembly line in which the loading/unloading of the machines and the material transportation are carried out by a single robot is considered. Each part requires a number of operations to be processed on the machines. The problem is to determine the assignment of the operations to the machines, and also to determine the sequence of robot moves that jointly minimize the cycle time. An integer programming formulation and a heuristic are developed. The effectiveness of the heuristic is tested.

2 - Significant Influential Factors in Flow Shop Research

Milton Smith, Professor, Texas Tech University, Dept. of Industrial Engineering, Mail Stop 3061, Lubbock, TX, 79409, United States of America, milton.smith@ttu.edu, Shrikant Panwalkar, Christos Koulamas

Flow shop sequencing research has been affected by several developments; no review of developments causing major impacts on research exists. NP theory, computing technology, optimizing and heuristic procedures are examined. We look at our discussion from a paper on lessons of flow shop scheduling research.

3 - Assignment and Sequencing of Multipass Assembly & Test Operations in Semiconductor Manufacturing

Zhufeng Gao, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712-0292, United States of America, gaozhufeng@gmail.com, Jonathan Bard

We present a three-phase methodology for assigning and sequencing assembly and test operations for semiconductors. The facility in which these operations are performed is similar to a reentrant flow shop. The chips follow a specific route through the facility where each step in the route is referred to as a pass. In phase 1 lots are assigned to machines; in phase 2 they are sequenced; in phase 3 changeovers are performed. The methodology was tested using data provide by a leading manufacturer.

4 - Integrated Production and Distribution Scheduling for Fresh Agri-food Supply Chain in China

Mu Du, Dalian University of Technology, Institute of Systems Engineering, School of Management, Dalian, 116023, China, dumu.dlut@gmail.com, Xiangpei Hu, Nan Kong

Farm-to-home online retail is a fast-growing supply chain mode for fresh produce in China. Makespan, one of the most important metrics in such a make-to-order process, is highly sensitive to the production and distribution decisions. We introduce an integrated production and distribution scheduling model that minimizes the total make-span. We propose a heuristic method to solving the problem efficiently. We report a case study based on real-world business practice in China.

5 - Randomized On-line Algorithms for Throughput Maximization with Advance Informat
Ishwar Murthy, Professor, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, ishwar@iimb.ernet.in, Sumit Sarkar

We consider the problem of equal length jobs that arrive at random. Further, the scheduler has advance knowledge of all jobs that will arrive over a finite horizon Ta, but no information beyond. We first present lower bounds on the competitive ratio of any randomized on-line algorithm as a function of Ta. We then present a randomized on-line algorithm that matches the lower bound.

■ WD63

Hilton- Plaza B

Decision Analysis 2

Contributed Session

Chair: Shweta Agarwal, PhD Student, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, s.agarwal@lse.ac.uk

1 - Sequential Exploration with Geological Dependencies and Uncertainty in Oil Prices
Babak Jafarizadeh, Statoil, Forusbeen 50, Stavanger, Ro, 4034, Norway, bajaf@statoil.com

Oil & gas prospects in vicinity are likely to share geologic features. Using these relationships, an optimal sequential drilling program can be devised. Because It takes up to a year to interpret the outcomes of a well, the variations in the forward curve may change the economics of the upcoming wells. We introduce a framework for evaluating sequential exploration strategies where prospects are geologically dependent and the uncertainty in prices is described as a meanñreverting process.

2 - Resolving Expected Utility Paradoxes with a Moving Target Partial Moments Model
Mark Schneider, University of Connecticut, 2100 Hillside Road #1041, Storrs, CT, 06269, United States of America, mark.schneider@business.uconn.edu, Robert Day, Robert Garfinkel

A model of skewness preference relative to an endogenous target is shown to explain the Allais paradoxes, favorite-longshot bias, and fourfold pattern of risk attitudes without requiring nonlinear probability transformations. The maximin payoff is shown to be a simple and natural specification for the target return in a choice set. An implication of the model is that the decision maker is risk-seeking toward upside risk and risk-averse to downside risk, relative to the target.

3 - Developing a Decision Support Tool for Evaluating Partnerships in Forest Products Value Chains
Mehdi Piltan, PhD Candidate, University of British Columbia, Department of Wood Science, Main Mall Univ, Vancouver, BC, V6T1Z4, Canada, mehdi.piltan@alumni.ubc.ca, Taraneh Sowlati

In this study we investigated the correlation between companies' characteristics and their partnering practices (types and drivers) in the context of forest product industry in Canada. Then we studied the factors contributing to the successful partnership using regression. In the second phase, we focused on one partnership to evaluate the success factors and the performance of the partnership using Analytical Network Process and Interpretive Structuring Modeling.

4 - Zero-Inflated Transformation Hazard Modeling for Corporate Bankruptcy Prediction
Shaonan Tian, Assistant Professor, San Jose State University, One Washington Square, San Jose, CA, 95192, United States of America, Aidong Ding, Yan Yu

A main challenge for modeling corporate bankruptcy prediction is the so-called "excess-zeros", that is, the number of defaults is extremely small comparing to the number of non-defaults. We propose to introduce a zero-inflated transformation hazard modeling to predict corporate default. In particular, we propose to build a mixture model framework with certain likelihood that a firm will almost surely stay at the non-bankruptcy state but otherwise follow the hazard-model framework.

■ WD64

Parc- Cyril Magnin I

Algorithms on Graphs and Trees

Sponsor: Applied Probability Society

Sponsored Session

Chair: Mariana Olvera, Columbia University, 500 W 120th Street, Suite 306, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu

1 - Quick Detection of High-degree Entities in Large Directed Networks
Nelly Litvak, Associate Professor, University of Twente, PO Box 217, Enschede, 7500AE, Netherlands, N.Litvak@utwente.nl, Konstantin Avrachenkov, Liudmila Ostroumova

We suggest an efficient randomized algorithm for quick detection of high-degree entities in large online networks. Practical importance is attested by the many companies that maintain networks' statistics. Our algorithm significantly outperforms existing methods. For instance, we find the top-100 most followed users in Twitter with 92% precision using only one thousand API requests. We derive predictions for the algorithm's performance and show that its complexity is sublinear in network size.

2 - Stability of the Stochastic Matching Model
Pascal Moyal, Associate Professor, UTC, LMAC - Rue Roger Couttolenc, CS 60319, Compiégne, 60203, France, pascal.moyal@utc.fr, Jean Mairesse

We introduce what we call the 'stochastic matching model': items arrive one by one in a buffer and depart from it as soon as possible, by pairs. There is a finite set V of classes of items, and the allowed matchings by pairs depend on the classes, according to a matching graph on V. We investigate the stability of the underlying Markov chain. We show in particular that the model may be stable if and only if the matching graph is non-bipartite.

3 - Queues with Synchronization
Mariana Olvera, Columbia University, 500 W 120th Street, Suite 306, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu

We study a queueing network with synchronization requirements such as those found in cloud computing implementations. When the number of servers is large, we show that the distribution of the waiting time of a job can be approximated by the solution to a branching stochastic fixed point equation. This solution can be analyzed via weighted branching processes.

4 - Ranking Algorithms on the Directed Configuration Model
Ningyuan Chen, Columbia University, 321 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 100275811, United States of America, nc2462@columbia.edu

We study a family of generalized PageRank algorithms on the directed configuration model with prescribed degree distributions. We show that as the number of nodes in the graph goes to infinity, the rank of a randomly chosen node converges in distribution to the solution of a stochastic fixed point equation whose asymptotic behavior is explicit. The main tool in our analysis is a coupling of the graph with a weighted branching process whose growth is determined by the in-degree distribution.

■ WD65

Parc- Cyril Magnin II

Performance Evaluation and Optimal Policies

Sponsor: Applied Probability Society

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - On the Inter-departure, Inter-start, and Cycle Time Distribution of Closed Queueing Networks
Svenja Lagershausen, Dr., Leibniz Universitaet Hannover, Koenigsworther Platz 1, Hannover, 30167, Germany, svenja.lagershausen@prod.uni-hannover.de, Baris Tan

We present a method to determine the exact inter-departure, inter-start and cycle time of closed queueing networks that can be modeled as Continuous-Time Markov Chains with finite state space. The method is based on extending the state space to determine the transitions that lead to a departure or an arrival of a part on a station using a first passage time analysis. We consider closed-loop production lines with phase-type service time distributions and finite buffers.

WD66   *INFORMS San Francisco – 2014*

2 - Optimal Service Rate & Servers in Closed Finite Queueing Networks

James MacGregor Smith, Professor, University of Massachusetts, 874 North Pleasant Street, Amherst, MA, 01002, United States of America, jmsmith@ecs.umass.edu

Many manufacturing and service systems service rates & servers require care in determining their optimal values. Because of blocking in closed finite queueing systems, this service rate & server allocation issue is a challenging nonlinear optimization problem. A new decomposition method together with a nonlinear sequential quadratic optimization algorithm is demonstrated for solving this problem in series, merge, and split topologies.

3 - Optimal Purification Strategies Based on Quality-Yield Tradeoffs in Biomanufacturing Operations

Tugce Martagan, University of Wisconsin-Madison, Engineering Centers Building, Madison, WI, 53705, United States of America, martagan@wisc.edu, Ananth Krishnamurthy

We develop an infinite horizon Markov decision model to minimize costs of purification operations in biomanufacturing. The model considers quality-yield tradeoffs, and identifies the best equipment selection (chromatographic technique) and operating policy (pooling window) to minimize purification costs, and penalty costs for not meeting the demand or quality requirements.

4 - Score Based Anticipative Transfer Requests in the Intensive Care Units

Guodong Pang, Penn State University, College of Engineering, University Park, PA, United States of America, gup3@engr.psu.edu, Yasin Ulukus, Andrew Schaefer, Gilles Clermont

The efficient operation and management of ICUs is critical to providing high quality of care while managing costs. We construct a new Transfer Score to estimate readmission and death probabilities. We further show that an anticipative transfer request policy combined with effective use of clinical markers can significantly decrease transfer delays without increasing the capacity. We present a Markov Decision Process (MDP) model for the transfer request problem and solve it via approximations.

■ WD66

Parc- Cyril Magnin III

Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhenyu Kong, Associate Professor, Virginia Tech, 1145 Perry Street, Blacksburg, VA, 24061, United States of America, zkong@vt.edu

1 - A Novel Method for Monitoring of Image Sequences

Kamran Paynabar, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30327, United States of America, kamran.paynabar@isye.gatech.edu, Hao Yan, Jianjun Shi

We present a novel monitoring method for monitoring and anomaly detection in image sequences and videos using the sparse-smooth decomposition (SSD). SSD significantly reduces the dimensions of images leading to more effective process monitoring. Using empirical data, we show the efficacy of the proposed method in terms of the detection power and computational speed.

2 - Prediction of Tissue-engineered Scaffold Degradation using Constrained Gaussian Processes

Li Zeng, Assistant Professor, University of Texas - Arlington, 500 West First Street, P.O. Box 19017, 4, Arlington, TX, 76019, lzeng@uta.edu, Xinwei Deng

Degradation prediction is a critical problem in tissue-engineered scaffold fabrication to produce products with desirable properties for the development of engineered tissues/organs. This research develops a constrained Gaussian Process approach for scaffold degradation prediction.

3 - Robust Predictive Modeling through Self-organized Variable Clustering

Gang Liu, Graduate Student, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, gliu@mail.usf.edu, Hui Yang

In the literature, the problem of variable clustering was not well-addressed especially when nonlinear and unsymmetrical dependence involved. In this paper, we propose a novel self-organizing algorithm to cluster variables with nonlinear and unsymmetrical dependence. The experimental results show that our method outperforms the previous methods. Further, the self-organized clusters of variables will be utilized in the predictive models to have a robust performance.

4 - Heterogeneous Sensor Data Fusion for Real-time Monitoring in Additive Manufacturing (AM) Process

Prahalad Rao, Assistant Professor, The State University of New York at Binghamton, Binghamton, NY, United States of America, prahalad.k.rao@gmail.com, Zhenyu Kong

In this talk, we present a non-parametric Bayesian analysis, namely, Dirichlet Process (DP)-based evidence theoretic decision-making approach for real-time process monitoring in Fused Deposition Modeling (FDM) Additive Manufacturing (AM) process using data from multiple, heterogeneous sensors.

■ WD67

Parc- Balboa

Gaussian Process and Spatial Data Analysis (II)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Chia-Jung Chang, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, cchang@psu.edu

Co-Chair: Ran Jin, Virginia Tech, Virginia Polytechnic Institute and State, University, 111 Durham Hall,, Blacksburg, VA, 24061, United States of America, jran5@vt.edu

1 - Penalized Quantile Asymmetric Laplace Process Model for Computer Experiments

Yufan Liu, Dun & Bradstreet, Short Hills, NJ, 07078, United States of America, liuyuf@dnb.com, Ying Hung

Despite numerous research on computer experiment modeling, how to model conditional quantiles of the response and identify the corresponding important variables remain unresolved. In this talk, we present a new framework to address these issues.

2 - Spatial Data Classification in Biomedical Thermal Images

Xinwei Deng, Assistant Professor, Virginia Tech, 250 Drillfield Drive, 211 Hutcheson Hall, Blacksburg, VA, 24061, United States of America, xdeng@vt.edu, Ran Jin

In biomedical thermal image analysis, feature extractions and selections are widely used for image classification. However, useful information can be lost due to improper feature generations and selections. In this work, we present a novel method to perform image classification through spatial modeling. The proposed method not only provides good prediction, but also gives meaningful interpretation. The performance of the proposed method is evaluated by using organ thermal images.

3 - Statistical Surface Monitoring by Spatial-Structure Modeling

Andi Wang, HKUST, Academic Bldg 4223, HKUST, Hong Kong, Hong Kong - PRC, awangab@ust.hk, Kaibo Wang, Fugee Tsung

Surface data occurs frequently in manufacturing processes, but existing control charts in profile monitoring are not suitable for monitoring surfaces. In this research we propose a new chart based on the Gaussian-Kriging model that considers several surface patterns. We compare performance of this chart with that of an existing profile monitoring method through simulation.

4 - Profile Modeling for Geometric Shapes with Spatially Correlated Errors

Sobambo Sosina, Harvard University, Cambridge, MA, United States of Amaerica, sosina@fas.harvard.edu, Arman Sabbaghi, Qiang Huang, Tirthankar Dasgupta

We consider the problem of modeling profiles of geometric shapes which have spatially correlated error terms. We propose a maximum likelihood estimation procedure under a spatial autoregressive error model and demonstrate the procedure with applications from graphene synthesis and 3D-printing.

■ WD68

Parc- Davidson

Agent-Based Computational Models of Economic and Financial Processes

Sponsor: Simulation

Sponsored Session

Chair: Robert Axtell, Chair, Department of Computational Social Science, George Mason University, 4400 University Drive, Fairfax, VA, 22102, United States of America, rax222@gmu.edu

1 - Alternatives to Ideal Rationality

Steve Kimbrough, Professor, Department of Operations and Information Management, The Wharton School, 565 Huntsman Hall, Philadelphia, PA, 19104, United States of America, kimbrough@wharton.upenn.edu, Frederic Murphy

Ideal rationality models pervade economics and game theory. Such models have always been considered to be unrealistic in their assumptions regarding agent capabilities, except in special circumstances. A main reason that has been expressed for their continued use, even their continued prominence, is the lack of attractive alternatives. We review the scene and present a number of attractive minimal rationality" alternatives for modeling in economics and game theory.

2 - Agent-based Models of Microstructure for Order-driven Markets

Andrew Todd, PhD Candidate, University of Virginia, Dep't. of Systems and Info Engineering, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, aetodd@gmail.com, Matt Burkett, Roy Hayes, Peter Beling, William Scherer

Regulators and policy makers, facing a complicated, fast-paced and quickly evolving marketplace, require new tools and decision aides to inform policy. Agent-based models, which are capable of capturing the intricacies of market mechanisms and the heterogeneity of market participants, offer a powerful method for understanding the financial marketplace. We improve an existing statistical microstructure model by systematically introducing deterministic strategic behavior.

3 - A Multi-factor Model of Heterogeneous Traders in a Dynamic Stock Market

Dong-Jin Pyo, PhD Candidate, Iowa State University, Department of Economics, Ames, IA, 50011, United States of America, djpyo@iastate.edu

This study develops a computational stock market model in which each trader's buying and selling decisions are endogenously determined by multiple factors: namely, firm profitability, past stock price movement, and imitation of other traders. Each trader can switch from being a buyer to a seller, and vice versa, depending on market conditions. Simulation findings demonstrate that this model can generate many stylized facts regarding stock returns and volume of trade.

4 - The U.S. Housing Market Bubble: Why it Happened and How it Could Have Been Avoided

Robert Axtell, Chair, Department of Computational Social Science, George Mason University, 4400 University Drive, Fairfax, VA, 22102, United States of America, rax222@gmu.edu

An agent-based model of a city has been built, consisting of a large population of households and a corresponding stock of housing, in order to study house price bubbles. We have instantiated the model for the Baltimore-Washington, D.C. metro area. We demonstrate that low interest rates had little to do with the bubble but rather relaxed lending were the proximate cause of the take off phase of the bubble, and later responsible for its bursting.

■ WD69

Parc- Fillmore

Pollution Regulation and Abatement

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Francois Giraud-Carrier, Assistant Professor, University of Illinois Springfield, College of Business and Management, One University Plaza, UHB MS 4021, Springfield, IL, 62703, United States of America, fgira2@uis.edu

1 - Pollutant Abatement Investment under Ambiguity in a Two-Period Model

Motoh Tsujimura, Associate Professor, Doshisha University, Kamigyo-ku, Kyoto, 602-8580, Japan, mtsujimu@mail.doshisha.ac.jp

This paper investigates a pollutant abatement investment under ambiguity in a two-period setting. We consider there are representative consumer and firm in an economy and formulate the social welfare maximization problem. Then we derive the optimal level of abatement investment. Furthermore, we analyze the comparative static effects of the model's parameters.

2 - Model Design and Environmental Study on Radiative Forcing and Climate Change

Cheng-Marshal Wang, Cheng-Marshal.Wang@ec.gc.ca

I will introduce some primary study on how to model the economic impacts of Polar Vortex. First we will review what has happened of extreme cold in North American last winter. Is this a counter example of global warming? Then we will review our primary studies on modelling RCP scenarios in the climate module of our Integrated Assessment Model (IAM). The four RCPs are named after a possible range of Radiative forcing values in the year 2100 relative to pre-industrial values.

3 - Does Cap-and-Trade Enable Collusion?

Francois Giraud-Carrier, Assistant Professor, University of Illinois Springfield, College of Business and Management, One University Plaza, UHB MS 4021, Springfield, IL, 62703, United States of America, fgira2@uis.edu, Krishnan Anand

Carbon Taxes and Cap-and-Trade are the two leading approaches for pollution regulation. Proponents of Taxes have argued that Cap-and-Trade could facilitate collusion among firms via the trading mechanism, leading to suboptimal welfare outcomes. We examine this claim using a rigorous yet rich model of production and pollution under competition that allows for the possibility of collusion among firms via a market exchange for emission allowances.

4 - Incentives to Invest in Pollution Abatement Innovations

Krishnan Anand, Associate Professor, University of Utah, 1655 E Center Campus Dr, Salt Lake City, UT, 84112, United States of America, k.anand@utah.edu, Francois Giraud-Carrier

We analyze and compare three popular pollution control mechanismsóa strict pollution cap, a cap-and-trade system, and an emission taxóin a two-stage model in which the regulated firms first choose between two abatement technologies, and then produce a good or service with pollution as a byproduct. We find that the emission tax is a superior mechanism for many important performance measures.

■ WD70

Parc- Hearst

Forecasting 1

Contributed Session

Chair: Murat Fadiloglu, Professor, Yasar University, Department of Industrial Engineering, Yasar University Bornova, Izmir, 35100, Turkey, murat.fadiloglu@yasar.edu.tr

1 - Probabilistic Forecasting of Wind Power Ramps using Autoregressive Models

James Taylor, Professor, University of Oxford, Said Business School, Park End Street, Oxford, OX1 1HP, United Kingdom, james.taylor@sbs.ox.ac.uk

A challenge for the efficient operation of a wind farm is the occurrence of ramps, which are sudden large changes in generated power. We consider the probabilistic forecasting of a ramp, which we define as exceedance, beyond a chosen threshold, of hourly changes. We fit new autoregressive logit models, including a multinomial logit model that simultaneously estimates the ramp probabilities for different thresholds, and another that jointly models the ramp probability at more than one wind farm.

WD72   *INFORMS San Francisco – 2014*

2 - The Influence of Weather in Online Retailing –
An Empirical Analysis
Sebastian Steinker, Kühne Logistics University,
Grofler Grasbrook 17, Hamburg, HH, 20457, Germany,
Sebastian.Steinker@the-klu.org, Kai Hoberg

We incorporate weather data into the sales forecasting of the largest European online fashion retailer. Using weather forecasts we are able to improve the sales forecasting accuracy (measured as the mean absolute percentage error (MAPE)) by an incremental 62.4% on summer weekends. These considerable improvements in forecast accuracy may have an important impact on logistics and warehousing operations.

3 - A Close Investigation on Spare Parts Demand Patterns and Their
Inventory Implications
Laura Turrini, PhD Student, Kühne Logistics University, Grofler
Grasbrook 17, Hamburg, Germany, Laura.Turrini@the-klu.org,
Joern Meissner

Spare parts are essential for many companies, but an effective management of their inventories is often very challenging due to their slow-moving and erratic demand,that almost never follows the commonly used Normal distribution. We study the case of a German worldwide leader in the wind-turbines market and analyze their weekly demand patterns in the last three years.We focus on testing the right tails of the distribution, a crucial element to implement a successful inventory management system.

■ WD72

Parc- Stockton
Energy VII
Contributed Session

Chair: Khashayar Mahan, Rutgers University, 1507 Azalea Drive,
North Brunswick, NJ 08902, United States of America,
mahani.khashayar@gmail.com

1 - Renewable Energy Export Planning under Uncertainty

Ebisa Wollega, Doctoral Candidate, University of Oklahoma,
202 W. Boyd St., Norman, OK, 73019, United States of America,
ebisa@ou.edu, Soumyadip Ghosh, Ali Koc, Mark Squillante

In this presentation, we address a wind-hydro integrated energy that is exported as part of a day-ahead plan under stochastic demand and various wind supply scenarios. A profit maximization planning problem is formulated and its solution is computed via a stochastic gradient algorithm. From a practical perspective, renewable energy industry stakeholders can use the techniques we present to make optimal export planning decisions under uncertainty.

2 - Fast Pyrolysis Facility Investment Valuation via A Real
Options Approach
Yihua Li, Iowa State University, 0076 Black Engineering, Ames, IA,
50011, United States of America, yihuali@iastate.edu,
Chung-Li Tseng, Guiping Hu

The valuation of a fast pyrolysis facility investment at a predetermined location is studied under the consideration of multiple uncertainty factors. A real options approach takes into account the managerial options, e.g. optimal investment timing and optimal operating decisions, and maximizes expected gross present value of the project.

3 - Robustness of Renewable Energy Support Schemes Facing
Operational and Regulatory Uncertainty
Ingmar Ritzenhofen, WHU - Otto Beisheim School of Management,
Burgplatz 2, Vallendar, 56179, Germany,
ingmar.ritzenhofen@whu.edu, Stefan Spinler, John Birge

Renewable portfolio standards and feed-in-tariffs are widely used policy instruments to promote investments in renewable energy sources. Regulators continuously evaluate these instruments along the main electricity policy objectives ñ affordability, reliability, and sustainability. We quantitatively assess these policies along these dimensions using a long-term electricity capacity expansion model and compare their robustness in the light of uncertain renewable feed-in and future regulation.

4 - Comparison of Modeled and Actual Power Interchanges for the
Eastern U.S.
Emily Fisher, Lawrence Berkeley National Lab, One Cyclotron Rd,
MS 90R4000, Berkeley, CA, 94720, United States of America,
esfisher@lbl.gov, Alan H. Sanstad

Planning models used in the electricity industry employ a variety of simplifications in order to make representations of the complex electricity system more tractable. One way to examine the impact of these simplifications is to compare the model results to actual data. In this talk we present a comparison of regional interchanges resulting from a resource expansion planning model to scheduled and actual system flows in the Eastern United States.

5 - Heuristic Optimization Technique for Storage Control with High
Penetration of Renewables
Khashayar Mahan, Rutgers University, 1507 Azalea Drive, North
Brunswick, NJ 08902, United States of America,
mahani.khashayar@gmail.com,Mohsen Jafari

Finding near-optimal control schemes for energy storage units has always been a challenge for power utilities. We consider a microgrid with high penetration of renewable resources, such that renewable output may exceed system load from time to time. The reverse flow of renewable output could cause damage to distribution infrastructure. Energy storage can be used in such systems to not only absorb the excessive power from renewable but also reduce energy purchase from the grid during peak hours.

■ WD73

Parc- Mission I

Integrating High Resolution Spatial Data and Optimization Models for Energy Production/distribution Analysis

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: T. Edward Yu, Assistant Professor, University of Tennessee,
2621 Morgan Circle, 314A Morgan Hall, Knoxville, TN, 37996-4518,
United States of America, tyu1@utk.edu

1 - Economic Impact of a Renewable Fuels Biorefinery Expansion:
A Case Study in Mississippi
Burton English, Professor, The University of Tennessee, 2621
Morgan Circle, Knoxville, TN, 37996-4518, United States of
America, benglish@utk.edu, Lixia He, T. Edward Yu, Brad Wilson,
R. Jamey Menard

An advanced renewable fuels company has developed a proprietary technology platform to convert biomass into renewable oil used for gasoline, diesel and fuel oil blendstocks. The company now plans to double the production of its cellulosic fuel facility. This study aims to locate the residues from existing softwoods to meet expanding feedstock demand and to estimate feedstock harvesting costs. The regional economic impact from the transactions of softwood residues will also be assessed.

2 - Optimizing Economic and Environmental Performance of
Advanced Biofuel Supply Chains in Tennessee
T. Edward Yu, Assistant Professor, University of Tennessee, 2621
Morgan Circle, 314A Morgan Hall, Knoxville, TN, 37996-4518,
United States of America, tyu1@utk.edu, Lixia He, Burton English,
James Larson

Given the surging pressure of making advanced biofuels empirically feasible in the US, a growing number of studies have integrated decision models with spatial data in the recent literature of biofuel supply chains. The present study identifies the crucial factors affecting the profit and greenhouse gas of switchgrass biofuel supply chains in Tennessee using a high-resolution GIS-based optimization model. The optimal location of feedstock area, refineries and blending sites are also determined.

3 - Renewable Energy and Carbon Capture and Storage:
A Cost-Benefit Analysis of Technologies
Andrew Arnette, Assistant Professor, University of Wyoming,
Laramie, Wyoming, United States of America
aarnette@uwyo.edu

Built on a framework that combines GIS and a multi-objective optimization modeling that has been used to analyze costs and benefits of renewable energy sources (wind farms, solar farms, biomass co-fire, rooftop solar), this research introduces the potential for carbon capture at coal plants and the potential for storage of carbon in underground locations. The aim of this research is to provide a model that can allow for the comparison of greenhouse gas emission-reducing technologies.

4 - Refining the Economic Potential of Biofuel Production with CCS
using Spatially-explicit Modeling
Nathan Parker, Postdoctoral Researcher, Institute of Transportation
Studies, University of California, Davis, Institute of Transportation
Studies, 1715 Tilia Street, Davis, CA, 95616, United States of
America, ncparker@ucdavis.edu, Joan Ogden, Nils Johnson

To limit global warming to 2 degrees C, it is likely that net anthropogenic CO_2 emissions will eventually need to go negative. One of the most promising options for achieving negative emissions is the production of electricity or fuels using biomass with carbon capture and storage. This project combines a spatially-explicit biorefinery siting model with a spatially-explicit CO_2 transport and disposal model to optimize the deployment of biofuel production with CCS in the United States.

■ WD74

Parc- Mission II

Modern Optimization Techniques for Fundamental Computation Problems in Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Andy Sun, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, andy.sun@isye.gatech.edu

1 - Spatial Branch-and-Bound for the Alternating Current Optimal Power Flow Problem

Chen Chen, University of California, Berkeley, 1561 Arch St., Berkeley, CA, 94708, United States of America, chenchen@berkeley.edu, Alper Atamturk, Shmuel Oren

Optimal Power Flow (ACOPF) is a problem of finding minimum-cost electric generation dispatch subject to network constraints. We develop a novel spatial branch-and-bound approach for ACOPF. We derive valid inequalities to strengthen the typical SDP relaxation, and introduce bound-tightening procedures based on the convex hull of certain nonconvex constraints. Experiments on IEEE test cases up to 118 buses help establish some intuition regarding conditions that may cause duality gap.

2 - Convex Relaxation for Optimal Power Flow Problem: Mesh Networks

Javad Lavaei, Assistant Professor, Columbia University, 120th St, New York, NY, 10027, United States of America, lavaei@ee.columbia.edu, Somayeh Sojoudi, Ramtin Madani

This talk is concerned with the optimal power floow (OPF) problem. We have recently shown that a semidefinite programming (SDP) relaxation is able to find a global solution of OPF over acyclic networks. The present work proposes a penalized SDP relaxation to find a near-global solution for mesh networks. The remarkable performance of this technique will be demonstrated on IEEE systems with more than 7000 different cost functions.

3 - New SOCP Relaxations for ACOPF Problem

Burak Kocuk, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, burak.kocuk@gatech.edu, Santanu Dey, Andy Sun

In this work, we first present several examples where existing methods fail to solve ACOPF to global optimality even in the case of radial networks. Then, we propose two SOCP relaxations for ACOPF problem, which are targeted to solve radial and mesh networks. We come up with some heuristics to construct feasible solutions and give an MISOCP formulation, which can approximate a global optimal solution to arbitrary accuracy. Finally, extensive numerical analysis is provided.

4 - Large-scale Decentralized Unit Commitment

Mohammad Javad Feizollahi, Phd Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Suite 439 (main building), Atlanta, GA, 30332-0205, United States of America, feizollahi@gatech.edu, Santiago Grijalva, Mitch Costley, Shabbir Ahmed

A method for formulating and solving a decentralized unit commitment problem is presented in this work. The method, which extends the ADMM, is presented along with several heuristics to mitigate nonconvexity challenges, oscillations and traps in local solutions. We present the promising results from testing the method on large-scale power systems. The results suggest that this method is a practical option for use with large systems and may provide a significant benefit for computational speed.

■ WD75

Parc- Mission III

Simulation II

Contributed Session

Chair: Diana Pfeil, OptTek Systems, Inc, 2241 Seventeenth Street, Boulder, CO, United States of America, pfeil@opttek.com

1 - Comparison and Validation for Twospotted Spider Mites System

Yan Kuang, PhD Candidate, Kansas State University, 2020 Tunstall Cr, Apt. 31, Manhattan, KS, 66502, United States of America, ykuang@ksu.edu

The twospotted spider mite, Tetranychus urticae, is one of the most serious pests that cause damage to crops. Its predator, a mite of the family Phytoseiulus persimilis, plays an important role in keeping the spider mites population under control. There are many mathematical models for their system. The purpose of the work is to validate the models by fitting experimental data. The results are discussed from both the mathematical and the epidemiological perspective.

2 - Machine Learning Methods for Insightful Simulation Optimization

Diana Pfeil, OptTek Systems, Inc, 2241 Seventeenth Street, Boulder, CO, United States of America, pfeil@opttek.com

Simulation optimization is used to automatically find optimal or near-optimal parameter settings for a simulation model. Typically, these optimal settings do not yield insight into the simulation model or the parameter space. We introduce OptAnalysis, a suite of machine learning and analysis tools to automate the discovery of influential variables, to identify and characterize multiple good and bad regions of the model tradespace, and to classify the robustness of point solutions and regions.

3 - Health Care Supply Chain Coordination – Service Improvement and Cost Saving through Collaboration

Eike Nohdurft, WHU - Otto Beisheim School of Management, Burgstrasse 2, Vallendar, 56179, Germany, eike.nohdurft@whu.edu, Stefan Spinler

Facing enduring cost pressure, the health care industry has not yet applied supply chain (SC) management methods like collaborative forecasting and planning which improved SC performance in other industries. A model quantifying the impact of such an application in the health care sector is missing. This paper aims to close this gap through quantifying the corresponding impact on SC performance in health care. The study is based on a 3-tier downstream SC simulation using patient demand data.

■ WD76

Parc- Embarcadero

New Analytics Frontiers in Retail

Sponsor: The Practice Track
Sponsored Session

Chair: Paritosh Desai, paritosh.desai@stanfordalumni.org

1 - New Analytics Frontiers in Retail

Paritosh Desai, paritosh.desai@stanfordalumni.org

This talk will focus on some of the emerging needs for applying data science in the field of Retail. We will explore a range of decisions within the retail sector and then focus on some of the techniques for making good decisions.

2 - Personalizing Recommendations for Ubiquitous Shoppers – Challenges in Recommender Systems in Retail Setting

Shilad Sen, Assistant Professor, Macalester College, St. Paul, MN, United States of America, ssen@macalester.edu, Ramasubbu Venkatesh

Retail product recommendations have transcended simple associations like beer and diapers. Product recommendations now shape customer interactions across tremendously diverse channels: browsing store aisles, navigating a website, or redeeming a mobile coupon. These contexts produce rich, heterogenous datasets capturing a customer's clicks, purchases, searches, and sentiment. Data scientists charged with extracting value from these customer interactions face a bewildering sea of datasets and algorithms. This talk will outline common product recommendation scenarios and touch upon challenges for providing robust recommendations.

■ WD77

Parc- Market Street

Analytics at its BEST

Sponsor: Analytics
Sponsored Session

Chair: Tarun Mohan Lal, Senior Health Services Analyst, Mayo Clinic, Robert D. and Patricia E. Kern, Rochester, MN, United States of America, mohanlal.tarun@mayo.edu

1 - Analytics for Monitoring and Evaluation of Water Supply Sanitation and Hygiene (WASH)

Darshan Desai, Professor, Larry L. Luing School of Business, New York, NY, 10017, United States of America, darshudesai@gmail.com

In the world of business, analytics and "big data" have created huge hype. However, the field of international development, more specifically, the water supply sanitation and hygiene (WASH) sector lagged behind in applying analytics. Billions of poor people still lack access to the basic water and sanitation services. The WASH sector has chronically faced a wide range of diverse and complex challenges. In such scenarios, we'll discuss ways of applying analytics to create better future.

WD78   *INFORMS San Francisco – 2014*

2 - The Five Minute Analyst

Harrison Schramm, Campaign Analysis Deputy, OPNAV N81, 1507
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The Five Minute Analyst, appearing in INFORMS/Analytics Magazine, has, for the
past 3 1/2 years looked at everyday, bite-sized problems through an Analytics lens.
This presentation consists of 5-minute long vignettes, representing the 'best of'.
How many Legos fit in a Brickbox? What's the best line position for airline seating?
How can you tell if a long-running sports rivalry is fair? What were the odds of
winning Buffet's Billions? Important note: There will be Zombies.

3 - Predicting Patent Litigations

Papis Wongchaisuwat, IEMS, Northwestern University, 2145
Sheridan Road, Evanston, IL, 60208, United States of America,
papiswongchaisuwat2013@u.northwestern.edu,
John Oldham McGinnis, Diego Klabjan

Patents form the backbone of intellectual property and as such are a common
target of litigations. By using patents, court documents of litigations, and additional
external data sources we develop a prediction model. Its accuracy for several
keywords is approximately 75%.

4 - Large-scale Optimization with MapReduce

Alexandros Nathan, Northwestern University, 2145 Sheridan Road,
Room C210, Evanston, IL, 60208, United States of America,
alexandrosnathan2012@u.northwestern.edu, Diego Klabjan

In the age of Big Data, the need to train massive statistical models is ever-
increasing. Parallel computing is arguably the most efficient way to train such
models. In this work we use MapReduce, the popular programming paradigm, to
develop parallel optimization algorithms for solving linear regression and binary
classification problems. We conduct numerical experiments for different
optimization methods and analyze their performance.

■ WD78

Parc- Mason

Decision Support Systems 2

Contributed Session

Chair: Sara Nourazari, PhD Candidate, Northeastern University,
360 Huntington Ave, Boston, MA, 02115, United States of America,
s.nourazari@neu.edu

1 - Engineering Control of Appointment Access with Capacity Adjustment Time Delays

Sara Nourazari, PhD Candidate, Northeastern University,
360 Huntington Ave, Boston, MA, 02115, United States of America,
s.nourazari@neu.edu, James Benneyan, Rifat Sipahi

Long waits to receive care plagues many patients and healthcare systems. While
access delay is a quality care measure for timely service, it is also an indication of
how well a healthcare system synchronizes utilization of resources and its patients'
demands. This work proposes a semi-real time queue management approach for
health systems with inherent time delays in service capacity adjustments.

2 - A Life Cycle-Based Framework to Support Energy Resource Use Decisions: Application to Oil Sands Coke

Jennifer McKellar, Assistant Professor, University of Ontario
Institute of Technology, 2000 Simcoe Street North, Oshawa, ON,
L1H 7K4, Canada, jennifer.mckellar@uoit.ca, Janne Kettunen,
Heather MacLean, Joule Bergerson

A Decision-Support Framework is developed, combining two-stage life cycle
assessment and life cycle costing analyses, feasibility screening and stakeholder
preference analysis. As a case study, the Framework is applied to oil sands by-
product coke. In the base case, selling coke to China for electricity generation
performs best financially (NPV of $55/t coke). The Framework can inform strategic
decisions on energy resource use and facilitate discussion internally and among
stakeholders.

3 - Financial Decision Support in a Local Government

Armando Mendes, Professor, Azores University, Rua da Mae de
Deus, Ponta Delgada, 9501-801, Portugal, amendes@uac.pt,
Hugo Rego, Hélia Guerra

In a local government organization, management decisions are based on guidelines
provided by areas of expertise. Thus, it is intended to create a Decision Support
System for providing financial indicators to support management decisions. For
this it is necessary to load the data for indicators creation from the IS in use on the
organization. Then, tendencies and seasonality factors are identified by means of a
forecasting model. These information will be accessible using an appropriate
interface

■ WD79

Parc- Powell I

Project Analytics

Sponsor: Decision Analysis
Sponsored Session

Chair: Janne Kettunen, Assistant Professor, The George Washington
University School of Business, 2201 G Street, NW, Funger Hall 415,
Washington, DC, 20052, United States of America,
jkettune@gwu.edu

1 - Causal Network Methods for Project Risk-Based Decision Analysis

Paul Govan, PhD Candidate, Texas A&M University, 3136 TAMU,
College Station, TX, 77843, United States of America,
pgovan1@neo.tamu.edu, Ivan Damnjanovic

The goal of this research is to develop a hybrid causal network methodology for
general project risk-based decision making. The network method identifies causal
relationships among events and conditions and integrates opinions with the
observed data. The causal model also helps identify risk-related dependencies given
varying levels of information and promote organizational learning by identifying
what data to collect in order to create value for the organization.

2 - Estimation and Mitigation of Downside Risk in Project Portfolio Selection

Janne Kettunen, Assistant Professor, The George Washington
University School of Business, 2201 G Street, NW, Funger Hall 415,
Washington, DC, 20052, United States of America,
jkettune@gwu.edu, Ahti Salo

We show that uncertainties in project portfolio selection have major implications
for the development of risk estimates about portfolio value. To improve the
accuracy of risk estimates, we propose the use of calibration curves which can be
derived by analyzing past selection processes or by simulating the portfolio
selection process. We also consider the introduction of risk constraints, but show
that this approach may yield risk estimates which are too optimistic.

3 - EDM, an Innovative Approach to Schedule and Duration Estimation, Management and Control

Homayoun Khamooshi, Chair Project Management Program,
George Washington University, Room 408, Funger Hall,
2201 G Street, NW, Washington, DC, 20052,
United States of America, hkh@gwu.edu

Schedule control in comparison to cost control has not been fully exploited in
projects and project management environments (PMOs). In contrast to Earned
Value and Earned Schedule, we have developed the Earned Duration Management
(EDM) in which we have decoupled schedule and cost performance measures and
developed a number of indices to measure efficacy and efficiency of the schedule
and planned duration at any level of the project. These tools can be used by
contractors and clients alike.

4 - Strategic Risk Management

Ernest Forman, Professor, George Washington University, Decision
Sciences, Washington, DC, 20052, United States of America,
forman@gwu.edu

A framework and methodology for strategic risk management, including risk
identification, risk assessment, and risk treatment/mitigation/response will be
presented. The process includes the derivation of ratio scale measures of the
likelihood and impact of risk events, effectiveness of controls to reduce risks, and
the allocation of resources to reduce risk.

■ WD80

Parc- Powell II

Behavioral Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Matthias Seifert, Assistant Professor of Quantitative Methods,
IE Business School, Maria de Molina 12 5∞, Madrid, 28006, Spain,
Matthias.Seifert@ie.edu

1 - Research on Near Miss Events and Risky Choice: Challenges and Opportunities

Florian Federspiel, PhD Candidate, IE Business School,
Maria de Molina 12, Bajo, Madrid, 28006, Spain,
ffederspiel.phd2014@student.ie.edu, Matthias Seifert

We focus on the issues of definitional clarity and scope in defining near miss events
and the ability to account for different kinds of near miss events in explaining
differing risk perception and risky choice. We propose a new definition to bridge
extant research from distinct fields and offer a conceptual framework that opens
the way for further research on risk perception and risky choice following near
miss events.

2 - Gender Bias in Hiring Decisions: The Role of Decoy Effects
Wenjie Tang, Assistant Professor, IE Business School, Calle de Maria de Molina 12, Piso 5, Madrid, 28006, Spain, Wenjie.Tang@ie.edu, Steffen Keck

Drawing on prior research on decoy effects, we suggest that a joint evaluation of candidates might introduce a new form of bias that could amplify the existing gender bias. In a laboratory experiment we find that the presence of asymmetrically dominated applicants in the choice set strongly increases the odds of a male applicant to be chosen, but does only have only very little positive effect for a female applicant and thus leads to a strong gender bias in participants' hiring decisions.

3 - Risky Business (for Women): understanding the Gender Gap in Risk-Taking Behavior
Susan Fisk, PhD Candidate, Stanford University Sociology Department, 450 Serra Mall, Building 120, Room 031, Stanford, CA, 94305, United States of America, sfisk@stanford.edu, Ross Shachter

It is a well-established fact that women take fewer risks than men, a disparity which has largely been attributed to gender differences in risk preferences. We explore the role that social forces play in women's and men's risk-taking decisions; specifically, we examine how gendered beliefs and expectations may cause women to experience greater sanctions when they take a risk and fail, and how these harsher consequences may cause women to experience greater negative affect in risky settings.

■ WD81

Parc- Divisadero

Data Mining in Renewable Energy

Sponsor: Data Mining
Sponsored Session

Chair: Zijun Zhang, Assistant Professor, City University of Hong Kong, SEEM Department, P6600, 6/F, Academic 1, Kowloon Tong, Hong Kong - PRC, zijzhang@cityu.edu.hk

1 - Wind Turbine Power Curve Monitoring and Clustering Analysis
Zhe Song, Associate Professor, Nanjing University, Business Adminstration Department, School of Business, Nanjing, China, zsong1@nju.edu.cn

The power curves are constructed using historical wind turbine data. Power curve models are developed by the least squares method or the other by the maximum likelihood estimation method. The models are solved by an evolutionary strategy algorithm. Power curve model is used for on-line monitoring of the power curve to identify abnormal data points. These abnormal data points are further analyzed by clustering algorithms to identify similar patterns which could be used for fault analysis.

2 - Plug-in Electric Vehicle (PEV) Load Pattern Analysis: A Data-mining Approach
Kai Yang, Director, Healthcare Systems Engineering Group, Wayne State University, 4815 4th Street, Detroit, MI, 48201, United States of America, kai.yang@wayne.edu, Anoop Verma, Satish Tyagi

The usage patterns of EVSE charging affects the overall electricity load and thus poses challenges to utility companies. There is a need to identify users with EVSE to better manage the load distribution. Analysis of load usage data with an aim to isolate the residential and aggregate usage patterns is targeted. The approach developed is tested and validated on real world data obtained from a regional utility company

3 - Optimization of Wind Power and Its Variability with a Computational Intelligence Approach
Zijun Zhang, Assistant Professor, City University of Hong Kong, SEEM Department, P6600, 6/F, Academic 1, Kowloon Tong, Hong Kong - PRC, zijzhang@cityu.edu.hk

An optimization model is presented for maximizing the generation of wind power while minimizing its variability. In the optimization model, data-driven approaches are used to model the wind-power generation process based on industrial data. A new constraint is developed for governing the data-driven wind-power generation model based on physics and statistical process control theory. Computational intelligence algorithms are utilized to solve the optimization model.

4 - Application of Computational Intelligence in Modeling and Optimization of HVAC Systems
Mingyang Li, University of Arizona, 1127 James E. Rogers Way, Tucson, AZ, 85721, United States of America, mingyangli@email.arizona.edu

HVAC (Heating Ventilating and Air-Conditioning) system is multivariate, nonlinear, and shares time-varying characteristics, posing challenges for both system modeling and optimization. In this research, computational intelligence methods are employed in modeling and optimization of HVAC systems. Energy savings are accomplished by minimizing the cooling output, reheating output or

fan running time as well as on-line monitoring.

5 - Investigation of the Impact of Total Solids and pH on Biogas Production with a Data-driven Approach
Xiupeng Wei, Research Assistant, University of Iowa, 3131 Semans Center, Iowa City, IA, 52246, United States of America, xiupeng-wei@uiowa.edu

Biogas is a typical byproduct in wastewater treatment by anaerobic digestion the sludge. To improve biogas production, the impact of total solids and pH is investigated with a data-driven approach. Five data-mining algorithms have been used to build biogas production models. Based on the built production model, genetic algorithm is used to find the optimal control settings of total solids and pH value. The biogas production can be significantly increased with optimal settings.

■ WD82

Parc- Haight

Data Mining 7

Contributed Session

Chair: Mohammad S. Jalali, Virginia Tech / MIT, 113 Harvard St, Apt 1, Cambridge, MA, 02139, United States of America, mj@vt.edu

1 - Support Vector Machines Based on Convex Risk Functional and General Norms
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Stan Uryasev

We revisit the formulations of support vector machines (SVMs) for binary classification on the basis of convex analysis. Interpretability of dual formulations is related to properties of the convex empirical risk functionals. Besides, we demonstrated how robust optimization modelings are easily incorporated. With regularizers based on new families of polyhedral norms (in place of the lp-norms), regularizer tuning can be efficiently incorporated via (possibly, parametric) linear programming.

2 - Generating Contextual Insights for the Social Enterprise
Ying Li, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, yingli@us.ibm.com, Ashish Jagmohan, Yi-Min Chee, Krishna Ratakonda, Elham Khabiri

Social enterprise technology can enhance organizational productivity by surmounting knowledge silos and promoting collaboration. We present a social enterprise tool which uses natural language and machine learning algorithms to make sense of large enterprise data repositories. The tool extracts specialized knowledge from such repositories, and generates new contextual insights allowing users to leverage the organization's collective intelligence for problem-solving and collaboration.

3 - Quantitative Aggregation of Prior Statistical Findings
Mohammad S. Jalali, Virginia Tech / MIT, 113 Harvard St, Apt 1, Cambridge, MA, 02139, United States of America, mj@vt.edu, Hazhir Rahmandad, Kamran Paynabar

Taking stock of prior research requires combining previous findings yet current methods limit such quantitative aggregation to studies with very similar designs. We introduce Generalized Model Aggregation (GMA) that can consistently combine prior statistical findings of a phenomenon into a meta-model. Numerical and empirical examples demonstrate GMA's ability to extract the underlying data generating process from biased and incomplete prior studies.

4 - Global Bicycling Trends
Olufolajimi Oke, Johns Hopkins University, 3400 N Charles St, Baltimore, MD, United States of America, ooke1@jhu.edu, Sauleh Siddiqui, David Love, Kavi Bhalla

Over the past four decades, bicycle ownership has been tracked but not globally analyzed. We gather survey data from 155 countries, and assume ownership as a usage indicator. Performing cluster analysis, we identify five global trends cutting across geographical regions. We also observe relationships between bicycle usage and socio-economic indices. We determine a worldwide ownership trend and demonstrate a basis for understanding the global impact of cycling as a sustainable transit mode.

5 - eWOM Public Transportation Decision Making Variables
Benjamin George, University of North Texas, 1155 Union Circle, Denton, TX, 76203, United States of America, benjamin.george@unt.edu, Rebecca Scott

This research uses electronic word of mouth (eWOM) to identify public transportation decision-making factors. Text analytics techniques identify the frequency and strength of variables from end-user customer comments. Implications from the results address service issues and how to increase public transportation use.

■ WD83

Parc- Sutro

Data Mining 4

Contributed Session

Chair: Youqin Pan, Assistant Professor, Salem State University, 3
52 Lafayette Street, Salem, MA, 01970, United States of America,
youqinpan@my.unt.edu

1 - File Classification Problem in Hybrid Cloud Storage Systems
> Fan Liu, Kansai University, No. 306,1-17-13 Senriyamanishi, Suita,
> Osaka, 565-0851, Japan, liufan09006@gmail.com, Hiroyuki Ebara

In hybrid cloud storage system,it is important to solve the problem of file
classification,in order to use effectively the storage space and improve security.In
the classification process,we can analyze content of a file using machine learning,in
addition to using the size and type of a file.

2 - What Drives Marketplace Effectiveness and Growth?
An Empirical Investigation.
> Pavel Izhutov, Stanford University, 736 Escondido Rd,
> Apt 203, Stanford, CA, 94305, United States of America,
> izhutov@stanford.edu, Haim Mendelson

Online marketplaces are becoming increasingly important mechanisms for
matching supply and demand. This paper presents findings from a marketplace for
services (in particular, a tutoring vertical). Using a rich data-set, we study the
drivers of marketplace growth and the factors that lead to successful matching of
supply and demand.

3 - A New Model for Binary Classification
> Jian Luo, North Carolina State University, Daniels 443,
> North Carolina State University, Raleigh, NC, 27695,
> United States of America, jluo3@ncsu.edu, Zhibin Deng

In this study, a kernel-free soft quadratic surface support vector machine model is
proposed for binary classification directly using a quadratic function for separation.
We have also studied some properties of this proposed model such as the
solvability, uniqueness of the solution and so on. Finally, our computational results
on artificial data sets and four real-world benchmark data sets indicate that the
proposed model outperforms Dagher's quadratic support vector machine model
and soft support vector machine models with Gaussian or quadratic kernel.

4 - Predicting Stock Index Movement using Advanced Machine
Learning Techniques
> Youqin Pan, Assistant Professor, Salem State University,
> 352 Lafayette Street, Salem, MA, 01970, United States of America,
> youqinpan@my.unt.edu

In this study, advanced machine learning techniques are applied to predict the
direction of stock market movement. Experimental results show that EMD
transformation of original stock index into a time-frequency feature space
improves the accuracy of the forecasting models commonly used in the literature.
All models examined in this study generate an acceptable model performance, the
EMD-Neural Network model seems to outperform other models in general.

5 - Mining Process Patterns from Noisy Audit Logs with Application to
Electronic Medical Record Systems
> He Zhang, Northwestern University, The Technological Institute,
> 2145 Sheridan Road, Room C210, Evanston, IL, 60208,
> United States of America, hezhang2012@u.northwestern.edu,
> David Liebovitz, Carl Gunter, Bradley Malin, Sanjay Mehrotra

Mining the process patterns in the access logs from information systems can
provide useful insights for the workflow patterns. One important issue in process
mining is that the workflow is usually highly dynamic and the access logs are
noisy. We present a four-step framework to analyze process models with noisy data
at an abstract level. We implement our approach using several months of data from
a large academic medical center. Empirical results show that our framework can
work effectively.

Wednesday, 4:30pm - 6:00pm

■ WE02

Hilton- Golden Gate 7

Technology Management

Contributed Session

Chair: Paola Gonzalez, PhD candidate, Queen's University,
PhD Office, Goodes Hall, Kingston, ON, K7L 3N6, Canada,
pgonzalez@business.queensu.ca

1 - Supporting or Killing Platform Design? Towards New Contingent
Criteria for Strategies Selection
> Olga Kokshagina, Mines ParisTech, 60 Boulevard Saint-Michel,
> Paris, 75006, France, olga.kokshagina@mines-paristech.fr,
> Pascal Le Masson, Benoit Weil, Hassen Ahmed

The circumstances in which firms operate have moved towards unknown
environments, thereby rendering planning approaches inadequate. In these
situations companies have to adapt more flexible approaches. When technology
and markets are unknown an interesting solution is highlighted: the design of
technological platform creating value across many emerging markets. A study is
carried out to clarify the criteria in which the exploration of multiple technologies
and markets lead to platform design.

2 - Capability Changes at a Firm Due to Offshoring:
Antecedent to the Commons Challenge
> Anshuman Tripathy, Indian Institute of Management Bangalore,
> Bannerghatta Road, Bangalore, India, atripathy@iimb.ernet.in,
> Shilpa Jaiswal

We use SD to model a firm's decision to increasing its offshoring content. As
capabilities at the offshored agent develop, we find that the firm's system
development capabilities increase though part development keeps diminishing,
more so when parts have higher modularity. This further motivates firms in
broadly similar industries to replicate the offshoring process; and over time, this
leads to the loss of certain collective capabilities that sustain innovation (industrial
commons).

3 - An Economic Analysis of Platform Structure with Hierarchies
> Sunghee Lee, Researcher, Korea E-Trade Research Institute, Chung-
> Ang Univ., Heukseok-ro, Dongjak-gu, Seoul, 136-701, Korea,
> Republic of, shedawa@gmail.com, Byung Cho Kim, Daeki Kim

We compare two distinct settings in two-sided markets: simple platform versus
hierarchical platform. Grounded on an analytical model, we investigate the
incentives of a platform provider to adopt a hierarchical structure. Our findings
indicate that that the presence of network externality creates such an incentive,
especially when there is a need for load-sharing. Consequently, a hierarchical
structure acts as a beneficial existence to consumers under certain conditions.

4 - Innovation and Policy Support for Platform Providers
under Competition
> Dawoon Jung, PhD Student, Korea University Business School,
> LG-Posco Hall, KUBS, 145 Anam-ro Seoungbuk-gu, Seoul, Korea,
> Republic of, bogsil@korea.ac.kr, Byung Cho Kim, Myungsub Park,
> Detmar Straub

Technological innovation becomes even more complicated for platform businesses
whose fate is heavily influenced by the network externality stemming from a two-
sided market. We introduce a model of competing platforms to examine whether
platform providers have an incentive for technological innovation, while the
existing literature on the two-sided market focuses on platform providers' pricing
strategies for network expansion without paying much attention to innovation
decisions.

■ **WE04**

Hilton- Continental 1

Remanufacturing

Contributed Session

Chair: Xiaoning Jin, Assistant Research Scientist, University of
Michigan, 1031 H. H. Dow Building, 2350 Hayward Street,
Ann Arbor, MI, 48109, United States of America, xnjin@umich.edu

**1 - Admission Policies for End-of-Life Product Returns in a
    Remanufacturing System**
    Xiaoning Jin, Assistant Research Scientist, University of Michigan,
    1031 H. H. Dow Building, 2350 Hayward Street, Ann Arbor, MI,
    48109, United States of America, xnjin@umich.edu, S. Jack Hu,
    Jun Ni

This paper considers a reassemble-to-order system with admission control on
product returns in a remanufacturing system. Warranty claims trigger orders for
product replacement by new or remanufactured products and also generate returns
of used products. The return process is a stochastic in terms of arriving time,
quality and quantity. We develop a quasi-birth-and-death model to obtain the key
performance measures of the system and provide managerial insights into decision-
making.

**2 - The Inter-Divisional Coordination of Manufacturing and
    Remanufacturing Operations in a CLSC**
    Tianqin Shi, University of Illinois at Urbana-Champaign,
    350 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820,
    United States of America, tshi3@illinois.edu, Dilip Chhajed,
    Zhixi Wan

We consider a firm consisting of two divisions, one responsible for designing and
manufacturing new products and the other responsible for remanufacturing
operations. Both divisions operate independently and distribute through the same
retailer. We show that divisional conflict can occur, which not only reduces sales
and profit of the firm but also discourages remanufacturable product design. Thus,
we propose an inter-divisional incentive scheme that facilitate divisional
coordination.

3 - Remanufacturing with Competing Manufacturers
    Kunpeng Li, Utah State University, 3555 Old Main Hill, Logan, UT,
    United States of America, kunpeng.li@usu.edu, Shaorui Li

Two manufacturers produce and sell substitute products through their respective
retailers. Under such a setting, we study the optimal remanufacturing strategies
with two competing manufacturers.

4 - Optimal Product Design in a Remanufacturing Setting
    Mustafa Akturk, PhD Student, Texas A&M University, Mays
    Business School, 4113 TAMU 320 R, College Station, TX, 77845,
    United States of America, makturk@mays.tamu.edu

Benefits from remanufacturing do not come for free. The recovery of parts from
returned products requires investment at the design stage. However, design for
remanufacturing takes longer time to market than other design options. So, we
model the optimal design philosophy at different market conditions both in a
single-period and multi-period settings.

**5 - A Fuzzy Linguistic Based Decision Support System for Evaluating
    Re-manufacturability of Products**
    Thomas Omwando, University of Wisconsin Milwaukee,
    3200 N Cramer Street, EMS 503, Milwaukee, WI, 53211,
    United States of America, tomwando@uwm.edu, Wilkistar Otieno,
    Anthony Ross

Remanufacturing as an end of life disposal option faces challenges due to
uncertainties associated with product attributes. This work presents a decision
support system based on a 2-tuple fuzzy linguistic computing approach to integrate
qualitative and quantitative product attributes in determining the
remanufacturability of a product. The model is applied to assess the suitability of
remanufacturing two products manufactured by a global industry based in the
mid-west region of the USA.

■ **WE05**

Hilton- Continental 2

Supply Chain/Closed Loop I

Contributed Session

Chair: Mostafa Sabbaghi, PhD Student, University at Buffalo,
State University of New York, 437 Bell Hall, Buffalo, NY, 14260,
United States of America, mostafas@buffalo.edu

**1 - Trends in Used Electronics Return Flows: A Perspective on
    Consumer Behavior and Design Features**
    Mostafa Sabbaghi, PhD Student, University at Buffalo, State
    University of New York, 437 Bell Hall, Buffalo, NY, 14260,
    United States of America, mostafas@buffalo.edu,
    Ardeshir Raihanian, Sara Behdad, Willie Cade

Inspired by the large amount of electronic waste (e-waste) discarded every year in
the US, this study aims to investigate consumer behavior aspects of return flows.
Using a large dataset consisting of characteristics of 44000 used personal computers
returned back to a remanufacturing company, the study examines the connection
among design features and consumers' behavior towards products usage duration
and time-in-storage.

**2 - Network Design for Commercial Returns under
    Time Value Consideration.**
    Sung Ook Hwang, Texas A&M University, ETB Building 101,
    Bizzell St, College Station, TX, United States of America,
    hwang1227@tamu.edu, Halit Uster

We consider logistics network design problem for commercial returns. The problem
is formulated as a multi-period mixed integer linear program with time parameters
introduced to express product residual value based on return channel selections.
We present an efficient solution approach and an analysis of network design and
channel selection strategies based on product characteristics.

**3 - Application of Robust Optimization to Mechanism Design in
    Waste Recycling**
    Kazuaki Okubo, Assistant Professor, Saitama University,
    255 Shimo-okubo, Sakura-ku, Saitama, 338-8570, Japan,
    okubo@dp.civil.saitama-u.ac.jp, Makoto Okumura

In Japan, some recyclable wastes are collected by local governments and delivered
to a contracted recycler, who is a winner of auction. However, there is uncertainty
in the quantity of waste collected. We show that if a recycler has advanced
technology, it will be less likely to be assigned a contract because of its high initial
cost. We propose a mechanism with minimum contract quantity and show that the
mechanism can increase the probability that the advanced recycler will win in the
auction.

4 - Consumer Returns Policies for a Price Setting Retailer
    Necati Ertekin, PhD Student, Texas A&M University, 320 Wehner
    Bldg. TAMU, College Station, TX, United States of America,
    nertekin@mays.tamu.edu, Michael Ketzenberg

We study a retailer that offers customers both returned and new products side by
side under a partial return policy as is very common in practice. The retailer
segments the market for new products and open-box returns based on customer
valuation and pricing and faces stochastic demands from price-sensitive customers.

■ **WE06**

Hilton- Continental 3

Supply Chain/Closed Loop II

Contributed Session

Chair: Yohanes Kristianto, Postdoctoral Researcher,
University of Vaasa, Yliopistonranta 10, Vaasa, 65101, Finland,
ykristiantonugroho@gmail.com

**1 - An Improved Reformulation for an Optimal Design Problem in
    Electronic Goods Recollection**
    Roger Rios-Mercado, Professor, Universidad Autonoma de Nuevo
    Leon, AP 111-F, CD. Universitaria, San Nicolas de los Garza, NL,
    66450, Mexico, roger@yalma.fime.uanl.mx, Jonathan Bard

The problem addressed here is motivated by a real-world case arising in the
recollection of waste electronic equipment in Europe. The process involves
assigning recollection units to companies subject to some planning requirements. A
new MILP model for this NP-hard districting problem is introduced. Empirical
evidence illustrate the positive impact of the new model and the proposed
algorithmic strategies resulting in dramatic speed-up of solution times when
compared to existing approaches.

WE07   *INFORMS San Francisco – 2014*

2 - Outsourcing Analysis in Closed-Loop Supply Chains for Hazardous Materials

Victor Manuel Rayas Carbajal, ITESM, Eduardo Monroy Cárdenas 2000, San Antonio Buenavista, Toluca, 50110, Mexico, victor.rayas@invitados.itesm.mx, Marco Antonio Serrato García

Environmental issues have become a main topic worldwide, forcing companies to satisfy specific requirements on their supply chain due to laws and policies to reduce the impact of their activity. This is why many companies consider outsourcing these functions. Through this research, a Markov decision models are developed to support outsourcing decisions in a closed-loop supply chain for hazardous materials. The models are based on the risk levels and sales behavior of the product considered.

3 - Procurement Maturity Model Reassures Contract System's Best Practices

Saroj Koul, Professor, OP Jindal Global University, Sonipat-Narela Road, NCR, 130001, India, skoul@jgu.edu.in

Procurement shares a significant responsibility towards ensuring organizational profitability and promoting organizational quality standards. In this research study, the Procurement Maturity Model was developed to assist procurement professionals in implementing procurement best practices as a means to improve the organizational performance and professional skills at a steel company.

4 - Decision Support Systems for Closed Loop Supply Chains under Uncertainties

Yohanes Kristianto, Postdoctoral Researcher, University of Vaasa, Yliopistonranta 10, Vaasa, 65101, Finland, ykristiantonugroho@gmail.com

This paper designs a decision support system to determine optimal poduct architecture modularity in closed loop supply chains. The objective is to investigate if remanufacturing and modular upgrading is appropriate at certain periods and in modules. The optimization model is tested under several production yield scenarios in order to determine manufacturing and remanufacturing capacity and production line scheduling under process yield uncertainty.

■ WE07

Hilton- Continental 4

Supply Chain Management IX

Contributed Session

Chair: Babak Abbasi, Senior lecturer, RMIT University, Swanston St, Melbourne, Australia, babak.abbasi@rmit.edu.au

1 - Driving Design Innovation up the Supply Chain

Ali Inay, PhD Student, McGill University, 3458 Rue Sainte Famille, Montreal, QC, H2X 2K8, Canada, ali.inay@mail.mcgill.ca

We consider innovative OEMs that design competing products relying on a key component sourced from a supplier with technological capability. Suppliers' innovation efforts define their capabilities, but OEMs can engage to enhance them (with spillovers). We derive equilibrium design (quality), innovation and capability investment, and pricing decisions for alternative configurations.

2 - The Centralization Impacts on the Two-echelon Supply Chain

Babak Abbasi, Senior lecturer, RMIT University, Swanston St, Melbourne, Australia, babak.abbasi@rmit.edu.au

This talk provides insights on the impacts of centralization in the second echelon of a two-echelon supply chain with perishable items and uncontrollable replenishment. The centralization in the second location means that agents in the second echelon share the inventory. We find that centralization is a key factor in the blood supply chain. For instance we observed reducing the number of inventory locations from 5 to 2 will reduce the total cost by around 21%.

3 - Cooperative Procurement in the Presence of Intermediaries

Behzad Hezarkhani, Technical University of Eindhoven, OPAC, Department of Industrial Engineeri, Eindhoven, No, 5600 MB, Netherlands, b.hezarkhani@tue.nl, Marco Slikker, Tom Van Woensel

In complex supply chains, agents who procure individually often find it beneficial to replenish their required products indirectly from a local intermediary rather than from the original manufacturers directly. But the agents could collectively benefit from aggregating their demands and placing joint orders with the manufacturers of specific products. This talk addresses the possibilities for cooperation in these situations and the structure of associated cooperative games.

4 - Impacts of Counterfeiting on a Global Supply Chain Impacts of Counterfeiting on a Global Supply Chain

Zelong Yi, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, yizl@ust.hk, Ki Ling Cheung, Man Yu

We investigate how a global supply chain is influenced by counterfeits and how the supply chain should take anti-counterfeit actions. Specifically, we consider a supply chain consisting of a manufacturer and a local retailer, and examine who should counteract counterfeits. We also evaluate the impact of counterfeits on supply chain profit, consumer surplus, and social surplus.

■ WE08

Hilton- Continental 5

Supply Chain Management X

Contributed Session

Chair: Shiqing Yao, PhD Candidate, Chinese University of Hong Kong, Rm 941, CYT Building, Shatin, Hong Kong - PRC, shiqing@baf.msmail.cuhk.edu.hk

1 - A Stochastic Programming Approach for Process Flexibility Design in Unbalanced Networks

Wancheng Feng, PhD Candidate, Tsinghua Univeristy, Dept. of Industrial Engineering, Beijing, 100084, China, fwc12@mails.tsinghua.edu.cn, Chen Wang, Jeffrey David Tew

This research proposes a stochastic programming model and an algorithm for solving process flexibility design problems in unbalanced networks. Our solution approach integrates the accelerated Benders decomposition algorithm in a Monte-Carlo Sampling approximation scheme, to quickly obtain high-quality solutions to SP models. Impacts of flexibility uniformity (e.g. plant uniformity and product similarity) when process flexibility is applied in real production system have been discussed as well.

2 - Concurrent Planning of Forward and After-sale Supply Chains Against Demand and Supply Side Uncertain

Shabnam Rezapour, Dr., University of Oklahoma, 2248 Houston Ave, Apt 2,, Norman, OK, 73071, United States of America, shabnam_rezapoor@yahoo.com, Farrokh Mistree, Janet Allen

A company supplying a product to its pre-markets through a forward supply chain (SC) is considered. Demand is a stochastic function of price, warranty time and service levels. Due of the warranty, returned defective products must be repaired or substituted. These parts are produced through an after-sale SC. Uncertainty in a) the demand of product and spare parts and b) qualified output of production facilities are considered. Nonlinear model of problem is linearized to be solvable globally.

3 - Traceability and Market Inspection

Shiqing Yao, PhD Candidate, Chinese University of Hong Kong, Rm 941, CYT Building, Shatin, Hong Kong - PRC, shiqing@baf.msmail.cuhk.edu.hk, Kaijie Zhu

We consider an industrial organization which assigns quality labels to its members in order to certify their products in the output market. By a desire of profits, its dishonest members may gain more through selling quality labels to an outside party. Traceable labels and market inspection might be advantageous to deter such under-the-table activity. However, under the leakage of market inspection, we show that this conventional wisdom may no longer be true.

4 - Evaluation and Selection of 3PL Provider using Taguchi Loss Functions and AHP

Sharon Ordoobadi, University of Massachusetts, 285 Old Westport Road, Dartmouth, MA, 02747, United States of America, sordoobadi@umassd.edu

The purpose of this study is to develop a model that helps manufacturers with decisions regarding the reverse supply chain. This is accomplished by using Taguchi loss functions and AHP methodology in the development of the model. Taguchi loss functions are used to calculate the loss scores based on the performances of the 3PL providers. AHP methodology is used to determine the relative importance of the criteria to the decision maker. The providers are ranked based on their loss scores.

■ WE09

Hilton- Continental 6

E-Business/ Commerce 3

Contributed Session

Chair: Nikunj Kumar Jain, Mr., Indian Institute of Management, Indore, Room No. 310, FPM Block,Rau, Indian Institute of Management, Indore, Indore, MP, 453331, India, f11nikunjk@iimidr.ac.in

1 - An Efficient Multi-attribute Reverse Auction Mechanism to Support the Repeated Procurement

Na Yang, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, Shaanxi, China, yang.na616@stu.xjtu.edu.cn, Xiuwu Liao

The actual supply of the winning supplier may be different with her committed offer. We propose a novel multi-attribute reverse auction mechanism in a repeated e-procurement setting to discourage such untruthful behavior of the suppliers. The simulation study shows that the dishonest suppliers have less opportunity to win and the buyer derives higher utility by using the proposed mechanism as compared to the existing mechanism.

2 - Exclusive outlets & E-tailing – Manufacturer's strategic instruments

Nishant Kumar Verma, Doctoral Student, Indian Institute of Management Calcutta, India, A201, Tagore Hostel, IIM Calcutta, Joka, DH Road, Kolkata, WB, 700104, India, nishantkv11@email.iimcal.ac.in, Abhishek Shinde

In the world of e-commerce, where manufacturing firms are making their presence felt on the click of a mouse, the same are increasingly opening a considerable number of exclusive outlets too. In this research we aim to develop a game theoretic model to study "how a manufacturing firm uses both e-tailing and exclusive outlets as strategic instruments to influence the pricing behavior of the traditional independent retailers".

3 - Alternative Payment Schemes on Micro-task Crowdsourcing Platforms

Mohammadmahdi Moqri, UF, 299 Diamond Village, Apt15, Gainesville, Fl, 32603, United States of America, mahdi.moqri@warrington.ufl.edu, Hsing Cheng, Subhajyoti Bandyopadhyay

This study focuses on two interrelated challenges in crowdsourcing, namely designing an efficient payment scheme and assuring quality of work. We develop an economic model to explain the relation between pay and quality under the commonly used piece-rate payment scheme. Recognizing the inefficiency of this common payment system, we then propose an alternative payment scheme. The results of our experiments show a significant improvement in the quality of work under the proposed payment scheme.

■ WE11

Hilton- Continental 8

Supply Chain, Managing Disruptions II

Contributed Session

Chair: Abdulaziz Almaktoom, PhD Candidate, Wichita State University, 8488 E. Granite CT, Bel Aire, KS, 67226, United States of America, atalmaktoom@gmail.com

1 - An Evaluation of Supply Disruption Management Strategies using Mixed-Integer Programming

Mahour Parast, Assistant Professor of Technology Management, NC A&T State University, 4018 Smith Hall, 1601 E Market St, Greensboro, NC, 27411, United States of America, mahour@ncat.edu

The purpose of this paper is to develop a mathematical model to examine the impact of four disruption management strategies on supplier selection and allocation: Pre-positioning of emergency supplies, using back up supplier(s), protecting supplier(s) against disruption, and suppliers' production flexibility. We discuss contingency plans for each scenario, and provide the proper supplier selection and allocation to meet customer demand during disruptions.

2 - The Effect of Learning and Supply Disruptions under Dual Sourcing

Lena Silbermayr, Vienna University of Economics and Business, Welthandelsplatz 1, Vienna, 1020, Austria, lena.silbermayr@univie.ac.at, Stefan Minner

The suppliers face the risk of temporary supply disruptions and reduce future supply cost with cumulative productions, i.e. due to learning effects. Including these two factors we examine the buyer's optimal dual sourcing strategy. Hence, we study the interplay of learning and supply disruptions in the buyer's order allocation problem.

3 - Resilience Quantification of Complex Supply Chain Networks

Abdulaziz Almaktoom, PhD Candidate, Wichita State University, 8488 E. Granite Ct, Bel Aire, KS, 67226, United States of America, atalmaktoom@gmail.com, Krishna Krishnan, Pingfeng Wang, Samir Alsobhi

The objective of this research is to explore supply chain network resilience concept and introduce a novel measure to evaluate supply chain network resilience such that the design of a resilient supply chain becomes possible. The developed measure is able to evaluate the resilience of each entity in the network and the overall supply chain network. Case studies with multi-level complex supply chain networks are developed to demonstrate the proposed measure.

4 - Monitoring a Complex Supply Chain

Lei Liu, Arizona State University, 699 S. Mills Ave, Tempe, AZ, United States of America, lliu58@asu.edu, George Runger, Mani Janakiram, David Bayba

Supply chains (SC) performance is impacted by both supply and demand variability. A SC is complex in both the number of SKUs and dynamics, and agile detection of small-scale disruptions is important. We propose a quite robust, monitoring and visualization scheme for SCs that handle dynamic complexities. Diagnostic tools are embedded to analyze signals from the scheme.

5 - Joint Problem Solving and Planning Roles in Supply Chain Collaboration

Gopal Kumar, Postdoctoral Fellow, Dublin City University, Room SG24, School of Mechanical Engineering, Dublin, 9, Ireland, gopshal.kr@gmail.com, Ravindra Banerjee

This research uncovers joint problem solving and planning roles in developing culture in supply chain collaboration (SCC). Collaborative activities are viewed in terms of internal and external focused functional areas. The model was verified with data collected from industries. Joint problem solving and measurement found critical and affect core and non-core activities. Joint planning at operation level is very important in culture development which gives a platform for the SCC.

■ WE12

Hilton- Continental 9

Supply Chain Optimization III

Contributed Session

Chair: Gang Wang, Assistant Professor, University of Massachusetts Dartmouth, 800 Pleasant Street, Apt 401, New Bedford, MA, 02747, United States of America, wang.gaby@gmail.com

1 - Capacitated Supply and Distribution Network Design with Stochastic Demand and Delivery Deadlines

Gang Wang, Assistant Professor, University of Massachusetts Dartmouth, 800 Pleasant Street, Apt 401, New Bedford, MA, 02747, United States of America, wang.gaby@gmail.com

This paper studies a make-to-order supply chain where stochastic customer demand and order delivery deadlines are both considered. After formulating the problem as a stochastic mixed integer nonlinear program, three different variations of this problem are investigated in terms of three distinct cost functions.

2 - Concurrent Supply Chain Network and Manufacturing System Design under Uncertain Demand

Bulent Erenay, PhD Candidate, Ohio University, 289 Stocker Center, Athens, OH, 45701, United States of America, be977209@ohio.edu, Gursel A. Suer

Traditionally supply chain network (SCND) and manufacturing system designs (MSD) are done in two phases using rough capacity requirements. In this study, MSD and SCND are made concurrently in an uncertain demand environment. First, a stochastic layered cellular design approach is used to handle uncertain demand, and then MSD and SCND are done simultaneously with the objective of cost minimization considering minimum capacity utilizations.

3 - Optimizing Performance Based Contracting in Multi-Part Multi-Mode Supply Support Systems

Rana Afzali Baghdadabadi, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65201, United States of America, ragh2@mail.missouri.edu, Wooseung Jang

After-sales support services are often provided by two different organizations, where each party is usually interested in their benefits. To observe the best contractual terms under different environmental assumptions, an optimization model is provided, where the supplier's decisions on resource allocation and transportation modes and the optimized terms of contracting are developed to minimize the total system's cost.?

WE14   *INFORMS San Francisco – 2014*

4 - Optimal Policy for the Stochastic Inventory Control Problem with Unreliable Sourcing

Shuohao Wu, North Carolina State University, 3515 Ivy Commons Dr, Apt 302, Raleigh, NC, 27606, United States of America, swu6@ncsu.edu, Sha Luo, Russell King, Donald Warsing, S.Sebnem Ahiska

We study a single-product inventory system under periodic review in the presence of two suppliers. Both suppliers charge a fix ordering cost. One supplier is perfectly reliable, and the other one offers a better unit price but may encounter supply interruptions, which is modulated by a discrete-time Markov chain. Orders can be placed at both suppliers or only one of them. Optimality of a parameter-dependent (s,S)-like policy is addressed.

5 - Optimizing the Profit under Performance-Based Maintenance Support

Xiaolong Guo, University of Science and Technology of China, 96 Jinzhai Road, Hefei, 230026, China, gxl@ustc.edu.cn, Nishant Mishra, Yugang Yu

We study how customers using systems with varying levels of profitability, decide contract terms for their maintenance suppliers, and how the suppliers set the spare-parts inventories when facing multiple customers with different contract terms. Also, by considering multiple customers and suppliers in our model, we are able to study when suppliers are benefitted by lower spare-parts inventory due to inventory pooling, and when they need to keep dedicated inventories for customers.

■ WE14

Imperial B

Retail Management II

Contributed Session

Chair: Anurag Agarwal, Professor, University of South Florida, 8350 N Tamiami Trail, SMC-C263, Sarasota, FL, 34243, United States of America, agarwala@usf.edu

1 - Data Driven Optimization for Retail Shelf Space

Anurag Agarwal, Professor, University of South Florida, 8350 N Tamiami Trail, SMC-C263, Sarasota, FL, 34243, United States of America, agarwala@usf.edu, Ramakrishna Govindu, Jim Curran

Retailers these days are collecting a lot of data and trying to optimize limited shelf space. In this paper, we propose optimization models for the retail shelf space problem and propose ideas on how to use data to make these models work in practice.

2 - Assortment Planning 2.0

Matthew Lanham, Doctoral Candidate, Virginia Tech, Dept of Business Information Technology, Pamplin Hall (0235), Blacksburg, VA, 24060, United States of America, lanham@vt.edu, Ralph Badinelli

Assortment planning is regarded as one of the most important decisions faced by retailers. We provide a taxonomy of the assortment planning problem and highlight extensions of the conventional assortment planning model which capture more realistic customer behavior, multi-channel coordination, supply-chain performance measures and cross-category tradeoffs. Opportunities for supporting these extensions through big data analytics are investigated.

3 - Market Dominance or Cost Advantage? The Effect of Retail Power on Assortment Planning Decisions

Hedayat Alibeiki, Desautels Faculty of Management - McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, hedayat.alibeiki@mail.mcgill.ca, Ramnath Vaidyanathan, Shanling Li

Some mass retailers are known to reduce their assortment, in certain product categories, more than other retailers. Some believe this phenomenon is because of their retail power. In this study, we investigate the underlying effect of 'market dominance' and 'cost advantage', as two important sorts of retail power, on assortment decisions. Our results show that 'market dominance', i.e. the ability to manipulate market price, is a necessary condition for assortment reduction.

4 - Delivery Planning in Retail Chains

Heinrich Kuhn, Professor, Catholic University Eichstatt-Ingolstadt, Auf der Schanz 49, Ingolstadt, Germany, heinrich.kuhn@ku.de, Michael Sternbeck, Andreas Holzapfel, Alexander Huebner

In grocery retail weekly repetitive delivery patterns have to be selected to deliver the products from the DC to the outlets. An IP model is presented which contains the decision relevant costs and capacities at the DC, in transportation and instore. We propose a simultaneous and a sequential solution approach. Applying the model and the solution approach at a major European grocery retailer leads to significant cost savings.

■ WE15

Hilton- Exec. Boardroom

Design Engineering

Contributed Session

Chair: Emrah Koksalmis, Teaching Assistant, Turkish Air Force Academy, Hava Harp Okulu Komutanligi Yesilyurt, Istanbul, 34149, Turkey, e.koksalmis@hho.edu.tr

1 - Health System Design Optimization using Taguchi Methods: A Necrotizing Enterocolitis Model

Emrah Koksalmis, Teaching Assistant, Turkish Air Force Academy, Hava Harp Okulu Komutanligi Yesilyurt, Istanbul, 34149, Turkey, e.koksalmis@hho.edu.tr, Gulsah Hancerliogullari

This study discusses the Taguchi method as an approach to design optimization and illustrates its application using a system optimization study for an experimental Necrotizing Enterocolitis (NEC) model, where NEC is one of the most common gastrointestinal emergencies in newborn infants. A series of parametric trade studies are conducted, and the results suggest that the Taguchi method is a systematic and efficient approach and its principal benefits include significant time and resource savings.

2 - Is Modeling Consideration Important to Product Strategy?

W. Ross Morrow, Assistant Professor, Iowa State University, 2104 Black Engineering Building, Ames, IA, 50011, United States of America, morrowwr@gmail.com, Minhua Long, Erin MacDonald

Operations researchers adopt marketing models of consumer choice to optimize decisions. Recent marketing research has shown that modeling non-compensatory consideration set formation improves model predictive power, but does not link this improvement to better strategic decisions. We compare decisions made using traditional compensatory choice models versus non-compensatory "consider-then-choose" models using a simulation based on a 2008 study of consideration in the new vehicle market.

3 - Linking Design and Engineering

Golnoosh Rasoulifar, Post Doctoral Research Fellow, University of Michigan, 3835 Green Brier Blvd 291B, Ann Arbor, MI, 48105, United States of America, golnoosh@umich.edu

Design of branded products involves consideration of both perceptual aspects of the product appearance (related to emotions and brand values) as well as the technical and engineering aspects. This research investigates the proposition and the evaluation of three potential approaches to support communication between product designers and engineering designers. An integration approach is also proposed following the three steps of modeling, transforming and integrating engineering and design.

4 - Estimating Expected Information Gain for Designing Calibration Experiments with Multiple Observables

Diane Villanueva, Research Engineer, Universal Technology Corporation, 1270 North Fairfield Rd, Dayton, OH, 45432, United States of America, diane.villanueva.ctr@us.af.mil, Benjamin Smarslok

The design of hypersonic air vehicles involves coupled interactions of physics, which are approximated by computational models and observed in a limited number of experiments. Global sensitivity analysis results are used with expected information gain for optimal design of an experiment for calibration of aerothermal models. The expected information gain will not only be used to compare specimen designs, but also the observables which provide the best trade-off with expected information gain.

■ WE17

Hilton- Franciscan B

Supply Chain, Design and Services

Contributed Session

Chair: Amir Masoumi, Assistant Professor, Manhattan College, 4513 Manhattan College Parkway, DLS 504, Riverdale, NY, 10471, United States of America, amir.masoumi@manhattan.edu

1 - A Supply Chain Network Model for Biological Medicinal Products

Amir Masoumi, Assistant Professor, Manhattan College, 4513 Manhattan College Parkway, DLS 504, Riverdale, NY, 10471, United States of America, amir.masoumi@manhattan.edu, Ashley Bowman

We develop a network model for the supply chain of "similar biological medicinal products". Often referred to as "biosimilars", these drugs have an active substance made by a living organism rather than being chemically synthesized. Our proposed multi-period framework captures inherent complexities in the manufacturing and inventory management of such sensitive products.

2 - Financing Contract For a Capital-constrained Newsvendor under Asymmetric Information

Kening Liu, Nanjing University of Science and Technology, Business School 624 Room, Xiaolingwei 200, Nanjing, 210094, China, kellyliu930@gmail.com, Huaming Song

This paper illustrates how a liquidity-constrained newvendor borrows funds from bank to procure the expect quantity. Since demand and selling price information is asymmetric to the bank, we design a screening model for both the bank to determine the interest rate and the retailer to optimize his procurement order. We uses Stackelberg game for newsvendor to make a strategic decision of how much to finance additional procurement.

3 - Integrated Optimization Model of Supply Chain Configuration for New Products with Two-Segment Market

Mehdi Amini, Professor, The University of Memphis, Fogelman College of Business & Economics, Department of Marketing & SCM, Memphis, TN, 38152, United States of America, mamini@memphis.edu, Haitao Li

We present an integrated optimization model to capture Supply Chain Configuration (SCC) for new products with the dual market. Computational comparison of one- versus two-segment market is offered based on 26 categories of consumer electronic products. We show that the dual-market consideration significantly improves the SCC profits over the single-market.

4 - Information Sharing in Two-stage Service Operations

Jin Kyung Kwak, Assistant Professor, Ewha Womans University, Ewhayeodaegil 52, Seoul, 120-750, Korea, Republic of, jkkwak@ewha.ac.kr

This study investigates a two-stage service operation to evaluate the value of information sharing between the stages. The demand observed at the first stage may be useful information to allocate labor capacity. By conducting extensive computational study, we can get some insights about information sharing in service operations.

5 - An Exploration of Industrial Vending Use within the Supply Chain

John Kros, Professor, East Carolina University, 3205 Bate, Greenville, NC, 27858, United States of America, krosj@ecu.edu, Jon Kirchoff

Industrial vending represents a very specific form of VMI that blends the benefits of point-of-need convenience, cost containment and control inherent to traditional consumer vending systems with the benefits of VMI in order to afford users access to real time information and the ability to assign costs more accurately. This study utilizes data obtained via a modified VMI survey instrument developed by Claassen in conjunction with transaction cost theory in order to test a proposed SEM model.

■ WE18

Hilton- Franciscan C

Optimal Pricing in E-commerce

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Wenbo (Selina) Cai, Assistant Professor, New Jersey Institute of Technology, MEC 308, University Heights, Newark, NJ, 07102, United States of America, cai@njit.edu

1 - Revenue-maximizing Pricing and Scheduling Strategies in Service Systems with Flexible Customers

Qiaochu He, University of California-Berkeley, Berkeley, CA, United States of Americaheqc0425@berkeley.edu, Ying-Ju Chen

Motivated by the presence of bilingual customers in the call centers, this paper investigates the design of service systems with flexible and dedicated customers. The service provider attempts to maximize revenue through jointly optimal pricing and scheduling. We analyze the system performances under different information structures and discriminatory service mechanisms, and illustrate the impacts of information asymmetry on the interplay between the flexible customers and the dedicated ones.

2 - Dynamic Pricing with Time-inconsistent Consumers

Xiangyu Gao, Department of Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, Room 04 Transportation Building, 104 S. Mathews, Urbana, Il, 61801, United States of America, xgao12@illinois.edu, Xin Chen, Ying-Ju Chen

We propose a dynamic pricing model in which consumers exhibit time-inconsistent behaviors, which is modeled by quasi-hyperbolic discounting, and may be partially aware of their self-control issues. We characterize the subgame perfect equilibrium for the full spectrum of consumers' naivete. Interestingly, consumers' time-inconsistent behaviors can actually boost the seller's profit. However, given time inconsistency, consumers' naivete may undermine the seller's profitability.

3 - New Product Pricing Strategy in the Social Media Era

Xiuli He, Associate Professor, UNC Charlotte, 9201 University City Blvd, BISOM Dept., Charlotte, NC, 28223, United States of America, xhe8@uncc.edu, Subodha Kumar, Qinglong Gou, Juzhi Zhang

With the popularity of various social media platforms, the impacts of the word of mouth effect and the reference price effect on a consumer's purchasing behavior have been significantly amplified in the current era. We incorporate these two effects into a two period pricing model to investigate whether and in which condition should a firm utilize a skimming or a penetration price strategy. Our results show how these two effects influence a firm's pricing strategy when he launches a new product.

4 - The Role of Social Planner in Closed-loop Supply Chain

Lan Wang, Student, University of Florida, 355B STZ, Gainesville, FL, 32603, United States of America, lan.wang@warrington.ufl.edu, Tharanga rajapakshe, Asoo Vakharia

Our paper studies the problem of legislation practices on who should be responsible for recycling, and compares the existing mechanisms on the efficiency of environmental protection. In particular, we compare three models, consumer-paid model(the social planner charges the consumer an electronic waste recycling fee), OEM-paid model(the social planner collects annual fees from OEM for recycling and disposal treatment) and OEM-recycling model(the OEM is responsible for recycling).

■ WE19

Hilton- Franciscan D

Sales Optimization Management System – A Combined Optimization and Statistical Approach to Proactively Managing Enterprise Sales Resource Requirements and Sales Forecasting & Funnel Management.

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: John Ryan, President, ORM Technologies, 4300 N. Central Expressway, Suite 365, Dallas, TX, 75206, United States of America, john.ryan@orm-tech.com

1 - Sales Headcount & Funnel Management Optimization – Quantifying the Risk in Sales Forecasting

John Ryan, President, ORM Technologies, 4300 N. Central Expressway, Suite 365, Dallas, TX, 75206, United States of America, john.ryan@orm-tech.com

This presentation outlines the design and actual implementation methodology of a Sales Headcount and Funnel Management Optimization System provided as a software as a service solution. The design approach is a unique combination of statistical cluster analysis and optimization to create a sales management system that defines the optimal headcount to achieve the company goals while also providing an optimal minimum sales deal flow required to the meet the company goals.

2 - Statistical Cluster Analysis as a Foundation for Estimating Future Revenues

Ryan Cooper, Vice President, ORM Technologies, 4300 N. Central Expressway, Suite 365, Dallas, TX, 75206, United States of America, ryan.cooper@orm-tech.com

This presentation documents the implementation approach to utilizing statistical cluster analysis to predict the revenue associated with a given sales funnel as recorded in Salesforce.com. The presentation will cover the methods utilized to not only predict the estimated revenue of categories of opportunities, it will also outline the methods used to determine the fallout" rate of opportunities and then outline the reporting process to quantify the risk vs. the planned revenue targets.

3 - Sales Optimization – Implementation Methods, Challenges and Outcomes

David Wagner, President, Entrust, 5430 LBJ Freeway, Suite 1250, Dallas, TX, 75240, United States of America, david.wagner@entrust.com

This presentation outlines the client experience of implementing a sales headcount optimization system combined with a sales opportunities statistical/optimization system. The presentation will outline the data input requirements and challenges. The system implementation lessons and the resulting benefits that resulted from implementing the system. The resulting benefits will include expected cost savings, revenue enhancements and the benefit of proactive identification of future revenue risks.

■ WE21

Hilton- Union Sq 1

Sustainable Transportation/Logistics System Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Guangrui Ma, The Hong Kong University of Science and Technology, Room 3208, Dept. of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, magr@ust.hk

1 - Coping with Uncertainties in Biofuel Supply Chain Design: A Continuum Approximation Approach
Xin Wang, PhD Candidate, University of Illinois at Urbana-Champaign, 205 N. Mathews Ave, Urbana, Il, 61801, United States of America, wangxin1@illinois.edu, Michael Lim, Yanfeng Ouyang

Rapid growth of biofuel industry brings challenges to its supply chain design coping with yield and disruption uncertainties under large-scale land use competition with the incumbent food market. We develop a game-theoretical modeling framework based on a continuum approximation to address the problem. Hypothetical problems and a U.S. Midwest case study are provided to show the algorithm effectiveness and managerial insights.

2 - Selection of Suppliers under Yield Uncertainty
Yan Li, PhD Candidate, HKUST, 3208, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, yliaj@ust.hk, Ho-Yin Mak

The selection of suppliers is a critical decision faced by all supply chain managers. We study the procurement problem for a manufacturer under supply uncertainty, where data on supply yield is limited. Using a distributionally-robust optimization model, we draw insights on the firm's optimal supplier selection and ordering strategies.

3 - Flexible Urban Car Sharing System Design and Operations
Guangrui Ma, The Hong Kong University of Science and Technology, Room 3208, Dept. of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, magr@ust.hk, Ho-Yin Mak

Car sharing becomes a popular solution to balance individual mobility and sustainability. However the unbalanced vehicle flow makes it difficult to match driving demand and vehicle availability, and leads to low vehicle utilization. In this paper, we propose two methods from revenue management perspective: 1) implementation of dynamic surcharge fees; 2) controlling vehicle returning destination, to overcome the above challenge. Finally, we compare the efficiency of the two strategies.

4 - A Review of Stabilizing Grand Coalition in Unbalanced Cooperative Game
Lindong Liu, PhD Candidate, Hong Kong University of Science and Technology, Room 5567, Academic Building, Hong Kong, Hong Kong - PRC, ldliu@ust.hk, Xiangtong Qi

Recently, stabilizing grand coalitions in unbalanced cooperative games are receiving increased attention. In this talk, we focus on the so called operations research game whose characteristic function is defined by an optimization problem. To stabilize its grand coalition, we first survey several types of instruments, including subsidy, penalty, simultaneous subsidy and penalty, and restricted coalition. Then, we show some new instruments by modifying the parameters of the optimization problem.

■ WE23

Hilton- Union Sq 3

Traffic Management II

Contributed Session

Chair: Regina Clewlow, Postdoctoral Scholar, Stanford University, Y2E2 Building, Room. 390C, 473 Via Ortega, Stanford, CA, 94305, United States of America, rclewlow@stanford.edu

1 - Forecasting Traffic Counts for High Tourism Areas
Joseph Wilck, East Carolina University, 204 Slay Building, Mail Stop 117, Greenville, NC, 27858, United States of America, joe.wilck@gmail.com

This presentation focuses on developing a method to predict tourist traffic. An implementation strategy for interpreting traffic counts in high tourism areas is provided to aid in the development of Comprehensive Transportation Plans (CTP). Because of the high variability of traffic counts in high tourism areas, it is unreasonable to apply the typical weekday traffic count as the baseline metric for developing the CTPs for these areas.

2 - Crash Prediction using Traffic Data
Kasun Wijayaratna, University of New South Wales, UNSW, Civil and Environmental Engineering, H20, CE111, Sydney, 2174, Australia, kasun.w@unsw.edu.au, Sisi Jian, Vinayak Dixit

Crash statistics and traffic flow data of four major motorways within the Sydney metropolitan area was used to develop a joint real time crash and severity prediction model. Statistical techniques were initially utilized to determine effects of various traffic flow parameters on the likelihood of crash involvement and the severity level. The predictions of these models were then evaluated over different time horizons. Finally, the models are cross validated between the motorways.

3 - using Analytics to Assess the Effect of Alcohol, Unemployment, and Education on Vehicle Fatalities
Hassan Marzoughi, Louisiana State University, 275 W. Roosevelt St., Apt # 2257, Baton Rouge, LA, 70802, United States of America, hmarzo2@tigers.lsu.edu, Helmut Schneider

This paper uses analytics to assess the relationship between alcohol uses, unemployment and education level of a state to predict motor vehicle fatalities. Employing descriptive and predictive analytics U.S. crash and census data are used to gain insight into factors that affect the vehicle fatalities in states.

4 - The Impact of Carsharing on Alternative Vehicle Ownership
Regina Clewlow, Postdoctoral Scholar, Stanford University, Y2E2 Building, Room. 390C, 473 Via Ortega, Stanford, CA, 94305, United States of America, rclewlow@stanford.edu

Over the past decade, carsharing has grown considerably, particularly in major metro areas. Utilizing California travel survey data, this paper presents an analysis of vehicle ownership among carshare adopters vs. non-adopters utilizing multinomial logit models. After controlling for demographic factors, a statistically significant relationship between carsharing and alternative vehicle ownership was found.

■ WE24

Hilton- Union Sq 4

Disaster and Emergency Management 2

Contributed Session

Chair: Paul Cronin, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78712, United States of America, paul.cronin@utexas.edu

1 - Locating Mobile Telecommunications Infrastructure in Extreme Events
Nannan Chen, Industrial and Systems Engineering - Texas A&M University, 3131 TAMU, College Station, TX, 77840, United States of America, nnchen@tamu.edu, Justin Yates

This research develops an integer formulation for locating mobile telecommunications equipment in the context of regional hurricane evacuation to temporarily alleviate cellular system stress. Agent-based simulation modeling is used to investigate the effectiveness of telecommunications equipment location given the inherent diversity and uncertainty of individual decision-making during evacuation.

2 - Managing Inventory under Catastrophe Risk
Bahar Biller, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, billerb@andrew.cmu.edu, Elliot Wolf, Enver Yucesan

We study the problem of managing inventory when the facilities storing inventory have exposure to catastrophic events such as fires, tornados, floods, and earthquakes. We develop a graphical model to capture not only the individual catastrophe risk at a single location but also the spatial dependencies among events across locations. Combining our catastrophe risk model with simulation optimization, we identify how to optimally manage inventory while hedging against catastrophe risk.

3 - Optimal Procurement Policies for Goods from Genuine and Potentially Counterfeit Sources
Laura Wagner, Zaragoza Logistics Center, C/ Bari 55, Edificio N·yade 5, Zaragoza, 50197, Spain, laurawa@mit.edu, Mahmut Parlar, Mustafa Cagri Gürbüz

Dispensers frequently faced with shortages of medicines from their main source. These periods are exploited by some distributors to breach supply chains and push counterfeits, forcing dispensers to implement measures to mitigate social/financial costs. We study dispenser's replenishment policies under various detection methods and determine the optimal strategy to safeguard against spurious drugs, and quantify the optimal procurement decisions in a dual-supplier and multi-period setting.

4 - A Decision-Theoretic Model for Hurricane Inventory Planning
Paul Cronin, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78712, United States of America, paul.cronin@utexas.edu, Douglas Morrice, John Butler, Fehmi Tanrisever

As a hurricane nears the coast, consumers stock up. Inventory allocation is challenging for retailers in the region. We use an econometric model to estimate demand using actual purchase data and NOAA data from 2003-2008. A stochastic inventory model is used to investigate the optimal timing and level of inventory allocation. We develop insights into the relationships among holding costs, shortage costs, initial inventory, and the value of a two-stage allocation policy.

■ **WE25**

Hilton- Union Sq 5

Transportation, Freight

Contributed Session

Chair: Kamal Lamsal, Emporia State University, S243, PBB, Emporia, KS, 52246, United States of America, kamal-lamsal@uiowa.edu

1 - Sugarcane Harvest Logistics in US
Kamal Lamsal, Emporia State University, S243, PBB, Emporia, KS, 52246, United States of America, kamal-lamsal@uiowa.edu, Barrett Thomas, Philip Jones

Louisiana sugarcane farms start harvesting early in the morning and deliver most of the cane to the mill within a few hours. The mill requires a steady supply, so current practice creates a mismatch between cane supply and demand, resulting in longer turn-around times for trucks at the mill which increases the number of trucks needed to haul the cane. We present a field logistics model that spreads arrivals at the mill to match cane supply and demand, thereby reducing turn-around time and cost.

2 - Strategies for Recovery from Railroad Disruptions
Manish Verma, Associate Professor, McMaster University, 1280 Main Street W, Hamilton, ON, L8S 4M4, Canada, mverma@mcmaster.ca, Elkafi Hassini, Nader Azad

Railroads can be disrupted due to accidents, work stoppages or natural disasters. In such events shipments may be delayed or damaged. In this presentation we propose a model for timely and efficient recovery from such disruptions in order to maintain high customer service levels.

3 - Transportation Options and Indexes
Ronald Lembke, Associate Professor, University of Nevada, MGRS / 0028, Reno, NV, 89503, United States of America, ronlembke@unr.edu, Dale Rogers

Transportation options provide the buyer the right, but not the obligation, to buy or sell transportation capacity at a future date. These options can provide shippers, carriers and logistics companies a significant opportunity to reduce risks and increase capacity flexibility. This paper summarizes some of these benefits, describes a number of issues to be resolved before trading transportation options can become a reality, and presents possible resolutions for these issues.

4 - Impact of Tollway Polices on Truck Route Selection for Shipping Containers of Specific Commodities
Mazen Hussein, Assistant Professor, University of Wisconsin Platteville, 1 University Plaza, Platteville, WI, 53818, United States of America, husseinm@uwplatt.edu

The cost model for shipping commodities by truck developed by Hussein M. (2010) is extended to consider the impact of tollway polices on truck route selection for shipping containers of specific commodity groups near a container terminal. A path-finding model is built for this purpose. The values of time were used to mimic the truck's choices to ship containers of different commodities between container terminal and different facilities.

5 - Exploring Shipper-Carrier Dynamics in a Truckload Environment
Alex Scott, PhD Student, Penn State University, 463 A Business Building, State College, PA, 16802, United States of America, alexscott@psu.edu, Chris Parker, Chris Craighead

Shippers share a common pool of for-hire truckload transportation providers. Short-term imbalances in supply and demand conditions can cause significant volatility in service levels and the cost of moving freight. When carriers reject tendered freight, shippers engage the spot market. The literature has acknowledged that not much is known about freight rejection and spot market prices. In this study, we explore shipper-carrier dynamics using a transactional data set from a large US shipper.

■ **WE26**

Hilton- Union Sq 6

Supply Chain, Shipping and Transportation

Contributed Session

Chair: Yann Bouchery, Ecole de Management de Normandie, 30, Rue de Richelieu, Le Havre, 76087, France, y.bouchery@tue.nl

1 - Raw Material Transportation System in Iron-steel Industry with Data-driven Consideration
Defeng Sun, PhD Candidate, The Logistics Institute, Northeastern University, NO. 3-11, Wenhua Road, Heping District, Shenyang, 110819, China, cdfsun@gmail.com, Lixin Tang

We considered the transportation system of multiple raw materials in iron-steel industry with a central warehouse and multiple production plants. The demand of each plant is uncertain and hard to predict, so we apply a data-driven approach to minimize the associated transportation and inventory costs.

2 - Modeling the Impact of Social Media on Collaborative Freight Transport
Michael Bartolacci, Pennsylvania State Univesity, Berks, Reading, PA, 19610, United States of America, mbartolacc@aol.com, Yasanur Kayikci

Collaborative transport is an ever-growing area of logistics and supply chain management. We investigate how to model the use of social media and utilize it in optimizing collaborative freight transport.

3 - Model and Analysis of Products Damage in Supply Chain Network
Samir Alsobhi, PhD Student, Wichita State University, 11328 E. Pine Meadow Ct., Wichita, KS, 67206, United States of America, saalsobhi@wichita.edu, Abdulaziz Almaktoom, Krishna Krishnan, Deepak Gupta

Supply chain complexity and uncertainty of transportations hazards and packaging quality increases product damages during shipping. Appropriate packaging quality and transportation method will help to reduce damage cost. A mathematical model has been developed and programed in MATLAB to find the best routes and packaging to minimize the cost of damages in transit. Case studies have been developed and implemented to illustrate and validate developed model.

4 - Cargo Driven Container Logistics for Fresh Products in the Netherlands
Yann Bouchery, Ecole de Management de Normandie, 30, Rue de Richelieu, Le Havre, 76087, France, y.bouchery@tue.nl, Jan C. Fransoo

To improve the competitiveness of hinterland supply chains, the traditional focus on containers has to be complemented by a focus on the cargo inside the containers. When taking this cargo driven perspective, new supply chain solutions such as cross-docking may be developed. This paper aims at identifying the key logistics factors affecting the location of a cross-docking facility by taking the example of the import of fresh products in the Netherlands.

5 - Determining Road Toll Charges: A Reference Model
Mario Dobrovnik, Research Associate, Vienna University of Economics and Business, Welthandelsplatz 1, Vienna, 1020, Austria, mario.dobrovnik@wu.ac.at, Sebastian Kummer

Numerous European countries have introduced road tolls as a means of traffic guidance and control. These policy decisions have significantly affected entire economic regions as well as individual companies along the supply chain. For transport companies, passing the additionally incurred cost to the (final) customer as reasonably as possible therefore is of utmost importance. We propose a reference model that allows for determining the additional toll costs for individual shipments.

INFORMS San Francisco – 2014

■ WE28

Hilton- Union Sq 8

New Concepts to Minimize Delay in Terminal Area Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Heng Chen, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu

1 - Distance vs. Time Based Metering in Optimized Profile Descent Operations
    Heng Chen, Isenberg School of Management, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu, Senay Solak

One of the NextGen operational concepts is the introduction of time-based metering, which is typically viewed as being more efficient. In this paper, we explore the optimal sequencing and spacing policies under the context of Optimized Profile Descent. Potential fuel and environmental savings are provided. A comparison between time-based metering method and distance-based metering is presented.

2 - The Departure Regulator
    John-Paul Clarke, Associate Professor, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu

Seventy percent of US airline passengers use at least one of the 35 OEP airports that serve major metropolitan areas, and 23 of these OEP airports have at least one pair of closely spaced parallel runways. The capacity of CSPRs and thus airport delay are strong functions of weather, therefore there is a great need for concepts and technologies that increase capacity in bad weather. To this end, we present a new concept of operations that increases the bad-weather capacity of CSPRs by up to 34%.

3 - Data-driven Approaches for Robust Airline Resource Allocation under Uncertainty
    Lavanya Marla, University of Illinois, Urbana, IL, United States of America, lavanyam@illinois.edu, Vikrant Vaze, Garrick Li

We address the issue of pro-actively building robust airline networks that are less vulnerable to uncertainty. We demonstrate the necessity of data-driven models in the context of aviation and present new data-driven approaches that (i)are faithful to implicit information in the underlying data, and (ii)are less fragile to disruption. We conclude with results from a real-world case study.

4 - Managing Demand Uncertainty through En Route Speed Control
    James Jones, University of Maryland, College Park, MD, 20742, United States of America, jonesjc1@umd.edu, David Lovell, Michael Ball

We present an approach for transferring terminal delay to the en route phase of flight. We propose two integer programming models designed to assign delays to flights in advance of the terminal. The first model attempts to assign controlled times of arrival to flights by reducing airborne queuing delay while the second reduces the probability of scheduling conflicts. Each model effectively transfers delay en route and yields significant fuel savings benefits on a per flight basis.

■ WE29

Hilton- Union Sq 9

Operations Management/inventory

Contributed Session

Chair: Qinan Wang, Associate Professor, Nanyang Business School, S3-B2A-31, Nanyang Business School, Nanyang Technological University, Singapore, 639798, Singapore, AQNWANG@ntu.edu.sg

1 - Optimal Responses to Stockouts: Lateral Transshipment versus Emergency Order Policies
    Yi Liao, Southwestern University of Finance and Economics, 555 Liutai Ave, Chengdu, China, yiliao@swufe.edu.cn, Xinxin Hu, Wenjing Shen

When a stockout takes place, retailers often apply one of two strategies to resolve the issue ñ placing an emergency order or arranging a lateral transshipment. Choosing the optimal response to a stockout is complicated by customers' spontaneous reactions. In this study, under a single-period setting with two retail stores, we investigate the optimal inventory decisions under each strategy, and conduct a comparison between lateral transshipment and emergency order options.

2 - Optimal Decisions in Production-inventory System with Demand and Production Disruptions
    Haiyan Wang, Southeast University, School of Economics and Management, Nanjing, China, hywang@seu.edu.cn, Xiaolin Xu

The paper discusses the optimal production-inventory decisions in a production-inventory system for products which have the characteristic of perishable items with demand and production disruptions. In order to lower the cost, we address these issues and propose optimal production run time, replenishment time and order quantity for manufacturer.

3 - Component Procurement Strategies in Decentralized Assembly Systems under Supply Uncertainty
    Wenting Pan, Assistant Professor, Saint Mary's College of California, 380 Moraga Road, Moraga, CA, 94597, United States of America, wp3@stmarys-ca.edu, Rick So

We analyze the interactions among the assembler and two component suppliers in their procurement decisions under a vendor-managed inventory contract. We assume that one of the component suppliers suffers from the random yield. We first analyze the special case under deterministic demand, and then extend our analysis to the general case under stochastic demand. We derive the optimal component prices offered by the assembler and the equilibrium production quantities of the component suppliers.

4 - The Effect of Manufacturer-to-Consumer Rebates in Competition Environment
    Pengyu Chen, PhD Student, Huazhong University of Science & Technology, School of Management, 1037 Luoyu Road, Wuhan, China, andychen@hust.edu.cn, He Xu, Shilu Tong

Previous research shows that M-to-C rebates help to manage strategic inventory in a serial supply chain. This paper extends this research by examining how competition from upstream firms or downstream firms may influence this effect of rebates. Our results show that this effect always exists under the downstream competition but may disappear if the upstream competition is intensive. We also observe that the intensity of competition has a negative externality towards the usage of rebates.

■ WE30

Hilton- Union Sq 10

Operations Management/Marketing Interface V

Contributed Session

Chair: Baozhuang Niu, Assistant Professor, Sun Yat-sen University, Lingnan College, No. 135, Xingangxi Road, Guangzhou, China, niubzh@mail.sysu.edu.cn

1 - Personalized Price Optimization through Controlled Price Experimentation
    Yan Zhao, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, zhaoyanmit@gmail.com, Xiao Fang, David Simchi-Levi

We consider the situation where customers can be randomly assigned to different groups and correspondingly offered different prices for a particular product. Customers' purchasing decisions, together with their characteristics, are observed. Our objective is to choose the revenue-maximizing price for each point in the space of customer characteristics.

2 - When and How to Rely on the Free-ride of Word of Mouth for a New Product Introduction
    Vahideh Abedi, Assistant Professor, California State University Fullerton, Information Systems & Decision Sciences, 800 N State College Blvd, Fullerton, CA, 92834, United States of America, vabedi@fullerton.edu, Oded Berman, Dmitry Krass

The success of introduction of a new product or service significantly depends on the firm's marketing strategies and the word of mouth spread about the product between customers. The firm can partly rely on customer word of mouth to reduce its marketing expenditures, but such a strategy might fail if not properly encouraged by the firm's marketing strategies. Using the Bass model for sales of a new product, we provide insights on how and when the firm can earn a free ride from word of mouth.

3 - Manufacturer Warranties for Durable Goods and Channel Structure
    Zeynep Kirkizoglu, MAN Truck and Bus Turkey, Esenboga Havalimani Yolu 22.km, Akyurt, Ankara, 06750, Turkey, zeynep.kirkizoglu@man.eu, Ozgen Karaer

Durable goods manufacturers usually provide sales and aftersales services through retailers. Especially aftersales revenues are essential for retailers that provide both the repair services for the manufacturer during the warranty period and all other repair and maintenance services demanded by the customer. In this study, we look into how the warranty period affects aftersales revenues, and the decisions made by the manufacturer and the retailer accordingly.

4 - Quality Yield Risk and Optimal Sourcing in a Co-opetitive Supply Chain
Baozhuang Niu, Assistant Professor, Sun Yat-sen University, Lingnan College, No. 135, Xingangxi Road, Guangzhou, China, niubzh@mail.sysu.edu.cn, Jiawei Li

Consider a co-opetitive supply chain comprising an OEM and a competitive supplier who provides qualified components, but also competes with the OEM in the downstream market. OEM may shift orders to a non-competitive supplier whose products have quality yield risk. We analyze the value of dual-sourcing for the OEM and the competitive supplier's optimal response.

■ WE31

Hilton- Union Sq 11

Data Analytics-based Service Concept Development

Sponsor: Service Science
Sponsored Session

Chair: Kwang-Jae Kim, Professor, Postech, Eng. Bldg. 4-316, 77 Cheongam-ro, Nam-gu, Pohang, Korea, Republic of, kjk@postech.ac.kr

1 - Analysis of Vehicle Operational Data for Driving Safety Enhancement
Min-Jun Kim, PhD Candidate, Postech, Eng Bldg. 4-316, 77 Cheongam-ro, Nam-gu, Pohang, Korea, Republic of, minjun@postech.ac.kr, Kwang-Jae Kim, Ki-Hun Kim, Chang-Ho Lee

The Korean government developed a system to collect the operational data of commercial vehicles. This talk presents an analysis of the operational data collected in conjunction with traffic accident data. The goal of the analysis is to gain insights for the development of new service concepts for driving safety enhancement. The relationship between the driving patterns and accident history of drivers is identified and utilized in developing service concepts supporting driving safety enhancement.

2 - Service Process Design for Hypertension Patient Management Services
Ryeok-Hwan Kwon, PhD Candidate, Postech, Engineering Building #4-316, Pohang, 790-784, Korea, Republic of, klh1706@postech.ac.kr, Ki-Hun Kim, Kwang-Jae Kim, Sung-Hong Kang, Yea-Eun Kim

The National Health Insurance Service of Korea has collected health service data of nearly all the citizens since 2001. This research aims to develop a new service model for hypertension patient management using a sample of the data set. This talk focuses on the process of designing and evaluating the service production and delivery processes reflecting the characteristics of target customers. The processes for a service supporting blood pressure self-control will be presented as an example.

3 - Development of Healthcare Service Concepts using National Health Insurance Service Database in Korea
Ki-Hun Kim, PhD Candidate, Postech, Eng Bldg. 4-316, 77 Cheongam-ro, Nam-gu, Pohang, Korea, Republic of, ksw12312@postech.ac.kr, Chi-Hyuck Jun, Chie-Hyeon Lim, Sung-Hong Kang, Kwang-Jae Kim

In Korea, the National Health Insurance Service (NHIS) has collected insurance and medical record data of nearly all the citizens since 2001. We developed eight new healthcare service concepts which utilize the NHIS database. In this talk, we present how the new service concepts were developed. We also discuss some challenges of developing healthcare service concepts.

■ WE32

Hilton- Union Sq 12

Operations/Economics Interface

Contributed Session

Chair: Augustine Osagiede, Professor, University of Benin, Ugbowo-Lagos Road, Benin City, Nigeria, augustine.osagiede@uniben.edu

1 - How Can Wholesale Price Contract Coordinate Supply Chain
Chongqi Wu, Associate Professor of Management, Cal State East Bay, 25800 Carlos Bee Blvd, Hayward, CA, 94542, United States of America, chongqi.wu@csueastbay.edu

Based on classic Hotelling model, I demonstrate that wholesale price contract and its derivative, two-part tariff contract, can coordinate a simple two-echelon supply chain, either with or without asymmetric information. Under some realistic conditions, not only is supply chain coordinated, both supply chain members make positive profits.

2 - The Transient Per Capita Income Shares in Continuous-time From a Tax-subsidy Perspective
Augustine Osagiede, Professor, University of Benin, Ugbowo-Lagos Road, Benin City, Nigeria, augustine.osagiede@uniben.edu, Virtue Ekhosuehi

We consider a scenario where individuals in an economy are classified according to their income. We determine the transient per capita income shares. The idea of entropy is employed as a theoretical underpinning to attain even per capita income shares. We provide a guide on subsidy selection from several alternatives.

3 - Rent Contracts Between Co-Stores
Lama Moussawi-Haidar, Assistant Professor, American University of Beirut, PO Box 11-0236 Riad El Solh, Beirut, 1107-2020, Lebanon, lm34@aub.edu.lb, Nagihan Comez Dolgan

High rental rates and space scarcity are pushing retailers to cooperate. One way of cooperating is co-location, where a retailer rents out some of his available floor space to another retailer. Using the double moral hazard theory, we show that a percentage revnue sharing contract results in the second-best optimal solution for the landlord. We analyze the properties of optimal contract, by assuming a Cobb-Douglas sales functions and exponential disutility functions of efforts.

4 - Impact of Upstream Strategic Alliance on Downstream Horizontal Competition
Jooyol Maeng, Assistant Professor, Pacific Lutheran University, 12180 Park Ave. S., Tacoma, WA, 98023, United States of America, maengjy@plu.edu

This paper examines a competition between two retailers sharing one upstream supplier. Dynamics between downstream firms is investigated when one of them has a strategic alliance with the supplier.

■ WE33

Hilton- Union Sq 13

Innovation/Entrepreneurship

Contributed Session

Chair: Abraham Lee, Professor of International Business, Handong Global University, 558 Handongro, Pohang, 791-708, Korea, Republic of, alee@handong.edu

1 - Innovation Diffusion in Citation Network
Chuanzhen Wu, Xiamen University, China, Boston University, Boston, MA, wuchzhen@126.com, Di Xu

This paper tries to use some open dataset to find the network structure and statistics of citation network. Characteristics for innovation diffusion process will be discovered and discussed.

2 - The Geography of Imitation: Global Innovation Ecosystems and the Risk of Being Infringed
J. Nils Foege, Research Associate, RWTH Aachen University, Kackertstrasse 7, Aachen, 52072, Germany, foege@time.rwth-aachen.de, Torsten-Oliver Salge, Erk Peter Piening

Firms are increasingly embedded in global innovation ecosystems, which enhance the potential for both valuable knowledge inflows and unintended knowledge leakage. Our analyses of 612 German manufacturing firms reveal the risk of collaboration-induced infringement of technical inventions to be greatest for those firms with a wide set of geographically distant innovation partners and a strong innovation track record increasing their perceived attractiveness as an imitation target.

3 - Startup Accelerators: The Role of Networks and Prior Experience
Jorge Mejia, PhD Candidate, University of Maryland, 421 A St NE #4, Washington, DC, 20002, United States of America, jmejia@rhsmith.umd.edu, Anand Gopal

There are approximately 2,000 startup accelerators worldwide. These programs provide entrepreneurs with mentorship, networking, and often capital to launch their business. Despite their importance in the current startup ecosystem, accelerators remain understudied in the management literature. Using team-level data from the full cohort of a major global accelerator, our study aims to understand the role of network ties and prior experience in the success of startups in these programs.

4 - Brazilian Laws of Industrial Property and Innovation: Analysis of Impact in Patent Applications
Suzana Russo, Dr, Federal University of Sergipe - UFS, Rua Josué de C. Cunha, Aracaju, SE, 49035490, Brazil, suzana.ufs@hotmail.com, Adonis Reis, Edilson Pires, Rafaela Silva, Ikaro Barreto, Stephane Fabris

This paper analyzes the behavior of the number of patent applications made in Brazil to identify the impacts, after the change in the Industrial Property Law. The analysis was performed globally, by residents and non-residents. Linear regression models were used. Data were analyzed seeking also compare and evaluate these indicators, so one can achieve a positive response or not for these law alterations, in order to support decision makers.

■ WE35

Hilton- Union Sq 15

Managing Supply Chains in the Public and Non-profit Sector

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Karthik Natarajan, Carlson School of Management, 321 19th Ave South, Minneapolis, MN, 55454, United States of America, knataraj@umn.edu

1 - Models for Allocation and Inventory Management of Specialized Nutritious Foods
    Melih Celik, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, United States of America, melihcelik@gatech.edu, Ozlem Ergun, Pinar Keskinocak, Dima Nazzal

Specialized nutritious foods (SNF) are blended foods that contain a broad set of macro- and micro-nutrients to treat or prevent malnutrition. In this study, we consider the allocation of SNF from a central warehouse to distribution locations through (i) hubs that act as crossdocks, or (ii) district warehouses that hold stocks. Our models and solution approaches analyze the effects of network structure, uncertainty of demand, perishability, and equity considerations on the allocation structure.

2 - Quantifying the Impact of Decentralization through Robust Optimization
    Luke Muggy, PhD Candidate, Kansas State University, Industrial and Manufacturing Systems Eng, 2037 Durland Hall, Manhattan, KS, 66502, United States of America, lmuggy@k-state.edu, Jessica Heier Stamm

Humanitarian operations are often characterized by decentralized decision making, in contrast to centrally coordinated actions. This research quantifies the impact of decentralized facility location decisions on beneficiary treatment access using a dynamic, robust facility location model as a centralized benchmark. The method is illustrated using data from the response to the 2010 Haiti cholera epidemic.

3 - Modeling for the Equitable and Effective Food Distribution under Uncertainty
    Irem Sengul, North Carolina State University, 400 Daniels Hall College of Engineering, Raleigh, NC, United States of America, isengul@ncsu.edu, Julie Ivy, Reha Uzsoy

Our objective is to identify equitable and effective food distribution policies under conditions of uncertainty in partnership with a local food bank that provides food assistance to people at risk of hunger in 34 counties. The primary source of uncertainty is the county capacity that limits total food distribution due to equity requirements. We develop robust optimization and stochastic programming models for optimal food distribution under stochastic capacity constraints.

4 - Delivering Health Care to underserved and Impoverished Communities
    Kingshuk Sinha, Professor, Mosaic Company Professor of Corporate Responsibility, Carlson School of Management, University of Minnesota, Minneapolis, MN, United States of America, ksinha@umn.edu, Emily Kohnke

We report the development of a framework to inform the delivery of socially responsible health care innovations in underserved and impoverished communities. The framework was developed through the application of grounded theory and empirical research methods. The setting for the study is an underserved and impoverished community in China.

■ WE36

Hilton- Union Sq 16

Sports & Entertainment II

Contributed Session

Chair: Agha Iqbal Ali, Professor, Department Isenberg School of Management, 121 Presidents Dr., University of Massachusetts, Amherst, MA, 01003, United States of America, aiali@isenberg.umass.edu

1 - Logistical Impact of Stadium Locations for the Qatar 2022 FIFA World Cup
    Agha Iqbal Ali, Professor, Department Isenberg School of Management, 121 Presidents Dr., University of Massachusetts, Amherst, MA, 01003, United States of America, aiali@isenberg.umass.edu, Ahmed Ghoniem, Mohammed Al-Salem

The number of venues for the twenty FIFA World Cups since 1930 has ranged from 3 to 20 and the number of participating teams has grown from 13 to 32. Due to the compactness of Qatar, the logistical impacts of different numbers and

locations of venues can be significant for the Qatar 2022 FIFA World Cup. These impacts are studied in a scenario analysis using mathematical programming.

2 - Olympic Team Selection Optimization: The Dutch Speed Skaters Case
    Gerard Sierksma, Professor, University of Groningen, PO Box 800, Groningen, 9747AE, Netherlands, g.sierksma@rug.nl

The Dutch speed skaters won 23 of the 36 medals during the Olympic Games. The success was preceded by a novel selection system. The IOC prescribes a maximum of 20 skaters so that choices between 500 and 5000m specialist needed to be made. We have applied an ILP-model with medal winning probabilities. We explain how this model was used for the final selection and elaborate on Gould's hypothesis: the differences between performances of top athletes become smaller and smaller over the years.

3 - Scheduling Games in Indian Premier League (IPL)
    Amit Verma, Assistant Professor of Logistics, Delta State University, 120, Gibson Gunn Building, Cleveland, MS, United States of America, averma@deltastate.edu, Kamal Lamsal

Scheduling games in the IPL is a challenge. The global nature of the audience means that not all live broadcasts of games air during optimal viewing hours. TV viewership of a match is contingent on the presence of famous foreign players. These players drive the viewership in their respective countries of origin. The local timing of the live broadcast also impacts the viewership. We present a scheduling model that maximizes global TV viewership considering the constraints and discuss the results.

4 - Pathologies of Ranking: An Improvement to the Sensitivity of the Markov Method
    Baback Vaziri, Purdue University, 315 N. Grant St., West Lafayette, IN, 47906, United States of America, bvaziri@purdue.edu, Tom Morin, Yuehwern Yih, PhD

The Markov method is a ranking method that uses Markov chains to rank items based on a collection of votes that represent pairwise comparisons between the alternatives. Its application spans from ranking webpages (PageRank) to sports teams. However, the Markov method has been shown to be sensitive to small perturbations, which can result in poor rankings. This study will propose a modified voting algorithm that will reduce the effect of unexpected results, and produce a more robust ranking.

5 - Stochastic Frontier Analysis Model of Players Performance Comparison for the NBA Teams
    Wei Xiong, PhD Student, University of Cincinnati, 880 Rue de La Paix, Cincinnati, OH, 45220, United States of America, xiongwi@mail.uc.edu, Yi Tan

Instead of generally comparing all players in a league, we act ourselve as a manager of a NBA team, and then compare targeting players via stochastic frontier analysis model with only considering of the game strategy of our team". We create a mutual platform which connect all targeting players, and exclude the effect from each targeting player's original team. The goal of this project is to avoid the over-estimation and bias via players' performance comparison procedure for each team in NBA.

■ WE37

Hilton- Union Sq 17

Marketing 2

Contributed Session

Chair: Yoshiyuki Okuse, Professor, Senshu University, 2-1-1, Higashimita, Tama-ku, Kawasaki, Kanagawa, 2148580, Japan, okuse@isc.senshu-u.ac.jp

1 - An Empirical Analysis of Smartphone Diffusions by Mobile Platform
    Daegon Cho, Assistant Professor, Pohang University of Science and Technology, 77 Cheongam-Ro, Nam-Gu, Pohang, 790-784, Korea, Republic of, dgcho@postech.ac.kr

This study examines the cross-country diffusion of the iPhone and the Android. A Bass diffusion model is applied, and we use a data set of aggregated smartphone sales from 15 countries between 2008 and 2013. Our result suggests that there would be a higher innovation effect for both platforms in developed countries than in developing countries. Our finding also suggests that the Android's diffusion negatively affects the iPhone's, but the iPhone's diffusion positively affects the Android's.

2 - A New Weighting Method of Measuring Corporate Social Performance (CSP)
Yoonsun Jeong, Masters Student, Korea University Business School, Anam-Dong, Seongbuk-Gu, Seoul, Korea, Republic of, yoonsun@korea.ac.kr, Shijin Yoo

The relationship between CSP and corporate financial performance(CFP) has been studied to find inconsistent results. This paper examines the possibility that the various ways of weighting CSP sub-dimensions can in fact determine the outcome of such results. A partial least squares model is proposed as a new way of weighting CSP sub-dimensions. In an empirical analysis using a database collected in Korea, the proposed PLS-weighted CSP only finds a significant relationship with CFP.

3 - An Empirical Analysis of Price Endings with Questionnaire data
YoshiyukiI Okuse, Professor, Senshu University, 2-1-1, Higashimita, Tama-ku, Kawasaki, Kanagawa, 2148580, Japan, okuse@isc.senshu-u.ac.jp

In the research area of pricing strategy, a lot of researches on price endings have been developed to date. This research attempted to specify the effect of price endings with data for Price Sensitivity Measurement (PSM). PSM is one of the most popular price research methods to understand consumers' acceptable price range. A questionnaire survey of Japanese people was conducted to collect PSM data. A total of 206 samples were collected for each of 9 product categories.

■ WE38

Hilton- Union Sq 18

Health Care Process 2

Contributed Session

Chair: Fan Tseng, Professor of Management Science, University of Alabama in Huntsville, AL, 301 Sparkman Dr., College of Business, Huntsville, Al, 35899, United States of America, tsengf@uah.edu

1 - Can Hospitals Streamline Patient Flow Through Identifying Sources of Variation? A Case Study
Nasim Arbabzadeh, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States of America, nasim.rutgers@gmail.com, Kian Seyed, Mohsen Jafari

Each hospital inpatient is classified into one of around 500 Diagnosis-Related Groups, and the hospital is paid a fixed amount irrespective of what it charges for. Therefore, it is logical to expect that by reducing the within DRG discrepancies, hospitals can cut cost and improve patient safety. This paper demonstrates the applicability of classical process control tools and data mining methods for variation reduction using a real case of a chest pain inpatient process in a New Jersey hospital.

2 - Balancing Outcomes of Care: Examining the Contribution of Nurse Staffing to Patient Outcomes
Fan Tseng, Professor of Management Science, University of Alabama in Huntsville, 301 Sparkman Dr., College of Business, Huntsville, AL, 35899, United States of America, tsengf@uah.edu, Karen Frith, Faye Anderson, Eric Fong

In this study, We investigate the relationship between nursing care resources and performance as indicated by multiple outcomes at the nursing unit level by applying the Data Envelopment Analysis technique to sample data collected from multiple hospitals. We also use multivariate statistical techniques to identify critical factors that determine the efficiency of a nursing unit.

3 - The Impact of Discharge Policies on the Efficiency of a Pediatric Ward
Robert Saltzman, Professor, San Francisco State University, College of Business, 1600 Holloway Ave., San Francisco, CA, 94132, United States of America, saltzman@sfsu.edu, Theresa Roeder, Judith Lambton

Hospital patients are often moved from one bed to another for both medical and non-medical reasons. In a highly-utilized in-patient pediatric ward that we have studied, bed and nursing resources are stressed not only by frequent movement of patients but also by the ward's patient discharge policy. We present a discrete-event simulation model for examining how patient movement and the ward's efficiency may be improved by a better discharge policy.

■ WE39

Hilton- Union Sq 19

Risk Assessment in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd, Industrial Engineering and Mgmt. Sciences, Evanston, IL, 60208, United States of America, mehrotra@northwestern.edu

1 - Lifetime Risk Assessment in the Presence of Incomplete Data
Brittany Bogle, PhD Candidate, Northwestern University, 2 145 Sheridan Road, Room C210, Evanston, IL, 60201, BrittanyBogle2015@u.northwestern.edu

We assess lifetime risk of a binary outcome in a longitudinal cohort study. In a this type of dataset, variables are measured during each exam; however, participants miss exams, some data is missing, and not all variables are collected over all exams. We use a competing Kaplan-Meier approach to compute lifetime risk. Complete-case analysis results are presented as well as a comparison of imputation methods, using the Framingham Heart Study with an outcome variable of sudden cardiac death.

2 - A DOE Approach to Validation Sampling for Logistic Regression with Error-Prone Medical Records
Liwen Ouyang, Graduate Student, Northwestern University, 2145 Sheridan Rd, C217, Evanston, IL, 60208, United States of America, LiwenOuyang2011@u.northwestern.edu, Daniel Apley, Sanjay Mehrotra

Disease risk factors are often identified via logistic regression on medical record databases. However, high error rates in the recorded response (ICD-9 codes) will render the model unreliable unless a sample of cases are validated by manual chart review and incorporated into the modeling. In contrast to the random validation sampling used in existing approaches, we propose a new paradigm using DOE principles to judiciously select which cases to validate for maximum information content.

3 - Bayesian Component Selection in Multi-response Hierarchical Structured Additive Models
Kai Yang, Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, Saeede Ajorlou, Kai Yang

We develop a multivariate version of hierarchical structured additive regression (STAR) models involving a set of patient factors and also higher level effects to capture heterogeneity between patients within the same medical home team and facility. We propose a Bayesian component selection that allows inclusion or exclusion single effects as well as grouped coefficients representing particular model terms. A case study of from VA patient centered medical home data is presented.

■ WE40

Hilton- Union Sq 20

Optimization Models in Healthcare Applications

Sponsor: Health Applications
Sponsored Session

Chair: Shan Liu, Assistant Professor, Industrial and Systems Engineering, University of Washington, UW Box 352650, Seattle, WA, 98195-2650, United States of America, liushan@uw.edu

1 - Bayesian Learning for Optimal Dosing in Adaptive Clinical Trials
Jakob Kotas, University of Washington, Applied Mathematics, Seattle, WA, United States of America, jkotas@uw.edu, Archis Ghate

We investigate the problem of finding optimal dosing policies in adaptive clinical trials while learning dose response parameters for a cohort of patients. We first study the clairvoyant case where we establish monotonicity of optimal doses in patient disease states. We then propose approximate dynamic programming methods to solve the full-scale optimal learning problem. Results will be illustrated through exponential and Michaelis-Menten dose response functions.

WE41   *INFORMS San Francisco – 2014*

2 - Network Optimization of Functional Connectivity MRI to Detect Cognitive Decline

Daehan Won, PhD Sstudent, University of Washington, Industrial & Systems Engineering, University of Washington, Box 352650, Seattle, WA, 98105, United States of America, wondae@uw.edu, W. Art Chaovalitwongse, Thomas J. Grabowski, Sherry Wills, Onur Seref, Paul Borghesani

We develop a sensitive non-invasive test to detect abnormal cognitive decline via fMRI. Default mode networks (DMN) have been identified to be sensitive to marker of abnormality. Since there is no exact physical information of the DMN, we suggest the k-cardinality tree (KCT) as a topological biomarker of functional connectivity network. In this study, we develop the IP model to find a KCT and conduct experiments to analysis our findings and provide the outcome from a population based comparison.

3 - Patient Transitions across Health Care Services: A Framework for Accountable Care Organizations

Zelda Zabinsky, Professor, University of Washington, Industrial & Systems Engineering, Box 352650, Seattle, WA, 98195-2650, United States of America, zelda@u.washington.edu, Joseph Heim, Paul Fishman

Managing care transitions is a critical aspect for successful implementation of Accountable Care Organizations (ACOs). We present a Markov model for how patients transition between and among providers and health care settings, using data from Group Health Cooperative with over 600,000 individuals enrolled. Our model allows us to explore different patterns of health service use and patient transitions in order to and assess the impact of alternative modes of care in particular medicine.

4 - Approximate Dynamic Programming for Advanced Scheduling with Cancellations and Overbooking

Mahshid Salemi Parizi, University of Washington, Industrial and Systems Engineering, Seattle, WA, United States of America, msalemip@uw.edu, Archis Ghate

Advanced scheduling arises in many applications including healthcare. The goal is to schedule randomly arriving jobs into future slots within a booking horizon. In practice, planners usually employ overbooking to mitigate adverse effects of cancellations. We present an MDP formulation of this problem and propose approximate dynamic programming methods for its solution. We compare the performance of these methods with simple heuristic scheduling policies.

■ WE41

Hilton- Union Sq 21

Supply Chain Management XI

Contributed Session

Chair: Ramakrishna Govindu, Instructor, University of South Florida, 8350 N Tamiami Trail, SMC-C263, Sarasota, FL, 34243, United States of America, rgovindu@usf.edu

1 - Minimizing Penalties in Supply Chain Scheduling Involving Multiple Customers

Ramakrishna Govindu, Instructor, University of South Florida, 8350 N Tamiami Trail, SMC-C263, Sarasota, FL, 34243, United States of America, rgovindu@usf.edu, Anurag Agarwal

We propose models, heuristics and results for a supply chain scheduling problem involving multiple customers operating in a just-in-time environment. The objective is to minimize penalties for late deliveries. The proposed heuristics involve splitting deliveries and lots to achieve its objectives.

2 - Pricing and Coordination Analysis of A Dual Channel Supply Chain in the Case of Free Riding

Shuzhen Sun, Oklahoma State University, 502 Engineering North, Oklahoma State University, Stillwater, OK, 74075, United States of America, shuzhen.sun@okstate.edu, Tieming Liu

We develop a Hotelling model to study a supply chain with one manufacture and two retail channels, where the manufacture-owned online channel free-rides the brick-and-mortar retailer's sales effort. To coordinate it, we examine two pricing scenarios: endogenous prices and exogenous prices. A new contract with selective rebate and revenue sharing under the price match policy is designed to coordinate the supply chain and realize the arbitrarily split of the system profit in the two scenarios.

3 - The Supply Chain Management of Fresh Produce with Price Fluctuation

Xiangyu Hou, Department of Industrial Engineering, Tsinghua University, Haidian District, Beijing, Beijing, China, houxy0727@gmail.com, Dacheng Liu

We study the supply chain of fresh produce in China, which is operated by many small self-employed vendors. For a typical supply chain, three echelons are included, i.e., supplier, wholesaler and retailer. The price at the wholesale market is fluctuant due to uncertainties such as weather. Such reasons make the supply chain cooperation almost impossible in China. We try to model this supply chain and propose a plan for the cooperation on the chain.

4 - Measurement and Optimization of Responsiveness in Supply Chain Networks

Sin-Hoon Hum, National University of Singapore, NUS Business School, 15 Kent Ridge Drive, Singapore, Singapore, bizhumsh@nus.edu.sg, Yun Zhou, Mahmut Parlar

We consider multi-stage supply chains of serial or network structure which are either exogenous or endogenous, and define supply chain responsiveness as the probability of fulfilling customer orders within a promised lead-time. We optimize the responsiveness of the supply chain by maximizing the probability that the order will be fulfilled within the promised lead-time subject to a budget constraint. With endogenous chains, we study the problem in the context of queuing effects.

5 - Strategic Debt and Supply Chain Games

Qiaohai Hu, City University of Hong Kong, AC-1, Room 7605, Dept. of Management Science, Kowloon, China, joice.hu@gmail.com, Ping Su

We examine the interaction of debt financing and supply chain competition. Two retailers use strategic debt to influence their product market competition. We find that both retailers will adopt strategic debt in equilibrium, producing more, but both worse off than if they were purely equity-financed. Their supplier(s), however, are better off. More interestingly, when the retailers have a common supplier and only one retailer use strategic debt, the leveraged one gains the first-move advantage

■ WE42

Hilton- Union Sq 22

Uncertainties in Radiation Therapy

Sponsor: Health Applications
Sponsored Session

Chair: Omid Nohadani, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, nohadani@northwestern.edu

Co-Chair: Arkajyoti Roy, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States of America, arkajyoti.roy@northwestern.edu

1 - A Column Generation and Routing Approach to 4p Vmat Radiation Therapy Treatment Planning

Troy Long, University of Michigan, Ann Arbor, MI, troylong@umich.edu, Thomas Bortfeld, David Papp, Edwin Romeijn, Jan Unkelbach, David Craft

Volumetric Modulated Arc Therapy (VMAT) is rapidly emerging as a method for delivering radiation therapy treatments to cancer patients that is of comparable quality to IMRT but much more efficient. Since VMAT only uses coplanar beam arcs, the next step is to consider non-coplanar arcs in the 4p space around the patient as well. We propose a constructive approach that employs both column generation and routing heuristics.

2 - Incorporating Liver Functionality Information in Radiation Therapy Treatment Planning

Victor Wu, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, vwwu@umich.edu, Mary Feng, Edwin Romeijn, Martha Matuszak, Marina Epelman

Goals of radiotherapy include (i) eradicating tumor cells and (ii) sparing critical structures to ultimately preserve functionality. Liver perfusion (blood flow) maps show that functionality is non-homogenous, implying the dose distribution's spatial features matter. We propose an optimization model that explicitly incorporates functionality information from perfusion maps to redistribute dose from well-perfused areas without sacrificing tumor coverage. We validate our model with patient cases.

3 - Optimal Learning in Adaptive Biologically Conformal Radiotherapy
Fatemeh Saberian, University of Washington, Industrial & Systems Engineering, Box 352650, Seattle, WA, 98105, United States of America, negar.saberian@gmail.com, Archis Ghate, Minsun Kim

We present a Bayesian framework for learning radiobiological parameters for dynamically adapting treatment plans based on information acquired from functional images over the treatment course. We model this as a high-dimensional stochastic control problem and discuss approximation algorithm rooted in convex programming. Computational results on head-and-neck test cases will be discussed.

4 - Robust Dynamic Multi-Objective IMRT
Arkajyoti Roy, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States of America, arkajyoti.roy@northwestern.edu, Omid Nohadani

Traditionally, competing objectives in radiation therapy are addressed using ad hoc weights to achieve desired dose distributions. Resulting plans are delivered repeatedly over several weeks. However, spatiotemporal anatomical changes often diminish the quality of such plans. We present a novel approach that exploits anatomical variations, improves plan quality, and is robust to model uncertainties.

■ WE43

Hilton- Union Sq 23

Computational Network Flows and Routing

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Saltzman, Associate Professor, Clemson University, Dept. of Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu

1 - Capacitated Flow-path Inequalities
Birce Tezel, University of California, Berkeley, Sutardja Dai Hall (CITRIS), Room # 450/63, Berkeley, CA, 94720-1764, United States of America, btezel@berkeley.edu, Simge Kucukyavuz, Alper Atamturk

We derive strong inequalities for capacitated fixed-charge network flow problems based on path-set relaxations. These inequalities are based on exact characterizations of submodular value functions for fixed-charge flow on simple paths and they generalize the well-known flow cover inequalities.

2 - Generalized Interval-flow Networks: Models, Applications, and Solution Methods
Angelika Leskovskaya, Southern Methodist University, PO Box 750123, Dallas, TX, 75275, United States of America, aleskovs@mail.smu.edu, Richard Barr

Generalized interval-flow networks are a new extension of the classic generalized network formulation that adds a conditional lower bound constraint on the arcs. Practical applications of this modeling technique are presented along with efficient solution methods that exploit the underlying network structure.

3 - Vehicle Scheduling with Time Windows and Business-driven Priorities
Barin Nag, Towson University, Towson, MD, United States of America, bnag@towson.edu, Natalie Scala

Customer priorities and preferences from business needs and strategies may exist in an applied routing problem. This research includes these factors by using the Analytic Hierarchy Process to map factors to consistent values, forming inputs to various algorithms developed to satisfy business strategies. Algorithmic results are compared using various metrics.

4 - Integer Programming Models for the Backhaul Vehicle Routing Problem
Yuanyuan Dong, PhD Student, Southern Methodist University, 3145 Dyer Street, Suite 337, Dallas, TX, 75205, United States of America, ydong@mail.smu.edu, Eli Olinick, Andrew Yu

We present a MIP for the backhaul vehicle routing problem whereby profit is maximized by accepting unscheduled deliveries during the time-limited backhaul trip to the vehicle's starting location. The MIP is inspired by a novel formulation of multicommodity flow that significantly reduces the size of the constraint matrix compared to a model based on the classical approach. We show that our model is a stronger formulation and present computational results using the two approaches.

■ WE44

Hilton- Union Sq 24

Strategy/Strategic Planning II

Contributed Session

Chair: Pooya Tabesh, Instructional Assistant, University of Houston, Department of Management, Bauer College of Business, Houston, TX, 77204, United States of America, ptabesh@uh.edu

1 - The Impact of Slack Resources on Exploration and Exploitation: An Upper Echelons Perspective
Pooya Tabesh, Instructional Assistant, University of Houston, Department of Management, Bauer College of Business, Houston, TX, 77204, United States of America, ptabesh@uh.edu, Dusya Vera

Slack is a pool of excess resources that can be critical for organizational success, but cumulative research on the slack-performance link has resulted in mixed findings. We untangle the effect of slack by differentiating between the impact of absorbed slack and unabsorbed slack and investigating their effects on exploratory and exploitative activities in organizations. Furthermore, we highlight the critical role of CEO tenure, functional track, and education level in slack resource deployment.

2 - Barbarians at the Gate: How Firm Competition Affects Intraorganizational Conflict
Bryan Hong, Assistant Professor, Ivey Business School, 1255 Western Road, London, ON, N6B 3R7, Canada, bhong@ivey.ca

Although intraorganizational conflict contributes to the economic rents extracted from a firm's resources and capabilities, little is known about how firm competition influences the degree of conflict within firms. In this study, I estimate the effect of foreign competition on the likelihood and prevalence of conflicts using a novel dataset of representative establishments in the Canadian economy. The results show that competition leads to a lower likelihood of strikes and fewer grievances.

3 - Healthcare Supply Chain: A Comparative Study of Practices in Emerging Economies
Mario Ferrer-Vasquez, Assistant professor of Operations Management, College of Business Alfaisal University Riyadh, KSA, P.O. Box 50927, Takhasusi Road, Riyadh, P.O. 50927, Saudi Arabia, mferrer@alfaisal.edu, Daniel Romero, Alvaro Sierra, Julio-Mario Daza-Escorcia

This paper is motivated by the significant economic importance of the healthcare industry in emerging economies, which needs to be modeled, understood and managed.The research involves conceptualizing the key healthcare supply chain coordination factors. We propose and test a model, that is founded constructs such as access, affordability, and awareness and their impact on supply chain operatives performance of two emerging economies.

4 - Applying Strategic Decision Analysis (Game Theory) to Project Dispute Resolution
James Lee, Staff Economist, Shell Exploration & Production, Woodcreek Center, Suite 7520, 200 North Dairy Ashford, Houston, TX, 77079, United States of America, James.Lee@Shell.com

An integrated business team added significant amount of value through acquiring working interests from partners by creating a win-win outcome with minimal cost. The decision analyst provided material advice during negotiation and dispute resolution. Strategic Decision Analysis (SDA) was applied and dynamic deal spaces of key players were quantified. This paper is to illustrate how to replicate this success and to apply SDA broadly, by using this actual project as case study.

■ WE45

Hilton- Union Sq 25

Behavioral Operations 3

Contributed Session

Chair: Matthew Walsman, Cornell University, 455 Statler Hall, Ithaca, NY, 14853, United States of America, mcw237@cornell.edu

1 - Allocating Service Capacity through a Multi-Item Second Price Auction: A Lab Experiment
Matthew Walsman, Cornell University, 455 Statler Hall, Ithaca, NY, 14853, United States of America, mcw237@cornell.edu, Chris Anderson, Scott Sampson

We investigate a service capacity problem where human subjects often attempt to "game the system" (i.e. course registration). By adapting auction and matching theory from economics, we developed an allocation system designed to discover true preferences and reduce gaming. We then test this system through a behavioral experiment.

WE46   *INFORMS San Francisco – 2014*

2 - Epistemic Demand Uncertainty and Inventory Control: The Ambiguity Effect and Performance
Siqi Ma, University of Arkansas, Sam M. Walton College of Business, Business Building 475, Fayetteville, AR, 72701, United States of America, siqima@uark.edu, John Aloysius

Demand uncertainty due to incomplete information from the environment creates challenges for inventory control. Prior literature has mostly studied risky inventory decisions, but we experimentally study the behavior of replenishment managers in the face of ambiguity. We find evidence for the ambiguity effect on both decision behavior and task performance.

3 - The Role of Diasporas in the Facility Location Decision
Peruvemba S. Ravi, Associate Professor, School of Business & Economics, Wilfred Laurier University, 75 University Ave, West Waterloo, ON, N2T1H9, Canada, pravi@wlu.ca, Peruvemba S. Jaya

It is often assumed that facility location decisions are based on an evaluation of the quantifiable costs and benefits associated with candidate locations. However, intangible factors such as the preferences and biases of the decision-maker may play a significant role. The fact that several decision-makers in multinational companies are members of diasporic communities may have a significant impact on the facility location decision.

■ WE46

Hilton- Lombard

Mixed Integer Programming

Sponsor: Optimization/Integer and Discrete Optimization
Sponsored Session

Chair: Mahdi Doostmohammadi, Research Associate, University of Strathclyde, 40 George Street, Glasgow, G1 1QE, United Kingdom, mahdi.doostmohammadi@strath.ac.uk

1 - Approximation Algorithms for the Incremental Knapsack Problem via Disjunctive Programming
Chun Ye, PhD Candidate, Columbia University, 500 West 120th Street, IEOR Department Rm 315, New York, NY, 10027, United States of America, cy2214@columbia.edu, Daniel Bienstock, Jay Sethuraman

We consider an incremental version of the knapsack problem (IK), where we wish to find an optimal packing of items in a knapsack whose capacity grows weakly as a function of time. We will first show that the problem is strongly NP-hard. We will then discuss a constant factor approximation algorithm for IK, under mild restrictions on the growth rate of the knapsack capacity, and a PTAS for IK when the time horizon T is a constant. Both of our algorithms uses ideas from disjunctive programming.

2 - Multiperiod Optimization for Fleet Defense: Centralized and Distributed Approaches
Nikita Korolko, PhD Candidate, Massacusetts Institute of Technology, 77 Massachusetts Avenue, E40-149 Operations Research Center, Cambridge, MA, 02139, United States of America, korolko@mit.edu, Dimitris Bertsimas, Patrick Jaillet

We prove that the highly nonlinear discrete fleet defense problem can be solved online with MIP callback techniques. A new extended MIP formulation is also introduced for multiperiod scenario when the fleet has to plan the defense for several consecutive attacks. Finally, we develop a cooperation protocol for the decentralized setting in which captains of the assets have to make local decisions based on their own objectives and some limited communication with other ships.

3 - Valid Inequalities for Two-Period Relaxations of Big Bucket Lot-Sizing Problems
Mahdi Doostmohammadi, Research Associate, University of Strathclyde, 40 George Street, Glasgow, G1 1QE, United Kingdom, mahdi.doostmohammadi@strath.ac.uk, Kerem Akartunali

Although many researchers have studied big bucket lot-sizing problems, they are still difficult to solve to optimality. In previous research different relaxations such as single-item and single-period have been investigated. In this study, we present two-period relaxations, and then we study the polyhedral structure of such a mixed integer set. We derive several families of valid inequalities, investigate facet-defining conditions, and present preliminary computational results.

4 - Three-partition Inequalities for Fixed-charge Network Flows
Andres Gomez, University of California at Berkeley, 2020 Delaware St. Apt. 3, Berkeley, CA, 94709, United States of America, a.gomez@berkeley.edu, Alper Atamturk, Simge Kucukyavuz

We define new valid inequalities for the capacitated fixed-charge network flow problem by exploiting the internal structure of the subgraphs defining the cuts. In particular, the new inequalities are based on three-partitioning of the nodes.

■ WE47

Hilton- Mason A

Theory and Applications of Robust Optimization

Sponsor: Optimization/Optimization Under Uncertainty
Sponsored Session

Chair: Phebe Vayanos, MIT Sloan School of Management, 50 Memorial Dr., Cambridge, MA 02142, United States of America, pvayanos@mit.edu

1 - Two-Stage Robust Integer Programming
Wolfram Wiesemann, Imperial College London, SW7 2AZ, London, United Kingdom, ww@imperial.ac.uk, Grani Hanasusanto, Daniel Kuhn

In this talk, we approximate two-stage robust optimisation problems with integer recourse by their corresponding K-adaptability problems, in which the decision maker pre-commits to K second-stage policies here-and-now and implements the best of these policies once the uncertain parameters are observed. We study the approximation quality and the computational complexity of the K-adaptability problem, and we propose two MILP reformulations that can be solved with off-the-shelf software.

2 - Robust Inventory Routing
Joel Tay, MIT Operations Research Center, 77 Massachusetts Avenue, Building E40-149, Cambridge, MA, 02139, United States of America, joeltay@mit.edu, Dimitris Bertsimas, Swati Gupta

We consider the finite horizon inventory routing problem with uncertain demand. Current techniques that solve an exact formulation of this problem with stochastic demand do not scale to large problems. We propose an efficient and scalable algorithm via robust and adaptive optimization, and present very promising computational results.

3 - Optimal Crowdsourcing via all Pay Auctions – A Robust Optimization Approach
Chaithanya Bandi, Kellogg School of Management, Northwestern University, Evanston, IL, United States of America c-bandi@kellogg.northwestern.edu, Rajarshi Ghosh

In this talk, we present and analyze a model in which users select among, and subsequently compete in, a collection of contests offering various rewards. The objective is to capture the essential features of a crowdsourcing system, an environment in which diverse tasks are presented to a large community. We answer this question in the setting of incomplete information via All pay auctions and robust optimization.

4 - Data-driven Approaches for Adaptive Optimization
Vishal Gupta, Assistant Professor, USC Marshall School of Business, Data Sciences and Operations, Bridge Hall, 401, Los Angeles, CA, 90089-0809, United States of America, vishal.gupta@aya.yale.edu, Dimitris Bertsimas

Inspired by machine learning algorithms, we propose data-driven constructions of uncertainty sets and policies for adaptive optimization. Both our sets and policies are theoretically tractable and enjoy probabilistic performance guarantees. We illustrate the methods through a case-study of the unit commitment problem using real data from ISO. Overall, both our sets and policies successfully exploit structure in the data, yielding higher quality solutions than non-data-driven robust approaches.

■ WE48

Hilton- Mason B

Resource Allocation

Contributed Session

Chair: Ju Myung Song, Rutgers Business School, PhD Program, 1 Washington Park, Room 430C, Newark, NJ, 07102, United States of America, jumyung.song@rutgers.edu

1 - Designing Allocation Mechanism for Scarce Capacity: Reserve and Trade
Ju Myung Song, Rutgers Business School, PhD Program, 1 Washington Park, Room 430C, Newark, NJ, 07102, United States of America, jumyung.song@rutgers.edu, Chan Choi, Yao Zhao

Turn-and-earn depends on only sales history and ignores market signals. Proportional, a well-known allocation rule, can include forecast and other private information, but it may inflate order. For unknown demand, we modified the proportional rule by a general two-stage mechanism using reservation fee and trade. We found the conditions under which this mechanism design works and mitigate inflation of retailers.

2 - Staffing under Uncertainty: The Case of Fast-food Industry
Raha Akhavan Tabatab, Los Andes University,
Cra 1 Este # 19A-40, Apartment 2625, Bogota, 76155, Colombia,
r.akhavan@uniandes.edu.co, Diego Javier Rodriguez,
Carlos Felipe Ruiz, Andrés L. Medaglia, Leonardo Lozano

Fast-food managers often face the problem of allocating human resources (cashiers, chefs or dispatchers), to meet a service level target at the minimum cost. Since in most cases, the demand is uncertain and highly volatile, determining the right number of staff to satisfy a predetermined service level can be a challenging task. We apply optimization techniques and queueing theory to find a near-optimal staffing policy that minimizes the costs subject to meeting a service level.

3 - Project Scheduling Methods: A Synthesis
Osman Oguz, Associate Professor, Bilkent University, 06800
Ankara Turkey, osoguz@gmail.com

Traditionally, there are three basic models of scheduling projects: i-Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT) PERT. ii-Time-cost trade off analysis using linear programming. iii-Integer programming models to allocate scarce resources to activities. The new approach proposed in this study consists of a new deterministic combined model that provides a single solution in one shot

4 - Analysis of Congestion Pricing Model to Handle Day of Operations" Airport Capacity Reduction
Abdul Qadar Kara, Asst. Professor, King Fahd University of Petroleum and Minerals, KFUPM Box 1819, Dhahran, 31261, Saudi Arabia, aqkara@kfupm.edu.sa

In my earlier work, a model was built on basic econometric principle of congestion pricing embedded within an optimization model. The model provided a mechanism to manage airport runway capacity reduction. The current work reports further analysis of the model and its response against the effect of airline's disagreement on assigned runway slots.

■ **WE49**

Hilton- Powell A

Statistical Analysis of Network Structures

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Xin Chen, Assistant Professor, Southern Illinois University, PO Box 1805, Edwardsville, IL, United States of America, xchen@siue.edu

1 - Complex Network Modeling using MLE and EM
Xin Chen, Assistant Professor, Southern Illinois University, PO Box 1805, Edwardsville, IL, United States of America, xchen@siue.edu

Structure of a complex network provides important information about its performance and may be used to predict changes in network performance. Four degree distributions, including the power law, Weibull, Poisson, and negative binomial, are applied to model three complex networks, the Krebs, HIV, and Power Grid networks. To improve accuracy of network modeling, the MLE method and EM algorithm are used to estimate parameters of the four degree distributions.

2 - Optimal Development of Wind Farm under Uncertainty
Qing Li, PhD, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States of America, ql78@rutgers.edu, Honggang Wang

Renewable resources, e.g. wind and solar, provide clean and zero-carbon emission energy. In this work, we propose stochastic models for optimal development of wind farm. Specifically, we aim to explore the number and placement of turbines considering wind uncertainty and dynamic interactions in the field. Computational models are demonstrated with wind/farm data for wind farms in the central US. Discrete field modeling and optimization methods of wind farm development will be discussed as well.

3 - Sustainable Wind Energy Distribution Network Based on Failure Prediction and Collaboration Protocols
Xin Chen, Department of Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, 216C Transportation Building, 104 S. Mathews, Urbana, IL, 61801, United States of America, xinchen@illnois.edu, Shimon Nof, Hoo Sang Ko, Ehsan Jahanpour

Wind energy has gained more attention as a green alternative. Uncertainties in power generation, however, limit its penetration into power grids. This study applies pattern recognition for improved output estimation by failure prediction. Also presented is a collaboration platform to support demand-and-capacity sharing and best matching protocols that facilitates collaboration to create sustainable networks. A simulation study of two communities is illustrated to show the impact of the platform.

■ **WE50**

Hilton- Powell B

Optimization, Application

Contributed Session

Chair: Mariya Naumova, Rutgers University, 100 Rockafeller Rd, Piscataway, NJ, 08854, United States of America, mnaumova@rci.rutgers.edu

1 - Optimizing Employee Compensation Plans: A Restless Bandit Approach
Munish Goyal, IBM Research, MEBP, Bangalore, India, mungoyal@in.ibm.com, Alankar Jain, Parijat Dube

Rewarding and Retaining productive employees is one of the most important functions of HR organizations. In this work we derive a productivity maximizing compensation investment strategy in a restless bandit framework. Specifically, given the attrition risk scores and the productivity levels of employees, we derive an index heuristic that determines a subset of employees and their respective compensation investment amounts while maximizing a long run expected return on investment.

2 - Application of the Discrete Moment Problem in Option Valuations
Mariya Naumova, Rutgers University, 100 Rockafeller Rd, Piscataway, NJ, 08854, United States of America, mnaumova@rci.rutgers.edu

We present a brief survey of some of the basic results related to the discrete moment problems (DMP) and a new numerical integration method, based on DMP that can be used for univariate piecewise higher order convex functions. We present novel applications of the DMP to valuations of financial instruments.

3 - Complexity and Approximation Algorithms in Elastic Optical Networks
Sahar Talebi, NCSU, 2113-A Gorman St, Raleigh, NC, 27606, United States of America, stalebi@ncsu.edu, George Rouskas

The routing and spectrum assignment (RSA) problem has emerged as the key design and control problem in elastic optical networks. We show that the RSA and its simpler version, i.e. the spectrum assignment (SA) problem, in mesh networks transforms to the multiprocessor scheduling problem. This new perspective helps us to investigate the complexity of the RSA/SA problem under different scenarios. We also develop new constant-ratio approximation algorithms for the SA problem.

■ **WE51**

Hilton- Sutter A

Game Theory 3

Contributed Session

Chair: Mikhail Sher, PhD Candidate, Decision Sciences Department, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, MikhailSher@gmail.com

1 - Price and Quality Competition with Quality Positions
Shogo Kurokawa, Keio University, 3-14-1, Hiyoshi Kouhoku-ku, Yokohama City, Japan, scarletcurio@gmail.com, Nobuo Matsubayashi

We investigate price and quality decisions under duopoly in the presence of firms' quality positions given as the quality levels of their existing core products. Based on a standard model of vertical differentiation, we incorporate a repositioning cost"which is in proportion to the quality differences between their core and new products. With varying quality levels of the core products, we analyze the impact of this cost on the equilibrium outcomes.

2 - Extensive-Form Game Abstraction with Bounds
Tuomas Sandholm, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, sandholm@cs.cmu.edu, Christian Kroer

Abstraction has emerged as the key to solving large extensive-form games of incomplete information. We develop the first analysis framework that can be used to give bounds on solution quality for extensive-form game abstraction. While it can be used for lossy abstraction, it is also powerful for lossless abstraction. Prior abstraction algorithms typically operate level by level in the game tree; we prove hardness results and an impossibility for that family. Experiments are presented.

WE52   *INFORMS San Francisco – 2014*

3 - Stochastic Duopoly Market Share Competition with Asymmetric Exercising Delay
> KiHyung Kim, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, kihyung.kim.1@purdue.edu, Abhijit Deshmukh

Option exercise games have become a popular approach for academic researchers and industry practitioners to deal with competition under stochastic environments. We investigated the mixed strategy closed loop equilibrium of R&D and patent protected technology competition in a stochastic duopoly market governed by a continuous time stochastic process. The main difference between the two players within the model is assumed to be the length of delay of the exercise decision.

4 - Supply Chain Coordination with Quantity Discount for Seasonal Demand
> Mikhail Sher, PhD Candidate, Decision Sciences Department, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, MikhailSher@gmail.com, Seung-Lae Kim

In this paper,we develop a supply chain coordination mechanism in a system with a dominant manufacturer that delivers seasonal products to a group of buyers. A twice-stage ordering and production system is introduced in which the first order is placed at some time prior to the selling season and a second order is placed closer to the selling period. This twice-stage model allows the buyer to collect additional seasonal demand information resulting in savings for both manufacturer and the buyers.

■ WE52

Hilton- Sutter B

Optimization, Other
Contributed Session

Chair: Mahendra Prasad Biswal, Professor, Indian Institute of Technology, Kharagpur, Department of Mathematics, IIT Kharagpur, Kharagpur, WB, 721302, India, mpbiswal@maths.iitkgp.ernet.in

1 - A MIP Formulation for the Capacitated Stochastic Lot Sizing Problem with Service-level Constraints
> Huseyin Tunc, Hacettepe University, Institute of Population Studies, Sihhiye, Ankara, Turkey, huseyin.tunc@hacettepe.edu.tr, Onur A. Kilic, S. Armagan Tarim

We study the capacitated stochastic lot-sizing problem with service level constraints under static uncertainty strategy and propose a mixed integer programming formulation thereof. We modify an earlier formulation of static-dynamic uncertainty strategy developed for the uncapacitated stochastic lot-sizing problem. We conduct an extensive numerical study and show that the formulation can optimally solve large problem instances in reasonable computation time.

2 - Application of the Penalty Function Method to Generalized Convex Programs
> Chandal Nahak, Associate Professor, IIT Kharagpur, Department of Mathematics, Kharagpur, 721302, India

We use the Penalty Function Method to study duality in generalized convex (invex) pro- gramming. In particular, we will obtain a new derivation under which the generalized convex (invex) programs do not have duality gaps.

■ WE54

Hilton- Taylor B

Risk Analysis
Contributed Session

Chair: Jonathan Crook, Professor, University of Edinburgh, 29 Buccleuch Place, Edinburgh, United Kingdom, j.crook@ed.ac.uk

1 - Competitive Analysis with Risk Considerations
> Jian Yang, Associate Professor, Rutgers University, Dept. of MSIS, Newark, NJ, 07102, United States of America, jyang@business.rutgers.edu

We explore games in which players are with risk considerations. Particular attention will be paid to the coherent risk measure. We address existence and various other issues.

2 - Intensity Modelling with Macroeconomic Effects and Simulated Transitions
> Jonathan Crook, Professor, University of Edinburgh, 29 Buccleuch Place, Edinburgh, United Kingdom, j.crook@ed.ac.uk, Mindy Leow

We estimate intensity models to predict probabilities of delinquency and default for individual credit card accounts over duration. We find different trends for different groups of accounts, and over time. Random distributions based on properties of observed transition rates are generated and compared against predicted probabilities to get predicted transitions for each account over time. From the results of this simulation, we calculate distributions for the transitions and losses.

3 - Resource Allocation to Reduce Active Shooter Risk
> Robert Brigantic, Operations Research Scientist, Pacific Northwest National Laboratory, 902 Battelle Blvd, Richland, WA, 99352, United States of America, robert.brigantic@pnnl.gov

An active shooter is defined by the U.S. Department of Homeland Security as "an individual actively engaged in killing or attempting to kill people in a confined and populated area." We present a methodology to quantify risk from an active shooter in a large scale venue (e.g., transportation system) and a means to reduce the risk from an active shooter via the efficient allocation of constrained security resources.

4 - Variance Reduction Techniques for Estimation of Distortion Risk Measures
> Lihua Sun, Tongji University, School of Economics and Management, Tongji Univ. 1239 Siping Road, Shanghai, China, sunlihua@tongji.edu.cn

Distortion risk measures has traditionally been used in insurance for premium setting and had been extended to various places such as calculating risk capitals of banks and insurers. In this paper, we propose several variance reduction methods to improve the accuracy in estimation of distortion risk measures via Monte Carlo simulation. We then prove the efficiency of our method theoretically and numerically.

5 - Analytics-based Method to Support Telecommunication Software Testing Design
> Adi Fledel Alon, Senior Data Scientist, Amdocs, Ganey Shefa, Raanana, Israel, adifl@amdocs.com, Gilli Shama, Sagar Surana

Software testing plays an important role in any software development project and the price of fixing a defect increases as the lifecycle of the software progresses. Testing under all combinations of inputs and prerequisites is not feasible, even with a simple product. Here, we present a big data analytics approach for planning of software testing in the Telecommunications industry. We developed a new risk based methodology and tool for efficient and effective test plan design.

■ WE55

Hilton- Van Ness

Tractable Models and Algorithms for Optimization in Engineering
Sponsor: Optimization/Global Optimization & MINLP
Sponsored Session

Chair: Cristobal Guzman, Georgia Tech, 755 Ferst Drive NW, Atlanta, GA, United States of America, cguzman@gatech.edu

1 - Additive Consistency of Risk Measures and Its Application to Risk-averse Routing in Networks
> Alfredo Torrico, Georgia Tech, 755 Ferst Drive, NW, Atlanta,GA, United States of America, atp.13jvl@gmail.com, Roberto Cominetti

This paper investigates the use of risk measures and theories of choice for modeling risk-averse route choice with random travel times. We interpret the postulates of these theories, and we identify additive consistency as a plausible condition that allows to reduce risk-averse routing to a standard shortest path problem. Within the classical theories of choice under risk, we show that the only preferences that satisfy this consistency property are the ones induced by the entropic risk measures.

2 - The Little Grothendieck Problem – Generalization and Applications to Orthogonal Procrustes
> Christopher Kennedy, christopher.garrett.kennedy@gmail.com

The little Grothendieck problem from combinatorial optimization consists of optimizing a quadratic objective function over binary variables. We first discuss an approximation algorithm for this problem and then consider the natural extension from binary variables to the general Orthogonal and Unitary groups. Our proposed algorithm - Orthogonal Cut - uses techniques in semi-definite programming to achieve a constant approximation ratio for the generalized Grothendieck problem. We will mention applications of this generalized algorithm to the Orthogonal Procrustes problem, global registration over Euclidean transforms, and others.

3 - Minimizing an Indefinite Quadratic Function Subject to a Single Indefinite Quadratic Constraint

Maziar Salahi, Associate Professor, University of Guilan, Namjoo Street, Rasht, Iran, salahim@guilan.ac.ir, Saeed Fallahi, Tamas Terlaky

In this paper we consider the problem of minimizing an indefinite quadratic function subject to a single indefinite quadratic constraint. We show that it can be solved by solving a linearly constrained convex univariate minimization problem. Our preliminary numerical experiments on several randomly generated test problems show that the new approach is much faster in finding the global optimal solution than the semidefinite relaxation approach especially on large scale problems.

■ WE64

Parc- Cyril Magnin I

Customer Performance ñ Models and Applications

Sponsor: Applied Probability Society
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - Employing the EDD Rule in MTO Production Systems with External Due Dates

Miray Oner-Kozen, Technische Universitat München, Arcisstr. 21, Munich, 80333, Germany, miray.koezen@tum.de, Stefan Minner

We model a single machine MTO production system as a discrete time M/M/1/K queuing system. The due date of an order is random. We perform an exact analysis for evaluating the effect of the earliest due date first rule (EDD) on the system performance and compare the results to the first-in-first-out (FIFO) rule as a benchmark. Our numerical results show that, although the EDD rule seems intuitive to improve the customer related performance, its effect is dependent on the performance criteria.

2 - Self-Interested Routing with Path-Flexible Agents

Andrew Frazelle, Duke University, Durham, NC, 27708, United States of America, andrew.frazelle@duke.edu, Yehua Wei, Alessandro Arlotto

We introduce a queueing network with self-interested, route-flexible agents who seek to minimize their individual wait times. Agents have no preference over the route they take through the network apart from the impact of the route on their total wait time. We model the system as an extensive-form game and derive subgame perfect Nash equilibria under several slightly different assumptions. Motivations/applications include amusement parks, grocery stores, and shopping malls (e.g. Black Friday).

3 - Estimating the Likelihood the Democrats will Retain Control of the Senate in the 2014 Midterms

James Cochran, University of Alabama, Culverhouse College of Commerce and Bus, 347 Alston Hall, Tuscaloosa, AL, 35487, United States of America, jcochran@cba.ua.edu

Control of the Senate is critical to both parties, but is of particular important to the party that does not hold the Presidency; this allows the party to wield greater power during confirmation proceedings and coordinate legislation with the House so as to force compromise from the White House. We apply a randomization test to the FiveThirtyEight forecasted probability a Democrat will win each contested seat in 2014 to estimate the likelihood the Democrats will retain control of the Senate.

■ WE65

Parc- Cyril Magnin II

Bayesian Approach

Contributed Session

Chair: Hiba Baroud, University of Oklahoma, 202 West Boyd St, Room 124, Norman, OK, 73019, United States of America, hbaroud@ou.edu

1 - An Proposal of How to Improve Conjoint Measurement Model using Hierarchical Bayesian Method

Sakamaki Yoshikazu, Miyagi University, 1, Gakuen,Taiwa-Cho,Kurokawa-Gun, Miyagi, Japan, megacity@f3.dion.ne.jp

Recent years, hierarchical Bayesian statistics that estimates model parameters by assuming prior distribution for each parameter gets high attention. In this study, we apply hierarchical Bayesian method to traditional conjoint measurement and show our proposal can improve fitness degree and forecasting power.

2 - A Dynamic Sampling Framework for Medical Overpayments

Rasim Musal, Assistant Professor of QM, Texas State University, 601 University Dr. McCoy 404F, Austin, TX, 78746, United States of America, mmusal@gmail.com, Tahir Ekin

Sampling methods take front stage in estimating loss due to over-payments to providers participating in Medicare/Medicaid programs. We propose a dynamic sampling framework for medical assessment that can capture the skewed nature and multi-modality of medical claims data. Our framework considers two decision indices that are based on estimated over-payment values and entropy based expected information gain. The model considers over-payments as a mixture of fixed number of populations.

3 - A Bayesian Dynamic Probit Approach to Predict Bidders' Behavior in Secondary Market Auctions

Babak Zafari, The George Washington University School of Business, 2201 G Street NW, Funger Hall, Suite 415, Washington, DC, 20052, United States of America, zafari@gwu.edu

The experience of the bidders in the market and the available information in auctions can shape bidders' bidding behavior. In this study, we use the Bayesian data augmentation algorithm for dynamic probit models in an attempt to predict whether a bidder will be the first bidder in an upcoming auction. While we're mainly focusing on the predictive modeling aspect of this problem, we're also observing the underlying dynamics and change of behavior of the bidders over the time (learning).

4 - Bayesian Modeling of Global Supply Chains Risk Analysis

Hiba Baroud, University of Oklahoma, 202 West Boyd St, Room 124, Norman, OK, 73019, United States of America, hbaroud@ou.edu, Kash Barker, Royce Francis

Companies often operate facilities or have suppliers in countries prone to natural hazards, extreme weather, or political turmoil. While such business strategies offer low operating costs, they might be introducing risks leading to high impact disruptions in global supply chains. Bayesian kernel methods are used here to assess the probability of a supply chain disruption given information on past disruptions and the company's risk management strategies.

■ WE66

Parc- Cyril Magnin III

The Impact of Heterogeneity in Reliability Prediction and Maintenance Planning

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yisha Xiang, Assistant Professor, Sun Yat-sen University, 135 W. Xingang Rd., Guangzhou, 57025, China, xiangysh@mail.sysu.edu.cn

1 - Condition-Based Maintenance using the Inverse Gaussian Degradation Model

Nan Chen, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, isecn@nus.edu.sg

Condition-based maintenance (CBM) has been proven effective in reducing unexpected failures with minimum operational costs. This study considers an optimal CBM policy with optimal inspection interval when the degradation conforms to an inverse Gaussian process with random effects. The random effects parameter is used to account for heterogeneities among a product population. We prove that the monotone control limit policy is optimal. We also provide numerical studies to validate our results.

2 - An Opportunistic Maintenance Model for Multi-component Systems under Mixed Policies

Qiushi Zhu, PhD Candidate, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, Q.Zhu@tue.nl, Hao Peng, Geert-Jan Van Houtum

We propose an opportunistic maintenance model for multi-component systems. Different components may follow different maintenance policies (i.e., age-based, corrective, and condition-based maintenance). The coordination of the maintenance actions is crucial since there is a high fixed setup cost for maintenance visits. To solve real-world problems, we propose a heuristic algorithm to optimize the opportunistic maintenance policy and verify its accuracy by comparing it with simulated results.

3 - Optimization of Manufacturer's Warranty Period in Consideration of After-sales Service Contract

Jin Qin, University of Science and Technology of China, 96 Jinzhai Rd, Hefei, China, qjin@ustc.edu.cn

Retailers, like bestbuy and buy.com, are zealously promoting after-sales warranty service contract to gain more profit from customers. Manufacturer needs to rethink its warranty policy considering customer heterogeneity and competition from the retailers. What is the optimal warranty period under this new situation?

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4 - Approximating Weibull Renewal via Regression and Sinc Function
Tongdan Jin, Associate Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Jose Espiritu, Fei Sun, Heidi Taboada

Weibull distribution is perhaps the most popular model for lifetime analysis, yet the closed-form solution to Weilbull renewal equation is not tractable. We propose a hybrid method to approximate the Weibull renewal equation. The method is built upon partial numerical computation together with a sinc function. We compare our model with the actual renewal data, and the result shows that the approximation model is quite satisfactory for a wide range of shape parameter between 1 and 10.

■ **WE67**

Parc- Balboa

Gaussian Process and Spatial Data Analysis (III)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Ran Jin, Virginia Tech, Virginia Polytechnic Institute and State, University, 111 Durham Hall, Blacksburg, VA, 24061, United States of America, jran5@vt.edu

Co-Chair: Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, kbwang@tsinghua.edu.cn

1 - Development of Modeling and Control Strategies for Approximated Gaussian Process
Shisheng Cui, The Pennsylvania State University, 355 Leonhard Building, University Park, PA, 16802, United States of America, suc256@psu.edu, Chia-Jung Chang

The Gaussian Processes Model has been widely used as priors of functions with good performance. However, specifying the large number of parameters correctly affects efficiency in computation and feasibility of implementing control strategies. We propose a linear model to approximate GP, which expands the GP model by basis functions. Several examples and simulation studies are presented to demonstrate the advantages of the method. A control strategy is provided with the proposed linear model.

2 - A Spatial Calibration Model for Nanotube Film Quality Prediction
Xin Wang, Tsinghua University, Zijing Apt 14, Room 406A, Tsinghua Univ, Haidian District, Beijing, 100084, China, xinwang09@mails.tsinghua.edu.cn, Su Wu, Kaibo Wang, Xinwei Deng

The anisotropy of CNTs film, which is a spatially distributed quality index, is hard to be measured in practice. As anisotropy is correlated with height and height can be measured much easier, we here propose a spatial model for predicting anisotropy using height. A hierarchical model is built to characterize the relationship between the spatial input and output; the proposed model is verified using both numerical simulations and a real data set.

■ **WE68**

Parc- Davidson

Sustainable Infrastructure Management and Decision-Making: Construction, Energy and Transportation Industries

Sponsor: Simulation
Sponsored Session

Chair: Hakob Avetisyan, Assistant Professor, California State University Fullerton, Department of Civil and Env. Engineering, 800 N. State College Blvd, Fullerton, CA, 92834, United States of America, havetisyan@fullerton.edu

1 - When Combining Sustainable Design with Sustainable Construction
Uksun Kim, Chair and Associate Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, ukim@fullerton.edu, Hakob Avetisyan

This research will incorporate sustainable design with sustainable construction. The outcome of this research directly affects the construction. The selection of construction equipment and methods for construction are highly dependent on the design outcomes. A modeling framework will be developed to analyze its consequence on equipment. As a case study a real life infrastructure project will be considered. Several scenarios will be compared to assess the overall sustainability practice.

2 - State Recognition of Construction Equipment for Emission Simulation Modeling and Control
Reza Akhavian, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, reza@knights.ucf.edu, Amir Behzadan

Extensive use of energy-intensive equipment in construction and infrastructure industries results in a high level of greenhouse gas emission. In particular, different working states of construction machinery such as idling modes (e.g. different rpm levels) and busy modes (e.g. different activities) produce different levels of emission. In this research, a data-driven simulation modeling approach using mobile sensor nodes for equipment state recognition and emission modeling is investigated.

3 - Integrating Qualitative and Quantitative Assessment Outcomes for Sustaining Long Term Projects
Deepak Sharma, Visiting Assistant Professor, University of Baltimore, 1420 N Charles Street, Business Center BC475, Baltimore, MD, 21201, United States of America, dsharma@ubalt.edu

Procurement decisions of long term infrastructure projects are based on the "value" expected from a candidate project. The value is determined by analyzing a project quantitatively and qualitatively and then integrating the outcomes. Review shows that the procurement guidelines have remained silent about the integration. This work introduces Data Envelopment Analysis (DEA) as a tool that can be used to integrate the assessment outcomes for better decision making.

■ **WE69**

Parc- Fillmore

Optimization Approaches for Designing a Green Energy System

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment
Sponsored Session

Chair: Hayri Onal, Professor, University of Illinois, Urbana, IL, United States of America, United States of America, h-onal@illinois.edu

1 - A Stochastic Multi-criteria Decision Model for Sustainable Biomass Crop Selection
Halil Cobuloglu, PhD Candidate, Wichita State University, 1845 Fairmount St, Wichita, KS, United States of America, halil.cobuloglu@gmail.com, Esra Buyuktahtakin

Biomass crop type selection is a multi-criteria decision-making (MCDM) problem since it has various environmental and economic impacts. In this paper, we determine criteria for decision makers (farmers) to select the most sustainable biomass crop type. We build up the Stochastic AHP evaluation model and criteria with respect to economic, environmental, and social aspects based on the literature. As an illustration of the model, we rank biomass crop type alternatives in Kansas.

2 - Integrated Sustainable Bioenergy Pathways: An Agent Based Modeling Approach
Liu Su, Iowa State University, 301 S. 4th Street, #13, Oakridge Apartment, Ames, IA, 50010, United States of America, suliu@iastate.edu, Lizhi Wang, Guiping Hu

We study the interactions between different interdependent market players in a bio-energy supply, which consists of land owners, biofuel producers, biopower producers, biofuel market, food market, biopower marker, and policy makers. We integrate the agent based modeling approach with actual agricultural data to analyze and predict potential interactions between different marker players under various policy scenarios.

3 - Metaheuristics applied to Biorefinery Supply Chain Problems
Krystel Castillo, Assistant Professor, The University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, krystel.castillo@utsa.edu

Metaheuristics are strategies for solving complex and large-scale optimization problems which provide a near-optimal or practically useful solution. The aim of this talk is to present a survey of metaheuristics and the available literature regarding the application of metaheuristics in the bioenergy supply chain field as well as the uniqueness and challenges of the mathematical problems applied to bioenergy.

4 - Green Building Decision-Making using Sequential Design and Optimization
John Dickson, University of Texas at Arlington, IMSE Dept, Arlington, TX, 76019, United States of America, john.dickson@mavs.uta.edu, Victoria Chen, Jay Rosenberger, Anthony Robinson

A decision making model is developed for green buildings to select a set of building options that will improve the building performance. A sequential design of experiments approach is used to select the design points to perform the simulation. A metamodel is created using treed regression which is then optimized using a mixed integer linear programming model. A single story residential building based in California is used as a case study

■ WE70
Parc- Hearst
Forecasting 2
Contributed Session

Chair: Semco Jahanbin, Doctoral Researcher, University of Bath, Flat 8, Royston House, 5 Duke Street, Bath, BA24AH, United Kingdom, s.jahanbin@bath.ac.uk

1 - DYI Forecasting: Judgment, Models and Judgmental Model Selection
Konstantinos Nikolopoulos, Bangor Business School, Bangor University, College Road, Bangor, LL57 2DG, United Kingdom, k.nikolopoulos@bangor.ac.uk, Nikolaos Kourentzes, Fotios Petropoulos

In this paper we explore how judgment can be used to improve statistical model selection for forecasting. We investigate the performance of various judgmental model selection methodologies against the benchmark statistical one, based on information criteria. We evaluate the performance of experts in terms of selecting the best model and forecasting performance, identifying major improvements. We examine how to extend statistical model selection to incorporate additional insights from experts.

2 - Determining an Optimal Hierarchical Forecasting Model Based on the Characteristics of the Data Set
Zlatana Nenova, University of Pittsburgh, 241 Mervis Hall, Pittsburgh, PA, United States of America, zdn3@pitt.edu, Jerrold May

High-dimensional pyramidal databases are common in the supply chains of large manufacturing companies. Such organizations often forecast shipments and consumption patterns at different hierarchical levels. Determining the most appropriate forecast aggregation approach is often a very computationally intensive task. Using a large food-processing firm data, we built a model that requires only correlation metrics and produces an accurate prediction of the optimal forecasting approach.

3 - How Change of the Relative Importance of Product Attribute to Consumers can Influence Sales Forecast
Semco Jahanbin, Doctoral Researcher, University of Bath, Flat 8, Royston house, 5 Duke Street, Bath, BA24AH, United Kingdom, s.jahanbin@bath.ac.uk, Sheik Meeran, Joao Quariguasi Frota Net, Paul Goodwin

Customer preferences are not stable, especially where a consumer needs to make a complex or unfamiliar decision. In this research, the instability of consumer preferences for different attributes for a purposive sample of electronics products will be examined and compared from different angles with the aim of finding its influence on choice based conjoint analysis as a new product sales forecasting method.

■ WE72
Parc- Stockton
Energy VIII
Contributed Session

Chair: Masood Parvania, Postdoctoral Scholar, University of California, Davis, One Shields Avenue, Davis, CA, 95616, United States of America, mparvania@ucdavis.edu

1 - Multiscale Analysis of Wind Power Ramping Events
Masood Parvania, Postdoctoral Scholar, University of California, Davis, One Shields Avenue, Davis, CA, 95616, United States of America, mparvania@ucdavis.edu, Anna Scaglione

The stochastic nature of wind speed makes the output power of wind plants highly variable in various time scales. Advanced knowledge about the time, magnitude, speed and frequency of large wind power variations, also called wind power

ramping events, is of great importance for secure and economic operation of power systems. In this presentation, we will present our efforts for multiscale analysis of stochastic wind power generation and the associated ramping events.

2 - The Impact of Supply Chain Resilience on the Business Case for Smart Meter Installation
Behzad Samii, Vlerick Business School, Ave. du Boulevard 21, Brussels, Belgium, behzad.samii@vlerick.com, Hakan Umit, Kris Meyers

To produce realistic cost benefit assessments for the rollout of electricity smart meters, financial and operational decision-makers can collaborate using the framework of operational excellence and supply chain resilience. Strategies of product standardization, installation cost unification, onsite uncertainty reduction, and binding investments deferral not only reduce electricity supply chain vulnerabilities but also provide considerable cost reduction and resource optimization.

3 - Influence of Pricing Policies on Industrial Competition among Different Energy Technologies
Zhaomiao Guo, University of California, Davis, One Shield Ave., Davis, CA, United States of America, zmguo@ucdavis.edu, Yueyue Fan

Most U.S. electricity markets impose some pricing regulations, e.g. price cap, to mitigate market power abuse, which makes frequently-assumed smooth demand function unrealistic. In general, pricing policies directly affect companies' revenue. Moreover, in imperfect competition, they might also affect companies strategic behaviors. In this paper, we investigate how pricing policies might influence industrial competition among renewable and conventional energy technologies.

4 - Effects of Human Health Externalities on Generation Expansion Plans
Mark Rodgers, PhD Candidate, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, mdrodgers07@gmail.com, David Coit, Frank Felder

Generation expansion planning problems are least-cost, optimization problems, and the resulting expansion plans include fossil fuels, which satisfy the load on the system, but produce emissions that are health hazards. These health hazards as negative externalities realized by consumers. In this research, mixed-integer, multi-period optimization problems are solved to find the optimal expansion plan in order to minimize total system-wide costs, including human health externalities.

5 - Maximizing Wind Power Capture Considering Wind Turbine Dynamics
Fran Li, Associate Professor, University of Tennessee, 1520 Middle Drive, MHK 523, Knoxville, TN, 37996, United States of America, fli6@utk.edu, Can Huang

This paper aims to achieve a balance between maximization of power output and minimization of the drive train torsional torque fluctuation for a wind energy conversion system (WECS). A realistic model of a box uncertain set is applied to consider spatial and temporal distribution of wind speed forecast error. Then, the box uncertainties are combined with a proposed Intelligent Maximum Power Point Tracking method to a WECS robust optimization problem solved by semi-definite programming (SDP).

■ WE73
Parc- Mission I
Targeted Demand Side Management: Uncovering Energy Usage Decisions from Data
Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Adrian Albert, Senior Scientist, C3 Energy, 1300 Seaport Blvd, Redwood City, CA, 94062, United States of America, adrian.albert@c3energy.com

1 - Detecting Thermal and Occupancy-related Energy Use from Smart Meter Data: An Experimental Validation
Adrian Albert, Senior Scientist, C3 Energy, 1300 Seaport Blvd, Redwood City, CA, 94062, United States of America, adrian.albert@c3energy.com, Ram Rajagopal

We present an experimental evaluation of a methodology that decomposes single-point source smart meter data into thermal, baseload, and occupant-driven components by viewing consumption as a sequence of user decisions of what level of each of these components to consume. We show that, given just hourly consumption time series data, the model is able to accurately detect significant levels of HVAC, as well as usage induced by occupant activity.

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2 - Negative Dividends: Internality Losses can Outweigh Externality Gains

Anshuman Sahoo, PhD Candidate, Stanford University, 473 Via Ortega, Stanford, CA, 94305, United States of America, asahoo@stanford.edu, Nik Sawe

The Energy Star label could increase or decrease a consumer's focus on the energy consumption of alternatives. We ask if individuals of different types respond to the label in systematically different ways and, if so, what these differences imply about its value to consumers. Results from a stated choice experiment suggest an affirmative answer to the first question. Moreover, heterogeneity in responses implies that losses from larger internalities outweigh gains from lower externalities.

3 - Do Wind Power Producers have Market Power and Exercise It?

Yang Yu, PhD Candidate, Stanford University, 139 Running Farm Ln Apt 104, Stanford, CA, 94305, United States of America, yangyu1@stanford.edu

In this paper, we developed a theoretical framework to measure the ability and willingness of wind power producers in manipulating the market price. Through a case study of the ERCOT control area, we demonstrate these producers do posses market power even at relatively low penetrations.

4 - Scalable Algorithms for Control and Assessment of Electric Vehicle Charging Services

Jing Ma, PhD Candidate, Stanford University, Management Science and Engineering Dept, Stanford University, Stanford, CA, 94305, United States of America, jingma@stanford.edu, Ram Rajagopal, Erica Plambeck

We consider electric vehicle (EV) charging models for different scenarios. Our optimal charging rules are characterized by explicit equilibrium equations and are efficiently computable. The framework of our analysis gives rise to the scalable algorithms for control of large-scale EV charging systems and services. Simulation results involving real-life EV data (taking into account both energy and emission cost) are discussed.

■ **WE74**

Parc- Mission II

Power System Resilient Design and Optimization

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Seyedamirabbas Mousavian, Assistant Professor, Clarkson University, School of Business, Potsdam, NY, 13699, United States of America, amir@auburn.edu

1 - Optimal Resilient Distribution Grid Design

Russell Bent, Los Alamos National Laboratory, PO Box 1663, MS C933, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Scott Backhaus

Natural disasters such as earthquakes, hurricanes, and other extreme weather pose serious risks to modern critical infrastructure such as electrical distribution grids. Here, we present optimization methods for designing and upgrading these grids with smart devices to better withstand and recover from these threats, i.e. so that the post-event damaged grid meets a minimum standard of service (98% of the critical demand is met and 50% of all other load is served).

2 - Software System for Large-Scale Decentralized Unit Commitment

Mitch Costley, PhD Candidate, Advanced Computational Electricity Systems (ACES) Laboratory, Georgia Institute of Technology, Atlanta, GA, United States of America, mitch.costley@gatech.edu, Mohammad Javad Feizollahi, Sungkap Yeo

In this work, we describe the implementation of a novel decentralized algorithm for solving power system unit commitment problems. The algorithm itself, based on ADMM, is described, and its performance is evaluated in a computing cluster. Test systems include various configurations of openly available 3,000-bus power systems and a utility system model of over 12,000 buses. The software architecture using both Open MPI and the CPLEX C++ API is discussed along with dynamic job migration features.

3 - Resilient Distribution System by Microgrids Formation After Disastrous Events

Chen Chen, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg. 221, Argonne, IL, 60439, United States of America, morningchen@anl.gov, Jianhui Wang, Feng Qiu

We propose a novel distribution system operational approach that will build on recent industry trends and form multiple microgrids from the distribution network in real-time operations, to restore the loads of customers from power outage. Specifically, an integer linear program is formulated for the self-adequacy microgrids formation problem. A distributed multi-agent coordination scheme is designed via local communications for the global information discovery as inputs of the optimization.

4 - Investment Decisions on Optimal Resilient Allocation of Phasor Measurement Units

Seyedamirabbas Mousavian, Assistant Professor, Clarkson University, School of Business, Clarkson University, Potsdam, NY, 13699, United States of America, amir@auburn.edu, Jianhui Wang, Jorge Valenzuela

Reliability of the electrical power systems necessitates full observability of the power grid. PMUs collect synchronized phasors of voltages and currents in real time and are utilized for full observability of the power systems. Due to considerable cost of installing PMUs, it is not possible to install PMUs at all buses. We study the effect of transmission switching and single contingencies on the optimal placement of PMUs and propose an ILP model to find the optimal two-phase PMU allocation.

■ **WE75**

Parc- Mission III

Simulation III

Contributed Session

Chair: Amine Kamali, The University of Oklahoma, 202 W. Boyd St., Room 436, Norman, OK, 73019, United States of America, amine@ou.edu

1 - Simulation Optimization of Production and Maintenance Policies for Manufacturers with Deterioration

Héctor Rivera-Gömez, Researcher, Autonomous University of Hidalgo, Pachuca-Tulancingo Road, km. 4.5, Pachuca, Hg, 42184, Mexico, hriver06@hotmail.com, José Ramön Corona-Armenta, Ali Gharbi, Eva Selene Hernández-Gress, Jaime Garnica-Gonzalez

We investigate the simultaneous production and maintenance planning for an unreliable manufacturing system subject to deterioration, whose effect is observed mainly on the rate of defectives. Overhaul activities can be conducted to counter the effect of deterioration. A stochastic dynamic programming model is proposed, where we approximate the related control parameters, through a simulation optimization approach. Sensitivity analyses are conducted to show the usefulness of the policy obtained.

2 - Reducing Water Discharges Exceedances a Wastewater T reatment Plant

Jean Carlos Rivera, Universidad del Turabo, P.O. Box 3030, Gurabo, PR, 00778-3030, Puerto Rico, jrivera735@email.suagm.edu, Wesley Marrero, Marie Velazquez, Martha A. Centeno

We present the modeling of a water treatment plant that serves four industrial plants. Water discharges are regulated by the Puerto Rico Aqueduct & Sewer Authority, which has established a maximum of 130,000 GPD. The plant has had 90 exceedances from 08/2013 to 04/2014, representing $505,814 in penalties. Solutions include reusing and manage stored water to balance discharge flow. Using a simulation model, we determine a configuration for the tank pump set points that reduces the exceedances.

3 - Design and Analysis of Agent Based Simulation for Cellular Transport System

Elif Karakaya, TU Dortmund, Leonhard-Euler-Str. 5, Dortmund, 44227, Germany, elif.krky@gmail.com, Tobias Hegmanns, Axel Kuhn

Recent developments in the field of intralogistics have led to fully automated warehouses in order to obtain high throughput volume and improve the accuracy.However, intralogistics systems are not flexible enough due to bulk conveyor systems, huge sorters with installation cost.In accordance with this purpose,Cellular Transport System (CTS) has been developed as an alternative intralogistics system by Fraunhofer Institute (IML).This study examines CTS as a whole by using Agent-Based Simulation.

4 - Natural Gas Trading: A Simulation Optimization Approach

Amine Kamali, The University of Oklahoma, 202 W. Boyd St., Room 436, Norman, OK, 73019, United States of America, amine@ou.edu, Hank Grant

This research focuses on developing a simulation optimization framework that models the price impact of high-frequency trading on the natural gas market. The objective is to maximize the expected profit subject to multiple constraints over a limited time horizon. Different scenarios are simulated and the data collected are compared to historical data. In this setting, high-frequency trading can disturb temporarily or permanently natural gas market equilibrium price.

■ **WE76**

Parc- Embarcadero

Practicum and Internship Experiences at Analytics Programs

Sponsor: The Practice Track

Sponsored Session

Chair: Jeff Hamrick, Associate Professor of Finance and Analytics, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, jhamrick@usfca.edu

1 - LSU Master of Science in Analytics Practicum

James Van Scotter, Associate Professor of ISDS, Louisiana State University, 2215 Business Education Complex, Baton Rouge, LA, 70803, United States of America, jvanscot@lsu.edu, Joni Shreve, Saumitra Sharma

Team-based projects are at the core of LSU's M.S.in Analytics program. These projects are intended to produce tangible value for sponsors and help students learn important lessons about the practice of analytics that can't be taught in a classroom. Key lessons include: critical thinking, understanding business models, choosing appropriate analytical approaches, project management, team work, maintaining relationships with company sponsors, and communicating results to executives.

2 - Overview of the USFCA MS in Analytics Practicums

Matthew Dixon, Assistant Professor of Analytics, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, mfdixon@usfca.edu

This talk describes the USFCA MS in Analytics Practicum - a 9 month industry collaborative course designed for students to solve data mining intensive analytics problems posed by participating companies. We describe the process by which student teams use state-of-the-art technical skills to provide research insights across a range of business functions. Example projects shall be used to illustrate the value of the Practicum through advancing a company's analytics capabilities.

3 - An Exploratory Study of the Development of Analytics Capabilities within Organizations

Matthew Liberatore, Director, Center for Business Analytics, Villanova University, 800 E. Lancaster Avenue, Villanova, PA, 19085, United States of America, matthew.liberatore@villanova.edu, Bruce Pollack-Johnson, Suzanne Clain

Little is known about the characteristics of firms that decide to invest in analytics. Do the factors that influence IT investment intensity also relate to investing in analytics? The purpose of this research is to determine what factors influence a firm's decision to invest in analytics. This study draws on data obtained from firms that participated in a series of intensive workshops held by IBM over 2009 - 2011.

4 - University of Tennessee Business Analytics Capstone Experience

Melissa Bowers, Beaman Professor of Business, University of Tennessee at Knoxville, 255 Stokely Management Center, Knoxville, TN, 37996, United States of America, mrbowers@utk.edu

The University of Tennessee, Knoxville offers a Master's Degree in Business Analytics. The academic program is three semesters in length. In the third semester of the program, each student enrolls in a three-hour "Business Analytics Experience" capstone class in which student teams work on a real world problem with a business partner in real time. The administrative and pedagogical structures of the capstone experience will be outlined.

5 - The Practicum Experience at NC State's Institute for Advanced Analytics

Christopher West, Practicum Manager, North Carolina State University, 920 Main Campus Drive, Suite 530, Raleigh, NC, 27606, United States of America, cjwest4@ncsu.edu

Our practicum learning experience involves 5 person student teams conducting real-world analytics projects for sponsors, understanding the business problem, then cleaning and analyzing the data. Projects span 7 months and culminate with a report and presentation to the sponsor. Teams perform their work under confidentiality agreement. Results are the sole property of the sponsor. There is no sponsorship fee. Past projects span every industry segment and include the world's best known brands.

■ **WE77**

Parc- Market Street

Joint Session Analytics/HAS: Strategic Payment and Pricing Healthcare Analytics

Sponsor: Analytics & Healthcare Applications

Sponsored Session

Chair: Thomas Roh, Mayo Clinic, 200 1st St. SW, Rochester, MN, 55905, United States of America, roh.thomas@mayo.edu

1 - Healthcare Asset Replacement Problem under Technological Change and Deterioration

Emmanuel des-Bordes, Graduate Research Assistant, Wichita State University, 1845 Fairmount Street, Wichita, KS, 67260, United States of America, exdes-bordes@wichita.edu, Esra Buyuktahtakin

This paper presents a discrete optimization model for keeping or replacing a group of aging assets that operate in parallel under a limited budget. Numerical results and sensitivity analyses are presented to illustrate the optimal replacement strategies for Magnetic Resonance Imaging (MRI) and Extremity-MRI machines (eMRI).

2 - Identifying Episodes-of-Care Trough Data Mining

Seyed Emami, RIT, 716 Merchants Road, Rochester, NY, United States of America, sme3279@rit.edu

We designed a clustering based methodology to identify episodes-of-care for medical conditions in order to assess the implementation of bundled payment reimbursement system. Our methodology automatically determines the set of services that constitute an episode-of-care for discrete group of diagnoses and patient cohorts.

3 - Fair Division of Shared Savings for Value-Based Purchasing Payment Model

Brendan Bettinger, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, b.bettinger@neu.edu, James Benneyan

The goal of this research is to design a new payment model between a nonprofit care delivery organization and skilled nursing facilities to reward a better standard of care at lower cost. Mechanism design is applied to define and calibrate financial incentives so the expected division of savings satisfies both parties.

■ **WE78**

Parc- Mason

Decision Support Systems 3

Contributed Session

Chair: Thomas Edmunds, Associate Program Leader - Energy Systems Analysis, Lawrence Livermore National Laboratory, 7000 East Av. L-175, Livermore, CA, 94550, United States of America, edmunds2@llnl.gov

1 - Stochastic Optimization of Renewable Generators

Thomas Edmunds, Associate Program Leader - Energy Systems Analysis, Lawrence Livermore National Laboratory, 7000 East Av. L-175, Livermore, CA, 94550, United States of America, edmunds2@llnl.gov

Wind and solar renewable generators increase the variability and uncertainty in power grid operations. Demand response, where consumers choose to reduce or increase energy usage in response to grid states, and energy storage can be used to mitigate uncertainty and variability. We describe coupled stochastic weather, renewable generator, and production simulation models that can assess the value that demand response and storage can provide.

2 - Tips and Tricks to Write Scalable Models using Cplex Optimization Studio

Arnaud Schulz, Software Architect, IBM, 1681 Route Des Dolines, Les Taissounieres HB2, Valbonne, 06560, France, arnaud.schulz@fr.ibm.com

A good optimization model has to execute fast, but also it has to be scalable to adapt to changes in data and/or constraints. In this software tutorial, we will give you tips and tricks to write such models using the OPL Language.

3 - Evaluation Model for Signal Coverage of Satellite Communication, Navigation and Positioning System
Maria José Pinto Lamosa, Dra., IEAv/CTA, Trevo Cel Av. José A. A. do Amarante, 1, São José dos Campos, Brazil, maju@ieav.cta.br, Monica Maria De Marchi, Diogo Maciel Almeida, Osvaldo Catsumi Imamura

Embedded spatial sensor coverage evaluation takes into account spatial and temporal parameters. Decision making process often requires data associated to the monitored targets and their features. To provide satellite attitude and sensor positioning optimized control, the model takes sensor and target characteristics for coverage planning and performance analysis, matching the sensor capacity with the target in the observed scenario. Sensor technical characteristics and limitations are simulated.

4 - Detecting Knowledge Transitions between Science and Technology for Forecasting Growing Fields
Hajime Sasaki, The University of Tokyo, #307 Build. Engineering 3, 7-3-1, Hongo, Bunkyo-ku, Tokyo, To, 1138656, Japan, sasaki@pp.u-tokyo.ac.jp, Yuya Kajikawa, Ichiro Sakata

The purpose of this research is to suggest a methodology for identifying promising fields by grasping dynamic transition between science and technology. We extracted 50,913 academic papers and 63,972 patent gazettes with solar cell" as search queries. We applied Newman clustering to these citation networks for identifying fields and tracked time-series of Cosine similarity within the clusters thorough the time window. Then we grasped a forerunner of transition between science and technologies.

■ WE79

Parc- Powell I

Model and Model Validation in Disaster Management

Sponsor: Decision Analysis
Sponsored Session

Chair: Jing Zhang, University at Buffalo,SUNY, 2 Bristol Ct, Apt B, Buffalo, NY, 14228, United States of America, jzhang42@buffalo.edu

1 - Measuring a Community's Resilience to Disasters
Julia Phillips, 9700 S. Cass Avenue, Argonne, IL, United States of America, Argonne National Laboratory, phillipsj@anl.gov

Community resilience is often viewed as a combination of societal, organizational and infrastructure resilience. Holistically capturing this symbiotic relationship is challenging. Community resilience studies have traditionally required large amounts of data and significant time to complete. We present a decision analytic approach to capturing components of community resilience and discuss a potential framework to provide the holistic view necessary for disaster management and recovery efforts

2 - Risk Tolerance Model Validation Before and After Significant Disasters
Darlene Alexander-Houle, UoP/HP, 14207 Torrey Vista Dr, Houston, TX, 77014, United States of America, dalexhoule@att.net, Gary Houle

The RiskPACK model measures individuals' risk tolerance in decision making. A change in risk tolerance after weather and financial disasters validate the model using the FRB's SCF data for the USA over a 21-year period. Results propose characteristics of risk takers and avoiders, controlling for age and education.

3 - Defensive Resource Allocations of Assembly Occupancies System in a Sequential Defender-attacker Game
Shuying Li, Tsinghua University, Institute of Public Safety Research, 1018 Liuqing Building, Beijing, 100084, China, lishuying_susie@qq.com, Shifei Shen, Jun Zhuang

Optimal defensive resource allocation was studied facing with intentional attacks using game theory and risk analysis methods. This research considers a series of assembly occupancies, such as large railway stations, as the system targets (classified into two categories). The consequences of attack are calculated, based on the optimal resource allocations for both attackers and defenders studied in an n-period game. We illustrated the model using the 2014 Kunming terrorist attack case study.

4 - Modeling Ballistic Missile Defense Deterrence
Jonathan Trexel, Program Manager, SAIC, 7416 Grand Oaks Drive, Lincoln, NE, 68516, United States of America, trexelj@saic.com

This presentation explores the role of Japan's ballistic missile defense (BMD) program and its deterrent effect upon North Korean behavior during general deterrence conditions. A mixed-methods approach is employed. Empirical quantitative data included tabulated monthly cooperative-conflictual behavioral interaction between Japan and North Korea. A strategic profile developed from deterrence theory provided essential qualitative background to compliment the quantitative analysis.

5 - Optimal Allocation of Defensive Resources for Counter-Terrorism: Modeling and Validation
Jing Zhang, University at Buffalo,SUNY, 2 Bristol Ct, Apt B, Buffalo, NY, 14228, United States of America, jzhang42@buffalo.edu, Jun Zhuang

In this research, we study the optimal defensive resource allocation by proposing a novel class of multi-period and multi-target attacker-defender games where the attackers may have multiple attacking options. We provide both analytical results and algorithm to solve this game, as well as numerical illustration and model validation using real data. This research provides some new insights to homeland security resource allocation.

■ WE81

Parc- Divisadero

Predictive Models in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Onur Seref, Assistant Professor, Virginia Tech, Pamplin 1007, Blacksburg, VA, 24061, United States of America, seref@vt.edu

1 - Relaxed Support Vector Machine Extensions
Talayeh Razzaghi, Postdoctoral Research Fellow, School of Computing, Clemson University, Clemson, SC, 29634, United States of America, trazzag@clemson.edu, Onur Seref, Petros Xanthopoulos

Relaxing the constraints of support vector classifiers has been found to work well for classification problems in the presence of outliers. Here we present the extension of this concept for applications beyond supervised learning and compare against traditionally popular algorithmic schemes.

2 - Inferring Correlated Consumer Valuations for Data-Driven Bundle Pricing
Ben Letham, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, United States of America, bletham@mit.edu, Anshul Sheopuri, Wei Sun

Optimal bundle pricing requires learning the joint distribution of consumer valuations for the items in the bundle, that is, how much they are willing to pay for each item. We suppose that a retailer has sales transaction data, and the corresponding consumer valuations are latent variables. We develop a statistically consistent and computationally tractable inference procedure for fitting a copula model of correlated valuations, using only sales transaction data for the individual items.

3 - A Latent State Hazard Model
Ramin Moghaddass, MIT Sloan School of Management, Cambrdige, MA, United States of America, raminm@mit.edu, Cynthia Rudin

We present a new statistical model for reliability analysis that is able to distinguish the latent internal vulnerability state of the equipment from the vulnerability caused by temporary external sources. If we can isolate the underlying latent state, we will better understand the effects of external sources, leading to more robust decision making. Our hazard model has been effective both in simulations and on a wind farm study based on SCADA data from 28 turbines in Italy.

4 - The L1-Norm Best-Fit Line Problem
Paul Brooks, VCU, PO Box 843083, Richmond, VA United States of America, jpbrooks@vcu.edu, Jose Dula

The L1-norm best-fit line problem has applications in facility location and robust principal component analysis. In this talk we present properties of the L1-norm best-fit line that suggest an efficient heuristic.

■ WE82

Parc- Haight

System Analysis
Contributed Session

Chair: Ali Shafaat, Purdue University, 3386 Peppermil Dr., Apt 2A, West Lafayette, IN, 47906, United States of America, ashafaat@purdue.edu

1 - A Photo Elicitation of Systemic Perception
James Corner, University of Waikato, 12 Bronte, Cambridge, 3432, New Zealand, jcorner@waikato.ac.nz, Raimo Hamalainen, Rachel Jones

Systems perception is important as a necessary ingredient for acting with systems intelligence. However, research shows that the average person is unable to articulate their understanding of systems and apply systems thinking formally. This study attempts to expand our understanding of how people perceive the systems around them. A photo elicitation methodology, coupled with thematic analysis, shows how the use of photos can significantly improve one's understanding of the complexity of systems.

2 - A System Dynamics Model for Estimating the Energy Imbalance Among US Children
Saeideh Fallah-Fini, Assistant Professor, California State and Polytechnic University, Pomona, 3801 W. Temple Ave, Pomona, CA, 91768, United States of America, sfallahfini@csupomona.edu, Hazhir Rahmandad, Regina Bures, Terry Huang

This paper uses systems dynamics to present a population-level model that quantifies the energy imbalance gap responsible for the obesity epidemic among U.S. children (across different gender/ethnicity/age subpopulations) during the past decades. Our model creates a platform to better understand obesity intervention targets in different segments of children.

3 - Measuring Complexity in Mechanical Systems
Ali Shafaat, Purdue University, 3386 Peppermill Dr., Apt 2A, West Lafayette, IN, 47906, United States of America, ashafaat@purdue.edu

In engineered systems, complexity of human-human and human-mechanical system interactions absorbed the main attention. This paper tries to fill the gap by using a forward approach with clear terminology. This research would take a simple reactive mechanical system and make it gradually more complex. Each step increases the system adaptivity by getting farther from reactivity. It makes the measurement, comparison, and judgment of the system complexity more precise.

4 - Implementations of Remote Sensing and Traceability Technologies
Chun-Hung Cheng, Associate Professor, The Chinese University of Hong Kong, Dept of Syst. Engg. & Engg. Mgmt., Shatin, NT, Hong Kong - PRC, chcheng@se.cuhk.edu.hk, Dorbin Tobun Ng, Ziye Zhou

In this project, we will talk about implementations of remote sensing and traceability technologies in an airmail center and a museum. Remote traceability technology is used to track air mail bags more efficiently and remote sensing technology is designed for real-time monitoring the environment of the museum. The implementation challenges in these facilities are discussed. Initial experiences in using these systems are shared. Other applications of the technologies are also explored.

5 - Linking Requirements Change to Project Performance
Sherrica Holloman, Aerospace Corporation, 2100 Crystal Drive, Arlington, VA, 22315, United States of America, ssn@gwu.edu

Requirements is often implied or cited as critical to overall project performance; however, little empirical data outside of interview or survey data exists to support the notion. This gap in literature can be addressed by analyzing requirements change over the life-cycle of select NASA projects. It is expected that measurements of requirements change is an early indicator of project performance.

■ WE83

Parc- Sutro

Data Mining 5
Contributed Session

Chair: Fakhrosadat Mohammadi, PhD Student in Library and Information Sciences, Chamran Univeristy, Motahayeri Street, Sohrevardi Shomali, Tehran, Iran, fmohamadi1@gmail.com

1 - Functional Hazard Analysis of Call Center Data
Gen Li, UNC-CH, 100 Rock Haven Road E207, Carrboro, NC, 27510, United States of America, ligen@live.unc.edu, Jianhua Huang, Haipeng Shen

We build a novel two-dimensional hazard model to study customer patience and offered waiting time across different time of a day of a call center. The smooth hazard surface is estimated by maximizing a regularized likelihood function. The optimization problem is efficiently addressed by an alternating direction method of multipliers (ADMM) algorithm. We apply the method to US bank call center data. The proposed method reveals interesting patterns of calls being abandoned or answered.

2 - The Ten Killer Data Mining Errors:
Sam Koslowsky, VP Modeling Solutions, Harte Hanks, 1271 Ave. of the Americas, 43rd Floor, New York, NY, 10020, United States of America, sam.koslowsky@hartehanks.com

Most errors that occur in a data mining exercise are ones that can easily be avoided. Indeed, contrary to what many analysts may believe, these issues are non-technical in nature. From using biased samples to employing inappropriate predictors, these errors can easily be avoided. And they come from all three phases of a project-data preparation, algorithm development, and model deployment. I show some actual mini case studies, and provide some quick rules that will aid in avoiding these problems.

3 - Learning Product Knowledge from Online Reviews
Feng Mai, PhD Student, University of Cincinnati, Carl H. Lindner Hall, 2925 Campus Green Drive, Cincinnati, OH, 45221, United States of America, maifg@mail.uc.edu, Xin Wang, Roger Chiang

We investigate how consumer generated product reviews can facilitate product designing and brand positioning. We propose and evaluate a new framework for learning from unstructured online reviews to conduct market structure analysis.

4 - using Data Mining Techniques for Reaching to Competitive Edge, Evaluating Customer Loyalty
Fakhrosadat Mohammadi, PhD Student in Library and Information Sciences, Chamran Univeristy, Motahayeri Street, Sohrevardi Shomali, Tehran, Iran, fmohamadi1@gmail.com, Farideh Osareh, Behzad Sanayei

Customer loyalty have critical role in reaching to competitive edge in market. We evaluate it using data mining techniques by focusing on the numbers like lifetime customer value. Mining these data can help us improve acquisition costs and also identify why customers bail. The combination of tacit may come in handy because of the data will tell us where they are falling off.

5 - A New MIP Model for Clustering Binary Networks
Harun Pirim, KFUPM, Dhahran, Saudi Arabia, harunpirim@gmail.com

Integer programming models for clustering have applications in market segmentation, facility location problems. Models are important for guiding clustering algorithms that are capable of handling high dimensional data. Here, a new mixed integer programming model for clustering relational networks is presented. Relational networks are mainly used in social sciences and bioinformatics. The model is applied on several social networks.

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Bayati, Mohsen   SC20, SC64, MA41, MC39
Bayba, David   WE11
Baydogan, Mustafa Gökçe   MC83, TD81
Bayen, Alexandre   WD28
Baykal-Gursoy, Melike   SA32, WC60
Bayraksan, Güzin   SB47, MA43, WB47
Bayraktaroglu, Ayse Elvan   WB20
Bayram, Armagan   MC09, TC31
Bayram, Jamil   WD40
Bayram, Vedat   MC34
Bazargan, Massoud   WC75
Bazhanov, Andrei   SA10
Bazrafshan, Mohammadhafez   TD72
Bean, Michael   WB56
Beavis, William D   WC50
Beccue, Phil   TA79
Beck, Carolyn   TC48
Beck, Christopher   SA65
Beck, Ekkehard   SC42, IS-M
Becker, Annika   MB50
Becker-Peth, Michael   TC45, WB60
Beduhn, Tyler   MB25
Beebe, Jonathan   TD17
Beer, Ruth   TA45
Begen, Mehmet   MC09, MC42, TB10
Behdad, Sara   WC12, WE05
Behfard, Sina   TD60
Behroozi, Mehdi   TC52
Behzad, Banafsheh   TD59, WA33
Behzadan, Amir   WE68

Beil, Damian   SA11, MA71, MB71, TC12
Bekker, Rene   TC38
Bekki, Jennifer   MB68, WB13
Belavina, Elena   SB11, SD05, MD16, MD17, WA18, WB06
Belien, Jeroen   WA25
Beling, Peter   SD78, WD68
Bell, David   MC79, MD17, TC80
Bell, John E.   WD15
Bellalij, Mohammed   SB55
Bellamy, Marcus   MB11
Bellian, Ken   SA38
Belloni, Alexandre   MA71
Bellos, Ioannis   SC03, WA12
Belloso, Javier   SD23
Belo, Rodrigo   SB44, SC37
Belotti, Pietro   TB82, WA48, WB55
Ben-Akiva, Moshe   WC25
Ben-Arieh, David   WD51
Ben-Ayed, Omar   WD25
Bendavid, Eran   SB41
Bendavid, Linda   IS-M
Bendoly, Elliot   MB45
Benediktsdottir, Sigridur   TB81
Benedy, Irina   MC23
Ben-Gal, Irad   MA77
Bengtsson, Jens   WB48
Benjaafar, Saif   SC16, TA53, WB12, WB75
Benner, Mary   MA38, MD33
Bennett, Kristin   MD83
Benneyan, James   TA40, TB41, WD78, WE77
Benneyan, James   WB72
Bent, Russell   MA72, WE74
Benturk, Mehmet   TD53
Bentzen, Eric   WB02
Beraudier, Vincent   TC50
Berbeglia, Gerardo   TA16
Berenguer, Gemma   SD35, TC35
Berg, Bjorn   SA42
Bergemann, Dirk   SB71
Bergendahl, John   MB73
Bergerson, Joule   WD78
Bergman, David   MC43, MD43, TC71
Berk, Emre   WA59, WA60, WB51
Berman, Oded   SB26, WA17, WC17, WE30
Berman, Ron   MC44
Bermiss, Y. Sekou   WD22
Bernard, Cora   SB41
Bernstein, Brock   MB79
Bernstein, Fernando   MA11, WA05
Berrebi, Simon   MB25
Berry Jaeker, Jillian   SA09, TB39
Bertazzi, Luca   WA43
Berthold, Timo   MA55, WA50
Bertolaccini, Kelly   MB25
Bertram, Melanie   MA35
Bertsch, Kylie   TA40
Bertsch, Valentin   WC72
Bertsimas, Dimitris   SC46, MB39, MC46, MC48, TA47, TA47, TA47, TB51, TB51, WC47, WC47, WE46, WE47, WE47
Bertuccelli, Luca   TC01
Berumen, Lorena   WC70

Besbes, Omar   SD18, MD17, TA10, TA16, TA65, WC04
Besiou, Maria   TB06, WA35
Best, Daniel   MC36
Best, Katharina   TC61
Best, Thomas   SB38, MA09
Bettinger, Brendan   WE77
Bewli, Jagtej   SD74, IS-M
Bhadury, Joy   SA26
Bhalgat, Anand   WA71
Bhalla, Kavi   WD82
Bhamidipati, Narayan   MA52
Bhardwaj, Avinash   WD46
Bhargava, Hemant   TB44, TB71
Bhaskar, Sonia   MC39
Bhaskarabhatla, Ajay   SC29
Bhaskaran, Sreekumar   SC33, SD02, MA33, MA44, MD03
Bhat, Nikhil   SA47, MD71
Bhat, Sanket   TA64
Bhatnagar, Rohit   MC27
Bhatnagar, Shalabh   MA68
Bhattacharjee, Sudip   SD69, MD20, TA44
Bhattacharjya, Debarun   MB80, TC80
Bhattacharya, Arnab   SA72
Bhattacharya, Indrajit   WC09
Bhattacharya, Shantanu   WC02
Bhattacharya, U.K.   SC65
Bhinge, Raunak   TD68
Bhuiyan, Nadia   WB33
Bhulai, Sandjai   TD22, WB63
Bi, Ran   MD34
Bialkowski, Jedrzej   WD54
Bianco, Lucio   TD34
Bicer, Isik   TA80, WC41
Bichler, Martin   MA71
Bichuch, Maxim   MC54
Bidanda, Bopaya   TD29
Biehl, Markus   SC06
Biehn, Neil   SA19
Bienstock, Daniel   SD46, TB46, WE46
Bier, Vicki   TB59, WC63
Bierly, Stephen   TC37
Bijvank, Marco   WB17
Bikhchandani, Sushil   MC71
Bilal, Nadia   MB40
Bilen-Green, Canan   TB59
Bilgin, Enes   WC15, WD35
Billah, Syed   WB08
Biller, Bahar   TA68, WA06, WC10, WE24
Billups, Stephen   SD68
Bimpikis, Kostas   SA81, SB81, SC11, MA10, MA41, MC04, TC06, WD04
Bin, Linkan   MA67
Bingham, Chris   WD22
Biobaku, Taofeek   TC34
Birge, John   SB39, SC50, SC72, MA41, MC16, MC53, MD54, TA53, TA74, TB04, TB54, TC74, TD74, WA65, WC54, WD72
Birhade, Mahendra   MC27
Birisci, Esma   SD35
Bischak, Diane   SC40
Bish, Douglas   TB38, TD22, WC49
Bish, Ebru   MD37, TB38, WD17

Bjarnadóttir, Margrét   MA41, MB39, MD40, TB81, TD42, TD77, WB77
Bjørndal, Endre   MA15, TB75, TD72
Bjørndal, Mette   MA15, TB75, TD72
Blackburn, Joe   MA12
Blanchet, Jose   SC54, MB54, TD64, WA68
Blanchet, Karl   WB42
Blanco, Christian   TA12
Blanco, Victor   SD26, TA26
Blandin, Sebastien   SD21
Blanquero, Rafael   WD55
Blass, Vered   MA12, TB12
Bledsoe, Jesse   MA83
Bleichrodt, Han   TB80
Bley, Andreas   SB36
Block, EMily   WA22, WB22
Bloem, Michael   SA28
Blok, Herman   SA78
Blome, Constantin   SA15
Blum, David   TD61
Bo, Zha   WB53
Bock, Adrian   WA46
Bock, Stefan   TB58
Bockstedt, Jesse   SA33, TA33
Bodea, Tudor   WA19
Bodily, Sam   SD79, MC79
Bodur, Merve   MA48
Boehmann, Tilo   MB32, WB02
Bogetoft, Peter   TD10
Boginski, Vladimir   SA50, MA49, MB49, MC49, WC55
Bogle, Brittany   WE39
Bohannon, Tom   WB56
Boidot, Emmanuel   WD28
Bokrantz, Rasmus   SD81
Boland, Natashia   SB43, TB23, TB82, TC23, WB46
Bolandifar, Ehsan   WD07
Bolia, Nomesh   MC27
Bolívar, Manuel A.   WA28, WC18
Bollapragada, Ramesh   TA25
Bollapragada, Srinivas   MC28
Bolton, Gary   MA45, TD45
Bompadre, Agustin   WA59
Bonami, Pierre   TC46
Bonatti, Alessandro   SB71
Bonifas, Nicolas   WC58
Bonnefoy, Philippe   SC28
Boodram, Basmattee   SC42
Bookbinder, James   MA23, MD14
Boomsma, Trine Krogh   SA73, TD73
Boone, Edward   TB70
Boone, Tanya   MB12
Bora, Hardik   TC78
Bora, Selim   TC34
Bordley, Robert   MB79
Bordoloi, Sanjeev   MB41
Borghesani, Paul   WE40
Borgonovo, Emanuele   MC80
Boriboons, Kanok   SA24
Borjian, Setareh   TA18, WB21
Boros, Endre   SA34, SB43, SD52, MD22, TA38, WC20
Borrero, Juan   MB49
Borst, Sem   TD65
Bortfeld, Thomas   WE42

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Bos, Jaap   MA15
Bosch, Scott   SD04
Bose, Subhonmesh   TD71
Bosetti, Valentina   SC73, MD69
Bosman, Joost   MB31
Bossert, John   SB76
Boter, Jaap   WB17
Bottani, Eleonora   MB75
Botterud, Audun   SC72, TC74, TD74
Bouchard, Mathieu   MC70
Bouchery, Yann   TD69, WB23, WE26
Boudreau, Kevin   SA03 MA38, MB33
Boulaksil, Youssef   WB27
Boulougouris, Evangelos   MA73
Bouncken, Ricarda   WA02
Bourque, Alex   WA28
Boute, Robert   WA25
Boutilier, Justin J.   WB76
Bowers, Melissa   TB76, WE76
Bowman, Ashley   WE17
Bowman, Kevin   TC76
Boyabatli, Onur   SB16, MC16
Boyaci, Tamer   SD06
Boyd, Stephen   SA52, SA55, SB74
Boyles, Stephen   MA24, MC24, MD24, TA24, TC24
Boysen, Hans   MD27
Bozkaya, Burcin   MC34
Bozorgi, Ali   WD10
Brailsford, Sally   IS-M
Branco, Rafael   SD80
Brandão, Julliany   TA48
Brandão, Luiz   SD80
Brandeau, Margaret   SB41, SD40, MA41, MC40, TB65, TC40
Brandes, Leif   SB31
Brandimarte, Laura   MA03
Bratvold, Reidar   SD80
Braun, Gabor   WD46
Braun, Marcus   TC39
Braun, Rob   MC72
Bravi, Luca   SC55
Bravo, Fernanda   SB09, TC39
Bray, Robert   MA17
Brayton, Kimberly   WC40
Brennan, Patricia   SB67
Bresnick, Terry   SA79, TD61
Bretthauer, Kurt   SC09, TA41, TD17
Brickey, Andrea   SC70
Bridges, Todd   TB78
Briest, Patrick   IS-M
Brigantic, Robert   WC62, WE54
Briggs, Alan   SC80
Brimberg, Jack   SA26
Brinkhoff, Andreas   MB04
Briskorn, Dirk   MB30
Brisson, Marc   WA43
Brito Jr, Irineu   MA82
Brock, Luther   TC25
Bronfman, Andres   SA35
Brooks, Benjamin   SB71
Brooks, Jessica   IS-T
Brooks, Paul   WB76, WE81
Brooks, Robert   TA72
Brosig-Koch, Jeannette   WC45
Brouwer, Gijs Joost   WD37
Brouwer, Jack   SA72
Brown, David   SB53, SB54, MC64

Brown, Elisabeth   MD83
Brown, Gerald   SB07
Brown, Jay R.   WA23
Brown, Robert   SA02
Brown, Sean   TB39, TC37
Browning, Nigel   TD67
Bruce, Peter   MD56
Brunner, Jens   TC25
Bruntsch, Andy   TD37
Brusoni, Stefano   MA38, WD44
Brynjolfsson, Erik   MC48
Bu, Dan   WD02
Bu, Hui   WC11
Buchanan, Austin   SC49, MA49, MC49
Buck, Greg   WB76
Buede, Dennis   TD61
Buell, Ryan   SA05, SA17, MC45, TA17
Buke, Burak   MB65, WB47
Bukenberger, Jesse   SC76
Bukkapatnam, Satish   SA68, MB37, TA66, TB42
Bulavsky, Vladimir A.   WC51
Bulbul, Kerem   MC30
Bullock, Sally   SC38
Bulut, Aykut   TA09
Bunn, Derek   SC74
Bunz, Benedikt   TC71
Burchett, Deon   MB36
Burciaga, Aaron   SC80, TD07, WA20
Burer, Samuel   SD46, TB46, WD55
Bures, Regina   WE82
Burger, Manuel   TB09
Burk, Roger   WA58
Burkart, Christian   TA35
Burkart, Michael   SC83
Burke, James V.   MA52
Burke, Jessica   SC76
Burkett, Matt   WD68
Burks, COL (R) Robert   WA01
Burnak, Nimetullah   MD82
Burns, William   TD35
Burnside, Elizabeth   WA62
Burq, Maximilien   MA41
Burtch, Gordon   SB44, SD44
Bury, Scott J.   TB37
Busby, Carolyn   MA39
Bushuev, Maxim   TB33
Büsing, Christina   MA28
Bussieck, Michael   TD55
Bustos, Jaime   WD14
Butenko, Sergiy   SC49, MA49, MC49, TD49, WC55
Butler, C. Allen   MA29, MB29, MC29
Butler, John   MC80, WE24
Butry, David   MB70
Buttazzoni, Cameron   MB70
Buttrey, Samuel   TB08
Buyukkaramikli, Nasuh Cagdas   WD21
Büyüktahtakin, Esra   MA70, TA59, TA69, IS-T, TC69, TD14, WE69, WE77
Buzacott, John   MA07
Byon, Eunshin   SA66, SB68
Byon, Young-Ji   WB24
Byun, HyeongMin   WC53
Byun, JH   SD72

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Cabigiosu, Anna   WB02
Cabrera-Ríos, Mauricio   IS-T
Caceres, Hernan   SB35
Cachon, Gerard   SB11, WB06
Cadarso, Luis   SB28
Cade, Willie   WE05
Cadenillas, Abel   WA70
Cafferty, Kara   MA69
Cafieri, Sonia   WB55
Cai, Desmond   SB72, TD71
Cai, Dongling   WA30
Cai, Gangshu   SD16
Cai, Hong   TD72
Cai, Liming   WB42
Cai, Ning   MC53
Cai, Qishu   MA23
Cai, Wenbo (Selina)   MC69, WA16
Cai, Xiaoqiang   MA30, MC30, WC32
Cairns, Karen   WA78
Cakanyildirim, Metin   TD18
Cakici, Özden Engin   MC06
Cakir, Fahrettin   TC81
Calantone, Roger   SC05
Caldentey, Rene   SB19, SC16, TB18, TC17, TC22
Calfa, Bruno A.   TB37
Calisir, Fethi   WB20
Caliskan Demirag, Ozgun   MC14, WD19
Callegaro, Aline Marian   IS-M
Calmon, Andre   MC04
Camacho-Caceres, Katia   TC50
Camara, Bumi   IS-T
Camargo, Maria Emilia   WC59
Cambero, Claudia   MD70
Camelio, Jaime   IS-T, TD41
Cameron, John N   WC50
Camlibel, Emre   SC65
Camm, Jeffrey   TB76, WC52
Campagnolo, Diego   WB02
Campaigne, Clay   SB74
Campbell, Ann M.   SB23, MB34, WC23
Campbell, Dennis   SA05
Campbell, James   SD50
Campello, Fernanda   TB34
Canca, David   TA27
Cancela, H   TB36
Candas, Mehmet   WC15
Candelo, John   WA72
Candes, Emmanuel   MC51
Candogan, Ozan   MB71, MC04
Canessa, Gianpiero   SD68
Cantillon, Estelle   SC20
Cantor, David   SB06
Cao, Hanqing   IS-M
Cao, James   WC41
Cao, Mei   WC59
Cao, Qingning   TC05
Cao, Wenhua   SD81, TA38, WD39
Cao, Wenwei   WC46
Cao, Xi-Ren   WA54
Capan, Muge   TB41
Capar, Ibrahim   SB35, MB21
Capar, Ismail   WC25, WD25
Cappa, Stefano   MA38
Capponi, Agostino   SA54, SB54, SC5, MC54

Caramia, Massimiliano   TD34
Cardin, Michel   MA75
Cardoen, Brecht   TC38
Çarikci, Baris   WB78
Carle, Marc-André   MC70, MD70
Carley, Micharl   MC02
Carlo, Hector   SB22
Carlsson, Dick   SB70
Carlsson, John   MA50, TA26, TB55, TC52, WB06
Carlyle, Matt   SB07, TA73, TB49
Carnovale, Steven   WB07
Caro, Felipe   MC18, TA12
Carpio, Jaime   TB66
Carr, Robert   MB36
Carrasco, Diego   TC67
Carrasco, Luis Miguel   SC34
Carrier, Emmanuel   TB28
Carrier, John F.   MA08
Carrillo, Janice   SC05
Carrion, Miguel   WB74
Carrizosa, Emilio   SA26, TA43, WD55
Carroll, Gabriel   SB71
Carroll, Paula   TC82
Carter, Michael   MA39, MB42, MC40
Cartis, Coralia   SC51
Carvalho, Arthur   MA80
Casbeer, David   TD01
Cashore, Masssey   IS-T
Cassioli, Andrea   TA56
Castaing, Jeremy   MB48, TC30
Castanier, Bruno   WC72
Castillo, Ignacio   TB38
Castillo, Krystel   TC69, WE69
Castro, Lauren   IS-M, IS-T
Cataldo, Alejandro   WD30
Catanzaro, Daniele   TB48
Catay, Bulent   WB26
Catlett, Christina   WD40
Catsumi Imamura, Osvaldo   WE78
Cattani, Kyle   TA41
Caughey, Aaron   SA40
Caulkins, Jonathan
Caunhye, Aakil   WD06
Cavalcante, Victor   TD50
Cavalcanti, Ceres   TD82
Cavalcanti, Luísa   MA82
Cavallaro, John   SB80
Cavdar, Bahar   SC50
Cavdaroglu, Burak   WC49
Cavus, Ozlem   TB47
Cay, Pelin   WB48
Cay, Sertalp B.   TA52
Cazalet, Edward   MA79
Cebelak, Meredith   IS-T
Çekiç, Bülent   TD38
Celik, Melih   MC34, WE35
Celik, Nurcin   TD68
Celikbilek, Can   WB26
Celona, John   TA79
Centeno, Efraim   MC73
Centeno, Martha A.   WE75
Ceprini, ML   MA08
Ceran, Yasin   SA20
Ceroni, Jose   SA70
Cerrone, Carmine   SB35
Cervellera, Cristiano   MD81
Ceryan, Oben   TD18
Cesaret, Bahriye   MC19
Cetinkaya, Saadet   WB13

Cetinkaya, Sila   WB18
Cetintas, Suleyman   SC19
Cevik, Mucahit   MD41
Ceyhan, Gokhan   MB82
Ceyhan, Mehmet Erkan   SD42
Chachere, John   SD74
Chacosky, Austin   MD32
Chae, Young Tae   SA72
Chai, Sen   MB02
Chakrabarti, Sambuddha   SB74
Chakraborty, Aindrila   TC36
Chakraborty, Goutam   TB76, WB08
Chakraborty, Indranil   WA70
Chalabi, Zaid   WB42
Chalutz Ben-Gal, Hila   MA71, MA77, TB67
Chamberland, Jean-Francois   SC67
Champion, Bill   WB73
Chan, Carri   SA06, SB83, SC64, SD09, MA09, TD40
Chan, Derek   WA42
Chan, Gabriel   MD69
Chan, Hing Kai   WA37
Chan, Jason   SA44, SB44, TB03
Chan, Jennifer   SC34
Chan, Tian   MB33, WC04
Chan, Timothy C. Y.   TD57, WA39, WB40, WB76, WB77, WC35
Chan, Yupo   MD36
Chandra, Yanto   MA02
Chandrababu, Anushka   TD48
Chandrasekaran, Aravind   SA33, SB33, MD33
Chandrasekaran, Karthekeyan   WA46
Chaneton, Juan   SD78, TA10
Chang, Allison   WC61
Chang, Byeong-Yun   WD41
Chang, Chia-Jung   WE67
Chang, Curie   MA37
Chang, In-Kap   MC83
Chang, Jiyoun   WC69
Chang, Kuo-Hao   MA78
Chang, Sungyong   MA38
Chang, Won   WA67
Chang, Woojin   TC53
Chang, Yanling   IS-M, WA65
Chang, Yi-Yun   TA48
Chang, Yu-Ting   WA82
Chao, Mei-Wen   WD37
Chao, Xiuli   MC04, MD18, TC04
Chaovalitwongse, W. Art   MA83, TB42, TD51, WE40
Chaparala, Abhilash   WA52
Charif, Yasmine   WC31
Charkhgard, Hadi   TB82, WB46
Chatain, Olivier   SD29
Chati, Yashovardhan   WD28
Chatterjee, Samrat   TC78, WC62
Chattopadhyay, Nilanjan   WD31
Chaturvedi, Aadhaar   MA71
Chatwattansiri, Nida   TD66
Chaudhari, Sneha   WA09
Chaudhuri, Saikat   TA02
Chaves, John   SA56
Chavez, Adriana L.   TC09
Chavez, Valerie   WC41

Chavez-Bedoya, Luis   MA53, MD54
Chawla, Nitesh   SB50
Cheang, Brenda   IS-M
Chee, Yi-Min   TD37, WD82
Chehrazi, Naveed   SA53
Chelst, Kenneth   IS-M, TC57
Chemama, Jonathan   MC11
Chen, Annie   TC60
Chen, Bintong   TC78
Chen, Bokan   MD52, WA73
Chen, Boxiao   MD18
Chen, Chen   SB53, WC67, WD74, WE74
Chen, Cheng-Bang   TA48, TA67, TD47
Chen, Chien-Ming   SC06, TA15
Chen, Chongli Daniel   TD16
Chen, Chun-Hung   MD65, TD68
Chen, Cuicui   TA59
Chen, David   SC16, TA53
Chen, Erick   SA53
Chen, Fang   WC73
Chen, Frank Youhua   SD06
Chen, George   TA19
Chen, Hailiang   WB03
Chen, Hanyi   MB65
Chen, He   MC33, WB05
Chen, Heng   WC28, WE28
Chen, Henry   WB21
Chen, Heping   IS-M
Chen, Hong   MB41
Chen, Hongfan   TA60
Chen, Hsuanwei   SD32
Chen, Jason   TA18
Chen, Jen-Yi   TD18, WA07
Chen, Jeremy   TA05
Chen, Jian   MA30, TC58
Chen, Jing   TC78
Chen, Jingnan   MD54
Chen, Kay-Yut   WB45
Chen, Kehui   TB66
Chen, Kun   IS-M
Chen, Li   SA11, SD05, MC10, WC19
Chen, Liwen   WD32
Chen, Min   TB03
Chen, Mingliu   MA21
Chen, Mingyuan   WA62
Chen, Nan   SA54, SB65, SB67, SB68, MA54, MA66, WE66
Chen, Nannan   WE24
Chen, Ningyuan   WA53, WD64
Chen, Pei-Hua   WA13
Chen, Pei-yu   MB03, TC03
Chen, Peng-Chu   MC54
Chen, Pengyu   WE29
Chen, Qiong   TA33, TB11
Chen, Qiushi   SC41
Chen, Rachel   MD19, WB70
Chen, Richard Li-Yang   MB36, MB36, TD74
Chen, Ruobing   SC51
Chen, Ruoran   WB71, WD15
Chen, Shaokuan   MC10
Chen, Shengyuan   SD48
Chen, Shi   SC11, MA33
Chen, Si   TB68
Chen, Steven   TC28
Chen, Victoria   MA74, MD81, TA83, WE69

Chen, Wei   TB03, TB11, WB71, WC05, WD27
Chen, Weiwei   TB30
Chen, Wen-Chih   TA15
Chen, Wenyi   WB12
Chen, Xi   SD21, MD68, TC27, WA64, WB12
Chen, Xiangfeng   SD16
Chen, Xin   SC10, SD43, TD19, WE18, WE49
Chen, Xinyun   MB54, WA68
Chen, Xiqun (Michael)   TA21
Chen, Ya   TB15
Chen, Yang   MD72
Chen, Yao-Hsuan   SC35, IS-M
Chen, Yihsu   SC73, TA69, TB53
Chen, Yikai   SD24
Chen, Ying   WC65
Chen, Ying-Ju   SC12, SD16, MB04, TA04, WA16, WE18
Chen, Yingshan   WD54
Chen, Yiwen   WA29
Chen, Yong   SB49, WB66,WC67
Chen, Yongqiang   TA29
Chen, Yuanyuan   MB53
Chen, Yuche   WA10
Chen, Yun   TB83, WC66
Chen, Yuwen   WA44
Chen, Zhi   TA29
Chen, Zhibin   TB21
Chen, Zhihao   SB50
Chen, Zhi-Long   SD30
Chen, Zhou   WC51
Cheng, Bolong   TC74
Cheng, Changqing   SA68, MB37
Cheng, Ching-Hsue   WC82
Cheng, Chun-Hung   WE82
Cheng, Clark   MA27
Cheng, Hsing   MB44, WE09
Cheng, Lingfeng   TA72
Cheng, Luke   MD74
Cheng, Shih-Fen   MA21
Cheng, Xiaomei   TB75
Cheng, Yiling   TD51
Cheon, Myun-Seok   SB21, TB23, TD55
Cheong, Soon-Nyean   SA20, WB36
Cheong, Taesu   WB41
Cheridito, Patrick   SB53
Cheriyan, Vinod   WB16
Chern, Yu-Ching   IS-T
Chernikov, Dmitry   WD48
Chernoff, Harry   WA13
Chestnut, Jacob   TC35
Cheung, Ki Ling   WE07
Cheung, Maurice   MA27
Cheung, Wang Chi   MA20
Chevalier, Philippe   TD10
Chew, Ek Peng   MA68, TA20, TC11, WC11
Chew, Song   TA48
Chhajed, Dilip   WE04
Chhatwal, Jagpreet   SC41
Chi, Guangqing   MA37
Chiang, David   TB33, WB11
Chiang, Naiyuan   MA51
Chiang, Roger   WE83
Chick, Stephen E.   SC75
Chien-Chun Hung, Micheal   TB64
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Choi, Tsan-Ming   WB11
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Faro, Jose Heleno   SB02
Farrell, Timothy   WB42
Farren, Derek   SD32
Farrokhvar, Leily   TB20
Farzan, Azin   SB04
Fasano, Chris   MD83
Fast, Caleb   TD49
Fatemi Ghomi, S.M.T.   WC12
Fathi, Faranak   SA68
Fathi, Yahya   SC82, WC52
Faturechi, Reza   SC22
Faulin, Javier   SC23, SD23
Fazel, Maryam   SA52
Fazelnia, Ghazal   SB72, WA74
Fazi, Stefano   WB23

Fearing, Douglas   TC06, TC22, WB77
Fearon, Michael   TA35
Federgruen, Awi   SD19, MD42
Federspiel, Florian   WD80
Feijer, Diego   WA70
Feijoo, Felipe   WA34, WB73
Feiler, Daniel   SB45
Feinberg, Eugene   SA78, MB52
Feizollahi, Mohammad Javad   TD48, WD74, WE74
Felder, Frank   WC74, WE72
Feldman, Guy   SC68
Feldman, Jacob   SD18, MA18, TA10
Feldman, Pnina   SA17, SD17, TC39, WC06
Feliz, Leibiana   MD34
Fellman, Philip   SB01
Feng, Baichun   MD78
Feng, Haolin   WD54
Feng, Juan   MD44
Feng, Lin   WB18
Feng, Mary   WE42
Feng, Mingbin   MD52
Feng, Qi   SC10, SC11
Feng, Taiwen   WC32
Feng, Tianjun (TJ)   TA45
Feng, Wancheng   WA11, WE08
Feng, Yifan   WD19
Feng, Yiheng   WC24, WD23
Feng, Yonghan   TD74
Feng, Youyi   TB60
Feng, Youyi   WC30
Fenix, Darlene   WA19
Fenster, Aaron   WB40
Ferguson, Mark   SD06, SD12, TA06, WA12, WA19
Fernandes, Jessica   SA69
Fernandez-Villaverd, Jesus   SA53
Feron, Eric   WD28
Ferrand, Yann   TB39, WD24
Ferreira, Pedro   SB44, SC37
Ferrell Jr., William   WA52
Ferrer, Juan-Carlos   WD30
Ferrer Ortiz, Juan-Carlos   IS-T
Ferrer-Vasquez, Mario   WE44
Ferretti, Valentina   TB78
Ferris, Michael   TA39
Fichtner, Wolf   WC72
Fields, Evan   TB24
Fink, Clay   TD62
Finkelstein, Stacey   TD17
Fiorillo, Ricardo   MA27
Firouz, Mohammad   TC60
Fisher, Emily   WD72
Fisher, Marshall   SC17, MC45, WD05
Fishman, Paul   WE40
Fisk, Susan   WD80
Fitzpatrick, Therese   IS-M
Fiuza, Sergio   MA15
Flaherty, Patrick   MB83
Flajolet, Arthur   SD21
Flamand, Tulay   WB52
Flatberg, Truls   TB25
Flath, Christoph   TB72
Flath, Christoph   WB17
Flaxman, Seth   TD43
Fledel Alon, Adi   WE54

Fleischhacker, Adam   MB80
Fleming, Joanna   MD38
Fleming, Lee   MC02
Fletcher, Chloe   IS-T
Fleten, Stein-Erik   SA73
Flisberg, Patrik   SB70, MD70, WB48
Floden, Jonas   MD49
Flores, Angela   MC73
Flores-Serralde, Mariana   TB15
Fodstad, Marte   TB25
Foege, J. Nils   WE33
Fogliatto, Flavio S.   TD58
Fok, Pak-Wing   MB80
Fokoue, Ernest   MC48
Folga, Stephen   TA73
Fong, Eric   WE38
Fontaine, Pirmin   WC21
Forbes, Chris   MD76
Forgie, Sarah   MA40
Forman, Ernest   WD79
Forrer, Salome   WA43
Forrester, Richard   SA43
Forshee, Richard   TA51
Fortz, Bernard   SB36, MA36
Foster, James   SB43
Fotuhiardakani, Fateme   WB27
Fouque, Jean-Pierre   SD53
Fourer, Robert   SC56, MB08, MC46
Fowler, John   SA38
Fox, Andrew   SA83
Fox, Edward   MA18
Fox, William   SD01, TC08, WA01
Franceschetti, Anna   SB23
Franchetti, Matthew   WA58
Francis, Royce   WE65
Francisco, Claudia   TB15
Frandsen, Thomas   WB02
Frangioni, Antonio   SB36, WA55
Franklin, J. Rod   WB21
Franklin, John   MB40
Fransoo, Jan C.   SB05, MB11, TA64, TC33, TD05, TD69, WA23, WE26
Franz, Axel   MB28
Frazelle, Andrew   WE64
Frazier, Peter   SA77, SC68, SC83, TB68, IS-T, TC43
Frechette, Alexandre   SC71
Fredriksson, Albin   SD81
Freed, Tali   SC76
Freedy, Amos   TD01
Freedy, Elan   TD01
Freeman, Gregory   TB08
Freeman, Michael   SC09
Freeman, Nickolas   TC11
Freimer, Mike   SD19
Frenk, J.B.G.   WC18
Freund, Robert   SB52
Frey, Markus   SD25, TB32
Friedman, Samuel   SC35
Friesz, Terry   SC23, SC24, SD25, MA24, IS-T, TD21
Frith, Karen   WE38
Froehle, Craig   TB39
Frutiger, Michael   SD44
Fry, Michael   TA06
Fu, Hu   WA71
Fu, Ke   MA30

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Gopalakrishnan, Raja MC27
Gopalappa, Chaitra SC35, MA35
Gorahava, Kaushik IS-M
Gore, John MA81
Gorgone, Enrico SB36
Gorman, Michael TA14
Goto, Makoto WA53
Gotoh, Jun-ya WD82
Gou, Jizhan MC24
Gou, Qinglong WD30, WE18
Gouveia, Luis SB36, SC36, MA36
Govan, Paul WD79
Govindaraj, Suresh SA78
Govindu, Ramakrishna WE14, WE41
Goyal, Manu MC33, TB11, WB05
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Goyal, Vineet SA18, TB51, WC64
Goycoolea, Marcos SB70
Grabarnik, Genady TB31
Graber, Anna MB42, MC40
Grabowski, Martha WC20
Grabowski, Thomas MA8, WE40
Gradisar, Mirko WA24
Graham, Charlie SB01
Graham, Colin MD65
Graham, Stu MC02
Graham, Thea MA14
Gralla, Erica WA35
Gramacy, Robert B. MB66
Gramani, Maria Cristina IS-T
Grangier, Philippe WA26
Grannan, Benjamin MA01
Granot, Daniel MA06
Grant, Hank WE75
Grant, Tim WA08
Grasman, Scott IS-M, MC48, MD32
Grassmann, Winfried WB68
Graves, Stephen MA05, TA14, TC05, TC60, WA10
Gray, John SD04, MA31
Grbovic, Mihajlo MA52
Green, Tuell TB48
Greenberg, Robert WD40
Greenia, Daniel SC31, SC32
Greenstein, Joel IS-M
Greenwood, Brad SB44, TC03
Gregg, Edward TD51
Griffin, Jacqueline MA22, MC42, IS-T
Griffin, Joshua MD09
Griffin, Paul MA01, MB40, MD34, TA67
Griffiths, Randy WA66
Grigas, Paul SB52
Grijalva, Santiago WD74
Grimshaw, Scott WA67
Groleau, Thomas TB77
Grønland, Stein Erik WA35
Gross, Abram WA58
Gross, Jean-Philippe SB23
Gross, Ralph MA03
Grossmann, Ignacio E. TA55, TB37, WC50, WC82
Grosu, Daniel MB32
Groves, William WB83
Gruber, Aritanan SD52
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Grundel, Sara TD52
Grunow, Martin TD30
Grushka-Cockayne, Yael SC80, SD10, TD79
Gu, Weijia TA05
Gu, Wenxi WC32
Gu, Xi WB29
Gu, Xiaohong TB66
Guajardo, Jose SA05, SC03, MD10
Guajardo, Jose SD03
Guajardo, Mario TA70
Guan, Peiqiu WB79
Guan, Yongpei MD46, TC47, TC73, WC47, WD47
Guden, Huseyin TC58
Gue, Kevin R. TB20, TC20
Guenduez, Halil Ibrahim SD50, TD38
Guerra, Ernesto SA05
Guerra, Hélia WD78
Guerrero, Vanesa SA26
Guerrero-Cusumano, Jose Luis SC80
Gui, Luyi SB12, TC22
Guide, Dan MA12
Guide, Jr., Daniel TA71
Guiffrida, Alfred L WA07, WA23
Guignard, Monique TD55
Guikema, Seth MD79, WB79, WB80, WC80
Guimaraes, Renato SA26
Guinan, Eva SA03
Gujarathi, Saurabh SA48
Guldmann, Jean-Michel SA69, MB75
Gülel, Derya WB53
Guler, Kemal MA71
Gullhav, Anders Nordby TC36
Güllü, Refik TD53
Gully, Torsten TC45
Gulsen, Mehmet TC58
Gultekin, Hakan WD58
Gulten, Sitki WD47
Gumus, Fatma MA81
Gumus, Mehmet SA16, SD06, SD16, MC16, MD41, TD31
Gumus, Serkan WB69
Gunes Corlu, Canan TA68, WA06
Gunes, Evrim SB77, WC17
Güney, Özgür MC83
Gung, Roger MB78, MC20
Gungor, Celal WA33
Gungor, Osman Erman MA25
Gunluk, Oktay SB51, MA48, MD46
Gunnam, Aswin MA14
Gunnec, Dilek MD50
Gunter, Carl WD83
Guo, Bing WC83
Guo, Chenhui SB31
Guo, Cui SD72
Guo, Ge TC47
Guo, Hong MB44, MC03, WA44
Guo, Jing SD54, WA54
Guo, Kevin MB54
Guo, Pengfei WA17, WD06
Guo, Qingxin TB30
Guo, Ruixue TD06, WD04
Guo, Shanshan SD12
Guo, Wei SA51

Guo, Weihong WB67
Guo, Xiaolei TA21
Guo, Xiaolong WE12
Guo, Xiaomeng MB16
Guo, Xin MB53
Guo, Xitong WC07
Guo, Yin SA69
Guo, Yuntao MA25, MC23
Guo, Zhaomiao WE72
Gupta, Alok SA71
Gupta, Anupam TA46
Gupta, Deepak WE26
Gupta, Diwakar MC39, TA41
Gupta, Shivam WB71
Gupta, Swati TD50, WA05, WA46, WE47
Gupta, Varun SA19, SB17, MA09, TB64, TD18, WC64
Gupta, Vishal WC47, WE47
Gupte, Akshay MA46, MC55, TB82
Gur, Yonatan SD18, MD17
Gürbüz, Feyza WB83
Gürbüz, Mustafa Cagri WE24
Gurbuzbalaban, Mert TD52
Gürel, Sinan SA21, MB28
Guresen, Erkam WB69
Gurler, Ulku WA60, WB51, WD21
Gurnani, Haresh SC04, MC14, TA11
Gursoy, Kemal WC60
Gurumurthi, Suri MD33
Gurvich, Itai SA06, SA64, SC09, SD09, MB65, WB17
Gusikhin, Oleg MC29
Gutfraind, Alexander SC42, SD39, IS-M
Gutierrez, Andrew Paul TC14
Gutierrez, Genaro WC79, WD30
Gutowski, Timothy WA10
Guttieri, Karen TB61
Güvenen, Orhan MD78
Güzelsoy, Menal TA09
Guzman, Cristobal WD46
Gwiggner, Claus SA28
Gwon, Hyejeong WD45
Gzara, Fatma TD48

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Ha, Albert MC16
Haas, Peter MC68
Haber, Eben WA09
Hacamo, Isaac WB53
Hach, Daniel MB75
Haddad Sisakht, Seyyed Ali MC69
Hadianniasar, Mina SD65
Hadjiliadis, Olympia TD54
Hafen, Ryan MC36
Hafezi, Maryam SD69
Hafizoglu, Baykal TA10
Haghani, Ali TB22, TB26, TC73, WB83, WD23
Haghnevis, Moeed TC32
Haghtalab, Siavash MB83
Hagmann, Christopher MD47, WD36
Hagspiel, Verena SA73, TA80
Hagtvedt, Reidar MA40
Hahn, Peter TD55

Hahsler, Michael TB43
Haider, Murtaza WC77
Haight, Robert TA59
Haines, Andy WB42
Haji, Babak WB75
Hajian, Mohammad WC35
Hajibabai, Leila MA21
Hall, David SC02
Hall, Nicholas G. MC30, TA30
Hall, Patrick TB37
Hall, Rob SA76
Hallen, Benjamin WD22
Haller, Susan TB37
Hall-Phillips, Adrienne TA57
Halme, Merja SB82
Hamada, Michael WA66
Hamalainen, Raimo TD63, WE82
Hamedi, Masoud TC70, WD23
Hamel, Andreas H. TC53
Hamidi, Maryam TA37, TC67
Hamilton, Rebecca SB10, SB31
Hammond, Robert MC71
Hampf, Benjamin SB15
Hampshire, Robert MB64, MC31
Hamrock, Eric WD40
Hamta, Nima WC12
Hamzaoui, Salem WD25
Hamzeei, Mahdi WB55
Han, David WA75
Han, Jiaojie WD16
Han, K. MA24, SC24
Han, Ke SC23, SD25, IS-T, TD21
Han, Kunsoo TD44
Han, Sang Pil WA03
Han, Spring MA31, MB12
Han, Sumin SD72
Han, Sung Won MC81, WB76
Han, Xu TA44
Han, Ye WC50
Han, Yongseung SD15
Han, Zheng SA51
Hanafi, Said SB55
Hanany, Eran SC28
Hanasusanto, Grani WE47
Hancerliogullari, Gulsah MB30, WE15
Handley, Holly MB75
Handley, John MA19
Hanisch, Brock SC38
Hanks, Don MD01
Hansen, Mark SA28, MA14, WD28
Hansen, Thomas Dueholm MB52
Hanson, Gregory J. SA39
Hanson, Kevin SA34, WC20
Hanzon, Bernard WD53
Hao, Gang WB11
Hao, Lin MD44
Hao, Lu MA14
Hao, Peng SA24, SD24, TB24
Haouari, Mohamed WA58, WB52
Haque, Rezwan IS-T
Haran, Murali WA67
Harchol-Balter, Mor MC31, TD65, WA17
Hardie, Tim MC37
Hare, Mike WA74
Hargaden, Vincent TC82
Haridy, Salah TB41
Harmanli, Oz SA40, TC31
Harmon, Robert SA02

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IS-M Interactive Session – Monday (12:30-2:30)
IS-T Interactive Session – Tuesday (12:30-2:30)

Harper, Michelle   SA28
Harris, Anthony   MA40
Harris, Brian   SA80
Harris, Shannon   IS-M, MD75
Harrison, Michael   TD65
Harrod, Steven   TB27
Hasar, John   IS-T
Harsha, Pavithra   MC18, TC16, WA12, WA15, WA18, WB62
Hart, Quinn   WC12
Hart, William   SC43, MC46
Hartley, Dean   SB01, TB61
Hartman, Joseph   WB63
Harzendorf, Freia   SA73
Hasanzadeh Mofrad, Maryam   MD41
Hasenbein, John   MA48, MA65, WC65
Hasgul, Servet   WA27
Hashemi Doulabi, Seyed Hossein   WC43
Hashemi, Hossein   SC21, WD23
Hashmi, Sahar   WA42
Hasija, Kanav   TA31
Hasija, Sameer   MC11, WC02, WD18
Hassan Zadeh, Amir   WC77
Hassani Goodarzi, Shadi   MA35
Hassani, Ashkan   TA38
Hassini, Elkafi   WB15, WE25
Hassmiller Lich, Kristen   SD41, TC42, WC39
Hassoun, Michael   WA51
Hastings, Alan   TA59
Hastings, Katherine   MA21
Hasuike, Takashi   MA26
Hatami-Marbini, Adel   SA15
Hatfield, Gary   WC34
Hato, Eiji   IS-M
Haugh, Martin   MC53
Haughton, Michael   MA23
Haus, Utz-Uwe   MC43
Hausken, Kjell   WC63
Hausman, Warren H.   WC15
Hayashi, Yasuhiro   MD43
Hayes, Roy   WD68
Hayward, Mark   SA08
Hayward, Rodney   SA40
Hazen, Benjamin   WD30
Hazen, Gordon   MC80
Hazin, Luciana   TD82
Hazlett, Daniel   TA40
He, Fang   TB21
He, Jie   TA51
He, Kai   SA32
He, Lixia   WD73
He, Long   WA12
He, Miao   MA32
He, Niao   MC51
He, Qiaochu   WE18
He, Qie   TC49
He, Qi-Ming   MA23, SC45
He, Qing   SA23, SB24, SB35, MB27, MC24
He, Rongchuan   SD43
He, Shuangchi   MA65, TB60
He, Simai   IS-M, TD39
He, Xiang   WD33
He, Xiaozheng   SC22, MA25, MB22, MC25, TB24
He, Xiuli   WA30, WE18

He, Xuedong   SD54, WA54, WC54
He, Xueqi   WA63
He, Yanyan   WD30
He, Yanyi   MB19
He, Yilling   WB72
He, Ying   MC80
He, Yuanjie   MD19
He, Yuhong   MD11
He, Zhengwen   TC29
Head, Larry   WB24, WC24, WD23
Hearne, John   SB21
Heath, Emily   WC49
Heching, Aliza   MC31, MD39
Heckmann, Iris   TA11
Hedman, Kory   MB74, MC74, IS-T, TC47, TD74
Heese, Seb   TC67
Hegde, Deepak   SC29, MC02
Hegde, Vishwanath   TB29
Hegmanns, Tobias   WE75
Heier Stamm, Jessica   WE35
Heilig, Leonard   TB07
Heim, Gregory R.   SB30
Heim, Joseph   WE40
Heinrich, Timo   WC45
Heipcke, Susanne   WA48
Hekimoglu, Mert Hakan   SA04
Hekimoglu, Mustafa   IS-M
Heliövaara, Simo   MA75
Helm, Jonathan   SC09, SC41, SD09, MA09, TB40, IS-T, TD17
Helmer, Elena   MD76
Helmrich, George   IS-M
Helms, David   WC62
Henao Botero, César   IS-T
Henao-Perez, Alvin   SB73
Hendershott, Terrence   MB53
Henderson, Dale   TC78
Henderson, Louise   IS-T
Henderson, Nicholas   WB51
Henderson, Shane   SA75, SC68, SD68, SD83, TB34
Hendricks, Kevin   WC11
Henrion, Max   MB79, MD69
Henry, Stephen   WC61
Heo, Deung-Yong   TA44
Heo, Jun-Yeon   TC32
Hepler, Amanda   TD61
Herazo, Nilson   IS-M
Herczeg, Gabor   WB10
Herekoglu, Ahmet   WD26
Herer, Yale T.   MA06, MD07, WD12
Hermel, Dror   MA06
Hernández, Helman   WA72
Hernandez, Rodrigo   MB01
Hernández-Gress, Eva Selene   TB26, WE75
Hernandez-Urrea, Jaime Alberto   MA25
Herrera-Restrepo, Oscar   SC15, TC15
Herrmann, Jeffrey   TD78
Herrmann, Philipp   TB44
Herzig, Jonathan   WC09
Hewitt, Michael   SD21, MD32, TB32, TC23
Heydar, Mojtaba   MD27
Heydari, MohammadHossein   TC75
Heydari, Ruhollah   TC25

Hezarkhani, Behzad   WE07
Hiatt, Shon   WA22
Hibshoosh, Aharon   TD53
Hicklin, Karen   MC75
Hickman, Joel   SA39
Hickman, Mark   MB25
Hickman, Randal   WA50
Hicks, Illya   TD49
Hidalgo, Ieda   SA69
Higbie, Jon   SD11, WA19
Higgins, Matthew   MA28, TB28
Higle, Julie   TB59
Higuera, Shane   MD15
Hildmann, Marcus   TB72
Hildreth, John   IS-M
Hill, Alessandro   IS-T
Hill, Daniel   WD37
Hill, James   MA31
Hill, Raymond   WC49
Hill, Stephen   WD36
Hilliard, Elizabeth   WA71
Hilton, Ross   TD43, WA41
Hines, J Wesley   WA75
Hinrichs, Curt   TC57
Hirsch, Gary   WB42
Hirsch, Michael   TA01, TB01, TC01, WA52
Hisayuki, Kurokawa   WD24
Hiskens, Ian   WD43
Hitt, Lorin   WC06
Hjaar, Ali   IS-T
Hlatky, Mark   SD40
Ho, Chin Pang   MA55
Ho, Jonathan   SD49
Ho, Joyce C.   SC77, WB76
Ho, Qirong   MC48
Ho, Sin C.   TA23
Hobbs, Ben   SA07, SC74, SD49, MB74, MD73, TB74, WC74
Hoberg, Kai   WB41, WB60, WD70
Hoburg, Warren   SA55
Hoch, Daniel   WB72
Hochbaum, Dorit   TA43, TD46
Hochberg, Ephraim   SA39
Hochstein, Axel   TD43
Hoddle, Mark   TC14
Hoen, Kristel   TD69
Hoffman, Karla   SA46, SC71, SD71
Hoffman, Matthew   TD50
Hogan, William   WC80
Hojjat, Ali   SC19
Holechek, Jason   MC20
Holguin-Veras, Jose   SA35, TB06, TD24, WD06, WD35
Holloman, Sherrica   WE82
Holman, Jon   WC49
Holodniy, Mark   SB41
Holtta-Otto, Katja   MA02
Holvenstot, Peter   TB41
Holzapfel, Andreas   WE14
Homem-de-Mello, Tito   SD68
Homer, Jack   WB42
Hong, Bryan   WE44
Hong, Jong Chul   TD73
Hong, Jong Soo   SB53
Hong, Kevin (Yili)   TC03
Hong, L. Jeff   SA75
Hong, Liu   MB22
Hong, Mingyi   MC51
Hong, Pei-Ru   WA13

Hong, Soondo   TB20
Hong, Yili   TB66
Hong, Young-Chae   MC38, TC30
Hong, Yuan   TB30
Honhon, Dorothee   MA45, TC59, TD05, WC19
Honma, Yudai   MA26, IS-M
Honnappa, Harsha   WA62
Hooker, John   MC46, WC43
Hoos, Holger   WB09
Hopp, Wallace   MD45
Hora, Manpreet   MB05, MB11
Horesh, Raya   SA72
Hörmann, Wolfgang   TD53
Horton, John   SB20
Horváth, Zoltán   TB52
Hosanagar, Kartik   TC03
Hoskins, Aaron   WC48
Hosseini, Narges   SC40, WA33
Hosseini, Vahid   TC70
Hotle, Susan   TB28
Hottum, Peter   SA31
Hou, Sicong   WC60
Hou, Xiangyu   WE41
Hou, Yuxing   WC67
Houle, Gary   WE79
Hourani, Anas   SD83
Houseman, Greg   TA59
Howard, Ronald   MA79
Howell, Jason   IS-T
Hsieh, Chia-Yin   WD19
Hsing, Yu   TB53
Hsu, Carol   TD19
Hsu, Vernon   MA30, WD04
Hsuan, Juliana   SC05, WA23, WB02
Hu, Bin   SA11
Hu, Bo   WC31
Hu, Guiping   MC35, MD70, TA69, TC69, TD48, WC63, WD72, WE69
Hu, Jian   WA82
Hu, Kejia   MD12, WA10
Hu, Kun (Maggie)   WA42
Hu, Liujia   TD68
Hu, Mengqi   MD72, TA72
Hu, Michael   SD09, IS-T
Hu, Ming   SB29, MA19, TA04, TB45, TD19, WD04
Hu, Paul   WC44
Hu, Peng   TD19
Hu, Qiaohai   WE41
Hu, Qiying   WC30
Hu, S. Jack   MB37, TB83, WB67, WE04
Hu, Shanshan   SD09, SD12, WC19
Hu, Weici   TB68
Hu, Weihong   TB23
Hu, Wenqi   MA09
Hu, Xiangpei   TD58, WC09, WC78, WD58
Hu, Xing   TC22
Hu, Xinxin   TA11, WE29
Hu, Xinxin   WE29
Hu, Yaohua   TD37
Hu, Yihong   SB32
Hu, Yu Jeffrey   TB44
Hu, Zhenyu   TD19
Hua, Cheng   TA60
Hua, Dingguo   SB68, MA66
Huaman-Aguilar, Ricardo   WA70

Huang, Bo   TC52
Huang, Boray   TB33, WD33
Huang, Can   MA02, WE72
Huang, Chien-Hsun   IS-T
Huang, Edward   TC20, TD68
Huang, George Q.   TC58
Huang, He   WD03
Huang, Heng   MD42
Huang, Hsin-Chan   SB83, WB35
Huang, Jefferson   MB52
Huang, Jianhua   SA66, MB37, TD67, WE83
Huang, Jun   IS-M
Huang, Junfei   IS-M
Huang, Kai   SC48, WC48, WC68
Huang, Kuo-Ling   SC48, WA52
Huang, Kwei-Long   TD19
Huang, Lu   SA12
Huang, Minfang   WC09
Huang, Ming-Hui   MB32
Huang, Ningjian   WC58
Huang, Ping H.   SB38, MD67
Huang, Qiang   SA68, MB67, MC67, WB66, WD67
Huang, Shenglan   WA61
Huang, Shijie   SB34
Huang, Shuai   MB37, MC67, TA83, TD66
Huang, Shu-Wei   WA13
Huang, Simin   WB71
Huang, Simin   WD15
Huang, Terry   WE82
Huang, Tingliang   SC45, WA04, WB75
Huang, Weihao   WC33
Huang, Xiao   SD06
Huang, Ximin (Natalie)   TA06, TB69, TD69
Huang, Xuan   WA37
Huang, Yan   MA03
Huang, Yiwei   SB30
Huang, Yixiao   SB23
Huang, Yongxi   SB69, MB69, MC55
Huang, Yufei   SB02, MA33
Huang, Yuping   MA47
Huang, Zhimin   WD30
Huang, Zhouchun   MA47, TC49
Hubbard, Alan   WD37
Huchette, Joseph   SB46, SD51, MC46
Huchzermeier, Arnd   IS-T, TC33
Huckman, Robert   TA17, IS-T
Huddleston, Jeanne   SA39, SC40, TB41, WA33
Huebner, Alexander   SB05, WE14
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Mantalaris, Athanasios   TC58
Mantin, Benny   SA16, SC04, TC19, WD16

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Mao, Huiqiang   WD14
Mao, Isaac (Yuan)   MB53
Mao, Zhimin   MD35
Marangoni, Giacomo   MD69
Marashi, Seyed Mani   IS-M
Marco, Alan   MC02
Marcotte, Patrice   WA19
Marcotte, Suzanne   MB75, TD20
Marella, Lavanya   TA25
Marella, William   TC41
Margalit, Ruth   SC38
Margot, Francois   MD46, TA10, TA46
Marianov, Vladimir   SC26, MC26
Mariel, Katharina   MB50
Marier, Philippe   MD70
Marin, Angel   SB28
Marinchek, Dean   TD20
Marins, Fernando   WA82
Mark, Wright   TC69
Markakis, Mihalis   MA10, WD04
Marklund, Johan   MC50
Markou, Panayotis   TB33
Markovic, Nikola   SC21
Marla, Lavanya   WC35, WE28
Marlow, David   SD01
Maroulis, Spiro   MA34
Marquez, Claudia   WB45
Marquez, Leorey   IS-T, WC21
Marrero, Wesley   TC35, WE75
Marsden, Alison   TC43
Marsden, James   WB03
Marshall, Adele   WA78
Marshall, Luke   TC23
Marston, Sean   WA44
Martagan, Tugce   IS-M, WD65
Martell, David   MB70
Marti, Hazan Deniz   MC83
Martin, Sebastian   SB74
Martin-Campo, F. Javier   SB55, SC34
Martinelli, Gabriele   MB80
Martinez de Albeniz, Victor   SB10
Martinez, Dayna   TA40, TB41
Martinez, Gabriela   TB37, WA69
Martinez, Waldyn   WA78
Martinez-Moyana, Ignacio   TB61
Martonosi, Susan   TD57
Martz, H. F.   WA66
Marucheck, Ann   TD41
Marufuzzaman, Mohammad   MA69, TC69
Marvin, Freeman   MB77, TD61
Marx, Leslie   MA71
Marx, Matt   TC02
Marzoughi, Hassan   WE23
Marzuoli, Aude   WD28
Masel, Dale   TD20
Mashayekhy, Lena   MB32
Masih, Behdad   MD76
Masini, Andrea   TC12, TD12, WC10
Mason, Jennifer   MA35, IS-T, WC39
Mason, Scott   SD22, MB69, WC15
Masoud, Neda   SC25
Masoumi, Amir   WE17
Mass, Yosi   WC09
Massel, Paul   WA28
Massey, William   MD75

Massie, Allan   MB29
Massimino, Brett   SD04, MA31
Masten, Kurt   WC41
Mastin, Andrew   TD46
Matheson, Jim   SA79, MA79, MD79, TA78, TD80
Mateus, Geraldo R.   SC36
Matin Moghaddam, Navid   MB69
Matis, Timothy   SA70
Matlin, Alisa   WC20
Matos, Miguel   SC37
Matos, Rafael   WA20
Matsubayashi, Nobuo   WD51, WE51
Matsui, Kazuya   MA26
Matsukawa, Hiroaki   WC41
Matsuzaki, Raito   SA22
Matsypura, Dmytro   SB49, SC69
Matteson, David   SD83
Maturana, Sergio   WC32
Matuszak, Martha   WE42
Maurer, Olaf   SB36
Mausser, Helmut   MA53
Maxwell, Matt   SC18, MA20
May, Jerrold   MD75, WB78, WE70
Mayande, Nitin   TB09
Mayer, Kyle   TD02
Mayer, Stefan   MA71
Maynard, M. Travis   TD29
Mayo, Merrilea   MA34
Mayorga, Maria   SA32, SD41, MA35, MC75, TB34, TC42, WC39
Mayoros, Peter   MC38
Mayzlin, Dina   SB31
Mazahir, Shumail   MA12, TC12
Mazumdar, Theo   TC08
Mazumder, Rahul   SB52
Mazur, Lukasz   TD38
Mazzuchi, Thomas   MD66
McCaffrey, David   SD19
McCardle, Kevin   MC78
McCormick, Tyler   MA81, SD83
McCoy, Kevin   MA70
McCullough, Warren   SA76
McDermott, Christopher M.   SC04
McDonnell, Mae   WB22
McGarvey, Ronald   SD35, MD35, TD77
McGinity, Curtis   SA34, TB47, WC20
McGinnis, John Oldham   WD77
McGregor, Nydia   WB22
McKay, Kenneth   SB42
McKee, Martin   WB42
McKellar, Jennifer   WD78
McKenzie, Kendall   MA35
McKeown, Ryan   MA37
McKinney, Gregory   WB19
McLaughlin, Amy   TD17
McLaughlin, Katharina   TC28
McLay, Laura   MA01, TC31, WC35
McLeod, Logan   TB38
McMurry, Pat   MA01
Mears, Laine   WA48
Medaglia, Andrés L.   SD21, WA28, WB80, WC18, WE48
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Megahed, Fadel   MC37
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Mehr, Maryam Nikouei   MD35
Mehra, Amit   MB03, WD37
Mehrotra, Ateev   SD38, MB03
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Mehrotra, Sanjay   SC48, SD47,
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Mehta, Siddhartha   TA01
Mehta, Sonya   MA83
Meiren, Thomas   TD32
Meisheri, Eric   TB41
Meissner, Joern   TB06,
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Mejia, Jorge   WE33
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Meketon, Marc   SC27, SD27
Melachrinoudis, Emanuel   MD26,
  TC25, WC35
Melamed, Benjamin   TD04
Melcher, Marc   SA41
Melkonian, Vardges   TC48
Mellers, Barbara   MA80
Melo, Wendel   TB55
Melouk, Sharif   TC11, TC60
Meltzer, David   SB38
Melville, Nigel   TB03
Memisoglu, Gokhan   MA69
Menard, R. Jamey   WD73
Menasco, Michael   TC78
Mendelson, Haim   MA17,
  MD02, WD83
Mendes, Andre   MA82
Mendes, Armando   WD78
Mendoza, Jorge   SD21
Mendoza-Arriaga, Rafael   TA54,
  TB75
Menezes, Mozart   SA26,
  SB26, SC40
Meng, Chao   WA81
Meng, De   SA52
Meng, Lingyun   TB27
Meng, Sisi   TA35
Menietti, Michael   MA38
Menon, Syam   MA44
Merdan, Selin   IS-T
Merkhofer, Lee   TC79
Merkle, Edgar   MA80
Merrick, James   MD73
Merrick, Jason   TA14, WB79
Mersereau, Adam   MC64, WC19
Mes, Martijn   SD22, TD25,
  WA26, WB25
Mesa, Juan Antonio   TB25
Mesquita, Diego   IS-M
Messinger, Paul   WA16
Metaxas, Dimitris   IS-M
Meyer, Samantha   WC59
Meyers, Kris   WE72
Meyers, Lauren   IS-M, WB35
M'Hallah, Rym   TD50
Miao, Daniel   WB75
Miao, Zhaowei   WD14
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Michailidis, George   TB81
Michalek, Jeremy   MB69
Michalsen, Mandy   TD78
Michini, Carla   MC43
Michlin, Haim   TB31
Mihic, Kresimir   TC48
Mihm, Jurgen   SB33, MB33,
  WA04
Mihovska, Albena   TB36
Milburn, Ashlea   SD65, IS-M,
  TA26, TD41, WA49, WD35
Miles, Ryan   SB70
Milgrom, Paul   SC71
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Miller, George   TD41
Miller, Harvey   MD25
Miller, Kevin   MC29
Miller-Hooks, Elise   SC22, SC25,
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Mills, Alex   MA09, TA41
Mills, Andrew   SC72, TD74
Milner, Joseph   MB10,
  MC09, MD42
Min, Jo   TD73
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Minaeian, Sara   WC62
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Minato, Shin-ichi   MD43
Minner, Stefan   MB50, TA05,
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Miralinaghi, Mohammad   TA21
Miranda, Pablo A.   SA70
Mirchandani, Pitu   SA24, SD24
Mirshak, Ramzi   WA28, WC61
Mirzaei, Fouad   TC19
Mirzaei, Shokoufeh   MA25
Mise, Murat   WC36
Misener, Ruth   TC58
Mishra, Anant   SA33, TA33
Mishra, Nishant   MD16,
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Mishra, Rajhans   TD41, WD09
Mishra, Spandan   TC75
Misic, Velibor   TB51
Misra, Pratik   WC50
Missbauer, Hubert   TA58, TC58
Mistree, Farrokh   MA74,
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Mital, Pratik   MA34, TC20,
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Mitchell, Daniel   SC53,
  TA54, WD54
Mitchell, John   MC35,
  MD52, TA52, WC49
Mitchell, Victoria   TC41
Mitchell-Guthrie, Polly   WA77
Mithas, Sunil   WA44
Mitra, Amit   TD29
Mitra, Debanjan   MC03
Mitra, Roopak   SC76
Mitra, Sinjini   SD38
Mittal, Anuj   TC78
Mittal, Areesh   TB49
Mittelmann, Hans   MB43
Mittenthal, John   TC11
Miyamoto, Yuichiro   SD26
Miyashiro, Ryuhei   SD26
Miyazawa, Masakiyo   MA65,
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Mnyshenko, Oleksiy   SA03
Mo, Jiahui   MA44, MD44

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Moallemi, Ciamac   SA47, SB53,
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Moarefdoost, M. Mohsen   MC72
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Modi, Vijay   WA69
Moeke, Dennis   TC38
Moench, Andrew   WD34
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Moghaddass, Ramin   WE81
Mogre, Riccardo   MC17
Mohammadhashemi, Ali   WC25
Mohammadi, Fakhrosadat   WE83
Mohammadian, Iman   MB14
Mohan Lal, Tarun   SA08,
  SD39, WA33
Mohan, Bhavya   SA17
Mohan, Lakshmi   SD03
Mohan, Shyam   WA11
Mohan, Srimathy   SA38
Mohseni, Alireza   SD24
Mohsenian-Rad, Hamed   WC73
Moinzadeh, Kamran   SC11, TC05
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Mokashi, Anup   SB75, SD75
Mokhtari, Zahra   MA23
Mola, Joe   TD01
Moldovanu, Benny   TA16
Molinaro, Marco   SB46,
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Møller Jensen, Rune   TD26
Molzahn, Daniel   WD43
Momber, Ilan   TB73
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Momot, Ruslan   SB11, MD17
Monbourquette, Vincent   MD70
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Monsuur, Herman   MD48, WA08
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Montanari, Roberto   MB75
Montaño Arango, Oscar   TB26
Monteiro, Leandro   SD80
Montero, Javier   SC34
Montes-Sancho, Maria   SC06
Montgomery, Douglas   TC66,
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Montibeller, Gilberto   SB79,
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Montie, James   WC39
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Montreuil, Ben   TD20
Mookerjee, Vijay   SC44
Moon, Jeongyi   MD36, TC46
Moon, Jihwan   TC18
Moon, Kyungjin   MC28
Moore, Clinton   SC69
Moore, David   SC64
Moore, Jared   WC69
Moore, Jeff   TA18
Moore, Roxanne   MA34
Moore, William   TD44
Moosavi, Seyed Hossein   TA39
Moqri, Mohammadmahdi   IS-M,
  WE09
Mora Vargas, Jaime   SB22

Moradi, Esmaeel   SC49
Morais, Danielle   TD82
Morales, Gilberto   MA70
Morales, Juan Miguel   TD73
Morales, Ridley S.   MA70
Morales, Vanessa   WA40
Moran, Diego   MD46
Mordi, Benita   MC21
Moreira, Fernando   WD53
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Moreno-Garcia, Antonio   MC45,
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Morgan, Daniel   MA40
Morgan, Jasmine   SA01
Morgan, Shona   TB30
Morgan, Todd   WC39
Morin, Tom   WE36
Morita, Hiroshi   TA15
Moritz, Brent   SD45, TA45, TA71
Morlan, Bruce W.   SA39
Morrice, Douglas   TD33,
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Morrill, Thayer   MC71
Morrison, David   MC43
Morrow, Paula   SB06
Morrow, W. Ross   WE15
Mortaz, Ebrahim   TD50
Morton, Alec   WC79
Morton, David   MA48, MB72,
  TA20, TB49, TC73, WB35
Moryade, Seksun   WB73
Mosaly, Prithima   TD38
Moshref-Javadi, Mohammad
  SD65, WD49
Moskal, Mike   TA01
Möslein, Kathrin   MB32
Moss, Todd   WD22
Mostagir, Mohamed   SB81,
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Mosterman, Pieter   WD35
Motaei, Amir   SB64
Motahari-Nezhad, Hamid R.
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Motie, Mohammad   MA24
Moura, Pedro   SB36
Mourtos, Ioannis   WB50, WD52
Mousavi, Mohammad   TA68
Mousavian, Arsalan   WC62
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Moussawi-Haidar, Lama   WE32
Movahed Nejad, Mahyar   MB32
Mowrey, Corinne   TA20
Moya, Hiram   TB58
Moyal, Pascal   WD64
Mozumder, Pallab   TA35
Mu, Cun   MD51, TC52
Muckstadt, John   WC31
Mueller, Hans-George   TB66
Mueller, Juliane   WB51
Muggy, Luke   WE35
Muharremoglu, Alp   SA19, MC10
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Mulamootil, Lency   WC78
Muldoon, Frank   WB52
Mullen, James   TC37
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Mulvey, John   TC53, WB53
Mumford, Suzanne   WC76
Mun, KwonGi   MD22, TA38
Munir, Tahsin   SB83
Munoz, Francisco   SB73,
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Munson, Todd   MA51
Murage, Maureen   WA69
Murali, Karthik   SC12, TA12
Murali, Pavankumar   WB31
Murat, Alper   MC21, TA38, TD33,
  WA33, WC50, WD38
Muriel, Ana   SA77, WB38
Murphy, Frederic   WD68
Murray, Alan   SC26, SD26
Murray, Chase   TB01
Murray, Elizabeth   TC57
Murray-Tuite, Pamela   SC15, TC15
Murthy, Ishwar   WD58
Murthy, Nagesh   SD30, MC19
Musal, Rasim   WE65
Mut, Murat   TB52
Muthulingam, Suresh   SD04,
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Muthuraman, Kumar   SC53,
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Mutlu, Fatih   TA50, WB18, WD35
Mutlu, Nevin   MD37, WD17
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Nagarajan, Balaji   WC28
Nagarajan, Mahesh   SA04,
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Nageshwaraniyer, Saisrinivas
  TA75
Nageswaran, Leela   MD39
Nagi, Rakesh   TA50, TB49, TD01,
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Nagle, Frank   WA36
Nagurney, Anna   MD49, WB32
Nahak, Chandal   WE52

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Nair, Rahul   TC55
Najafi-Asadolahi, Sami   MD16,
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Nakamura, Brian   SA34, WC20
Nakamura, Hiroko   WC82
Nakamura, Taiga   SC31, SC32
Nakayama, Marvin   SD75
Nakiboglu, Gulsun   WA10
Nakkas, Alper   TD31
Nalca, Arcan   SA16
Nall, Clint   WA19
Nam, Hyoryung   SB31
Namen Leon, Isabel   SD40
Namkyu, Park   TB38
Nandi, Apurba   TA49
Nandkumar, Anand   MC33
Narasimhan, Sridhar   TB44
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Nardelli, Danijela   SA28
Naseraldin, Hussein   WA17
Nasiry, Javad   SB16, SB33,
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Nasrollah Zadeh, Seyed Amir Ali
  SA32
Nassiri, Shima   MB06
Nataraj, Nisha   MA35
Natarajan, Harihara   MD35
Natarajan, Karthik   SD53,
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Natarajan, Ramesh   WA12, WB62
Nateghi, Roshanak   WC80
Nathan, Alexandros   WD77
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Nault, Barrie   TC41, SA20
Naumova, Mariya   WE50
Navarte, Luis   SC34
Nazari, Asef   WC21
Nazarian, Ehsan   SA69, WA29
Nazerzadeh, Hamid   SA81, TB16
Nazzal, Dima   WD10, WE35
Nduka, Ifechukwu   MD66
Neagu, Nicoleta   TD25
Neal, Larry   SD79
Nediak, Mikhail   SA10, SB19
Nedich, Angelia   MB47,
  MC51, MD52
Needy, Kim   MC14
Neemuchwala, Hakimuddin
  TA38, WA33, WD38
Neff, Jessica   TB08
Negahban, Ashkan   WC30
Negoescu, Diana   MA41
Neill, Daniel   TD43
Nejad, Mahyar   MD21
Nekooeimehr, Iman   WB72
Nelson, Andrew   MB38
Nelson, Barry   SB75, MB66,
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  IS-M, WC20
Nemati, Sepehr   SA41
Nembhard, David A.   TA32
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Nemhauser, George   SB21,
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Nemirovski, Arkadi   MC51, WD46

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Nesbitt, Peter   TB49
Nestler, Scott   MB77
Nestor, Patrick   SA11
Netessine, Serguei   SA03, SB03,
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Neuburger, Jenny   WB42
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Newman, Jeff   MA28
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Ng, Adam   WB10
Ng, Dorbin Tobun   WE82
Ng, Szu Hui   MD68
Nguyen, Bao   WA28
Nguyen, Christine   TC22, WC40
Nguyen, Hoang   TC28
Nguyen, Huy   WC49
Nguyen, Jason   SC06, TB69
Nguyen, Kenneth   SB79, TD35
Nguyen, Thanh   WA79
Nguyen, Trang   SB46
Nguyen, Tri-Dung   MB71
Nguyen, Viet Anh   WA63
Ni, Eric   SA75
Ni, Jian   MC06
Ni, Jun   WB29, WE04
Ni, Ming   SA23, SB24
Niblett, Matthew   MB26
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Nickel, Stefan   TA11
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Nielsen, Elizabeth   MB77
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Nikoofal, Mohammad   SA16,
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Nikoue, Harold   TA28
Nikzad, Afshin   SD10
Ning, Jie   MA19
Ning, Minjing   TC29
Ning, Wei   IS-M
Ninh, Anh   TD04
Niño, Esmeralda   IS-T
Niranjan, Suman   WC68
Nittala, Lakshmi   WC05
Niu, Baozhuang   WE30
Niu, Ganggang   WB31
Niu, Huimin   TA27
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Nixon, Richard   IS-T
Niyirora, Jerome   MD75
Niznik, Tim   WC28
Nobles, Mallory   TD43
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Nogales Gomez, Amaya   TA43
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Nooraie, Seyed Vahid Rez   WB11
Noori, Hamid   WC11
Noorily, Susan   TD33
Norback, Judith   TA57
Norman, Bryan A.   MD41, TA40
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Norwood, Kevin   MC29
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Nouri, Hadis   WB66
Novais, Augusto   WB74
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Nowak, Maciek   TC23
Nowicki, David R.   WD35
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  MD47, WA38
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Okumura, Makoto   WE05
Okuse, Yoshiyuki   WE37
Olaleye, Olaitan   MD73
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Oron, Daniel   WB58
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Orso, Andrew   TA46
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Ott, Marion   TD71
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Otto, Kevin   MA02
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Ouyang, Liwen   WE39
Ouyang, Min   MB22
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Ouyang, Yun   MC20
Ouyang, Yuyuan   MB51
Ouyang, Zhi   TD32, WD31
Ovchinnikov, Anton   MA12, MC18, TB10, TB12, WD16
Oveis Gharan, Shayan   MD71
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Owen, Zachary   WD18
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Ozaydin, Ozay   WB78
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Ozdaglar, Asuman   SA81, SB50, SB81, SD10, MD48, TA65, TD52
Ozdemir, Deniz   WA21
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Ozkan, Gulru   SC02, TA33, TB11
Ozlen, Melih   SB21, MD50
Ozlu, Oguzhan   WB77
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Ozmen, Muberra   TA60
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Ozsakalli, Gokberk   WA21
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Palaparambil Dinesh, Lakshmi   WC52
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Pallone, Stephen   SC68
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Pan, Amy Xiajun   TD05
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Park, Inchae   WC33
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Parker, Nathan   WC12, WD73
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Parlakturk, Ali   SB10
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Qin, Fei   TA06
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Rodgers, Mark   WE72
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Rodosthenous, Neofytos   MA54
Rodriguez Alamo, Betzabe   MC35
Rodriguez, Alexander   MA74
Rodriguez, Diego Javier   WE48
Rodriguez, Gabriel   SB83
Rodriguez, Ilka   MC35
Rodriguez, J.Tinguaro   SC34
Rodriguez-Gomez, David   WB16
Rodriguez-Sanchez, Sara   SB30

Roeder, Theresa   TD57, WE38
Roehrig, Charles   TD41
Roels, Guillaume   SA03, SB17, SD02, TB45, WC04
Roet-Green, Ricky   MB10
Rogers, Dale   WE25
Roggenkamp, Nolan   MA01
Roginski, Jon   WB01
Roh, Taewoo   IS-T
Rohleder, Thomas   TB40
Rojas-Cordova, Alba   SB80
Rolka, Deborah   TD51
Rolling, Craig   IS-M
Rom, Walter   WD11
Roma, Paolo   WB70
Romeijn, Edwin   MB52, WD52, WE42
Romero Brufau, Santiago   SA39
Romero, Daniel   WB07, WE44
Romero, Gonzalo   SB09, TC16
Romero-Morales, Dolores   TA43
Romich, Andrew   MB36, MC01
Rong, Ying   MC12, WA12, WB44
Roni, Md   MA69
Rönnqvist, Mikael   SB70, MD70, TA70, WB48
Rook, Laurens   TA44, TC45
Roos, Kees   TB52
Rosa, Alberto   MA25
Rosales, Claudia   TA11
Rosario, Thiago   TD50
Rosas, Bryan   IS-T
Rosenbaum, Imry   SB54
Rosenberg, Lawrence   MA39
Rosenberger, Jay   MA74, MC52, MD81, WE69
Rosenthal, David   TD17
Rosen-Zvi, Michal   TC09
Roshan Zamir, Kiana   TB26
Roshanaei, Vahid   MC42
Roshchina, Vera   MC52
Rosoff, Heather   SB79, TA82, TD35
Rosokha, Yaroslav   MD03, TA17
Ross, Anthony   TA75, IS-T, WE04
Ross, Bill   WB03
Ross, Jason   TA73
Ross, Kai   SC69, MC70
Ross, Sheldon   TA80, WB75
Rosset, Saharon   WA83
Rossetti, Manuel   WA06, WA59
Rossi, Sebastiano   TB72
Roth, Aleda   SD31, MB05, TA33, TB11, WD24
Roth, Brian   MA27
Rothberg, Ed   TB56, WB43
Rothenberg, Sandra   MB12
Rothkopf, Alexander   WA41
Roughgarden, Tim   SD20
Roujas, Benjamin   TB60
Roumani, Yaman   WB38
Roumani, Yazan F.   WB38
Roumeliotis, George   WC76
Roundy, Robin   TD11
Roupin, Frédéric   SD52
Rouse, William   TA67
Rouskas, George   WE50
Rousseau, Louis-Martin   WA26, WA43, WC43
Roy, Abhik   TC78

Roy, Arkajyoti   WE42
Roy, Debjit   WA21
RoychoWEhury, Sayak   SB34, TB75
Royset, Johannes   SC07
Ru, Jun   SA23
Rubin, Eran   TC19
Rubin, Paul   SB35
Rubio-Herrero, Javier   SA32
Rudge, Travis   TB32
Rudi, Nils   SA36
Rudie, Keith   TD78
Rudin, Cynthia SC64, SD83, MA81, MD83, TD83, WE81
Rudloff, Birgit   TB50, TC53
Rudolf, Gabor   TC59
Ruegg, Melanie   SA70
Ruggiero, John   MD15
Rui, Huaxia   SB04
Ruiz, Carlos   SA07, TB73, WB74
Ruiz, Carlos Felipe   SD21, WC18, WE48
Ruiz, Roy   MC35
Ruiz-Hernandez, Diego   SA26, SC26
Runger, George   WA67, WB13, WE11
Rungtusanatham, Manus   MD14
Rush, Daniel   TB03
Rusmevichientong, Paat   SA18, TB16
Russell, Tim   MB35
Russo, Daniel   TB05
Russo, Suzana   WC59, WE33
Rust, Roland   MC32
Rusyaeva, Olga   WA63
Ruszczynski, Andrzej   MA83, TB47, TC51, WD47
Ruthmair, Mario   SB36
Ruthruff, Joseph   MB36
Ryan, Chris   MA41, TD39
Ryan, David   WD50
Ryan, Jennifer K.   SA77, MC32
Ryan, John   WE19
Ryan, Kevin   WB46
Ryan, Sarah M.   MC69, TC47, TD74
Rye, Erik   WB01
Ryoo, Hong Seo   SD72
Rysz, Maciej   SB49
Ryzhov, Ilya   SB29, SC21, SC75

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Saad, Walid   SB72
Saad, Yousef   SB55
Saat, Mohd Rapik   MB27, WB24, WB25
Saba, Samir   SC39
Saban, Daniela   SB11, SD20, MB71
Sabarshad, Hamid R.   SD25
Sabbaghi, Arman   SD66, MC67, WD67
Sabbaghi, Mostafa   WE05
Saberi, Sara   WB32
Saberian, Fatemeh   MB18, WD39, WE42
Sabharwal, Ashish   MD43, WB09, WC43

Sabouri, Alireza   SA41, TD40
Sacaleanu, Bogdan   TD80
Sachs, Anna-Lena   TA05, TC45
Sachse, Joshua   TC28
Sadat, Somayeh   MB42
Saddoune, Mohammed   WB28
Sadeghi, Elham SA49, TC83, WB49
Sadeghnejad Barkousa, Azar   TB01
Sadler, Evan   TA04
Sadykov, Ruslan   WA50
Saenz, Maria Jesus   WB12
Safaei, Nima   WD45
Saghaei, Abbase   IS-T
Saghafian, Soroush   WA06
Saharidis, George   TD25
Sahin, Guvenc   WB52
Sahin, Ozge   SB18, MC06, TB16, TD18, WB04
Sahinidis, Nick   SA43, MA43, MC55, WB55
Sahinyazan, Feyza   SB83
Sahoo, Anshuman   MA73, WE73
Sahraei-Ardakani, Mostafa   MB74
Said, Adnan   SB42
Saif, Ahmed   SB26
Sainathan, Arvind   MC69, WB17
Sajja, Shravan   SB80
Sajjadi, Seyed Javad   SA50
Sakata, Ichiro   WE78
Sakti, Apurba   WC69
Salah, Florian   TB72
Salahi, Maziar   WE52
Salahi, Niloofar   SA72
Salami, Maryam   SC55
Salar, Menekse   WA33
Salasar, Sesar   MA25
Salazar, Fernando   MC35
Saldana, Christopher   WA81
Saldanha da Gama, Francisco   TA11
Saleh, Moein   SD66
Salemi Parizi, Mahshid   WE40
Salge, Torsten-Oliver   WE33
Salhi-Koca, Asli   TC57
Salman, Sibel   SC50
Salmeron, Javier   MA72, WA60
Salo, Ahti   WD79
Saltzman, Robert   WE38
Salvador, Fabrizio   SA33, WA61
Salvagnin, Domenico   MB43
Samadi, Mohammadreza   TB49
Samantli, Gulay   WA16
Samat, Sonam   MA03
Samiedaluie, Saied   SB40, MC16
Samiee Daluie, Alireza   WD10
Samii, Behzad   WE72
Sammut, Claude   WB52
Samorani, Michele   TC31, WA16, WC83
Sampaio, Mauro   IS-T, IS-M
Sampath, Siddhartha   MA29
Sampson, Scott   WE45
Samudra, Michael   TC38
Samuel, Andrew   WB79
Samuelson, Douglas   IS-T
Samulowitz, Horst   MD43, TD63, WB09, WC43
Sanabria, David Escobar   WD35

Sanayei, Amir   WB33
Sanayei, Behzad   WE83
Sanchez, Fabian   WB07
Sanchez-Silva, Mauricio   WB80
Sandberg, Warren   SA38
Sanders, Mark   MA15
Sanders, Michael   MC29
Sanders, Rachel   MA35
Sandholm, Tuomas   MB71, MD71, TD39, WE51
Sandikci, Burhaneddin   SB38, SD47, MA09
Sanghani, Kunal   TC35
Sanita, Laura   TA36, WA46
Sankaran, Sethuraman   TC43
Sano, Ryuji   TB71
Sano, Yukie   WC83
Sansom, Stephanie   SC35, IS-T
Sanstad, Alan H.   WD72
Santana, Vagner   TD50
Santanam, Raghu   WA03, WD41
Santana-Viera, Victor   IS-M, WA10
Santander-Mercado, Alcides   WA72
Santi, Paul   MA70
Santiago, Claudio   SA48, WC62
Santiago, Leonardo   SB02
Santivanez, Jose   MD26
Santos, Cipriano   SD48, MD78, WB45
Santos, Clarice   TB55
Santos, Joost   TA35, WC63
Santos, Marcos   WA82
Santra, Sumitro   WA19
Sapkota, Nabin   TD62
Saraswat, Vijay   MD43
Sargut, Gökçe   MB04
Sarhadi, Hassan   IS-M, TB25
Sarhangian, Vahid   MC17, WA17
Sari, Birce   IS-T
Sarikprueck, Piampoom   MA74
Sarin, Rakesh   TC80
Sarin, Subhash C   TD29
Sarkar, Avijit   WC26
Sarkar, Sourish   WB14
Sarkar, Sumit   MA44, WD58
Sarmiento, Andres   SD21
Sasaki, Hajime   WE78
Sasaki, Mihiro   MA26
Sasanuma, Katsunobu   MB64, MC31
Sasaya, Toshinori   IS-T
Sassano, Antonio   SC36
Sauer, Lauren   WD40
Sauma, Enzo   SB73
Saunders, Michael   SD51
Sauppe, Jason   TB43
Sauré, Antoine   SB39, MC09, TD40, WA13, WC40
Saure, Denis   MB49, TB68
Sauser, Brian   TB50
Sava, Magda Gabriela   WB78
Savachkin, Alex   WB07
Savage, Sam L.   SA56
Savard, Gilles   WA19
Savelsbergh, Martin   TB82, TC23, TC49, WA24, WB46
Savin, Sergei   MC39, MD39
Savla, Ketan   MA24

Savva, Nicos   SA81, SC09, MA17, MD04
Sawaki, Katsushige   WA53
Sawaya, Nicolas   TD55
Sawe, Nik   WE73
Sawhney, Rapinder   TA25, WC25, WC29, WC52, WD15
Sawik, Tadeusz   WD11
Sawyer, Jim   MC76
Sayah, David   WB15
Sayim, K.Zeynep   WC78
Sayin, Filiz   MD66
Scaglione, Anna   SA72, WE72
Scala, Natalie   MB01, WE43
Scammon, Debra   WB42
Scarpel, Rodrigo   WD27
Scarpino, Samuel V   WB35
Scarsini, Marco   SA81
Scerri, Paul   TA01, TD01
Schaefer, Andrew   SA41, SB39, SB42, SC39, MB48, TC43, TD39, WD65
Schaefer, Brian   WA23
Schecter, Aaron   TD49
Scheinberg, Katya   SC51, MD51
Scheinker, David   TD17
Schell, Greggory   SA40
Scheller-Wolf, Alan   SD12, MB17, MB64, IS-M, MC31, MD39, TA42, TD65, WA06, WA57
Scherer, William   WD68
Schieber, Tiago   SA49
Schiller, Jordan   TC37
Schittekat, Patrick   WD27
Schlanser, Matt   TC39
Schlapp, Jochen   SD33
Schlickel, Maik   MC33
Schmeiser, Bruce   SB75, WB68
Schmerling, Edward   SB51
Schmidt, Alejandro   WB13
Schmidt, Andrea   SC76
Schmidt, Chuck   TD60
Schmidt, Glen   WB05
Schmidt, Marie   SA82
Schmidt, Ulrich   TD17
Schmidt, William   MC04, MC29, TA17, TB04
Schmiegelow, Michelle   SD40
Schmitt, Ketra   TA39, TC78
Schmitz, Edward   TD77
Schmorrow, Dylan   TD62
Schneider, Helmut   TD25, WB13, WE23
Schneider, Mark   WD63
Schöbel, Anita   SA82
Schoenbeck, Joe   SB23
Scholten, Lisa   TC82, TC82
Scholtes, Stefan   SC09, MB09
Scholz-Reiter, Bernd   WC10
Schonfeld, Paul   SC21, SC25
Schramm, Harrison   WD77
Schroeder, Daniel   TA01
Schroeder, Rob   TB08
Schruben, Lee   TD68
Schuh, Anna   TD41
Schultz, Ken   MA40, WA45
Schultz, Ruediger   SB48
Schulz, Arnaud   WE78
Schutten, Marco   WA26, WB25
Schuwirth, Nele   TC82

Schwarz, Michael   SB71
Schwenkler, Gustavo   MC54
Schwille, Michael   TC61
Schyns, Michael   SD28
Sciandrone, Marco   SC55
Scioletti, Mike   WC73
Scott, Alex   WE25
Scott, Graeme   TC28
Scott, James   WB35
Scott, Joseph   MA55
Scott, Rebecca   TB25, WD82
Seada, Aya   MB68
Seamans, Robert   TB03
Secchi, Enrico   SD31
Seck Tuoh Mora, Juan Carlos   TB26
Secomandi, Nicola   SC47, SD12, MB17, TA10
See, Brendan   MB71
Seed, Ian   WA56
Seelhorst, Michael   SA28
Sefair, Jorge A.   TC46
Segal, Ilya   SC71
Segev, Dorry   SA41, MB29
Seidmann, Abraham   SB38, SB77, WD45
Seifert, Matthias   WD80
Seifert, Ralf W.   TC60, WC07
Seiver, Adam   TC77
Sela, Alon   MA77
Selcuk, Baris   TD15
Sellmann, Meinolf   TD63, WB09
Semple, John   SB10, MA18
Semrud-Clikema, Margaret   MA83
Sen, Alper   TB19
Sen, Arun   SC44
Sen, Shilad   WD76
Sen, Suvrajeet   MD74, TB14, WA47, WB47
Sengul, Irem   WE35
Sensenich, Marc   TC37
Seo, Yong Won   WC45
Serban, Nicoleta   SB39, MC40, TD43
Seref, Michelle   TC81
Seref, Onur   TC81, WE40, WE81
Serin, Yasemin   MB82
Serpa, Juan   MB05, MB16
Serper, Elif Zeynep   MA50
Serrano, Adrian   SD23
Serrato García, Marco Antonio   WE06
Servi, Les   TD62
Sesek, Richard   WA33
Seshadri, Sridhar   TB04
Sethi, Saratendu   WB08
Sethi, Suresh   WA30
Sethuraman, Jay   SA77, SD20, WE46
Sethuraman, Samyukta   MB64
Setia, Pankaj   WB44
Seuken, Sven   TC71
Sever, Derya   MB23
Sewell, Edward   MC43
Sexton, Thomas   MD15
Seyed, Kian   WE38
Sezer, Semih O.   WC18
Shachat, Jason   MA45, WB45
Shachter, Ross   TD80, WD80
Shafaat, Ali   WE82

Shafique, Mubashsharul   SA43
Shah, Devavrat   WA18
Shah, Mrinalini   WD31
Shah, Nilay   IS-T, WA39
Shah, Rachna   SC06, MA04, MA31, MB05
Shahabi, Mehrdad   MA24, MC24
Shahabuddin, Syed   WC63
Shahbazi, Hossein   TC70
Shahinpour, Shahram   MA29, MB14
Shahvari, Omid   WB58
Shaked, Moshe   WB70
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Shaku, Kosuke   IS-T
Shallcross, David   SD36
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Shama, Gilli   WE54
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Shamsi, Davood   WC52
Shan, Xiaojun   WB79, WC74
Shan, Zhe (Jay)   SC32
Shanbhag, Uday   SC52, MA52, MB47, WC48
Shang, Jennifer   WD27
Shang, Kevin   SA12, MA11, MA16, MC10
Shang, Yan   SD16
Shankar, Ramesh   TD44, WA44
Shanthikumar, George   SC10, SD35, WB03
Shantia, Ali   WC10
Shao, Bing   MA32
Shao, Chenhui   MB37, TB83
Shao, Lusheng   WD15
Shao, Nan   WB31
Shao, Yihuan (Ethan)   TB21
Shaposhnik, Yaron   TD16
Shapoval, Andriy   WA32
Sharda, Ramesh   WC77
Sharif Azadeh, Shadi   WA19
Sharif, Azaz   MC42
Sharkey, Thomas   WA49, WC20, WC49
Sharma, Ajit   MA03
Sharma, Anuj   SC22
Sharma, Deepak   WE68
Sharma, Luv   SB33
Sharma, Mayank   MB31, WA12
Sharma, Rashmi   SB06
Sharma, Ratnesh   MB19
Sharma, Saumitra   WE76
Sharma, Shrutivandana   TA42
Sharma, Siddhartha   WD37
Sharpe, Michael B.   WB76
Shashank, Abhinav   TA31
Shateri, Mahsa   MB42
Shaw, Jason   WB83
Shaw, Paul   TD52
Shaw, Tina   MA29, WA28
Shayegh, Soheil   MB72
She, Jinjuan   TC70
Sheather, Simon   MA76
Shebalov, Sergey   TB28
Shechter, Steven   SA41, SC41, TD40
Sheikhzadeh, Alireza   WA59
Shen, Haipeng   TB17, WA45, WE83

Shen, Houcai   MA30
Shen, Ming-Chen   MB78
Shen, Shifei   WE79
Shen, Siqian   SB47, SB50, SD47, MA48, TA46, TB59, TD23
Shen, Wenjing   WA16, WE29
Shen, Xin   MD52
Shen, Yanfang   SD55
Shen, Yilin   SA49, TC83
Shen, Zuo-Jun Max   SB04, SD35, MD26, WA12
Sheng, Lifei   MA05
Sheng, Olivia   TD44, WC44
Shenoy, Prakash P.   TD80
Sheopuri, Anshul   TD16, TD37, WB31, WE81
Sher, Mikhail   WE51
Sherman, Anne   MB12
Sherwin, Mike   TA35
Sheth, Arnav   TC53
Shi, Cong   SB09, SD47, MC04, TA60
Shi, Jianjun   SA67, SC83, TB83, TC66, WA81, WD66
Shi, Jing   TC72
Shi, Leyuan   WA81
Shi, Lihui   TC75
Shi, Lu   MC75
Shi, Peng   MA64
Shi, Pengyi   TB40
Shi, Renhe   SB32
Shi, Ruixia (Sandy)   SA23
Shi, Tianqin   WE04
Shi, Tie   TC27
Shi, Wen   WD03
Shi, Xin   SA21, WC27
Shi, Xiutian   MA30
Shi, Yuhui   TC30
Shi, Yun   WA54
Shi, Zhenyu   WA67
Shier, Douglas   MA21
Shih, Hsu-Shih   WA82
Shih, Jesse   MB78
Shih, Mei-Cheng   TB27
Shim, Sangho   IS-T, WC46, WD49
Shimada, Tomoaki   WD44
Shimkin, Nahum   WC53
Shin, Hyoduk   SA03, SA11, MA06, MB06, TC18, TD03, WC05
Shin, Jinwoo   TC68
Shin, Kee Yong   IS-M
Shin, Seungjae   TC70
Shinde, Abhishek   WC30, WE09
Shirokikh, Oleg   MA49
Shittu, Ekundayo   MB73
Shkolnik, Alexander   SB65, TC54
Shlakhter, Oleksandr   MC26
Shoberg, Thomas   SB22
Shoemaker, Christine   TB73
Shojaie, Ali   TB42
Short, Jodi   MB45
Shorten, Robert   SB80
Shott, Tom   SC15
Showalter, Timothy   WC39
Shreve, Joni   WE76
Shrivastava, Abhishek   SC67, WC67
Shtub, Avraham   MD07
Shu, Zhichao   IS-M
Shugan, Steven   TC18

Shui, C. S.   TA23
Shukla, Vipul   TD78
Shunko, Masha   SA06, SB38, TA17
Shwartz, Larisa   TB31
Shwartz, Michael   TA81
Shylo, Oleg   MB48
Si, Wujun   MA67
Sibdari, Soheil   MB14
Siddiqui, Afzal   SA73, TB53
Siddiqui, Sauleh   MD73, WA72, WD40, WD82
Siebert, Johannes   WA80
Siemsen, Enno   SA33, MB45, TC45
Sierag, Dirk   TD18, WD53
Sierksma, Gerard   WE36
Sierra, Alvaro   WE44
Siirola, John   MC46
Sikavika, Katarina   WB22
Silberholz, John   MB39, MC48, TD50
Silbermayr, Lena   WE11
Silva Sotillo, Walter   MA35
Silva, Aneirson   WA82
Silva, Daniel   SA65
Silva, Dhania   MC35
Silva, Djalma   TB15
Silva, Graça   TC70
Silva, Jorge   TB37
Silva, Rachel   MA82
Silva, Rafaela   WE33
Silva-Monroy, Cesar   TD74
Silveira, Roseane   TA29
Sim, Melvyn   WC47
Simao, Hugo   TA74
Simard, Martin   MC70
Simatos, Florian   TC68
Simchi-Levi, David   SB03, MC04, MC29, MD12, TA19, TB18, TD06, WD18, MA20, WE30
Simeth, Markus   WC07
Simon, Howard   SC65
Simon, Jay   TB78, WC36
Simonetti, Arianna   TA51
Simsek, A. Serdar   SA19, SD19, TB18
Singh, Bismark   SB83, TB49, WB35
Singh, Narendra   TA33, WB12
Singh, Param   MB03
Singh, Sudhanshu   TA31
Singh, Sundeep   SC64
Singh, Tejinder   TA70
Singh, Yuvraj   SB83
Singham, Dashi   SC68, MC69
Singla, Naveen   TB77
Sinha, Amitabh   SC19, TA19
Sinha, Ankur   SD82
Sinha, Ashesh Kumar   TA64
Sinha, Kingshuk   SC05, SD04, MA04, TD04, WE35
Sinha, Shoubhik   SD04
Sioshansi, Ramteen   SA74
Sipahi, Rifat   WB72, WD78
Sir, Mustafa Y.   TB22, TD77
Sirignano, Justin   SC54, MC54
Sirinanda, Kashyapa   SC70
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IS-T Interactive Session – Tuesday (12:30-2:30)

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Skiani, Evangelia   WC31
Skolarus, Ted   SC09, SD09, IS-T
Skordilis, Erotokritos   TD25
Skroch, Paul   TB77
Slaugh, Vincent   WC10
Slednev, Viktor   WC72
Sleeth, Jeffrey   MD65
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Slikker, Marco   WE07
Sloan, Peter   TA16
Slonim, Anthony   SB80, MB40
Slopsema, Jim   TD47
Slotnick, Susan A.   WA07, WD11
Slowinski, Roman   TB35, WB82
Smalenberger, David   SA01
Smallwood, Brad   TC76
Smarslok, Benjamin   WE15
Smart, Matt   WC61
Smeers, Yves   SB74, TB74
Smilowitz, Karen   SC34,
  MC09, TA22
Smirnov, Dina   WD12
Smit, Laurens   SA78
Smith, Alice E.   MD14, TA18,
  TB59, TC20
Smith, Anne   SC79
Smith, Brian   SC71
Smith, Gary   TD61
Smith, J. Cole   SA29, SB29,
  MB36, MC01, MC14, MD48,
  TC46, TD59
Smith, James E.   MC78
Smith, James MacGregor   TB34,
  WD65
Smith, Jeffrey   WC30
Smith, Marc   TB81
Smith, Mark   WC61
Smith, Milton   SA70, WD58
Smith, Robert L.   MB52
Smith, Stephen   SD12
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Sniekers, Daphne   MA39
Snow, Arthur   SD15
Snyder, Lawrence V.   MC72,
  WC73
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Sobel, Matthew J.   TD11
Socher, Richard   TD63
Sodhi, Manbir   TC67
Soheili, Negar   MC52
Sohn, Soyoung   TC15
Sohoni, Milind   SB16,
  MB35, MD06
Sojoudi, Somayeh   SB72, WD74
Sokol, Joel   SB21, SC35, SC50,
  IS-T, WB77
Solak, Senay   SA40, SD35,
  TC31, TD36, WC28, WE28
Soldner, Mallory   MB34
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Soloveva, Svetlana   IS-M
Soltani, Taimaz   TA64
Soltanolkotabi, Mahdi   MC51
Somani, Kamalesh   TC27
Somervuori, Outi   SB82
Sommer, Amy   TA29, TD29
Sommer, Svenja   MD33,
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Song, Cen   WA79
Song, Chao-Yang   MA02
Song, Dong Yoon   SA22
Song, Eunhye   MB66
Song, Huaming   WE17
Song, Jaeyong   MA38
Song, Jie   MB81
Song, Jing-Sheng   SA12, SD16,
  MB06, MC10, WA59
Song, Jin-Hwa   TB23, TD55
Song, Ju Myung   WE48
Song, Sang Hwa   WB41
Song, Sanling   WA75
Song, Suoyuan   WB66
Song, Wheyming   WB38
Song, Ying   WA19
Song, Yingda   WD54
Song, Yongjia   SB47
Song, Yunfei   TB52
Song, Zhe   WD81
Sonmez, Erkut   MB17
Soofi, Ehsan   MD66
Sorensen, Kenneth   IS-T
Sória Buss, Amanda   IS-M
Sorice, Justin   TD61
Sorokin, Alexey   MB27
Soroush, Hossein   WB58
Sosa, Manuel   MB33
Sosic, Greys   WB12
Sosina, Sobambo   WB66, WD67
Sosulski, Kristen   WA13
Soto-Ferrari, Milton   WA41
Souder, David   WD22
Soumis, Francois   WB28
Souyris, Sebastián   MA73
Souza, Fernanda S. H.   SC36
Souza, Gil   SD12, MC05,
  MD05, TA06, WA10
Sowlati, Taraneh   MD70, WD63
Soyer, Refik   MD66
Sparrevik, Magnus   MB80
Speed, Mike   MA76, TC57, WB56
Speranza, M.Grazia   TB23,
  TC21, WC23
Spetzler, Carl   MA79, TA78
Spetzler, Chris   WA80
Spieksma, Flora   SA78, TB75
Spiliotopoulou, Eirini   WA41
Spinler, Stefan   MB75,
  WD72, WD75
Spitzley, Lee   IS-T
Spohrer, Jim   SA31
Spollen, Martin   WA78
Sprenger, Charlie   TB80
Sprintson, Alex   SC36
Squillante, Mark   MB31,
  MC65, WD72

Sreekumaran, Harikrishnan
  MD72, TB49
Sri Bhashyam, Sumitra   TA82
Sriskandarajah, Chelliah   SB30,
  TB69, TD31
Srivastava, Manish K.   WA02
Srivastava, Santosh   TA31
Srour, Jordan   MD23
St. John, Dia   MD48
Staats, Bradley   MA09, TA17
Stäblein, Thomas   MB50, TD30
Stahl, Ingolf   WC75
Stahl, James   MC42
Staid, Andrea   WC80
Stamatopoulos, Ioannis   MD10,
  WD05
Standaert, Willem   TA71
Stanford, David   MC42
Stangl, Tobias   MA45
Stanley, Deborah   TB66
Stauffer, Jon   SC09, TD17, WA35
Staum, Jeremy   SB54, MB66
Stave, Jennifer   WB01
Stavrulaki, Euthemia   TC18
SteadieSeifi, Maryam   TC23,
  WC26
Stecke, Kathy   WA30
Steeger, Gregory   SA74
Steele, J. Michael   WC64
Steeneck, Daniel   TD29
Steffy, Dan   MA46
Steggall, John   TC14
Stein, Joshua   SC41
Stein, Roger   WD02
Steinker, Sebastian   WD70
Steinlicht, Carrie   TB33
Stenius, Olof   MC50
Stepanov, Alexander   TB34
Stephens, Kimberlie   TB08
Steri, Roberto   MA71
Sterman, John   SC38
Stern, Matthew   WA65
Sternbeck, Michael   WE14
Steven, Adams   MB14
Stewart, Brandon   TB81
Stewart, Katherine   SB31
Stewart, Theodor J.   WA82
Steyvers, Mark   MA80
Stickle, Kelly   MD15
Stickney, Lisa   TA29
Stiglic, Mitja   WA24
Stillman, Anthony   TD29
Stimpson, Daniel   SD01
Sting, Fabian   SB33, SC02, MC33,
  MD33, WC02
Stockbridge, Rebecca   WB47
Stolletz, Raik   MB28, MB50
Stolyar, Alexander   MC65, SA64
Stone, Tom   TA79
Stonebraker, Jeff   TA79
Storer, Robert   WB48
Stouras, Konstantinos   MB10,
  WC06
Stoyan, Stephen   SD76
Stozhkov, Vladimir   MC49
Strack, Philipp   TA16
Strandberg, Erika   SD40
Straub, Detmar   WE02
Street, Nick   SA37, MD83,
  TC81, TD83
Ströhle, Philipp   WB17

Strömblad, Christopher   SD39
Strong, Ray   WA51
Strub, Oliver   TA43
Struben, Jeroen   WA42
Stults, Erica   MB73
Sturm, Stephan   MC54
Sturtevant, Dan   MA34, TA02
Styles, David   WB08
Su, Che-Lin   MA17
Su, Heng   MB66
Su, Lin   WC83, WE69
Su, Ping   WE41
Su, Qin   TD32
Su, Shong-Iee   WA26
Su, Wen   WC33
Su, Xuanming   SA10, MB10,
  MD18, TA04
Subramanian, Anand   SD76
Subramanian, Dharmashankar
  WB62
Subramanian, Hemang   TB44
Subramanian, Ravi   SC03, SC06,
  TA33, WA57, WB12, WB16
Subramanian, Shiva   TC16, WA15
Subramanian, Upender   SB45,
  MD03
Subramanyam, Ramanath   SC03
Sucu, Seda   WA21
Sudit, Moises   TB01
Suelz, Sandra   MB09
Suen, Sze-chuan   SB41
Suer, Gursel A.   TD58,
  WB26, WE12
Sueyoshi, Toshiyuki   WD02
Suh, Chang-Kyo   WA07
Sui, Zhenhuan   TA08
Suk, TongHoon   TC68, WB65
Sullivan, Kelly   SA50, TA50, TC75
Sultana, Rudy   SC71
Summerfield, Nichalin   WB26
Sun, Andy   SA29, SC46, MA72,
  MC74, TA60, TC72, WA73, WD74
Sun, Baohong   SD03, MB03
Sun, Bo   SB49
Sun, Can   MB44
Sun, Defeng   WE26
Sun, Fei   WE66
Sun, Hao   SA52
Sun, Haoying   SA04, TD12
Sun, Hongyue   WC66
Sun, Jimeng   SC77, TD42
Sun, Lihua   WE54
Sun, Lijun   WC78
Sun, Longsheng   SB22
Sun, Peng   SA12, SC12,
  MC78, WC23
Sun, Ruichen   MB48
Sun, Shaorong   WB70
Sun, Shengnan   WD29
Sun, Shudong   WA58
Sun, Shuzhen   WE41
Sun, Tian   TC32
Sun, Tianshu   MD31, WA37
Sun, Wei   SB09, TD16, WE81
Sun, Xubo   MD16
Sun, Y   SC24
Sun, Yacheng   SC19, WD37
Sun, Yang   WB38
Sun, Yanshuo   TD22
Sun, Yue   WB53
Sun, Yuekai   WA37

Sun, Yujiao   TD58
Sun, Yuqi   TD21
Sun, Zhanbo   TB24
Sun, Zhankun   MA10
Sun, Zhen   SC44
Sun, Zhengwe   TC80
Sunar, Nur   SB12, TA53, TA74, TD65
Sundaramoorthy, Arul   WC82
Sundararajan, Arun   MD31
Sung, Je Sang   MC49
Sung, Shin Woong   WA77, WD14
Sung, Yi-Shan   SC49, TA67, TD47
Süral, Haldun   SA21, SD21, MB28
Surana, Amit   TC01
Surana, Sagar   WE54
Surasvadi, Navaporn   SA10
Suresh, Santhosh   SD12
Suresh, Sukruth   WB36
Surti, Chirag   WD07
Sussman, Jeremy   SA40
Sussman, Joseph   SD49
Sutherland, Alexandra   SA80
Suzuki, Atsuo   TD33, WA53
Suzuki, Masato   IS-T
Swaminathan, Jayashankar   SD17, MC11, MC32, MD11, WA29
Swank, David   SB80
Swann, Julie   SB39, SD07, MB34, MC40
Swanson, E. Burton   WB36
Swanson, Tessa   SA83
Swaroop, Prem   TD28
Swartz, Colleen   TA81
Sweda, Timothy   MD21
Swenson, Brian   SC52
Swenson-Roth, Wendy   SD65, WC57
Swersey, Arthur   TC31
Swinney, Robert   SA12, TC06, TD06, WD04
Switzer, Fred   SC02, TA33
Syeda-Mahmood, Tanveer   WA09
Szabo, Gabor   WC08
Szechtman, Roberto   SA75
Szeto, W. Y.   TA23
Szidarovszky, Ferenc   TA37
Szmerekovsky, Joseph   MD30, WD21
Szolovits, Peter   SA39
Szpruch, Lukasz   WB47
Szwarcfiter, Jayme   TB55

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Taaffe, Kevin   SC40
Tabaie, Azade   WA33, WD38
Tabesh, Pooya   WE44
Tabizadeh, Maryam   SD70
Taboada, Heidi   WE66
Tadelis, Steve   SB20
Taghavi, Majid   WC48
Tahbaz-Salehi, Alireza   SB53, SB81, MC54, TC06
Tajik, Nazanin   WA26
Takac, Martin   MA52
Takahashi, Paul Y.   SA39
Takano, Keiji   MD43
Takano, Yuji   IS-M, WC83
Takano, Yuto   TD72
Takanokura, Masato   WD38

Takashima, Ryuta   SA73, TA72, TC26, TD72, WA53
Takayasu, Koji   IS-T
Taki, Seiko   WD38
Taktak, Raouia   WA55
Talantsev, Anton   TC29
Talebi, Sahar   WE50
Talebian, Ahmadreza   TD27
Talgam-Cohen, Inbal   SD20
Tallorin, Lorillee   SC83
Talluri, Kalyan   TB19
Talluri, Srinivas   TA11, TC11
Talukder, Ashit   MC66
Talukder, Hisham   SC77
Tambe, Milind   TA82, WA79
Tan, Baris   SC65, WD65
Tan, Chin Hon   WD38
Tan, Jane Xue   MD31
Tan, Joseph   MC37
Tan, Lijia   WB45
Tan, Siah Hong   TC72
Tan, Sue Nee   TB73
Tan, Tarkan   TC10, TD69, WB27
Tan, Tom   MA17
Tan, Yi   WE36
Tan, Yinliang (Ricky)   SC05
Tan, Yong   MD31, MD44
Tan, Yue   MB31
Tanai, Yertai   WA07
Tanaka, Ken-ichi   SD26, MA26
Tanaka, Makoto   SC73, TB53
Taneri, Niyazi   SD33
Tang, Chris   MB16, SA10, SC12, WB23
Tang, Guochun   TD38
Tang, Liang   TA51
Tang, Lixin   SD30, MD30, TB30, TC72, WD50, WE26
Tang, Muchen   WB10
Tang, Pingzhong   MC71, TB71
Tang, Qihe   TD64
Tang, Qing   WC09
Tang, Ruoliang   WA33
Tang, Sammi Yu   SC04, MC16
Tang, Shoupeng   MD24
Tang, Victor   TB31
Tang, Wenjie   WD80
Tang, Wenyuan   MB19
Tang, Xiaocheng   MD51
Tanrisever, Fehmi   MA16, WE24
Tansel, Barbaros   MB21, MC34
Tansipong, Praowpan   SC04
Tao, Yi   TC11, WC11
Tarakci, Hakan   WC29
Tarakci, Murat   SC02
Tarantilis, Christos   IS-T
Tarel, Guillaume   MD56
Tarim, S. Armagan   WC60, WE52
TariVerdi, Mercedeh   TD22
Tarnutzer, Brett   SD71
Tarvin, Antony   SA43
Tas, Duygu   TA22
Tas, Sinan   WA34
Taslimi, Masoumeh   SB26
Tata, Amulya   WD44
Tatari, Omer   WB69
Tatman, Joe   TD61
Tatman, Sean   TD61
Tavlaridis-Gyparakis, Kostas   WA55
Tavoni, massimo   MD69, SC73

Tawarmalani, Mohit   SB46, MA46, MC55, TB46, TD03
Tay, Joel   WE47
Taylor, James   WD70
Taylor, Jeff   MB24
Taylor, Jonathan   WA37
Taylor, Josh   MC72
Taylor, Marianne   WC40
Taylor, Michael   WB59
Taylor, Quentin   WA19
Taylor, Sean   TC03
Taylor, Terry   SD05, MC11
Tayur, Sridhar   WA06, WC10
Teague, Walter   SB56
Teh, Pei-Lee   SA20, WB36
Tehan, Tara   TD17
Tejada, Jeremy   MA35
Tekin, Salih   WB53
Teksan, Z. Melis   TD23
Telang, Rahul   TC41
Telatar, Erdem   MD20
Tempelmeier, Horst   WA59
Ten Caten, Carla Schwengbe   IS-M
Tenenbaum, Joshua   SD37
Teng, Jiulin   WD44
Tenhiala, Antti   WC45
Teo, Chung-Piaw   SD47, SD53
Teodorovic, Dusan   TC28
Terekhov, Daria   SA65
Tereyagoglu, Necati   SA10, SC03, WC16
Ter-Hovhannisyan, Vardges   TB77
Terlaky, Tamás   TA52, TC51, WE52
Terpenny, Janis   TD59
Terwiesch, Christian   SA09, MC39, WC06
Tesfatsion, Leigh   TA44
Testa, Mariapaola   WA10
Teter, Mike   WA01
Tetlock, Philip   MA80
Tetterson, James   WB08
Teunter, Ruud   SB35, TD75
Tew, Jeffrey David   WA11, WE08
Teytelboym, Alex   SA81, MD48
Tezcan, Tolga   SB77, MB65, TB17, TB40
Tezcaner Ozturk, Diclehan   MA73
Tezel, Birce   WE43
Thagiah, Sam   TC37
Thai, My   SA49, SB47
Thakkar, Jitesh J   WD26
Thakran, Kanika   MA31
Thangiah, Sam   TC37
Thatchenkery, Sruthi   SB02
Thayer, Ashley   TD29
Theesar Shanmugam, Jeeva Sathya   TC37
Thekdi, Shital   WC63
Theokary, Carol   TC41
Thiele, Aurelie   SD54, MD40, WB19
Thimmapuram, Prakash   SC72
Thirumalai, N.C.   MD35
Thomas, Barrett   SB21, SD21, MD32, TB32, WE25
Thomas, Bex   MD20
Thomas, Douglas   MB70, TA45
Thomas, Gail   TB08
Thomas, Neethi   WC76
Thomas, Philip   SD80
Thomas, Valerie   MB72, SA69

Thompson, Brian   WC20
Thompson, James   TD68
Thompson, Matthew   MA70
Thompson, Theodore   TD51
Thonemann, Ulrich   MA45, MC50, TC45, WB60
Thorvaldsen, Sondre   WD25
Thraves, Charles   SC03
Thulasiraman, Krishnaiya   WD11
Tian, Fang   WB12
Tian, Haoshu   SA54
Tian, Lin   SA11
Tian, Shaonan   WD63
Tian, Yuan   WC48
Tian, Zhili   WD02
Tien, Kai-Wen   SD75
Tieves, Martin   MA36
Tilson, David   SC39
Tilson, Vera   SB38, SC39, WC57
Timmer, Douglas   TB25
Tindle, John   IS-T
Tino, Clayton   SD28
Tiong, Ewing   TB41
Titman, Sheridan   SC53
Tiwari, Vikram   SA38
Tobia, Michael   WC20
Toda, Takahisa   MC43
Todd, Andrew   WD68
Todosijevic, Raca   SB55
Toerper, Matthew   WD40
Toffel, Michael   MB45
Tokgoz, Emre   TA51, WB81
Toktay, Beril   SB12, SD06, TA06, TB65, TB69, TC12, TD69, WA12, WA57
Tokuta, Alade   SB37
Tollefson, Eric   SB75
Tomasgard, Asgeir   MC47
Tomastik, Robert   SA77
Tomlin, Brian   MC16, WA06
Tomlins, Scott   WC39
Tomoaia-Cotisel, Andrada   WB42
Tompaidis, Stathis   TB75, WD54
Tong, Jordan   SB45
Tong, Lu   MD25
Tong, Seung Hoon   MC83
Tong, Shilu   WE29
Tong, Yue   WB31, WC27
Tongarlak, Mustafa   SC12
Toor, Harpreet   MB01
Topaloglu, Engin   WA27
Topaloglu, Huseyin   SA18, SB18, SC18, SD18, MA18, TA10, WB16
Topan, Engin   TC10
Topuz, Kazim   TC38
Torabi, Elham   TB39
Toriello, Alejandro   MD23, TB23, TC22, TD46, WD51
Toriumi, Shigeki   MB26, TC26
Torrico, Alfredo   WE55
Tortonesi, Mauro   TB31
Tóth, Boglárka G   WD55
Toth, Sandor   MC70, SC69
Toubaline, Sonia   WA55
Toumazis, Iakovos   WA39
Tovey, Craig   SB75
Townsley, Rachel   SD41, MC75
Towsley, Don   MC65
Toy, Ozgur   WA59
Toyasaki, Fuminori   TA35
Trafalis, Theodore   WB81

Trainor, Joseph   SC15, TC15
Tramontani, Andrea   MB46, WB43
Tran, Huguette   WD35
Tran, Tony   SA65
Tran, Uyen   TA25
Trani, Antonio   MA14
Transchel, Sandra   WB60, WC30
Traore, Ismail   SC70
Trapp, Andrew   MB73, MB83, MC14
Trautman, Todd   TD36
Trautmann, Norbert   TA43, WA43
Trespalacios, Francisco   TA55
Trexel, Jonathan   WE79
Triantis, Kostas   SC15, TC15
Trichakis, Nikos   MC18, TA53
Tripathy, Anshuman   WE02
Tripsas, Mary   MB38
Troy, Samuel   SA26
Truong, Van-Anh   SB09, SB40, TD11
Tsai, Jeffrey   MA83
Tsai, Peifang   MC81
Tsai, Wan-Yu   WA13
Tsao, Jacob   WA62
Tsay, Andy   MD16
Tsay, Chia-Jung   MC45
Tsemekhman, Kiril   WB83, WD37
Tseng, Chung-Li   WD72
Tseng, Fan   WE38
Tseng, Shih-Hsien   TA08
Tsetlin, Ilia   MC78, WC79
Tsitsiklis, John   SB81, SD64, TD65
Tsodikov, Alex   SD67
Tsoukalas, Gerry   TA53
Tsuda, Koji   MD43
Tsui, Kwok Leung   SC67, WC67
Tsujimura, Motoh   WD69
Tsukamoto, Steven   TD50
Tsung, Fugee   WB66, WC66, WD67
Tsurkov, Vladimir   IS-T
Tucker, Anita   TB39, TD17
Tulett, David   IS-M, TB25
Tumuluri, Praveen   WC35
Tunc, Huseyin   WC60, WE52
Tunc, Sait   WA62
Tunc, Sidika   TA60
Tungtisanont, Niratcha Grace   WD24
Tuo, Rui   MB66
Tuohy, Aidan   WB74
Turan, Beyza   IS-T
Turan, Fikret Korhan   WB13
Turcic, Danko   MB16
Turcotte, David   SD35
Turgut, Ozgu   WC50
Turkcan, Ayten   SD42
Turkgenci, Arda   TC58
Turner, Delavane   MB73
Turner, John   SC19
Turner, Ryan   SB44
Turnquist, Mark   SC23, WA25
Turrini, Laura   TB06, WD70
Tursun, Umit   TA50
Tutunchi, Golbarg K.   SC82
Tuzhilin, Alexander   TD83
Tweddale, Scott   SC69
Tyagi, Satish   WD81

Tyber, Steven   MD20
Tyldesley, Scott   WC40
Tzeng, Gwo-Hshiung   IS-T
Tzimerman, Avinoam   MA06, MD07
Tziogas, Charalampos   WA35

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Uchoa, Eduardo   WA50
Ucko, Alexis   WD28
Uckun, Canan   SA47, SC72, TC04, TC74, TD74
Udell, Madeleine   SA55
Udenio, Maximilliano   MB11
Ugray, Zsolt   WA36
Uhan, Nelson   WB57, WD51
Uichanco, Joline   TC16, WA15
Ukkusuri, Satish   WC25
Ukai, Takamori   IS-M
Ulengin, Fusun   WB14
Ulku, M. Ali   WA23
Ülkü, Sezer   MC12, TC05, WA04
Ullrich, Kristoph   WC30
Ulu, Canan   MA45, MC78, TC59, TD05, WC19
Uludag, Ilknur   TA18
Ulukus, Yasin   WD65
Ulus, Firdevs   TB50
Um, SungYong   SC37
Umang, Nitish   MB23
Umetani, Shunji   MA26
Umit, Hakan   WE72
Unkelbach, Jan   WE42
Unland, Rainer   TA44
Unnikrishnan, Avinash   MA24, MC24
Unver, Utku   SC39
Upadhyay, Amit   MC27
Upatising, Benjavan   SA39
Uppari, Bhavani Shanker   SB19, WD18
Urata, Junji   IS-M
Urbach, David   MC42
Urban, Timothy L.   SB23
Urem, Ozlem   WB29
Urgaonkar, Bhuvan   SD49
Urrea Castaño, Gloria Cecilia   SC22, WB34
Uryasev, Stan   TD56, WD82
Ushizima, Daniela   TD67
Usta, Mericcan   WC15
Uster, Halit   SA21, MA69, MC21, TD22, WE05
Ustun, Berk   MD83
Ustun, Ceyda   WB13
Uyan, Berkcan   MA40
Uzicanin, Amra   IS-M
Uzsoy, Reha   WE35
Uzun, Kerem   IS-T

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Vaculin, Roman   WC09
Vad Karsten, Christian   WB21
Vadlamani, Venkata Surya   TA49
Vaghefi, Seyed   SA72
Vahabzadeh, Ali   WC17
Vahdatzad, Vahab   MC42
Vahn, Gah-Yi   SC64

Vaidyanathan, Ramnath   WE14
Vairaktarakis, George   MA30, MD30
Vaisman, Slava   WB62
Vakharia, Asoo   WE18
Vakhutinsky, Andrew   TA18
Valdes, Leon   MC12
Valencia, Carlos   SD48, MA70, WC18
Valenzuela, Jorge   SB73, IS-M, TD50, WE74
Valeva, Silviya   TB32
Valiakos, Athanasios   WA82
Valibeig, Nooshin   IS-T
Vallerand, Steve   MC70
Valogianni, Konstantina   TA44
Van Ackooij, Wim   WA55
Van Barneveld, Thije   TD22
Van Blommestein, Kevin   SA02
Van De Velde, Steef   TC45
Van Den Berg, Eric   SD36
Van Den Berg, V. A. C   MA25
Van Den Poel, Dirk   SC23, MA37, TD37
Van Der Gaast, Jelmer   TA75
Van Der Heijden, Matthieu   TD60
Van Der Meer, Robert   WA21
Van Der Mei, Rob   TD18, TD22
Van Der Merwe, Martijn   SB21
Van Der Rest, Jean-Pierre   TD18
Van Der Vliet, Kasper   TC33
Van Der Wal, Ariën   MD48
Van Der Weijde, Harry   MA25, TB74
Van Der Westhuizen, Jacques   TA70
Van Dorp, Johan Rene   MD66
Van Dyke, Carl   MC27
Van Eeden, Karin   TC38
Van Erp, Paul   WD28
Van Heck, Eric   SA71
Van Heeswijk, Wouter   WA26
Van Herwegen, Michiel   TD37
Van Hoeve, Willem-Jan   MC43, MD43, WC43
Van Houtum, Geert-Jan   MB67, MC50, TC10, TC60, WB27, WE66
Van Jaarsveld, Willem   MB17
Van Leeuwen, Steven   TC28
Van Mieghem, Jan   SA06, SD09
Van Ommeren, Jan-Kees   WA21
Van Oyen, Mark   SC41, TB40, TC39
Van Roy, Benjamin   MC64, TB05
Van Ryzin, Garrett   SA19, SD78, MA18, MC19, TB18, TB65, WC16
Van Scotter, James   WE76
Van Slyke, Richard   MB08
Van Urk, Rick   WB25
Van Wassenhove, Luk   SD34, MC11, TB06, TB12, TC12, WA35
Van Woensel, Tom   SB05, SB23, SC23, SD23, MB23, TB23, TC23, TC49, WB23, WC23, WC26, WE07
Vanajakumari, Manoj   SB30
Vandaele, Nico   TD10
Vandal, Valerie   MA39
Vanderbeck, Francois   WA50
Vanderbei, Robert   TB50

VanEnk, Richard   TB41
Vanli, Arda   TC75, WA51, WA75
Vanneste, Bart S.   SD29
Varas, Mauricio   WC32
Vargas Zuluaga, Maria Fernanda   TB58
Vargas, Luis   WB38, WB78
Vargas, Marcos   SD48
Varshney, Lav   TA04
Varzgani, Nilofar   SA78
Vasudeva, Vivek   SB43
Vayanos, Phebe   TA47
Vaze, Vikrant   SB28, TD28, WE28
Vaziri, Baback   WE36
Vaziri, Masoud   TC67
Veatch, Michael   MB35
Vedantam, Aditya   WB10
Veenstra, Marjolein   WA26
Veeramany, Arun   WC78
Veeraraghavan, Senthil   SA10, SA17, MB10, MC17
Velazquez, Marie   WE75
Velazquez-Martinez, Josue   TD69, WA23
Velliou, Eirini   TC58
Venkatachalam, Saravanan   MC21, MD47
Venkataraman, Sriram   SC33, SD31
Venkatasubramanian, Nalini   MC68
Venkateswaran, Venkat   WD41
Venkatraman, Vinod   MA38
Ventresca, Mario   TA49
Ventura, Dan   WB31
Ventura, Jose A.   TB26, WB25
Vera, Dusya   WE44
Vera, Jorge   MD70
Vera, Juan C.   TD53
Vercamer, Dauwe   SC23
Veremyev, Alexander   SA50, MB49, MC49
Vergara, Hector A.   SB25, MA23, MC23
Verhall, Cameron   WB22
Verhoef, E. T.   MA25
Verma, Amit   WE36
Verma, Anoop   WD81
Verma, Manish   IS-M,TB25, TD34, WE25
Verma, Nishant Kumar   WC30, WE09
Verma, Rohit   SD31, MA31, MB12
Vershynin, Roman   TC68
Verter, Vedat   SB26, SB40, MA39, MB42, MC40, MD41, TB35, TD34, WB12
Veselka, Thomas   TC73
Vesilo, Rein   TD65
Vetta, Adrian   TA16
Vickery, Shawnee   SC05
Victorino, Liana   MA31, SD31
Vidal, Thibaut   SD76, TC52
Vidyanti, Irene   SD41, MC75, TC42
Vidyarthi, Navneet   WD10
Vielma, Juan Pablo   SB46, SD46, TB46, TB68, WC08
Vijayaraghavan, Ravi   TD37, WB37

Vila-Parrish, Anita   TA57
Villa Betancur, Sebastián   SC22, WB34
Villanueva, Diane   WE15
Villas-Boas, Miguel   SB04
Vinel, Alexander   SC47
Vinze, Ajay   WD41
Vis, Iris   WB17
Viswanathan, Meera   MC75
Viswanathan, S   MC27, MC69
Viswanathan, Siva   MD31, WA37
Vitoriano, Begona   SC34
Vivas Valencia, Carolina   SD41
Vlasiou, Maria   MC65, WB63
Vo, Christopher   WC62
Voccia, Stacy   MD23
Vodopivec, Neža   SC25
Vogiatzis, Chrysafis   SB50, SC49
Vojvodic, Goran   TC73
Volk, Michael   SC39
Volovoi, Vitali   WC53
Von Heymann, Fred   MB46
Von Winterfeldt, Detlof   SB79, TA82
Voss, Stefan   SA70, TB07
Vossen, Thomas   SD28, MA18, MD28
Voyvoda, Ebru   MB82
Vu, Ky   SB46
Vu, Vince   MB55
Vulcano, Gustavo   SA10, MA18, TB19, WB04
Vuppala, Sunil   TD72

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Waddell, Lucas   MB43
Waechter, Andreas   SA51, SD51, MD52
Wagner, David   WE19
Wagner, Laura   WE24
Wagner, Michael   MC72
Wai, Hoi To   SA72
Wajda, Theresa   TC37
Wakolbinger, Tina   TA35, TB06
Walczak, Darius   SD19, MB18, MD19
Waldfogel, Joel   MA38
Walker, Cameron   WD50
Walker, Michael   MA75
Wall, Patricia   WC31
Wallace, John   WC76
Wallace, Stein W.   MB23, WB47
Wallace, William   WC20, WC49
Wallenius, Jyrki   SB82, SD82
Waller, Travis   TD28, WB52, WC26
Wallwater, Aya   WC31
Walrand, Jean   WB65
Walsman, Matthew   WE45
Walter, Fabian   MC23
Walteros, Jose   MC49
Walton, C. Michael   IS-T
Walton, Neil   WB65
Waltz, Richard   MC56
Wan, Guangyu   WC60
Wan, Guohua   TD38
Wan, Haohua   SC10, SD54
Wan, Hong   MA66
Wan, Xiangwei   WA54

Wan, Zhixi   MB06, TB69, TD45, WC02, WE04
Wang, Alan G.   MC37, TC81
Wang, Andi   WB66, WD67
Wang, Ben-Hao   MD09
Wang, Biao   SB42
Wang, Billy   WC28
Wang, Bruce X.   SB25
Wang, Chen   SD48, WB79, WE08
Wang, Cheng-Marshal   WD69
Wang, Chih-Hao   MB75
Wang, Chun   MC53, WA53
Wang, Chung-Hsiao   TD73
Wang, Chunlin   WB05
Wang, Dashun   TD16
Wang, Derek   WD02
Wang, Dongyang Ester   TD33, WA38
Wang, Fan   MD35, TA77, IS-T
Wang, Fulton   MA81
Wang, Gang   MD11, WB03, WE12
Wang, Hai   SD25
Wang, Haibo   IS-M, WB50
Wang, Haijun   SA35
Wang, Haiyan   WE29
Wang, Haizhong   MA70
Wang, Hao   MA52
Wang, He   TA19, TD06, WD18
Wang, Honggang   WE49
Wang, Hui   MB37, WA29
Wang, Huimin   WC71
Wang, I-Lin   MA78
Wang, Ji   WC28
Wang, Jialei   SC83, TB68
Wang, Jian   MC25
Wang, Jianfu   WC17
Wang, Jianhui   MC74, TA73, TC74, WA73, WA74, WC67, WE74
Wang, Jiashan   MA52
Wang, Jing   SA44
Wang, Jingguo   MA44
Wang, Jingqi   MB06
Wang, Jue   SB19
Wang, Jun   TC15
Wang, Jun Qiang   MD30, TC58
Wang, Kaibo   SB66, MB67, TB67, WD67, WE67
Wang, Kailai   SC26
Wang, Kan   MB37
Wang, Ke   TC15
Wang, Ko-Yang   MB78
Wang, L. Robin   IS-M
Wang, Lan   WE18
Wang, Lei   TD44, WA44
Wang, Liangyan   IS-M
Wang, Liyan   TC67
Wang, Lizhi   MD52, TD48, WA73, WC50, WE69
Wang, Lu   SA06, TD19
Wang, Mengdi   MB47
Wang, Mike   SC04
Wang, Na   MD81
Wang, Ningchuan   SA52
Wang, Pingfeng   WE11
Wang, Qianfan   TC47
Wang, Qianyi   WD46
Wang, Qinan   WC60
Wang, Qing   IS-T
Wang, Qiong   SC10
Wang, Quan   SA44

Wang, Rob   WB68
Wang, Rowan   WB75
Wang, Ruxian   SB18, MC06, TB16
Wang, Shengbin   TB30
Wang, Shouqiang   SA04, SA12, TB11
Wang, Shouyi   SD81, MA83, SD81
Wang, Shuhui   SC37
Wang, Shuyi   WB19
Wang, Tan   SB33
Wang, Tawei   MA37, TB53
Wang, Tian   WB14
Wang, Tingmao   MD65
Wang, Tong   SC10, TA05, TD83
Wang, Wei   MB18, IS-M, MD19, TB28, WB51
Wang, Wen   SB25
Wang, Wenbin   SD12
Wang, Wenjun   TC81
Wang, Wen-Ya   TA41
Wang, Xi   SA37
Wang, Xia   WC83
Wang, Xiaofang   MD39
Wang, Xiaojia   WA28
Wang, Xiaojuan   WA11
Wang, Xiaojun   WA37
Wang, Xiaoqing   TB21, TC22, WA24
Wang, Ximing   TC83
Wang, Xin   MA19, MB23, WE21, WE67, WE83
Wang, Xinchang   MB17, TC19, WA65
Wang, Xing   TD47, WA24
Wang, Xingyin   MB21
Wang, Xinping   WD29
Wang, Xinshang   SB09
Wang, Xuan   WA64, WB13
Wang, Yacan   WD30
Wang, Yan   TA82
Wang, Yanbo   TD02
Wang, Yang   SA81, TD44
Wang, Yaping   TC50
Wang, Yifan   MA72
Wang, Yijun   WC12
Wang, Yiming   SC49, MA49
Wang, Yingfei   MB47
Wang, Yingfeng   TC26, WC11
Wang, Yiou   SC23, SD25, IS-T
Wang, Yitong   IS-M
Wang, Yiwei   SA54
Wang, Yixin (Iris)   TB04
Wang, Yu   SB45, MA09, MD03, TC26
Wang, Yueheng   MA02
Wang, Yulan   WD06
Wang, Zhaodong   TC27, WD21
Wang, Zhe   MC64, WC19
Wang, Zheng   MB54
Wang, Zhiguang   TB33
Wang, Zhiwei   WB25
Wang, Zi   MD51
Wang, Zihe   TB71
Wang, Zimo   TA66
Wang, Ziteng   WB07
Wang, Zizhuo   SA18, MA19, MC06, WD19
Ward, Amy   SB17, MB65, TB17, WC17
Wardell III, Clarence   IS-M
Warner, Keith   TC14

Warnick, Sean   WB54
Warren, Ronald   SD15
Warsing, Donald   WE12
Warziniack, Travis   TC14
Wasil, Edward   SB35, MB21
Wasserman, Larry   SD38
Wassick, John M.   TB37
Watanabe, Daisuke   MB26
Watanabe, Takayuki   MD43
Watcha, Daena   SB41
Waterer, Hamish   SB43
Watkins, Kari   MB25
Watson, Jean-Paul   SB73, SC43, MC46, TC47, TD74
Wattal, Sunil   SC37, SD44, TA03
Weatherford, Larry   TB28
Weaver, Brian   WA66
Webb, Erin   TC69
Weber, Charles   TB09, WA02
Weber, Leah   SB39, WC40
Weber, Libby   WD22
Weber, Thomas   SA53, TB70, WA63, WC41, WC70
Webster, Mort   SD49
Webster, Scott   SA04, SB16
Webster, Steven   WD41
Weckerly, Aaron   TC37
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Wee, Kwan Eng   MC16
Wegryn, Glenn   SD77
Wei, Bo   WB18
Wei, Ermin   SB50
Wei, John   WC39
Wei, Lai   IS-M TC73
Wei, Mike   SC19, WD18
Wei, Ran   SD26
Wei, Xiahua (Anny)   TB03, WC05
Wei, Xiupeng   WD81
Wei, Yehua   MC04, MC29, TD06, WA64, WC64, WE64
Weil, Benoit   WE02
Weinan, E.   SA54
Weinstein, Alexander   TA19
Weintraub, Andres   MC47
Weintraub, Gabriel   SB11, MB71, TA16, TA65
Weinzimer, Phil   WA36
Weis, Allison   MB69
Weiss, Jason   MA25
Welburn, Jonathan   WC63
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Wen, Zheng   TB05
Wernz, Christian   SB80, MB40
West, Christopher   WE76
Westerlund, Tapio   TA55
Westervelt, James   SC69
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Wets, Roger   MC08, MC47
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Wheeler, Richard   WC62
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Wickramage, Nadeepa   WA52
Wickstrom, Leah   TD78
Wiecek, Margaret   SA82, TC52
Wiegele, Angelika   SD52
Wierman, Adam   SB72, MB19, TB64, TD71, WC17
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Wikum, Erick   MD37,
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Wilck, Joseph   WE23
Wiley, Mark   MB56
Wilhite, Chelsea   MB12, IS-M
Wilkins, Alan   WB22
Willemain, Thomas   SC01
Williams, Aaron   TB01
Williams, Jonathan   MD12
Williams, Justin   IS-T
Williams, Loren   SD11
Williams, Mark   SD09
Williams, Michele   SC29
Williams, Molly   MD65, TA38
Williamson, David   SB18
Willis, Henry   WA79
Willoughby, Keith   TD57, WD36
Willoughby, Kelvin   WA02
Wills, Sherry   WE40
Wilson, Alyson   WA66
Wilson, Brad   WD73
Wilson, James   SB75, SD75,
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Wilton, Megan   SA80
Wimonkittiwat, Poomyos   MD53
Windham, Matthew   MB77
Winkler, Robert   MC78, TD79
Winters, Jeff   TB76
Wirth, Fabian   SB80
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Wisniewski, Pamela   IS-T
Witt, David   WC78
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Witz, Steven M.   MD67
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Wogrin, Sonja   MC73,
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Wojtowicz, James   SA34, WC20
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Wollega, Ebisa   WD72
Wollenberg, Nadine   SB48
Wollenberg, Tobias   SB48
Wolsey, Laurence   MB46
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Womer, Keith   MD78
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Wong, Hoi Ying   SD53
Wongchaisuwat, Papis   WD77
Woo, Christopher   SD40
Wood, Alan   TC48
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Wood, Douglas L.   SA39
Wood, Matthew   TD78
Wood, Sam   SD56
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Woodard, Dawn   SD83
Woodard, Jason   TB02
Woodford, Philip   SC69
Woodruff, David   SC43, TA14
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Wortman, Martin   TB58
Woumans, Gert   WA25
Wozabal, David   SD53
Wright, John   TC52
Wu, Andy   TB33

Wu, Bangxian   TD32
Wu, Brian   TC42
Wu, C. F. Jeff   MB66
Wu, Chaojiang   WB83
Wu, Cheng-Feng   WB11
Wu, Chih-Hang   WD51
Wu, Chongqi   WE32
Wu, Chuanzhen   WE33
Wu, D. J.   SD44
Wu, Diana   WB45
Wu, Guoyuan   SA24
Wu, Han   WA63
Wu, Jiahua   MA19
Wu, Jianghua   IS-T
Wu, Jianguo   WC66
Wu, Jianqing   TD03
Wu, Jing   SC50, TB04, WC54
Wu, John   MB53
Wu, Kan   WA60
Wu, Kedi   SD09, IS-T
Wu, Lingli   WB70
Wu, Lynn   SA44
Wu, Michelle Xiao   MC16
Wu, Owen   SD12, TC04
Wu, ShiKui   WC09
Wu, Shinyi   SC77, SD41,
 MC81, TC42
Wu, Shuohao   WE12
Wu, Su   WE67
Wu, Ting   MA30, WC12
Wu, Tong   WD45
Wu, Victor   WE42
Wu, Weikao   IS-T
Wu, Xiang   TD30
Wu, Xiaole   WC30
Wu, Xing   TA50
Wu, Yan   TC15
Wu, Yaozhong   TD45, WC02
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Xia, Cathy   SB76, MB31,
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Xia, Yan   SA32, TD01
Xia, Yu   TB43
Xia, Yusen   WC18
Xiang, Yisha   SB67
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Xiao, Cao (Danica)   MA83,
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Xiao, Di   WA54
Xiao, Feng   MD24
Xiao, Guang   MD11, TA64
Xiao, Guoxian   TB58
Xiao, Haihong   TD25
Xiao, Jingjie   MD74
Xiao, Li   SD64, WA59
Xiao, Lin   SB52, TA24
Xiao, Liu   SB67
Xiao, Shengsheng   MD31
Xiao, Shuang   WD07
Xiao, Tengjiao   WB19
Xiao, Wenli   SB33
Xiao, Wenqiang   MA11, MC11

Xiao, Yongbo   MA30
Xiao, Zuhui   SB45
Xie, Chen   TA08
Xie, Fei   SB69
Xie, Jing   TC43
Xie, Jingui   TA67
Xie, Jinming   TC53
Xie, Lei   MA16
Xie, Siyang   MD26, TC27
Xie, Su   TC40
Xie, Wei   SB75, MD68,
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Xie, Weijun   SA21, MA21
Xie, Xiaolei   IS-M, TA81
Xie, Yongqin   TB53
Xin, Linwei   WA64
Xin, Mingdi   MD44
Xin, Yu   SA39
Xing, Dadi   MA66
Xing, Dahai   MD37
Xing, Eric   MC48
Xing, Lei   WD39
Xing, Wei   SA16
Xiong, Hui   SD16
Xiong, Wei   WE36
Xiong, Yu   TB10
Xu, Chunhui   WC53
Xu, Di   WD14, WE33
Xu, Dong   WC62, WD32
Xu, Feng   TC29
Xu, Gongjun   TD64, WA68
Xu, Guanglin   WD55
Xu, Guangyang   WC34
Xu, Haoxuan   TD30, WA37
Xu, He   WE29
Xu, Hongyan   WD03
Xu, Husheng   WD34
Xu, Jiansheng   TD29
Xu, Jiaqi (Joseph)   WD05
Xu, Jiayan   MD30
Xu, Jie   TD68
Xu, Jiuping   MD44
Xu, Kai   WB66
Xu, Kuang   SC64, SD64, TD65
Xu, Leon   SA45, TD04
Xu, Liujie   TB53, TB53
Xu, May   WC76
Xu, Min   WD03
Xu, Nuo   WA37
Xu, Pan   MD52
Xu, Pei   TC44
Xu, Peng   SD82
Xu, Su Xiu   WA27
Xu, Susan   SA45, SD64
Xu, Wenxin   WC79
Xu, Xiaohui   WC60
Xu, Xiaolin   MA30, WE29
Xu, Xiaoping   WA30
Xu, Xiaoya   WD30
Xu, Xin   SB67
Xu, Xun   WD31
Xu, Yan   MD09
Xu, Yanqi   MB18
Xu, Yi   MC33
Xu, Yifan   SA11
Xu, Ying   MC31
Xu, Yiwen   TD66
Xu, Yongcai   TC35
Xu, Yunchao   SD53
Xu, Yuqian   SA47
Xu, Zhou   SC30

Xue, Jiye   MA11
Xue, Weili   MA30
Xue, Yongqing   WB31
Xue, Zhengliang   TD15

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Yadav, Prashant   TC35
Yagci Sokat, Kezban   SC34
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Yagiz, Gamze   TA60
Yagoub, Mustapha C.E.   WA72
Yahalom, Tomer   MA53
Yalabik, Baris   WA10
Yamada, Tetsuo   WD38
Yamada, Yuji   WB54
Yaman Paternotte, Hande   MB21,
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Yamangil, Emre   SB43
Yamashita, Makoto   TC52
Yamazaki, Kazutoshi   MA54,
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Yan, Aaron   MB31
Yan, Channing (Chang)   IS-M
Yan, Chiwei   TD28
Yan, Hao   SC83, TB83,
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Yan, Hong   WA15
Yan, Jia   SA40
Yan, Lucy   TA03
Yan, Renfei   MD34
Yan, Xinghao   TB10, TD04,
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Yan, Yongze   MB22
Yang, Boshi   SD46
Yang, Chao-Lung   TD19
Yang, Cheng-hu   WC27
Yang, Christopher   SA37
Yang, Delin   TD02
Yang, Dengfeng   TD24
Yang, Eunho   WD43
Yang, Hai   MD24
Yang, Hao   TD21
Yang, Heng   TD54
Yang, Hongsuk   SD72
Yang, Hui   SA67, SC66, MA81,
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Yang, Jeaha   SC32, WA83
Yang, Jian   SC19, TB60, WE54
Yang, Jie   SB23, TB28
Yang, Kai   TA83, WD17, WD81,
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Yang, Lihong   MB15
Yang, Linan   MA54
Yang, Luyi   SB17
Yang, Mingchia (Dawn)   WA51
Yang, Muer   SB34, SB34
Yang, Na   WE09
Yang, Nan   MD11, TA64
Yang, Pu   SC83
Yang, Qingyu   MA67, TA66,
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Yang, S. Alex   MA16, MB16,
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Yang, Shilei   WC07
Yang, Sunny S.   MA02
Yang, Wei   TB60
Yang, Xia   MB24
Yang, Xiangyang   TB02
Yang, Xu   WA57, WD31

Yang, Yan   TA43
Yang, Yi   SB29, WB41
Yang, Yu-Chen   MB44
Yang, Yudi   SB25
Yang, Yutian   MA27
Yang, Zhibin (Ben)   TA11
Yang, Zhuqing   MD04
Yanik, Seda   WB14
Yano, Candi   MD16
Yao, Dacheng   TB60
Yao, David   SB65, SD64, TA67
Yao, John   MB10
Yao, Mark   MB19
Yao, Shiqing   WE08
Yao, Tao   SC23, SC24, SD25, MA24, IS-T
Yao, Wang   SA34, SA51
Yao, Zhihao   TA31
Yap, Wen-Jiun   WB36, SA20
Yapicioglu, Haluk   TC25
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Yasar Saglam, Senay   TD83
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Yates, Justin   MD50, WE24
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Yayla-Kullu, Muge   SC04, MC32
Ye, Chun   TB71, WE46
Ye, Fan   MD53, TB05
Ye, Han   TB17, WA45
Ye, Hongbo   MD24
Ye, Jieping   SC67, MB55
Ye, Minghai   TC67
Ye, Qiang   TA03, WD03
Ye, Qing   WC25
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Ye, Shengqi   WC19
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Yen, Aaron   WB65
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Yen, Ju-Chun   TB53
Yencak, Gorkem   WB52
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Yenipazarli, Arda   MC69, WB60
Yeo, Joongyeub   WA53
Yeo, Sungkap   WE74
Yeo, Wee Meng   TD12
Yetis Kara, Bahar   MC34
Yeung, Thomas   WC72
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Yildirim, Gonca   TD60
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Yildiz, Hakan   MA04, MD14, TC11
Yildiz, Ozlem   MB65, TB40
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Yildiz, Sercan   SA29, MA46
Yilmaz, Ibrahim   WB29
Yilmaz, Ovunc   WA19
Yilmaz, Serhat   WB41
Yim, Dobin   TD03
Yin, Junming   MC48
Yin, Kai   SB25
Yin, Qianbo   MA11
Yin, Rui   WB23
Yin, Shuya   MD11
Yin, Yafeng   TB21
Yin, Zhe   WC60
Yom-Tov, Galit   SD17, TC39, TD40
Yong, Taiyou   MB08
Yontay, Petek   MA67
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Yoo, Eunae   SD34
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Yoo, Youngjin   SC37, TA03
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Yoshikazu, Sakamaki   WE65
Yoshinaka, Ryo   MD43
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You, Jianxin   TB50
You, Mingdi   SA66
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Yu, Qiuping   SA17, MB04, MC45
Yu, Raymond   MB78
Yu, Sean   SD09
Yu, Siyun   SB77
Yu, Susan   WD17
Yu, T. Edward   WD73
Yu, Wenlong   SA22
Yu, Xinhua   MB41
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Yu, Yang   WE73
Yu, Yugang   WE12
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Yuan, Kai   TC64
Yuan, Quan   SD06
Yuan, Rong   MA05
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Zargoush, Abdolmanaf   MD41, WA83
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Zeng, Sai   MA32
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Zeng, Yaxiong   IS-T
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SB67   Condition Monitoring and Degradation Modeling
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SB72   Demand Response in Electricity Markets
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SB81   The Role of Information in Dynamic Games
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Sunday, 1:30pm - 3:00pm

SC01   MAS Tutorial Session. A Quick Peek at Predictive Analytics
SC02   Organizational Issues in Technology Management
SC03   Business Model Innovation in Cleantech Markets
SC04   Strategic Decision Making in Manufacturing &
            Service Operations
SC05   Innovation in the Supply Chain
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            Patient Outcomes
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            Related Models
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SC28   Advanced Analytics: Applications to Solve Aviation
            System Level Problems
SC29   "Just the Facts" Papers in Strategy
SC30   Scheduling in Maritime Logistics
SC31   Delivering Services Over the Digital Media
SC32   Accelerate Service Innovations with Data Mining and
            Machine Learning
SC33   Managing the Innovation Process for New
            Product Development
SC34   Humanitarian Logistics and Development
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SC39   Medical Decision Making
SC40   Scheduling Problems in Healthcare
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SC42   Network Epidemics: Theory Advancements and Applications
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SC48   Stochastic Integer Programming
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            Uncertainty, Imperfect Information, and
            Distributed Computation
SC53   Data Driven Computational Finance
SC54   Financial Risks
SC55   Global Optimization: Algorithms and Applications
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SC64   Data-driven Decisions in Healthcare
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SC68   Simulation Optimization and Sequential Sampling Rules
SC69   Land Use, Conservation and Sustainability
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SC74   Strategic and Complementarity Models in Energy Markets
SC75   Efficient Learning in Stochastic Optimization
SC76   Community Service OR: Learn By Doing
SC77   Joint Session Analytics/HAS: Topics of Healthcare Analytics I
SC78   Panel Discussion: Promoting INFORMS International Activities
SC79   Joint Session DAS/SPPSN: Societal Applications of
            Decision Analysis
SC80   Ensembles and Big Data
SC81   The Role of Information in Dynamic Games
SC82   Business Location Analysis with MCDM
SC83   INFORMS Data Mining Best Student Paper Award

Sunday, 4:30pm - 6:00pm

SD01   Mathematical Modeling and Operations Research in
            Military Decision Making I
SD02   Entrepreneurial Innovation Process (Discussant Session)
SD03   Innovating in the Mobile World using Analytics
SD04   Empirical Research in Operations Management
SD05   Supplier Responsibility Management
SD06   Strategic Supply Risk Management
SD07   Global Healthcare Operations
SD09   Tackling Readmissions: From Policy to Practice
SD10   Crowdsourcing
SD11   Joint Session M&SOM Supply Chain/BOM: Pricing from the
            Practitioner's Perspective
SD12   Sustainability Impacts of Operational Choices in Energy
            Generation and Storage
SD15   Stochastic Alternatives: SFA and StoNED
SD16   Information, Risk Management, and Production Strategies
SD17   Customer Behavior and Call Center Management
SD18   Choice Models in Revenue Management and Pricing IV
SD19   Integrating Pricing and Supply Chain Planning
SD20   Matching Markets
SD21   Transportation and Routing under Uncertainty I
SD22   Preparing for and Responding to Disaster with Tools of OR
SD23   Rich Vehicle Routing Problems II

SD24   Modeling of Emerging Sensor Technologies
SD25   Advances in Routing and Scheduling Problems
SD26   Location Optimization II
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SD28   AAS Dissertation Prize Finalists
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SD30   Supply Chain and Scheduling
SD31   Theory Development, Measurement and Testing in
           Service Science
SD32   Data Science in Online Retailing
SD33   Incentives and Organizational Issues In New
           Product Development
SD34   Humanitarian Operations Management Applications
SD35   Decisions in a Nonprofit Supply Chain I
SD36   Wireless Mobility Modeling
SD37   Social Intelligence: Learning, Aggregation and Applications
SD38   Healthcare Analytics
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SD40   Public Health Applications
SD41   Decision Modeling for Disease Prevention Considering
           Imperfect Screening
SD42   Healthcare Operations
SD43   Sparse Optimization: Theory and Applications
SD44   Social Media and Virtual Worlds
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SD47   Computations and Applications of
           Stochastic/Robust Optimization
SD48   Applications of Stochastic Programming
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           Lessons from Different Network Industries
SD50   Network Design with Hubs I
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SD67   Data Mining in Medical Decision Making and
           Bioinformatics Applications
SD68   Interfaces Between Simulation and Optimization
SD69   Sustainable and Responsible Supply Chain Management
SD70   Analytics in the Petrochemical/Petroleum Industry
SD71   Panel Discussion: Government Auctions of Spectrum Licenses
SD72   KINFORMS
SD73   ENRE Awards Session
SD74   Analytics Case Studies
SD75   Simulation Methods for Risk Analysis and Finance
SD76   Innovations in Supply-Chain Operations
SD77   Joint Session Analytics/CPMS: Panel Discussion:
           Making the Connection Between Analytics and OR
SD78   Predictive Analytics Models and Methods
SD79   Applications of Decision Analysis
SD80   Real Option Applications
SD81   Optimization and Modeling in Radiation Therapy
           Treatment Planning
SD82   Bilevel Optimization: Algorithms and Applications
SD83   Machine Learning, Data Mining, and Statistics I

Monday, 8:30am -9:30am

MA01   Advances in Military Healthcare Operations Research
MA02   Growth Oriented Innovation in Entrepreneurial and
           Ecosystem Settings
MA03   Social Networks, Personal Information, and Open Innovation
MA04   Empirical Research in Operations / Supply Chain
MA05   Supply Chain Operations
MA06   Information in Supply-Chains
MA07   From OR to OM: Observations on the Emergence of a Discipline
MA08   Applications of Little's Law
MA09   Healthcare Operations
MA10   Stochastic Models for Service Operations
MA11   Pricing and Contracts in Supply Chains
MA12   Pricing and Regulation Issues in Sustainable Operations
MA14   Air Traffic Control: Safe and Sound?
MA15   Applications in Electricity Networks and Natural Disasters
MA16   Operations and Finance
MA17   Empirical Research in Service Operations
MA18   Choice Models in Revenue Management and Pricing V
MA19   Operations and Marketing Interface
MA20   Pricing & Revenue Management Convergence
MA21   Transportation and Routing under Uncertainty II
MA22   Post-Disaster Relief and Response
MA23   Uncertainty in Transportation Models I
MA24   Active Traffic Control Strategies for Real-Time Management
MA25   Infrastructure Investment and Management
MA26   Urban Operations Research
MA27   Railroad OR Models
MA28   Airline Network Planning and Schedule Development
MA29   Joint Session Wagner/CPMS: Daniel H. Wagner Prize for
           Excellence in Operations Research Practice
MA30   Stochastic Scheduling and Supply Chains
MA31   Service Operations and Marketing Inter-Related Issues
MA32   Frontiers in Service Science
MA33   Incentives for Innovation/Innovative Projects
MA34   Modeling the Education System
MA35   Public Health II
MA36   Network Design
MA37   Predictive Analytics for Social Media
MA38   Exploring Strategies for Innovation and Learning
MA39   Hospital-based Challenges
MA40   Monitoring and Prevention of Hospital Acquired Infections
MA41   Online Decision Making in Healthcare
MA43   Computational Optimization
MA44   Information Systems and the Digital Society
MA45   Behavioral Research on Inventory and Pricing
MA46   Convexification Techniques in MIP & MINLP
MA47   Stochastic/Robust Optimization in Energy Systems
MA48   Decomposition Algorithms for Stochastic (Integer) Programs
MA49   Network Analysis Methods and Applications
MA50   Network Design with Hubs II
MA51   Optimization of Energy Systems
MA52   Stochastic Methods and Machine Learning in Optimization
MA53   Portfolio Planning
MA54   Stochastic Control and Optimal Stopping in Finance
MA55   Expediting Global Optimization Algorithms via Special
           Mathematical Structure
MA56   Software Demonstrations
MA64   Matching in Markets
MA65   Diffusion Models for Queues
MA66   QSR Best Student Paper Competition
MA67   Reliability Analysis and Fault Management for Complex
           Engineering Systems
MA68   Recent Advances in Simulation-Based Optimization
MA69   Applications of OR in Bioenergy
MA70   Natural Hazard Management
MA70   Natural Hazard Management
MA71   Auctions for Procurement
MA72   Study of Reliability and Security in Power Systems
MA73   Investment in Renewables & CCS Technology and

	Cost of Renewables
MA74	Design and Control of Energy Systems
MA75	Simulation and Optimization I
MA76	Predictive Analytics for Structured and Unstructured Data
MA77	Joint Session Analytics/CPMS: Predictive Analytics Applicatons
MA78	JIPE and IJOR Special Session on Analytics
MA79	Panel Discussion: Early DA Applications – What Would We Do Differently Today? A Panel of Early DA Pioneers will Review The Classic Applications and Share what they Would do Differently Today
MA80	Evaluating Forecasts
MA81	Data Analytics & Optimization with its Applications
MA82	Multi-Criteria Analysis for Supply Chain and Logistics
MA83	Statistical Approaches for Medical Engineering

Monday, 11:00am - 12:30pm

MB01	Analytics for New Efficiencies: Quality and Lifecycle Management in the DoD
MB02	Best Dissertation Award Finalists - Technology, Innovation Management and Entrepreneurship Section
MB03	Economics of Information
MB04	Information, Incentives and Behavioral Decision Making in Operations Management
MB05	Empirical Research and Quality Risk
MB06	Contract Design in Various Operations
MB07	Clearing the Jungle of Stochastic Optimization
MB08	Celebrating the Contributions of George Dantzig: Applications and Software
MB09	Empirical Studies on Hospital Operations
MB10	Learning in Queues
MB11	Empirical Research in Supply Chain Management
MB12	Environmental Sustainability in Service Operations
MB14	Airport/Airline Operations Management
MB15	Efficiency Analysis Applications
MB16	Managing Financial Flows in Supply Chain
MB17	Queuing Models for Service Management
MB18	RM & Pricing Topics
MB19	Demand Response Pricing in Data Centers and Grids
MB20	Pierskalla Award
MB21	Novel Techniques for Vehicle Routing
MB22	Disaster Planning
MB23	Uncertainty in Transportation Models II
MB24	Advances in Network Modeling
MB25	New Methods for Leveraging Open Data in Public Transit Analysis and Modeling
MB26	Location Modeling & Applications
MB27	Railway Analytics
MB28	Air Cargo and Aviation Operational Performance
MB29	Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice
MB30	Scheduling in Practice
MB31	Stochastic Methods in Cloud Computing Services
MB32	Service Science Best Paper Award
MB33	New Research Topics on Innovation
MB34	Joint Session SPPSN/MIF: Disaster Relief and Humanitarian Logistics
MB35	Decisions in a Nonprofit Supply Chain II
MB36	Reliable Sensor Cover and Network Design
MB37	Joint Session AI/QSR: Multidisciplinary Information Fusion for System Informatics
MB38	Cognition and Positioning
MB39	Joint Session HAS/Analytics: Learning from Healthcare Data
MB40	Payment Innovations in Health Care
MB41	Patient-Centric Healthcare and Personalized Medicine
MB42	Using OR to Model Healthcare Policy
MB43	Quadratic Assignment Problems and Applications
MB44	Digital Content Distribution and Management
MB45	Inspections and Improvement Initiatives in Supply Chains

MB46	Advances in Discrete Optimization
MB47	Computational Methods for Stochastic Optimization and Variational Problems
MB48	Multistage Stochastic Optimization and Applications in Healthcare
MB49	Interdiction Models in Complex Networks
MB50	Network Design in the Automotive Industry
MB51	Optimization for Large-scale Data Analysis and Optimization
MB52	Recent Progresses on Solving Markov Decision Processes
MB53	Mathematical and Statistical Analysis of High Frequency Tradings
MB54	Some Recent Topics in Financial Engineering
MB55	Optimization for Dimension Reduction
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MB66	Simulation and Computer Experiments
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MB68	Simulation Methodology Applications
MB69	Models for Electric Vehicle Charging Infrastructure Network
MB70	Using Optimization for Wildfire Preparation and Mitigation
MB71	Procurement and Auction Markets
MB72	Assorted Topics in Distributed Energy Generation
MB73	Uncertainty in Climate Policy Modeling
MB74	Existing Challenges in Non-convex Electricity Markets
MB75	Simulation and Optimization II
MB76	Making Operations Research Deliver
MB77	Joint Session Analytics/CPMS: The Whys Hows and Whats of Analytics Certification
MB78	Big Data Industry Applications
MB79	Decision Analysis in Organizations
MB80	Value of Information Analysis: Theory and Applications
MB81	Joint Session Data/AI/HAS: Big Data Analytics and Smart Health I
MB82	Multiple Criteria Decision Making Applications
MB83	Optimization Models in Data Mining

Monday, 12:30pm - 2:30pm

Interactive Session

Monday, 1:30pm - 3:00pm

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MC02	Rx for Patent Fatigue in Innovation Research: New Data, New Causal Methods, and New Results
MC03	Data-Driven Analysis in eBusiness
MC04	New Topics in Supply Chain Network and Design
MC05	MSOM Student Paper Competition Finalists
MC06	Operations and Marketing Interface
MC07	Cloud Computing for Optimization
MC08	George Dantzig?s Continuing Impact on Advances in Optimization
MC09	Appointment Scheduling Models
MC10	New Advancements in Classic Inventory Problems
MC11	Incentives for Socially-beneficial Goods
MC12	Green Business Models and Strategies
MC14	Best Practices in Reviewing Papers
MC15	Banking and Manufacturing Applications
MC16	Mitigating Supply Risk
MC17	Pricing and Strategic Behavior in Queueing Systems
MC18	Practice-driven Revenue Management I
MC19	New Applications in Pricing and Revenue Management
MC20	Joint Session Analytics/CPMS: Business Analytics in Higher Education Industry
MC21	Freight Fleets Logistics and Management
MC22	Application of Machine Learning in Transportation
MC23	Multimodal Transportation
MC24	Network Science and Transportation
MC25	Recent Advances in Day to Day Traffic Assignment

MC26	New Directions in Location Research
MC27	Models for Fleet Management and Scheduling
MC28	Airline Operations
MC29	Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice
MC30	Uncertainty and Cooperation
MC31	Service Queues
MC32	Service Science Best Paper Award
MC33	Managing Uncertainty in Innovation
MC34	Humanitarian Logistics
MC35	Socially Responsible Operations
MC36	Network Traffic Modeling
MC37	DM2: Data Mining in Decision Making with Theory & Applications
MC38	Scheduling Staff and Space in Healthcare
MC39	Innovations in Healthcare Delivery Systems
MC40	Methodologies for Health Policy Making
MC42	Healthcare Operations and Scheduling
MC43	Decision Diagrams in Optimization I
MC44	Multi-Channel Advertising
MC45	Field Experiments
MC46	Advances in MIP Modeling Systems
MC47	Stochastic Optimization for Natural Resources
MC48	Network and Graphs 1
MC49	Networks Robustness and Vulnerability Analysis
MC50	Service Parts Networks and Inventory Optimization
MC51	Recent Advances in First Order Methods
MC52	Recent Advances in Linear Programming and Complementarity Problems
MC53	Optimization and Financial Engineering
MC54	Default and Systemic Risk
MC55	MINLP Methodology and Applications
MC56	Software Demonstrations
MC64	POMDPs and Applications
MC65	Stochastic Systems
MC66	Joint Session QSR/DM: Panel Discussion: Funding Opportunities
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MC69	Carbon Footprint and the Management of Supply Chains
MC70	Incorporating Ecological Concerns into Harvest Scheduling
MC71	Analysis of Matching Markets
MC72	Optimization and Analysis of Smart Grids with Renewable Energy and Storage
MC73	Investment in Electricity Markets
MC74	Stochastic and Robust Optimization in Electric Power Systems Operations and Planning
MC75	Operations Research to Inform Health Policies
MC76	The Data Lifecycle - Selected Case Studies
MC77	Joint Session Analytics/HAS: Predictive and Prescriptive Analytics for Reducing Health Risks
MC78	Dynamic Decision Making
MC79	50th Anniversary Update from Some Ramsey Award Winners
MC80	Price, Ambiguity and Value of Information
MC81	Joint Session Data/AI/HAS: Big Data Analytics and Smart Health II
MC82	Tutorial: Exact Methods for Multi-Objective Combinatorial Optimization
MC83	Big Data Analytics for Various Applications

Monday, 4:30pm - 6:00pm

MD01	Analytics for Surviving Austerity: Doing More with Less
MD02	TIMES Distinguished Speaker - Haim Mendelson
MD03	Experimental Economics in E-Commerce
MD04	Social Operations Management
MD05	MSOM Student Paper Competition Finalists
MD06	Nonprofit Operations
MD07	Simulation Based Education in Supply Chain and Project Management

MD09	Big Data Optimization for Data Mining and Statistical Analysis
MD10	Disruptive Technologies and Business Models
MD11	Managing Relationships in Supply Chains
MD12	Empirical Operations Management and Sustainability
MD14	External Letters of Recommendation for Tenure: Hear from Those Who Write and Read Them
MD15	Applications of DEA
MD16	New Models in Revenue Management and Pricing
MD17	Innovation in Services and Retail
MD18	Practice-driven Revenue Management II
MD19	Product Quality, Information, Social Learning, and Pricing
MD20	Transportation Analytics
MD21	Electrical Vehicles Routing
MD22	Energy Logistics and Supply Chains
MD23	Same-Day Delivery and Routing
MD24	Parking and Network Modeling Innovations
MD25	Transportation Network Design and Pricing
MD26	Reliable Facility Location Models
MD27	Railway Operations Modeling and Analysis
MD28	Aviation Applications Section: Keynote Presentation
MD29	The George B. Dantzig Disseration Award
MD30	Contemporary Scheduling
MD31	Digital Services in the Sharing Economy
MD32	Workforce Planning I
MD33	Organizing for Successful Product Development
MD34	Community-Based Operations Research
MD35	Operations Research in Public Policy Analysis
MD36	Topics In Telecommunications
MD37	Supply Chain Optimization and Analytics
MD38	OR Techniques to Improve Patient Scheduling
MD39	Operations Analysis for Health Care
MD40	Bundled Payments and Payment Systems
MD41	Stochastic Models in Healthcare Delivery
MD42	Health Care Supply Chain, Competition, and Risks Management
MD43	Decision Diagrams in Optimization II
MD44	Information, Information Accuracy and Information Policy in E-commerce Applications
MD45	Opportunities in Behavioral Operations: Different Perspectives
MD46	Cutting Plane and Formulation Techniques for Mixed Integer Programming
MD47	Joint Session Optim/ MIF: Developments in Stochastic Integer Programming Methods
MD48	Network and Graphs 2
MD49	Supply Chain Network Competition: Advances in Models
MD50	Optimization, Network 1
MD51	First-order Methods for Large-scale Convex Optimization
MD52	Algorithms for Optimization and Learning
MD53	Portfolio Optimization and Solution Methods
MD54	Joint Session FSS/OPT: Optimal Portfolio Management and Execution
MD55	Optimization Modeling and Methodologies in Big Data
MD56	Software Demonstrations
MD64	Markov Lecture
MD65	Modeling & Simulation in Healthcare Service Delivery
MD66	Applied Probability and Bayesian Models for Industrial Statistics
MD67	Statistical Approaches to Personalized Healthcare I
MD68	Recent Advances in Simulation Metamodeling Techniques
MD69	Joint Session ENRE/DAS: Expert Judgment and Learning Curves in Energy & Environment
MD70	Supply Chain Management in the Forest Sector
MD71	Dynamic Matching Markets
MD72	Energy I
MD73	Energy/Climate Modeling
MD74	Stochastic Control and Optimization of Power Systems with Renewables
MD75	Joint Session MIF/HAS: Healthcare Analytics
MD76	O.R. Approaches to Plan and Build Data Networks
MD77	Joint Session Analytics/CPMS: 2014 Innovative Applications in Analytics
MD78	Decision Analysis 1
MD79	Decision Analysis Society Awards

MD80   Panel Discussion: Meet the Editors ? Service Science Track
MD81   Joint Session Data/Computing: Statistical Learning in
          Stochastic Optimization
MD82   Preferences and Multiple Objectives
MD83   Machine Learning, Data Mining, and Statistics II

Tuesday, 8:00am - 9:30am

TA01   Mission Planning I
TA02   Outsourcing, Offshoring, and the Changing Nature of
          Organizational Boundaries and Architectures
TA03   Social Media and Business Marketing
TA04   Operations Management and Marketing
TA05   Bayesian Estimation and Optimization
TA06   Operational Issues in Trade-in Programs
TA07   Service Science: Toward Systematic Service System Innovation
TA08   Optimization and Modeling for Individual Decision-Making
TA09   Novel Techniques in Integer Programming
TA10   Dynamic Optimization with Uncertain Demand
TA11   Topics in Supply Chain Management
TA12   Doctoral Work in Sustainable Operations Management
TA14   Panel Discussion on Journal Publication Tips
TA15   DEA Methodology
TA16   Dynamic Mechanism Design in Revenue Management
TA17   Behavioral Perspectives
TA18   Revenue Management in Retail and Service I
TA19   Dynamic Learning and Pricing
TA20   Facility Logistics I
TA21   Innovative Solutions for Congestion Mitigation I
TA22   Selective and Time Dependent Routing Problems
TA23   Network Design and Repositioning for Bike-sharing Systems
TA24   Emerging Vehicle and Sensor Technologies
TA25   Public Transportation
TA26   Facility Location
TA27   Demand-Responsive Rail Service Design
TA28   Air Transport Data Analysis for Safe and Efficient Operations
TA29   Project Management 1
TA30   Vacation and Online Scheduling
TA31   Analytics in Cloud
TA32   Team Performance
TA33   Product Design and Manufacturing
TA35   Risk Analysis Models for Critical Infrastructure and
          Service Systems
TA36   Telecommunications Network Flows and Design
TA37   Public-Private Partnership and Performance Based Logistics
          Contract Design
TA38   Health Care Modeling Optimization I
TA39   Optimization in Radiation Therapy and Epidemic Control
TA40   Healthcare Delivery Optimization
TA41   Workload, Quality, and Staffing
TA42   Inventory Management in Healthcare
TA43   Issues Related to Large-scale Data Mining
TA44   Energy Information Systems
TA45   Behavior in Supply Chains and Procurement
TA46   Non-traditional Topics in Integer Programming
TA47   Robust and Prior-free Optimization - Theory and Applications
TA48   Network and Graphs 3
TA49   Network Interdiction Applications
TA50   Optimization, Network 2
TA51   Network Flow & Nonlinear Optimization
TA52   Conic Optimization
TA53   Operations - Finance Interface
TA54   Stochastic Modeling in Financial Engineering
TA55   Improved Methods for Solving Special Classes of MINLP
TA56   Software Demonstrations
TA57   Assessment Techniques
TA58   Production and Scheduling 1
TA59   Joint Session JFIG/ENRE: Optimization Methods for
          Invasive Species Control
TA60   INFORMS Undergraduate Operations Research Prize

TA61   MAS Tutorial Session. Management Innovation to Transform
          The Department of Defense Logistics Enterprise: An Update
TA64   Optimal Policies - Supply Chain Applications
TA65   Stochastic Analysis in Games
TA66   Smart Monitoring of Complex Systems
TA67   Statistical Approaches to Personalized Healthcare II
TA68   Data Analytics in Simulation
TA69   Biofuel Supply Chain and Market
TA70   Analytics in the Petrochemical and Petroleum Industries
TA71   Bidding and Behavior in Procurement Markets
TA72   Energy II
TA73   Optimization for Critical Infrastructure Resilience
TA74   Renewable Energy Integration and Trading in
          Electricity Markets
TA75   Simulation and Optimization III
TA76   Succeeding with Revenue Management
TA77   Joint Session Analytics/HAS: Topics of Healthcare Analytics II
TA78   The Past, Present and Future of Teaching Decision Analysis
TA79   Medical Applications in Decision Analysis
TA80   Real Options in Business Strategy
TA81   Joint Session Data/AI/HAS: Big Data Analytics and
          Smart Health III
TA82   Behavioral Issues in Adversarial Preference Modeling
TA83   Quality and Statistical Decision Making in Health
          Care Applications

Tuesday, 11:00am - 12:30pm

TB01   Mission Planning II
TB02   Business Ecosystem, Networks and Innovation
TB03   IS Research with Policy Implications
TB04   Empirical Supply Chain Studies
TB05   Dynamic Learning and Decision Making
TB06   Practice-Based Research in Humanitarian
          Operations Management
TB07   Cloud Computing
TB08   Joint Session Social Media/MAS: Social Media in
          Disaster Response
TB09   Crowdsourcing and the Cloud
TB10   Economics of Operations Management
TB11   Procurement
TB12   Regulation Issues in Sustainable Operations
TB14   Panel Discussion: Philosophy of Hiring and Advising
          Graduate Students
TB15   Data Envelopment Analysis 1
TB16   Revenue Management and Pricing of Multiple Products
          and Assortments
TB17   Contact Centers
TB18   Revenue Management in Retail
TB19   Choice and Pricing Models in Revenue Management
TB20   Facility Logistics II
TB21   Innovative Solutions for Congestion Mitigation II
TB22   Designing, Modeling and Managing Disrupted
          Transportation Networks
TB23   Inventory Routing Models
TB24   ITS Best Presentation Award Session
TB25   Public Transportation - Railroad
TB26   Facility Planning and Design
TB27   Rail System Performance
TB28   Airline Choice-based Pricing and Revenue Management
TB29   Project Management 2
TB30   Supply Chain Scheduling and Optimization
TB31   Overcoming Business Impact Uncertainty
TB32   Workforce Planning II
TB33   Operations/Finance Interface 1
TB34   Models for Emergency Medical Services
TB35   Joint Session SPPSN/Minority Issues: Panel Discussion–
          Publishing Community and Humanitarian Operations
          Research in High-Impact Journals
TB36   Optimization Techniques for Reliable Operation of

	Mobile Communication Systems
TB37	Data Mining and Machine Learning
TB38	Health Care Modeling Optimization II
TB39	Managing Capacity and Demand in Healthcare Services
TB40	Stochastic Modeling in Healthcare Delivery
TB41	OR/MS in Healthcare Quality and Patient Safety
TB42	Joint Session HAS/QSR/Analytics: Advanced Predictive Analytics for Health and Wellness Assurance
TB43	Data Analysis
TB44	Economics of Information Systems
TB45	Modeling Human Behavior in OM
TB46	Recent Advances in Conic Integer Programming
TB47	Risk-Averse Dynamic Optimization
TB48	Optimization, Combinatorial 1
TB49	Social and Economic Network Models
TB50	Optimization Methodologies 1
TB51	Data-driven Methods for Decision Making
TB52	Linear Programs and Generalizations
TB53	Economics/ Finance
TB54	Tutorials in Financial Services
TB55	Euclidean Distance Geometry Problems
TB56	Software Demonstrations
TB57	Flipped Classrooms
TB58	Production and Scheduling 2
TB59	Panel Discussion: Academic Leadership
TB60	Inventory Management I
TB61	DIME/PMESII 2
TB64	Scheduling of Queues
TB65	Academic Job Search Panel
TB66	Technometrics Invited Session: Novel Statistical Methods with Interesting Applications
TB67	Complex Process Modeling and Monitoring
TB68	Learning in Optimization and the Exploration/Exploitation Tradeoff
TB69	Socially-Responsible Operations Management
TB70	Natural Resources
TB71	Auctions and Mechanism Design
TB72	Energy - Optimization
TB73	Multilevel Optimization Problems in Energy I
TB74	Accounting for Risk in Investments in Electric Power Systems
TB75	Stochastic Processes
TB76	Joint Session CPMS/Analytics: Panel Discussion: What is Industry Looking for in Analytics Hires?
TB77	Applications and Spreadsheets
TB78	Spatial Analysis for Multicriteria Decisions
TB79	Organizational Challenges in Decision Making
TB80	Behavioral Decision Theory
TB81	Analytics for Network and Text Data
TB82	Advances in Multiobjective Programming
TB83	Image and Functional Data Analysis: Methods and Applications

Tuesday, 12:30pm - 2:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01	Mission Planning III
TC02	Technology, Innovation Management and Entrepreneurship Section Best Paper Winner Presentation
TC03	The Social Crowd: New Research in Social Media and Crowdsourcing
TC04	Energy Markets and Demand Management
TC05	Retail Operations
TC06	Managing Supply Chain Disruptions
TC07	Identification, Assessment and Correction of Ill-Conditioning and Numerical Instability in Linear and Integer Programs
TC08	Joint Session Social Media/MAS: Diplomacy, Sentiment, & Social Network Analysis Using Social Media
TC09	Cognitive Decision Support Tool for Policy Makers

TC10	Information and Competition in Supply Chains and Service Systems
TC11	Supply Chain Risk Management
TC12	Sustainability Issues in Supply Chain Management
TC14	Joint Session JFIG/ENRE: Models and Analysis of Invasion Processes
TC15	Data Envelopment Analysis 2
TC16	Omni-channel Retail Analytics
TC17	Dynamic Pricing in Service Systems
TC18	Managing Customer Behavior in Service and Retail Systems
TC19	Contemporary Topics in Revenue Management
TC20	Facility Logistics III
TC21	TSL Prize Winners
TC22	Coordinating Decentralized Transportation Systems
TC23	Network Design Models and Methods
TC24	Professional Development Workshop
TC25	Transportation Planning I
TC26	Transportation, Maritime I
TC27	Advanced Analytics Tools for Smart Railroad Terminal Operations
TC28	Emerging Issues in Airport-Airline Gate Management and Operations
TC29	Project Management 3
TC30	Models and Algorithms for Sequencing and Scheduling in Applied Transportation Problems
TC31	Staffing and Resource Allocation in Public and Private Service Systems
TC32	Service Science - Telemarketing and Call Centers
TC33	Operations/Finance Interface 2
TC34	Transportation and Security under Uncertainty
TC35	Models for Health Care Delivery
TC36	Information Systems 1
TC37	Intelligent Heuristics and Systems
TC38	Health Care Modeling Optimization - Planning and Optimization
TC39	Hospital Capacity and Resource Management
TC40	Healthcare Operations Research
TC41	Health Care, Strategy, and Policy 1
TC42	Joint Session HAS/Analytics: Analytics for Chronic Care Decision-Making
TC43	Computational Optimization and Applications
TC44	Online Social Networks and Content Generation
TC45	Behavioral Aspects in Forecasting and Inventory decisions
TC46	MIP Theory and Multi-level Applications
TC47	Stochastic/Robust Optimization Application in Energy Systems
TC48	Optimization, Combinatorial 2
TC49	Network Optimization and Routing Problems
TC50	Optimization Methodologies 2
TC51	Optimization Society Prizes
TC52	Optimization, Convex
TC53	Finance, Portfolio Analysis 1
TC54	Quantitative Financial Risk Management
TC55	Stochastic MINLP With Endogenous Uncertainty
TC56	Software Demonstrations
TC57	Curriculum Development
TC58	Production and Scheduling 3
TC59	Special Session: Best of Women in OR/MS
TC60	Inventory Management II
TC61	Military Applications Research at RAND
TC64	Market Microstructure and High Frequency Asymptotics
TC65	Industry Job Search Panel
TC66	Panel Discussion on "Publishing in Quality and Reliability: The Editor's Perspective
TC67	Application of Game-Theoretical Methods in Supply Chain
TC68	New Directions in Applied Probability
TC69	Joint Session ENRE/JFIG: Analysis of Biomass/Biofuel Production: Economic and Environmental Impacts
TC70	Sustainability I
TC71	Pricing and Computation in Package Auctions
TC72	Energy III
TC73	Storage and Demand Side Resources in Power Systems

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TC74	Stochastic Programming in Energy
TC75	Reliability I
TC76	Practical & Tactical Pricing Decision Support Approaches
TC77	Joint Session Analytics/HAS: Clinical Analytics
TC78	Decision Analysis 4
TC79	Joint Session DAS/SPPSN: Decision Analysis in Policy Applications
TC80	Recent Advances in Utility Theory
TC81	Social Media and Network Analysis in Data Mining
TC82	MCDM & Service Science: Theory and Applications
TC83	Optimization Models and Algorithms for Data Mining with Uncertainties

Tuesday, 4:30pm - 6:00pm

TD01	Search Theory
TD02	Technology Entrepreneurship in China
TD03	Economics of Online Services
TD04	Pharmaceutical and Healthcare Supply Chains
TD05	Retail Operations
TD06	Disruption Risk Management
TD07	INFORMS Analytics Maturity Model
TD10	Supply Chain Design
TD11	MSOM Fellows Session
TD12	Emerging Issues in Sustainable Operations
TD14	Joint Session WORMS/JFIG/MIF: Speed Networking
TD15	Revenue/Yield Management I
TD16	New Applications of Pricing and Revenue Management
TD17	Empirical Studies in Healthcare Operations Management
TD18	Customer Choices, Upgrades and Prices
TD19	Pricing and New Product Development in Supply Chains
TD20	Facility Logistics IV
TD21	Innovative Solutions for Congestion Mitigation III
TD22	Emergency Response Capability Modeling
TD23	Joint Inventory and Location Models
TD24	Optimal Sensor Locations in Traffic Networks
TD25	Transportation Planning II
TD26	Transportation, Maritime II
TD27	Optimization for Rail Planning
TD28	Control of Airport Operations for Congestion Mitigation
TD29	Operations Management/Manufacturing
TD30	Operations Management/Marketing Interface I
TD31	Retail Service Operations
TD32	Service Science II
TD33	Health Care Modeling Optimization III
TD34	Transport Risk Management
TD35	Joint Session DAS/SPPSN: Decision Analysis Insights for Homeland Security
TD36	Information Systems 2
TD37	Big Data 1
TD38	Health Care Modeling Optimization IV
TD39	Kidney Exchange Models
TD40	Dynamic Programming in Health Care
TD41	Health Care, Strategy and Policy 2
TD42	Joint Session HAS/Analytics: Big Data Analytics in Healthcare
TD43	Data-driven Service Systems
TD44	Social Media Consumer Analytics
TD45	Quality and Inventory Issues in Behavioral Operations
TD46	Dynamic Combinatorial Optimization under Uncertainty
TD47	Information, Networks and Big Data
TD48	Optimization, Robust 1
TD49	Combinatorial Optimization and Social Network Analysis
TD50	Optimization, Robust 1
TD51	Data Mining in Medical and Engineering Domain
TD52	Optimization, Constraint Programming
TD53	Finance, Portfolio Analysis 2
TD54	Optimal Stopping with Applications to Finance and Economics
TD55	Integer Nonlinear Programming and Applications - 2
TD56	Software Demonstrations
TD57	Panel Discussion: Publishing in INFORMS Transactions

	on Education
TD58	Scheduling I
TD59	Panel Discussion with Department Chairs: How to Recruit, Retain, and Support Women and Minority Students
TD60	Inventory Management III
TD61	Joint Session MAS/DAS: Military Decision Analysis Applications
TD62	Social Media Sentiment
TD63	Behavioral OR and Applications of Cognitive Analytics
TD64	Rare Events, Sensitivity, and Exact Simulation
TD65	Stochastic Control Applications
TD66	Data Fusion for Prognostics
TD67	Data Driven Scientific Discovery
TD68	Emerging Topics in Simulation Analysis & Optimization
TD69	Carbon-Considerate Operations Management
TD71	The Economics of Auction Markets
TD72	Energy IV
TD73	Energy Planning and Uncertainty
TD74	Stochastic Programming for Planning Electricity Supply
TD75	Reliability II
TD76	Revenue Management Applications for non-Travel Industries
TD77	Joint Session Analytics/SPPNS: Analytics in Government
TD78	Decision Analysis 5
TD79	Forecasts and Judgments
TD80	Graphical Models in Decision Analysis
TD81	Time Series Data Mining
TD82	Building MCDM Models: Practical and Methodological Issues
TD83	Advances in Business Data Analytics

Wednesday, 8:00am - 9:30am

WA01	Mathematical Modeling and Operations Research in Military Decision Making II
WA02	Knowledge, Learning and Intellectual Capital (KLIC)
WA03	The Economic and Social Impacts of Mobile Apps
WA04	Entrepreneurial/Innovative Operations Management
WA05	Supply Chain Management
WA06	Data-Driven Methods in Inventory Management
WA07	Supply Chain Management I
WA08	Military Application 1
WA09	Applications of Cognitive Analytics
WA10	Operations/Sustainability 1
WA11	Supply Chain, Risk Management I
WA12	Sustainable Operations in Electric Vehicle and Electricity Generation Systems
WA13	Education 1
WA15	Revenue/Yield Management II
WA16	Returns Management at the Operations-Marketing Interface
WA17	Managing Queues in Service Systems
WA18	Data-driven Revenue Management Studies
WA19	Innovative Applications in Pricing and Revenue Management
WA20	Analytics for the Tactical Edge: Better Business through Operations Research in the DoD
WA21	Maritime Logistics and Operation
WA22	Business and the Bottom of the Pyramid
WA23	Sustainable Logistics: Models and Applications
WA24	Challenges in Dynamic Ride-sharing
WA25	Transportation Planning III
WA26	Vehicle Routing I
WA27	Logistics 1
WA28	Airline Crew Management
WA29	Manufacturing 1
WA30	Operations Management/Marketing Interface II
WA31	Matching-Based Service Allocation Models
WA32	Operations/Service 1
WA33	Health Care Modeling Optimization IV
WA34	Homeland Security and Energy Policy
WA35	Healthcare and Humanitarian Logistics
WA36	Information Systems 3
WA37	Big Data 2
WA38	Health Care Modeling Optimization VI

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WA39   Inverse Optimization in Healthcare
WA40   HSEA -I- Undergraduate Projects in Healthcare Engineering
WA41   Health Care, Public Health
WA42   System Dynamics in Health I
WA43   Applications and Computation
WA44   Strategic Value of IT/IS
WA45   Behavior, Queueing, and Processing Times
WA46   Games and Optimization Over Networks
WA47   Computational Challenges for Sequential
           Stochastic Optimization
WA48   Optimization, Robust 2
WA49   Routing Problems
WA50   Optimization, Integer 1
WA51   Operations/Quality Management
WA52   Optimization, Heuristic
WA53   Finance, Financial Engineering 1
WA54   Behavioral Portfolio Selection and Asset Pricing
WA55   Industrial Applications of MINLP
WA56   Software Demonstrations
WA57   Teaching Sustainability
WA58   Scheduling II
WA59   Inventory Management V
WA60   Inventory Management IV
WA61   Organization Theory 1
WA62   Applied Probability 1
WA63   Dynamic Programming/ Control 1
WA64   Flexibility, Inventory and Resource Pooling
WA65   Learning in Stochastic Systems
WA66   Journal of Quality Technology Invited Session
WA67   Gaussian Process and Spatial Data Analysis (I)
WA68   Recent Advances in Stochastic Simulation
WA69   OR for the Developing World
WA70   Economics
WA71   Ad Auctions
WA72   Energy V
WA73   Models and Algorithms for Renewable Energy Integration
WA74   Advanced Algorithms for Power System Operations
WA75   Reliability III
WA77   Exposing Students to Practice with a Case Competition
WA78   Decision Analysis 6
WA79   Joint Session DAS/MAS: Game Theory, Decision Analysis,
           and Homeland Security, Part I
WA80   How Sound Decision-making Can be Taught and Measured
WA81   Data Analytics for Manufacturing System Design
WA82   Multicriteria Decision Making 1
WA83   Data Mining 1

Wednesday, 11:00am - 12:30pm

WB01   New Voices in Military Operations Research
WB02   Modularity in the Context of Service Management
WB03   Social Media and Business Analytics
WB04   Operations Management and Marketing Interface
WB05   Economics in Operations
WB06   Urban Spatial Issues
WB07   Supply Chain Management III
WB08   Text Analytics Applications in Social Media
WB09   Meta-Algorithms - Algorithms that Improve other Algorithms
WB10   Operations/Sustainability 2
WB11   Supply Chain, Risk Management II
WB12   Incentive Issues in Sustainable Operations
WB13   Education 2
WB14   Supply Chain, Practice, Empirics
WB15   Revenue/Yield Management III
WB16   Behavorial Bias and Revenue Management
WB17   Reducing and Accommodating Customer Variability in Services
WB18   Joint Session RM/TSL: Pricing Applications in Logistics:
           Inventory Control, Distribution, and Transportation
WB19   Revenue Optimization under Uncertainty in Healthcare
WB20   Analysis

WB21   Maritime Transportation
WB22   Identity and Change in Organization Science
WB23   Container Supply Chain Coordination
WB24   Transportation, Intelligent Systems I
WB25   Transportation Planning IV
WB26   Vehicle Routing II
WB27   Logistics 2
WB28   Breaking the Silos in Airline Crew Scheduling
WB29   Manufacturing 2
WB31   Applying Computational Creativity in Service Industries
WB32   Operations/Service 2
WB33   New Product Development 1
WB34   Preposition and Distribution Decisions in
           Humanitarian Operations
WB35   Next Generation Decision Support for the Next Pandemic
WB36   Information Systems 4
WB37   Big Data 3
WB38   Health Care Modeling Optimization VII
WB39   HSEA -II-Spotlight on HSEA Student Research
WB40   Inverse Planning for Cancer Treatment
WB41   Supply Chain Management II
WB42   System Dynamics in Health II
WB43   Computational Integer Optimization
WB44   The Interface Between Information Systems and
           Operations Management
WB45   From Deadline to Reciprocity: Assorted Topics in
           Behavioral Operations
WB46   Advances in Mixed-integer Programming Theory
WB47   Monte Carlo Simulation-Based Methods for
           Stochastic Programming
WB48   Optimization, Robust 3
WB49   Network Optimization and its Applications
WB50   Optimization, Integer 2
WB51   Optimization, Nonlinear 1
WB52   Optimization, Large Scale 1
WB53   Finance, Financial Engineering 2
WB54   Control Methods in Finance
WB55   Algorithmic and Computational Aspects of Mixed-Integer
           Nonlinear Optimization
WB56   Software Demonstrations
WB57   Technology in the Classroom
WB58   Scheduling III
WB59   Group Decisions and Negotiation
WB60   Inventory Management VI
WB61   Organization Theory 2
WB62   Applied Probability 2
WB63   Dynamic Programming/ Control 2
WB64   Methods for Staffing Nonstationary Queueing Systems
WB65   Large-scale Stochastic Systems and Resource Allocation
WB66   Predictive Modeling and Control for Additive Manufacturing
WB67   Data Fusion in Manufacturing Systems
WB68   Initialization Bias and Related Problems
WB69   Decision Making for Holistic Sustainability Assessment
WB70   Economics (Game Theory)
WB71   Auctions/ Mechanism Design 1
WB72   Data Analytics for Healthcare Applications
WB73   Multilevel Optimization Problems in Energy II
WB74   Robust and Stochastic Modeling in Power System
           Operations and Planning
WB75   Queuing Models
WB76   Analytics in Bioinformatics and Healthcare
WB77   Joint Session Analytics/SpORts: Baseball Analytics
WB78   Analytic Hierachy Process
WB79   Joint Session DAS/MAS: Game Theory, Decision Analysis,
           and Homeland Security, Part II
WB80   Infrastructure Modeling for Improved Decision Making
WB81   Analytics and Energy
WB82   Multicriteria Decision Making 2
WB83   Data Mining

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Wednesday, 12:45pm - 2:15pm

WC02	Risk, Incentives and Cooperation in Technology Management
WC03	Economics of Information Systems
WC04	Service Operations Design and Management
WC05	Collaboration and Information in Supply Chains
WC06	Service Business Models
WC07	Supply Chain Management V
WC08	Models of Human Dynamics in Social Data
WC09	E-Business/ Commerce 1
WC10	Supply Chain/Green I
WC11	Supply Chain, Risk Management III
WC12	Supply Chain Optimization I
WC14	Supply Chain/Decision Analysis
WC15	Semiconductor Industry
WC16	Empirical Studies in Revenue Management and Pricing
WC17	Design and Control of Service Systems
WC18	Big Data Analytics and Predictive Modeling in Revenue Management
WC19	Retail Operations
WC20	Homeland Security Applications II
WC21	Maintenance Problems in Transportation and Routing
WC22	Organizational Behavior and Ethics
WC23	Topics in Freight Transport and Logistics
WC24	Transportation, Intelligent Systems II
WC25	Transportation, Operations I
WC26	Vehicle Routing III
WC27	Logistics 3
WC28	Measuring and Managing Delay through Trajectory Analysis
WC29	Manufacturing 3
WC30	Operations Management/Marketing Interface III
WC31	Incorporated Models in Business Processes Optimization
WC32	Supply Chain, Game Theory & Combinatorial Auctions
WC33	New Product Development 2
WC34	Performance Measurement 1
WC35	Fire and Emergency Medical Services
WC36	Humanitarian Operations in a Response Supply Chain
WC39	Operations Research Methods for Cancer Care
WC40	New Models of Health Care Delivery: Reengineering for Efficient
WC41	Supply Chain Management IV
WC42	HSEA - III - Undergraduate Student Research Presentation
WC43	Constraint Programming
WC44	IT in Healthcare and Education
WC45	Behavioral Operations 1
WC46	Advances in Theory and Computation of Integer Programming
WC47	Stochastic Optimization in a Data-Driven Context
WC48	Optimization, Stochastic 1
WC49	3Rs of Networks: Restoration
WC50	Optimization, Integer 3
WC51	Game Theory 1
WC52	Optimization, Linear Programming 1
WC53	Finance
WC54	Financial Regulation and Risk Management
WC55	Global Optimization in Graphs/Networks
WC57	Academic Projects and Cases Using Real-world Data and Scenarios to Prepare Students for the Workforce
WC58	Scheduling IV
WC59	Operations Management
WC60	Inventory Management VII
WC61	Military Application 2
WC62	Homeland Security
WC63	Decision Analysis 3
WC64	Probability Theory and Combinatorial Optimization
WC65	Optimal Control in Queueing Networks
WC66	Sensor-based System Informatics and Control
WC67	Data Fusion for Process Monitoring and Diagnosis
WC68	Simulation Applications of Supply Chain and Reverse Logistics
WC69	Expert Elicitation, Climate, and Energy Technologies
WC70	Economics- Policy
WC71	Auctions/ Mechanism Design 2
WC72	Energy VI
WC73	Optimization for Distributed Power Systems
WC74	Modelings in Electricity Markets for Policy Insights
WC75	Simulation I
WC76	Multi-Channel Attribution Modeling
WC77	Theory and Applications of Analytics and Big Data
WC78	Decision Support Systems 1
WC79	OR Models in Decision Analysis
WC80	Joint Session DAS/ENRE: Energy Infrastructure: Decisions and Models
WC82	Data Mining 6
WC83	Data Mining 3

Wednesday, 2:45pm - 4:15pm

WD01	MAS Tutorial Session. The State of Operations Research in the US Military: A 75th Anniversary Perspective
WD02	Product Development and Process Development in Pharmaceutical Industry
WD03	Electronic Markets and Mechanisms
WD04	Topics in Supply Chain Management
WD05	Multichannel Retailing
WD06	Humanitarian-Driven Inventory Management: Pre-positioning and Responses
WD07	Supply Chain Management VII
WD08	Supply Chain Management VIII
WD09	E-Business/ Commerce 2
WD10	Supply Chain/Green II
WD11	Supply Chain, Managing Disruptions I
WD12	Supply Chain Optimization II
WD14	Retail Management I
WD15	Procurement and Purchasing Management 1
WD16	Joint Session RMP/BOM: New Results on Strategic Consumer Behavior in RM
WD17	Customer Differentiation in Services
WD18	New Topics in RM: Demand Learning
WD19	Revenue Optimization in Retail and Services II
WD21	Supply Chain and Transportation
WD22	Historical and Microfoundations of Strategy
WC22	Organizational Behavior and Ethics
WD23	Traffic Management I
WD24	Disaster and Emergency Management 1
WD25	Transportation, Managing Disruptions I
WD26	Vehicle Routing IV
WD27	Aviation
WD28	Data Mining and Optimization for Air Traffic Operations
WD29	Operations Management/others
WD30	Operations Management/Marketing Interface IV
WD31	Innovation and Quality in Service Delivery
WD32	Supply Chain/Competition
WD33	Research and Development
WD34	Performance Measurement 2
WD35	Dynamic and Stochastic Models in Emergency Response and Preparedness
WD36	Sports & Entertainment I
WD37	Marketing 1
WD38	Health Care, Process 1
WD39	Optimization in Radiation Therapy
WD40	Center for Systems Engineering in Health
WD41	Supply Chain Management VI
WD42	HSEA -IV- Undergraduate Projects in Healthcare Engineering
WD43	Network Flow Optimization
WD44	Strategy/Strategic Planning I
WD45	Behavioral Operations 2
WD46	Complexity and Algorithmic Aspects in Linear and Nonlinear Optimization
WD47	Topics in Stochastic Programming
WD48	Optimization, Stochastic 2
WD49	Network Analytics
WD50	Optimization, Integer 4

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WD51	Game Theory 2
WD52	Optimization, Linear Programming 2 Integer 4
WD53	Finance Theory and Empirics
WD54	Modeling and Computations in Financial Engineering
WD55	Chance, Inference and Robustness
WD58	Scheduling V
WD63	Decision Analysis 2
WD64	Algorithms on Graphs and Trees
WD65	Performance Evaluation and Optimal Policies
WD66	Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations
WD67	Gaussian Process and Spatial Data Analysis (II)
WD68	Agent-Based Computational Models of Economic and Financial Processes
WD69	Pollution Regulation and Abatement
WD70	Forecasting 1
WD72	Energy VII
WD73	Integrating High Resolution Spatial Data and Optimization Models for Energy Production/distribution Analysis
WD74	Modern Optimization Techniques for Fundamental Computation Problems in Power Systems
WD75	Simulation II
WD76	New Analytics Frontiers in Retail
WD77	Analytics at its BEST
WD78	Decision Support Systems 2
WD79	Project Analytics
WD80	Behavioral Decision Making
WD81	Data Mining in Renewable Energy
WD82	Data Mining 7
WD83	Data Mining 4

Wednesday, 4:30pm-6:00pm

WE02	Technology Management
WE04	Remanufacturing
WE05	Supply Chain/Closed Loop I
WE06	Supply Chain/Closed Loop II
WE07	Supply Chain Managemen IX
WE08	Supply Chain Management X
WE09	E-Business/ Commerce 3
WE11	Supply Chain, Managing Disruptions II
WE12	Supply Chain Optimization III
WE14	Retail Management II
WE15	Design Engineering
WE17	Supply Chain, Design and Services
WE18	Optimal Pricing in E-commerce
WE19	Sales Optimization Management System – A Combined Optimization and Statistical Approach to Proactively Managing Enterprise Sales Resource Requirements and Sales Forecasting & Funnel Management
WE21	Sustainable Transportation/Logistics System Design
WE23	Traffic Management II

WE24	Disaster and Emergency Management 2
WE25	Transportation, Freight
WE26	Supply Chain, Shipping and Transportation
WE28	New Concepts to Minimize Delay in Terminal Area Operations
WE29	Operations Management/inventory
WE30	Operations Management/Marketing Interface V
WE31	Data Analytics-based Service Concept Development
WE32	Operations/Economics Interface
WE33	Innovation/Entrepreneurship
WE35	Managing Supply Chains in the Public and Non-profit Sector
WE36	Sports & Entertainment II
WE37	Marketing 2
WE38	Health Care Process 2
WE39	Risk Assessment in Healthcare
WE40	Optimization Models in Healthcare Applications
WE41	Supply Chain Management IX
WE42	Uncertainties in Radiation Therapy
WE43	Computational Network Flows and Routing
WE44	Strategy/Strategic Planning II
WE45	Behavioral Operations 3
WE46	Mixed Integer Programming
WE47	Theory and Applications of Robust Optimization
WE48	Resource Allocation
WE49	Statistical Analysis of Network Structures
WE50	Optimization, Application
WE51	Game Theory 3
WE52	Optimization, Other
WE54	Risk Analysis
WE55	Tractable Models and Algorithms for Optimization in Engineering
WE64	Customer Performance – Models and Applications
WE65	Bayesian Approach
WE66	The Impact of Heterogeneity in Reliability Prediction and Maintenance Planning
WE67	Gaussian Process and Spatial Data Analysis (III)
WE68	Sustainable Infrastructure Management and Decision-Making: Construction, Energy and Transportation Industries
WE69	Optimization Approaches for Designing a Green Energy System
WE70	Forecasting 2
WE72	Energy VIII
WE73	Targeted Demand Side Management: Uncovering Energy Usage Decisions from Data
WE74	Power System Resilient Design and Optimization
WE75	Simulation III
WE76	Practicum and Internship Experiences at Analytics Programs
WE77	Joint Session Analytics/HAS: Strategic Payment and Pricing Healthcare Analytics
WE78	Decision Support Systems 3
WE79	Model and Model Validation in Disaster Management
WE81	Predictive Models in Data Mining
WE82	System Analysis
WE83	Data Mining 5