Wednesday, 8:00am - 9:30am

■ WA01

Reputation and Ranking Systems

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Eric Friedman and Ashish Goel, Cornell and Stanford, ORIE and MSandE, Ithaca, NY, 14850, United States, friedman@orie.cornell.edu

1 - Game-Theoretic Aspects of Designing Hyperlink Structures
Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com

We study the problem of designing the hyperlink structure of a website to maximize the revenue generated by a random walk on the website. We ask if each webpage is controlled by an autonomous agent, is it possible to give all coalitions incentive to cooperate and build the optimal hyperlink design? We show that the optimal design is in the core of the transferable utility game. For non-transferable utilities, we show the core is non-empty but can be highly inefficient.

2 - Strategic Manipulation of Internet Opinion Forums: Implications for Consumers and Firms
Chrysanthos Dellarocas, R. H. Smith School of Business, University of Maryland, 4341 Van Munching Hall, College Park, MD, 20742, United States, cdell@rhsmith.umd.edu

Firms whose products are being discussed in online forums are tempted to manipulate consumer perceptions by posting anonymous messages that praise their products. This paper analyzes the impact of such behavior on firm profits and consumer surplus. Contrary to intuition, we show that strategic firm manipulation can sometimes help consumers better assess the true qualities of competing products and, thus, improves the information value of online forums to consumers.

3 - Incentive-Based Ranking Mechanisms
Ashish Goel, Terman 311, Stanford University, Stanford, CA, United States, agoel@cs.stanford.edu, Ashish Goel

We consider ranking/recommendation systems based on user feedback. We make a case for sharing with users the revenue generated by such systems. Our main contribution is a mechanism which rewards useful feedback and is resistant to selfish/malicious behavior (eg. click spam). The mechanisms are designed to reward discovery of high quality entities. Misclassified pages represent an arbitrage opportunity for the discerning user. The mechanisms are simple enough for use with existing technology.

4 - On the Efficiency of Ranking Methods
Eric Friedman, Associate Professor, ORIE Cornell, Ithaca, NY, 14850, ejf27@cornell.edu

We analyze the effectiveness of various ranking systems from a statistical perspective. We consider a class of random graphs in which nodes are more likely to link to higher "quality" nodes which are themselves more selective. We show that both pagerank and indegree are significantly suboptimal and thus there is significant room for improvement. Of independent interest, we prove new results about the distribution of pageranks on random graphs with bounded expected degree.

■ WA02

Joint Session Open-Source/ICS: Open-Source Application Programming Interfaces for Optimization II

Cluster: Open-Source Software: Open Source, Open Standards, Open Data, INFORMS Computing Society
Invited Session

Chair: Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

1 - The OSInstance Application Programming Interface for Optimization Problem Instances
Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Kipp Martin, Jun Ma

As a complement to our proposal for OSiL, a new XML-based representation for optimization problem instances, we propose OSInstance, an in-memory representation. An open-source library provides application programming interfaces for reading and writing OSiL and OSInstance and for converting between them. This arrangement allows the two standards to be defined by a single design, yet offers diverse "get" methods for extracting data from OSInstance objects in a variety of convenient ways.

2 - Convergence of Optimization Instance Languages in XML with Solver API's
Bjarni Kristjansson, Maximal Software, 2111 Wilson Boulevard #700, Bjarni@maximalsoftware.com

In recent years there has been lot of activity in the development standard languages of optimization instances through XML (OptML, OSiL). In this presentation we will explore various design issues and the benefits of possible convergence with published API's for optimization solvers and how they relate to each other.

3 - Using the Optimization Services hookup Language (OShL) to Invoke Remote Optimization Services
Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin

We describe an open-source, platform and language independent API that implements OShL, a universal framework for hosting and invoking optimization software as services. OShL makes use of Web service standards to facilitate synchronous ("solve") and asynchronous ("send") optimization via the Internet. OShL has built-in features to maintain states ("getJobID") between subsequent service invocations, and to remotely "knock", "kill", and "retrieve" optimization jobs from the services.

■ WA03

Large Scale Optimization Models and Solution Approaches in Health Applications

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Optimizing Beam Sequence for IMRT planning
Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston, TX, 77204, United States, ginolim@uh.edu

We consider a Beam Sequencing Problem (BSP) for IMRT planning. Given a fluence map, we aim to decompose the non-homogeneous beam intensity map into several (finite) number of beam shapes such that each beam will have a uniform intensity. It is known that solving BSP is NP-hard. We reformulate this problem as an optimization problem to minimize the final error between the fluence map and the results from the decomposition. We believe that this approach is much more practical for practioners.

2 - Probability Modeling for Heuristics to Beam Selection in Radiotherapy
Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, United States, aholder@trinity.edu, Evan O'Dea

Selecting optimal beams in the design of radiotherapy treatments often requires values (probabilities) to be assigned to angles. We show that a balanced solution provides a suitable distribution and characterize when this distribution correctly estimates zero probabilities.

3 - Robust Optimization for Intensity Modulated Radiation Therapy (IMRT) Treatment Planning
Yuriy Zinchenko, AdvOL, CAS, McMaster University, 1280 Main Street W, ITB 221, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca, Millie Chu, Michael Sharpe, Shane Henderson

We propose a robust formulation for IMRT fluence map optimization problem that allows to incorporate the inheritent geometric uncertainties into the model. This approach has the potential to find treatment plans that are more adept at sparing healthy tissue while maintaining the prescribed dose to the target as compared to traditional models. Several strategies to reduce the computational burden associated with solvimg this problem are discussed.

4 - Optimal Design of Regions for Liver Transplantation: A Stochastic Programming Approach
Mehmet Demirci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States, mcd21@pitt.edu, Brady Hunsaker, Mark Roberts, Andrew Schaefer

Currently the in the U.S., a harvested liver is offered hierarchically, first within the local area, then regionally and finally nationwide. We consider the problem of optimizing the design of regions for liver transplantation across the U.S. We employ a two-stage stochastic programming approach where the scenarios give snapshots of the waiting list and a pricing problem generates promising regions. We adopt a branch-and-price framework and present preliminary computational results.

■ WA04

Scheduling Applications I

Contributed Session

Chair: Ai Jun Zhang, Operations Analyst, Wells Fargo, 11601 N. Black Canyon Highway, Phoenix, AZ, 85029, United States, AiJun.Zhang@wellsfargo.com

1 - Stability and Scheduling of Cambridge Ring Queueing Network
Balaji Sampath, Graduate Research Assistant, The University of Texas at Austin, 3501 Speedway #103, Austin, TX, 78705, United States, balajis@mail.utexas.edu, John Hasenbein

This paper analyzes the stability of the Cambridge Ring Queueing network and discusses the scheduling of a few special cases of the network to optimize average work in progress (WIP). We also present simulation results of the performance of this network with respect to average WIP under different policies.

2 - Total Flow Time Minimization for a Flow Shop with Synchronous Transfers
Banu Soylu, Research Assistant, Middle East Technical University, Cankaya, Ankara, 06531, Turkey, bsoylu@metu.edu.tr

In this study, a flow shop sequencing problem with synchronous transfers is considered. Our objective is to minimize the total flow time. We assume that the speed of the transfer mechanism is adjusted by the end of each unit completion; i.e. cycle. We present a branch and bound algorithm. The algorithm returns optimal solutions to moderate-sized problems with reasonable solution times. For larger sized instances, the upper bounding procedures can be used to approximate the optimal solution.

3 - An Auction System for Scheduling Employees
Melanie De Grano, Penn State University, 310 Leonhard Building, State College, PA, 16802, United States, mxd265@psu.edu

This research illustrates a scheduling process in which employees can bid on preferred shifts in an auction format. Bids are used as input to an assignment model which allocates any remaining vacant shifts. The resulting schedule satisfies coverage and accommodates as many preferences as possible. Nurse scheduling is used for demonstration.

4 - Optimizing Capacity Planning in Real World
Ai Jun Zhang, Operations Analyst, Wells Fargo, 11601 N. Black Canyon Highway, Phoenix, AZ, 85029, United States, AiJun.Zhang@wellsfargo.com, Hung-Nan Chen, Charles Reichenbach

We model and achieve optimal staffing considering not only demands, employee categories, and cost but also learning curve, attrition and business practice. The non-linearity from the model complicates the derived solution; we are challenged by the non-smoothing results obtained from the optimization. We will demonstrate how a Dynamical Variable Grouping algorithm is developed for solving this problem and how a smooth, realistic and optimized capacity planning solution is obtained.

■ WA05

Coordination and Outsourcing of Supply Chain Processes

Contributed Session

Chair: Katariina Kemppainen, Assistant Professor, RSM Erasmus University, Burg. Oudlaan 50, 3062 PA, Rotterdam, Netherlands, kkemppainen@rsm.nl

1 - Channel Coordination in Increasing Price Environments
Guoren Zhang, PhD Candidate, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A3K7, Canada, gzhang@ivey.uwo.ca, Ai Xingzheng

This paper examines two policies that are used to coordinate supply chain channels in increasing price environments: Midlife Returns (M) and End-of-Life Returns (E). We show that the combination of two policies can achieve coordination. We give out a group of detailed coordination mechanisms.

2 - Outsourcing Design Works to Contract Manufacturers
Jun Shan, PhD Candidate, Hong Kong University of Science and Technology, A408A, UA, HKUST, Clear Water Bay, Kowloon, Hong Kong, jshan@ust.hk

We study a brand-name company that outsources the production of a product to a contract manufacturer. The brand-name company has two alternatives: He can either conduct product design by himself, or let the manufacturer take over the design work (if the latter is capable of doing so). We compare the channel performance across the two alternatives and identify conditions under which a win-win situation can be achieved by letting contract manufacturers taking over product designs.

3 - Lean Thinking in Semiconductor Manufacturing
Peng Qu, Senior Industrial Engineer, AMD, 5204 E Ben White Boulevard, MS 563, Austin, TX, 78741, United States, peng.qu@amd.com, Shekar Krishnaswamy

In Semiconductor Manufacturing,lots take months to be processed in front-end fabs and one week for assembly and test respectively.Within this period,the value-added time is only a few days while lots spend most of remaining times on waiting. High non-value-added time results in high production inventory and costs,which may be reduced by bringing in lean manufacturing concepts. This presentation reviews the general assumptions/challenges of implementing lean concepts in Semiconductor Manufacturing.

4 - Coordinated Customer Order Management
Katariina Kemppainen, Assistant Professor, RSM Erasmus University, Burg. Oudlaan 50, 3062 PA, Rotterdam, Netherlands, kkemppainen@rsm.nl, Ari P.J. Vepsalainen

As a result of specialization and outsourcing, manufacturing firms are increasingly challenged to design efficient methods for coordinating inter-organizational processes. This paper analyzes the power of dispatching rules in the customer order management. Computational results and real-life examples will be discussed.

■ WA06

Heuristic Techniques

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Alan McKendall, Associate Professor, West Virginia University, 325A Mineral Resource Building, Morgantown, WV, 26506, United States, Alan.McKendall@mail.wvu.edu

1 - Solution Techniques for a Crane Sequencing Problem
Jin Shang, Quality Planning Corportation, 388 Market Street, Suite 750, San Francisco, CA, 94111, United States, jshang19@gmail.com, Alan McKendall

In the areas of power plant maintenance, it is essential to develop efficient techniques for relocating resources to new locations such that the cost is minimized. In this paper, it is defined as the crane sequencing problem (CSP). It is closely related to some variants of the traveling salesman problem. The CSP is a unique problem with many applications and is computationally intractable. In this paper, a mathematical model and hybrid ant systems are developed to solve CSPs.

2 - The General Machine Layout Problem
Juan Jaramillo, West Virginia University, PO Box 6070, Morgantown, WV, 26506, United States, jrjarami@rocketmail.com, Alan McKendall

The general machine layout problem (GMALP) is the assignment of machines to locations while simultaneously assigning parts flows between machines, such as total system profits are maximized. The GMALP can be represented as a combination of the quadratic assignment problem (QAP) and the maximum profits multicommodity flow problem (MPMFP). Since the GMALP is closely related to the QAP, it is computationally intractable.

3 - IMBOSH: IMprovement BOundary Search Heuristic for Solving Unequal Area Plant Layout Problem
Artak Hakobyan, West Virginia University, 1056 Van Voorhis Road, Apt. K 418, Morgantown, WV, 26505, United States, artakhak@yahoo.com, Alan McKendall

In this paper promising techniques are presented to solve the Facility Layout Problem with unequal area departments. The deficiency of most methods used to solve the discrete representation of the unequal area FLP is that the departments in the solution may have irregular shapes, and the computational time may increase considerably when considering smaller grid sizes. However, the heuristics presented in this paper solve the discrete model without these deficiencies.

■ WA07

Global Optimization: Software and Applications

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

1 - Using Global Optimization, Physics and Information Theory in Image Analysis

Larry Deschaine, Engineering Physicist, SAIC / Chalmers University, 272 Parker Road, Edgefield, SC, 29824, United States, Larry.M.Deschaine@alum.mit.edu, Melissa McKay, János D. Pintér, Seth Blanchard, Frank Francone

This work extends subsurface exploration techniques in geological work by incorporating algorithms and techniques from Information Theory, Physics Based Modeling, Signal Processing/Filtering, Medical Imaging, Machine Learning, Cognitive Modeling and Global Optimization. The result is a method to optimaly define subsurface objects such as plumes and unexploded ordnance.

2 - Global Optimization with Maple: An Introduction with Illustrative Examples

János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca

The objective of this talk - based on our electronic book - is to present Maple as an integrated modeling and optimization environment. Within this broad context, the emphasis is placed on solving GO models, using the Global Optimization Toolbox. We highlight the key features of the e-book, and present 'live' numerical examples.

3 - Numerical Results Using AMIGO (A Mixed Integer Global Optimizer)

Zsolt Ugray, Assistant Professor, Business Information Systems Department, USU, 3515 Old Main Hill, Logan, UT, 84321, United States, Zsolt.Ugray@usu.edu, János D. Pintér

We present some preliminary results for solving mixed integer global optimization problems using AMIGO (A Mixed Integer Global Optimizer).

4 - Circle Packing Problems: Numerical Results and Applications

Ignacio Castillo, Wilfrid Laurier University, School of Business and Economics, Waterloo, ON, Canada, icastillo@wlu.ca, Frank Kampas, János D. Pintér

A circle packing is an optimized arrangement of N arbitrary sized circles inside a given container (e.g., a rectangle or a circle) such that no two circles overlap. We present several circle packing problems, review their practical applications, and some strategies for their solution. We also provide illustrative numerical examples using (our) global optimization software.

■ WA08

Building Regional Innovation Systems Through Entrepreneurship: Beyond Market Incentives

Sponsor: Technology Management

Sponsored Session

Chair: Robert Lowe, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15222, United States, roblowe@cmu.edu

1 - Are Environmental Technologies Unique?: University Inventions and Tech Adoption

Matt Hamilton, PhD Student, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, mhamilto@andrew.cmu.edu, Robert Lowe

Academics and practitioners have expressed concerns that environmental technologies struggle to transition from laboratory to commercial adoption. The open question in this line of research is: are barriers to adoption attributable to environmental technologies specifically or indicative of a broader set of technologies. We study disclosure and commercialization of environmental technologies developed at universities to explore this critical question.

2 - Government Regulation of Entrepreneurs

Steven Michael, Schoen Faculty Fellow and Associate Professor of Business Administration, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, 61801, United States, smichael@uiuc.edu, Candace Martinez

Little empirical research has been carried out to shed light on the relationship between the informal norms of a society (its culture) and the formal rules and regulations that structure the economic lives of its citizens (regulation). This study examines the effects of culture on regulation of entrepreneurs for starting new businesses in 51 countries. Culture does affect regulation of entrepreneurs in ways consistent with existing theory. Implications for theory and practice are discussed.

3 - Public Innovation and Commercial Entrepreneurship in Nascent Software Markets

Jon Eckhardt, Assistant Professor, University of Wisconsin-Madison, Madison, WI, 53706, United States, jeckhard@wisc.edu

This paper empirically examines in a sample of over one million transactions if the effect innovations have on a focal commercial product depends on whether innovators pursue financial incentives or not. I predict that innovations that are shared by individuals who are not guided by market incentives will increase the sales of commercial products. Conversely, due to competition products created for commercial purposes will decrease the sale of other commercial producers.

4 - Offshoring of Technology and Local Innovation Dynamics

Brian Fifarek, PhD Student, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, bfifarek@andrew.cmu.edu

Current research maintains that firm-level offshoring practices are beneficial to firms and national economies, but little is known about the long-term effect of offshoring on home economy innovation, especially at a regional or local level. We look at the rare earths industry to understand how offshoring practices have adverse effects on innovation at the regional and national levels.

■ WA09

Business Applications I

Contributed Session

Chair: Augusto Rupérez Micola, Research Fellow, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, Augusto.RuperezMicola@imd.ch

1 - Capital Investment of Wafer Foundry Industry: The Cases of TSMC and UMI

Kun-Jung Hsu, Assistant Professor, Leader University, No. 188 An-Chung Rd. Sec. 5, Tainan, 709, Taiwan, hsu@mail.leader.edu.tw, Chi-Wen He

Wafer foundry industry is the kind of high capital-intensive. But how the industry decides the ongoing capital investment? The paper uses profit opportunities and capital stock of the company as two major variables to explain the capital investment of TSMC and UMI. After examining the G-Q test, we find the market value of the company respect to the residual of the model exhibits hetereskedasticity. Accordingly the results of GLSE, the investment behavior of the two companies were discussed.

2 - Deploying Virtuality in Organization Studies: A Moment of Reflection

Pracheta Mukherjee, Mukherjee Associates, 20 West Cooper Street, Slippery Rock, PA, 16057, United States, pracheta@aol.com

The metaphor of virtuality is widely used in describing organizational phenomena. At least, eight different uses were identified in print. Sadly, a few of these applications or metaphors have no coherent link to the original optical phenomenon from which they draw their inspiration.

3 - Optimal Forward Buys of Commodities with Increasing Price Uncertainty

Andrew Manikas, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree Street, College of Management, Atlanta, GA, 30332, United States, andrew.manikas@mgt.gatech.edu, Yih-Long Chang, Mark Ferguson

Commodity prices often fluctuate significantly so firms often practice forward buying (buying for future demand) when prices are low. We provide models to determine the optimal number of future periods to purchase for at each ordering opportunity to minimizes total expected costs given the increasing uncertainty of future prices.

4 - Demand Forecasting - Case Study from the DVD Industry

Namit Mehta, Consultant, Infosys Technologies Limited, 9400 Wade Boulevard, Apt. # 1022, Frisco, TX, 75035, United States, namitmehta@gmail.com

Demand Forecasting and Operations Planning within the DVD market has the capability to make or break the Home Entertainmemt Divisions of the Hollywood studios. The need to build scientific forecasting processes for a new release of a DVD in the retail market and its implications are discussed. Implications of moving from a number forecast to a distribution based forecast are discussed.

5 - Toeholds as Real Options: An Empirical Approach
Augusto Rupérez Micola, IMD, Chemin de Bellerive 23, Lausanne, Switzerland, augusto.ruperezmicola@imd.com, Didier Cossin

We study partial acquisitions as a stepping stone ("toehold") in a full acquisition. Our main theoretical resting point is adverse selection: When target assets are specialised, information on their prices could be unavailable to the buyer. Small acquisitions could be a way of alleviating this problem.

■ WA11

Medical Appointment Scheduling

Contributed Session

Chair: Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States, laganga@colorado.edu

1 - Efficient Short Term Allocation of Patients to Floors of a Hospital During Demand Surges
Matthew Dean, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States, matthew.dean@business.uconn.edu, Robert Garfinkel, Manuel Nunez, Steven Thompson

Many hospitals face the problem of insufficient capacity to meet demand for inpatient beds, especially during demand surges. As a result, large delays occur between the admission of a patient and his arrival to a floor causing degraded patient care and lost revenue. One solution is to proactively transfer patients between floors in anticipation of demand. To solve this allocation problem, an optimization-based decision support system was developed and implemented at a local community hospital.

2 - Strategic Medical Scheduling: Evaluation of an Out-of-Office Scheduling System
Chris Duckworth, University of Tennessee, 451 Lager Drive, Maryville, TN, 37801, United States, cduckwor@utk.edu

A medical practice's schedule of patients can be separated into two separate queues, an out-of-office scheduled queue and an in-office queue. Dynamics affecting the out-of-office waiting portion of a single physician medical clinic are presented and discussed. A series of analytically stochastic classification-based scheduling systems are developed utilizing class dependent social utility functions to define a patient's ability to wait out-of-office.

3 - Scheduling Patients Elective Surgeries Using a Revenue Management Approach
Alia Stanciu, PhD Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, alstanciu@katz.pitt.edu, Luis Vargas

We present implementations of revenue management concepts and models for scheduling patients requesting elective procedures. Surgical units within a hospital should recognize the necessity of functioning as profit centers, and so, a segmentation mechanism based on patients' insurance type will be considered in allocating operating room times to various procedures.

4 - A New Formulation of Service Level for Overbooking Appointment Schedules
Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States, laganga@colorado.edu

We extend airline service level modeling to time-driven appointment scheduling to support decision-makers in efficiently evaluating the operational impact of overbooking on clinic overtime. Our dynamic branch and fathom model finds the maximum booking level that does not exceed a desired probability of overtime. This allows clinic managers to efficiently predict the impact of appointment overbooking policies on clinical providers.

■ WA12

Enterprise-Wide Optimization: Petroleum & Energy Industries

Cluster: Enterprise-Wide Optimization in the Process Industry
Invited Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Optimization of Recipe for and Scheduling of Gasoline Blending and Distribution
Jie Li, National University of Singapore, Singapore, 117576, Singapore, g0304872@nus.edu.sg, Iftekhar Karimi, Rajagopalan Srinivasan

In this paper, we develop a more efficient formulation for simultaneous treatment of recipe, blending, scheduling, and distribution in contrast to previous works that have considered only parts of these and a new algorithm to solve the nonlinearity arising from the variable property indices of the input materials to the bending unit. Several examples are provided to illustrate the effectiveness of our formulation and algorithm.

2 - Global Optimization for Scheduling Refinery Crude Oil Operations
Ramkumar Karuppiah, Graduate Student, Department of Chemical Engineering, Doherty Hall, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, rkaruppi@andrew.cmu.edu, Kevin Furman, Ignacio Grossmann

We present an Outer-Approximation algorithm to obtain the global optimum of a nonconvex Mixed Integer Nonlinear Programming model for the scheduling of crude oil movement at the front-end of a petroleum refinery. A spatial decomposition of the network is performed to enhance the computational efficiency of the algorithm.

3 - Upstream Supply Chain Planning in Natural Gas Systems: A Real World Case Study
Ajay Selot, Massachusetts Institute of Technology, 66-365, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, selot@mit.edu, Paul Barton

We present a short term planning framework for upstream natural gas supply chain operations using the Sarawak Gas Production System in Malaysia as a case study. Operation of the system is governed by complex contracts evolved over years. These are a challenge to model and require the use of binary variables. Moreover the infrastructure model is nonconvex. The overall program is a nonconvex MINLP and is solved with a global branch-and-reduce algorithm with customized heuristics.

4 - Incorporation of Emerging Technologies for Environmentally Conscious Energy Production Systems
Metin Turkay, Assistant Professor, Koc University, Rumelifeneri Yolu, Istanbul, 34450, Turkey, mturkay@ku.edu.tr

Industrial systems require energy for production, therefore the supply of energy is as important as the supply of any other raw material. It became a requirement to incorporate new technologies due to stricter environmental reglations in energy systems. In this talk, environmentally friendly technologies will be evaluated and an optimization model that considers some emerging technologies that are applicable in the short-term will be presented.

■ WA13

Teaching Operations Research in a Liberal Arts Setting

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Christopher J Zappe, Interim Dean of Arts and Sciences, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Teaching Operations Research in a Liberal Arts Setting
Christopher J Zappe, Interim Dean of Arts and Sciences, Bucknell University, 113 Marts Hall, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

In this session we will consider the opportunities and challenges of teaching operations research to predominantly undergraduate students at a liberal arts institution. Specifically, we consider how learning OR can enhance undergraduate liberal arts students' quantitative literacy as a critical component of their general education. Upon providing some background material, the presenter will facilitate a discussion of some critical issues facing those who teach OR in a liberal arts setting.

■ WA14

E-Business/Commerce I

Contributed Session

Chair: Yongma Moon, The Pennsylvania State University, 710 S. Atherton Street #512, State College, PA, 16801, United States, yongma@psu.edu

1 - Category Management and Internet Retailing
Adam Fleischhacker, Rutgers University, 73 Castle Rock Road, Lake Hopatcong, NJ, 07849, United States, adam_fleischhacker@yahoo.com, Mahesh Kumar

Given that online stores are typically organized by product category, this research investigates Internet retailing from a category perspective. By leveraging the increasing body of offline category management research, theoretical predictions of the key drivers of online category performance are surmised. These predictions are empirically tested and results are presented to provide insights into effective category management practices on the Internet.

2 - Comparing Comparison Shopping Sites
Jan Edman, Assistant Professor, Penn State University, 120 Ridge View Drive, Dunmore, PA, 18512, United States, jme22@psu.edu

Comparison shopping sites collect information about product offerings from retailers and present this information on their own sites. At a time of growth of E-commerce and growing use of comparison shopping sites, comparisons between the leading sites are of particular interest. This paper compares prices and number of listed retailers on six leading sites in three years. The paper also compares, with an experiment, consumer selections of retailers across four different designs of leading sites.

3 - Interaction Between Different Supplier Types in B2B Spot Markets
Hila Etzion, Assistant Professor of Business Information Technology, University of Michigan, Stephen M. Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States, etzionh@bus.umich.edu, Edieal Pinker

We model a spot market in a make-to-stock industry with two types of suppliers: a Type 1 supplier faces stochastic contracted demand and has access to the spot market for liquidating surplus, while a Type 2 supplier produces only for the spot market. We find the production quantity equilibrium when the market consists of one supplier of each type and determine which supplier benefits more from the existence of the spot market and from an increase in spot market's demand.

4 - Revenue Management and Investment for the Internet Channel: Real Option Approach
Yongma Moon, The Pennsylvania State University, 710 S. Atherton Street #512, State College, PA, 16801, United States, yongma@psu.edu, Tao Yao

With the rapid development of the Internet, manufacturers have been interested in constructing the direct internet selling channel. We study the investment decision to construct the Internet channel based on a real option approach to quantify the managerial flexibility under uncertainty. Our study shows paradoxical result and double marginalization in revenue for the dual channel. We use the Monte Carlo simulation to derive our solution.

■ WA15

Auctions and Computer Science

Cluster: Auctions and e-Commerce
Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, kevinlb@cs.ubc.ca

1 - Informational Limitations of Ascending Combinatorial Auctions
Liad Blumrosen, Microsoft Research, Silicon Valley, blumrosen@gmail.com, Noam Nisan

We study the inherent limitations of natural widely-used classes of ascending combinatorial auctions. Specifically, we show that ascending combinatorial auctions that do not use both bundle (non-linear) prices and personalized (non-anonymous) prices can not achieve social efficiency with general bidder valuations. This casts doubt on the performance that can be achieved using the simpler auctions suggested in the literature, and justifies the added complexity in the auctions suggested by Parkes and Ungar (2000) and Ausubel and Milgrom (2002). Our impossibility results are very robust in several senses: they hold for any price update system, pattern of interaction with agents, or payment determination rule. They do not depend on strategic aspects of the bidders, on computational limitations or on communication limitations. Finally, we show that the loss of efficiency is severe and that only a diminishing fraction of the social welfare may be captured.

2 - Combinatorial Agency
Moshe Babaioff, University of California, Berkeley, Michal Feldman, Noam Nisan

The field of Algorithmic Mechanism Design handles the issue of private information held by different "selfish" parties in computational settings. This paper deals with a complementary problem: handling the "hidden actions" that are performed by the different parties. Our focus is on cases where {\em complex combinations} of the actions influence the outcome. We present formal models for this setting, suggest and embark on an analysis of some basic issues, but leave many questions open.

3 - Bidding Agents for Online Auctions with Hidden Bids
Kevin Leyton-Brown, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, kevinlb@cs.ubc.ca, Albert Xin Jiang

When the valuation distributions of bidders in online auctions are not known ex ante, machine learning techniques can be used to approximate them from historical data. It is a characteristic feature of such auctions, however, that information about some bidders' valuations is systematically concealed. This occurs in the sense that some bidders may fail to bid at all because the asking price exceeds their valuations, and also in the sense that a high bidder may not be compelled to reveal her valuation. Ignoring these "hidden bids" can introduce bias into the estimation of valuation distributions. To overcome this problem, we propose an EM-based algorithm, which we validate experimentally using agents that react to their environments both decision-theoretically and game-theoretically, and using both synthetic and real-world (eBay) datasets. We show that our approach estimates bidders' valuation distributions and the distribution over the true number of bidders significantly more accurately than more straightforward density estimation techniques.

■ WA16

Forecasting: Issues, Models, and Challenges

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Edward Kambour, Director of Science and Research, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, ekambour@prosrm.com

1 - Measuring Forecast Precision in RM Applications, or "How Do I Know This Stuff is Working?"
Edward Kambour, Director of Science and Research, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, ekambour@prosrm.com

It is clearly important to deliver quality forecasts. However, in practice the process of measuring forecast effectiveness tends to be problematic, even though to the lay person it seems simple: just compare the forecasts to actual observations. In this presentation we will examine methods and metrics, and also touch on the pitfalls associated with the commonly used "common sense" approaches.

2 - Forecast Accuracy Monitoring & Control Process: Call Center Applications
Viroj Buraparate, Manager, Hewlett Packard Company, 20555 SH 249, Houston, TX, 77070, United States, Viroj.Buraparate@hp.com, Kristofer Johnson, David Olsen

The authors discuss how to integrate the call centers operations' requirements into the forecasting process. By applying quality control techniques, the new forecasts can be statistically adjusted to react to the dynamics of the in-bound call volumes and operations' constraints. Methodology and examples will be given.

3 - DARMA: Interpreting the Results of a Regression
Evan Brott, Scientist, PROS Revenue Management, 3100 Main Street #900, Houston, TX, 77002, United States, ebrott@prosrm.com

Driver Apportionment for Regression Model Analytics (DARMA), a novel method for visualizing and analyzing the results of a regression, is presented. Each covariate is represented as causing a specific deviation from a filtered response; shifts in this response over time can then be attributed to sources other than the analyzed covariates. Examples and applications using real datasets are provided.

■ WA17

Shipping, Maritime, and Supply Chain Logistics

Contributed Session

Chair: John Liu, Department of Logistics, Hong Kong Polytechnic University, Lgtjliu@polyu.edu.hk

1 - Efficiency Analysis of Global Container Ports with Time-Variant Individual Production Frontiers
Jia Yan, Hong Kong Polytechnic University, Lgtjiay@polyu.edu.hk, Xinyu Sun, Tsz Leung Yip

With the ever-increasing role of seaports in global supply chain, port efficiency has become one of the most critical indicators of global and regional economies. In assessing the production efficiency of global container ports, there are two well-noted intriguing points of complication, that is, operator-dependent heterogeneity and time-variant productivity. While effective methods of production efficiency analysis to address these two points are still seriously lacking. In this paper, we develop MC/MC based econometric models and algorithms for port efficiency analysis, using time-variant heterogeneous production frontiers. We report initial results of our ongoing empirical study of global container port efficiency, by applying the methods and algorithms we are developing on the database of over 150 terminals/operators.

2 - Law Enforcement at Sea by Port State Control
Kevin Li, Hong Kong Polytechnic University, Lgtkxli@polyu.edu.hk, Haisha Zheng

After the events of September 11th 2001, shipping as the one of next potential targets gets more and more attention on security. One of the effective and efficient measures against terrorism and strengthen safety of shipping seems to be PSC inspection systems. The higher and higher inspection rates are adopted by PSC authorities and now it has caused some issues since the inspection-related initiatives not only involve immediate costs but also slow down international trade and put up inventory costs and ultimately prices, moreover even the United State as the richest country in the world can afford the financial burden to realized 100% inspection. This research focuses on an inspection rate set by a PSC authority under different resource limitation. We investigate the relationship between a PSC authority and ship-operators. A generic game model of a decision-making mechanism used by a PSC authority is formulated by adopting the theory of Stackelberg theory. After specify the generic model, four inferences are obtained. We also show some real PSC inspection systems to reveal these results.

3 - Simulation Framework for Inter-Port Competition in the South China
Meifeng Luo, Hong Kong Polytechnic University, Lgtmluo@polyu.edu.hk, Tsz Leung Yip

Hong Kong port has been the world leading container port over the past 20 years. However, with the recently fast port development in Chinese Mainland, it is now facing strong competition from the new, low cost ports in South China. The rapidly changing environment offers researchers opportunities to disclose the mechanisms of inter-port competition. This paper first introduces the port development and competition in the South China. It includes recent international trade, national and regional port-related policies, and response of private investors. A spatial simulation framework will be introduced next, which takes into account shipper preferences, transportation facility development and strategic responses by existing ports. A discrete choice model to estimate shippers' spatial preference and experimental settings in the port simulation laboratory for hypothesis testing will also be discussed.

4 - Instability of Dynamic Inventory and P&I Insurance Reserve Systems
Jia Yan, Hong Kong Polytechnic University, Lgtjiay@polyu.edu.hk, John Liu

Motivated by the notorious volatility in insurance reserves of marine P&I (protection and indemnity) and the bullwhip effect in supply chain, we study in this paper the instability of a dynamic inventory system, with the understanding that the same transition dynamics are associated with insurance reserve and supply management. We report that instability in inventory transition alone can cause the bullwhip effect in a dynamic inventory system that is normally considered as free of the bullwhip effect. Based on stability analysis of difference equations, we obtained two important findings: 1) A one-time change in the fixed-point steady state will affect all the future inventory planning, such that the optimal order-up-to level will start to oscillate and diverge. The inventory system is therefore prone to the bullwhip effect, and thus explains volatility problems in insurance as well as in supply chain. 2) Inventory/insurance refunds can stabilize the system.

5 - A Tactical Planning Model for Liner Shipping Companies: Joint Management of Container Flow and Ship Deployment
Xinxin Liu, Heng-Qing Ye, Xue-Ming Yuan

This paper addresses two practical problems from a liner shipping company, i.e., the container flow management problem and the ship deployment problem at the tactical planning level. The joint optimization model, as well as a sequential model, are formulated to solve the problems. Our results show the company should implement the joint optimization model at the tactical planning level to improve the shipping capacity utilization rather than the sequential model used in the current practice. Repositioning of empty containers is also considered jointly with the loaded container flow at the tactical planning level. Some important managerial insights into the operational and business processes are gained.

■ WA18

Modeling Systems

Contributed Session

Chair: Mieko Moki, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, moki@jp.fujitsu.com

1 - New Approach to Management Accounting for Process Industries with Mathematical Programming
Tomoaki Miyazaki, Senior Research Fellow, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, t.miyazaki@jp.fujitsu.com, Susumu Ikenoue, Mieko Moki

Strategic use of IT spread by extension of SCM. Especially, by wonderful progress of computer, the mathematical programming technique has greatly contributed to SCM realization. This paper describes the new approach using the mathematical programming technique which supports management accounting of process industries. We will show the availability using visual modeling and simulation tool.

2 - New Paradigm of the Profit-and-Loss Planning and Simulation for Process Industries
Susumu Ikenoue, President, Ike Ltd., 5-33-4, Otsuka, Bunkyo, Tokyo, Japan, susumu.ikenouye@nifty.ne.jp, Tomoaki Miyazaki, Mieko Moki

To cope with economical environmental change and to keep enterprise profits, on demand decision-making become to be more difficult and to be done more promptly. In process industry, LP based profit management function will be very strong tool for the people who has responsibility of enterprise-wide profit control. From practical point of view, the structure of this tool should be designed for daily work for ordinary persons.

3 - Preprocessing DEA
Francisco Lopez, University of Texas-El Paso, 500 W. University Avenue, El Paso, TX, United States, fjlopez@utep.edu, Jose Dula

We compile, analyze, implement, and compare different preprocessing procedures for identifying efficient and inefficient DMUs in DEA. We treat the problem as a special application of procedures from the more general problem of classifying boundary and interior elements of finitely generated polyhedral sets. Contributions to DEA emerge from these adaptations . A new preprocessor is introduced based on the rotation of hyperplanes.

4 - The Future of Network-Based Modeling and Forecasting in the Transportation Industry
Anna Engelsone, MergeGlobal, Inc, 1010 N. Glebe Road, Suite 420, Arlington VA, United States, aengelsone@mergeglobal.com

Poor data availability and complexity of transportation networks are common obstacles to creating detailed network simulation models for the air freight industry. Our model incorporates network generation based on airline schedules, demand distribution based on data synthesis and optimization, and a forecasting engine. We will demonstrate how our model has aided our clients in making important strategic decisions and discuss extensions to sea freight and other industries.

5 - Visual Modeling and Simulation Tool for Process Industries
Mieko Moki, Fujitsu Research Institute, New Pier Takeshiba South Tower, 16-1, Kaigan 1-Chome, Minato-ku, Tokyo, 105-0022, Japan, moki@jp.fujitsu.com, Tomoaki Miyazaki, Susumu Ikenoue

This paper describes the visual modeling tool for process industries which offers easy and quick planning environment and supports management accounting. In this tool, defining Process flow and Table data generate automatically LP-format data. And, for management accounting, this tool decomposes the total cost which is result of optimization into the production cost i.e., resource cost, utility cost, operation cost for every product.

■ WA19

Optimization Under Uncertainty in an Electric Power System

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15206, United States, mmazumd@engr.pitt.edu

1 - Optimal Buying and Selling Strategies for a Power Retailer
Antonio J. Conejo, Professor, Univ. Castilla - La Mancha, Campus Universitario s/n, Ciudad Real, Spain, Antonio.Conejo@uclm.es, Jose M. Arroyo, Miguel Carrion

An electricity retailer faces two sources of uncertainty. While buying electricity, it must cope with uncertain pool prices or sign forward contracts. While selling electricity, it should handle the fact that customers might choose a different retailer if the selling price is not competitive. We propose a risk-constrained stochastic programming framework to decide which forward contract the retailer should sign and at which price it must sell electricity so that its expected profit is maximized.

2 - Effects of Market-Based Uncertainty on Optimal Flows of Fuels and Power in the U.S.
Yan Wang, Research Assistant, Iowa State University, 2019 Black Engineering, Ames, IA, 50011-2164, United States, yanwang@iastate.edu, Sarah Ryan

A generalized network flow model of the U.S. electric energy system reveals ideal movements of coal, natural gas and electric power. We introduce uncertainties in fuel prices and market demands for electric power and use stochastic programming to learn how energy flows would be affected if the national energy system were planned optimally under these uncertainties.

3 - Sources of Uncertainty for the Locational Marginal Prices of Electricity
Lizhi Wang, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, liw18@pitt.edu, Mainak Mazumdar

The probability distributions of the LMP's depend mainly on the following factors: load uncertainty, generator and transmission line outages and congestion, and strategic gaming. We examine the contribution of each factor in determining these distributions.

4 - Long Run Power Sector Response to CO2 Allowance Allocation Methods
Ming-Che Hu, PhD Student, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, mchu@jhu.edu, J.-S. Pang, Jinye Zhao, Yihsu Chen

By basing the allocation of CO2 emissions allowance on investment decisions, carbon trading systems (including the EU) risk distorting investments. A long run capacity equilibrium problem is formulated subject to allocation rules, and is analyzed for existence of solutions. Simulations show a potential for large distortions.

■ WA20

Risk Assessment in Decision Analysis

Contributed Session

Chair: Ayse Kocabiyikoglu, Assistant Professor, Bilkent University, Department of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr

1 - A New Way Estimating Project Volatility in Real Options
Hyun Jin Han, Auburn University, 306 Dunstan Hall, Auburn University, AL, 36849, United States, hanhyun@auburn.edu, Chan S. Park

In real options analysis, one of the critical parameters in determining the option value is the volatility of the underlying asset. Even though several methods have been suggested in the literature, each method has its own weakness to serve as a general technique to various real options environment. In this presentation we first review various existing methods for estimating the volatility and suggest a new way to estimate the project volatility by adapting the Free Cash Flow (FCF) concept.

2 - Assessing the Value of Information in Supply Chain Decisions
Kimberly Thompson, Associate Professor, MIT Sloan School of Management, 50 Memorial Drive, E53-339, Cambridge, MA, 02142, United States, kmt@mit.edu

Efficiently managing supply chains requires understanding the system and optimizing performance based on trade-offs of multiple (often competing) objectives. For example, managers seek to minimize cost while maximizing resilency in the context of an uncertain future. This paper explores the application of decision analytic tools and perspectives to supply chain management and demonstrates the utility of considering the many possible futures dynamically.

3 - Evaluating Real Options for Mitigating Risk in Government R&D Acquisitions
Jeremy Eckhause, Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, jeckhause@lmi.org, Danny Hughes

Government acquisitions requiring R&D efforts are fraught with uncertainty. The risks are often mitigated by employing a multi-stage competition, with multiple vendors funded initially, until a single successful vendor is selected. While decision-makers recognize they are using a real option approach, analytical tools are often unavailable to evaluate optimal decisions. We present a stochastic integer programming approach for obtaining optimal strategies for generic, hypothetical acquisitions.

4 - Heuristic Methods as a Tool to Improve Management Decision Making
Mahmood Ridha, Assistant Professor, Philadelphia University, Jordan-Amman PO Box 1, Amman, 19392, Jordan, mahbedir@yahoo.com

This research aims to explore and analyze how heuristic methods can give better support for managers compared with some of mathematical models. It will give examples of some heuristic methods applyed to solve production planning problems.

5 - Managerial Motivation Dynamics and Incentives
Ayse Kocabiyikoglu, Assistant Professor, Bilkent University, Department of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We investigate drivers of managerial motivation by focusing on an agent's optimal effort decision in trading off compensation utility with effort cost. We identify the relevant motivational drivers underlying the agent's utility and compensation plan. We characterize properties of the agent's preferences for performance lotteries (such as risk aversion) that trigger systematic motivational patterns with respect to a variety of factors, such as agent's past performance and market factors.

■ WA21

Risk Management

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, Department of Business, 900 Wood Road, Kenosha, WI, 53144, United States, sounderp@uwp.edu

1 - Extending Medical Preference Models to Include Lifetime Goals
Gordon Hazen, Professor, Northwestern University, IEMS Department, Evanston, IL, 60208, United States, hazen@iems.northwestern.edu

QALYs in medical decision analysis capture ongoing goals with impact proportional to lifetime, like mobility or comfort. Extrinsic goals, like finishing a key project or seeing a child's graduation, are independent of lifetime. We give a wider QALY model that includes both goal types. This allows one to decline trading lifetime for health quality when remaining lifetime is short; and to refuse time with poor health quality after important life milestones - behaviors forbidden by the QALY model.

2 - Exploring the Risk Preferences Towards the Pure and Speculative Risks
Clare Chua, Associate Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B2K3, Canada, cchua@ryerson.ca

It has been assumed that the individual is risk averse when it comes to decision making. However, the falsity of such an assumption had been demonstrated time and again. How do we account for this apparent inconsistency? This is a study to understand how people react to different types of risk. We will use the Prospect theory to predict the risk behavior under the scenario of speculative risk and pure risk.

3 - Balancing Risk and Return in R&D Portfolios
Jeffrey Keisler, Assistant Professor, University of Massachusetts Boston, MSIS Department, 100 Morrissey Boulevard, Boston, MA, 02125, United States, Jeff.Keisler@umb.edu

Portfolio decision analysts often chart expected value against probability of success and then intuitively select a balanced mix of attractive projects. A mean-variance rule could, under some conditions, provide a stronger basis for balancing the portfolio.

4 - Risk Sharing through Coalition Formation in Multiple Ruin Game Environments
Jayavel Sounderpandian, Professor, University of Wisconsin-Parkside, Department of Business, 900 Wood Road, Kenosha, WI, 53144, United States, sounderp@uwp.edu

The starting point for this paper is the basic ruin game for which Demoivre gave the solution. Suppose there are two pairs of players playing two independent ruin games. It is possible that a player in one pair forms a coalition with a player in the other pair so as to reduce the risk of ruin for both of them. The paper analyzes such risk sharing possibilities among different combinations of players, and looks for stable coalitions. The results can be extended to more pairs of players.

■ WA22

Joint Session MAS/ED: Social Network Analytics: Methods and Applications

Sponsor: Military Applications, Education (INFORM-ED)
Sponsored Session

Chair: Mary Helander, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, helandm@us.ibm.com

1 - Using Social Networks to Evaluate University-High School Partnerships
Donna Llewellyn, Georgia Institute of Technology, 225 North Avenue, Tech Tower Suite 4, Atlanta, GA, United States, donna.llewellyn@cetl.gatech.edu

Social Network theory is applied to the process of evaluating the evolution of a program that partners a university with neighboring high schools. Measures such as graph density, connectedness, cut sets, and other classical graph theory constructs translate into social network tools that are used to analyze partnerships and to make policy decisions about how to best institutionalize these programs.

2 - Managing Collaboration in Knowledge-Intensive Environment
Fang Liu, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, United States, f-liu@northwestern.edu, Seyed Iravani, Wally Hopp

Collaboration is critical in knowledge-intensive environments for promoting efficiency and creativity. Dynamics of collaboration depend on social connections among agents. In this paper, we develop models to investigate mechanisms of collaborations and the impact of social networks. We draw insights into managerial policies by comparing agent-based behavior with a centralized management strategy.

3 - Importance Measures for Social Network Links
Mary Helander, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, helandm@us.ibm.com, Kate Ehrlich, Sarah McAllister

In this paper, we consider the mathematical importance of individual links in a social network. Relative to various network-level metrics, we mathematically define importance measurements for arbitrary links. We consider these measurements relative to the problem of identifying best (or worst) links to remove (or add) to a social network, and we discuss the implications for what we call "robust" and "frail" social networks.

4 - An Interpersonal Influence Representation in Social Network Flow Modeling
Jonathan Hamill, USAF/AFIT, 2950 Hobson Way, WPAFB, OH, 45434, United States, thehamills@yahoo.com, James Chrissis, Robert Mills, Richard Deckro

Methods to measure the strength of interpersonal ties among individuals in a social network as well as a means to mathematically characterize source-dependent influence are presented. These techniques lend themselves to use of classic network flow formulations, to include a new centrality measure based upon generalized network flows.

■ WA23

Risks and Gains of Offshore Outsourcing

Cluster: Global Services Sourcing
Invited Session

Chair: Praveen Pathak, Assistant Professor, University of Florida, 362 Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, Praveen@ufl.edu

Co-Chair: Ravi Aron, Assistant Professor, The Wharton School, 545 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, raviaron@wharton.upenn.edu

1 - Effective Strategies For Internal Outsourcing and Offshoring of Business Services
Andrea Masini, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, amasini@london.edu, Zeynep Aksin

The growing pressure to reduce costs induces organizations to undertake shared services initiatives. This paper builds upon the "structure-environment" perspective to uncover configurations of Shared Services organizations and to explain why some of these configurations exhibit superior results. The conceptual model proposed suggests that the effectiveness of a shared services project depends on the degree of fit between the characteristics of the environment in and the capabilities developed.

2 - Multi-Shore Sourcing of Judgment and Expertise-Intensive Services: Evidence From Field Research
Ravi Aron, Assistant Professor, The Wharton School, 545 Jon M. Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States, raviaron@wharton.upenn.edu, Annapurna Valluri, Lyle Ungar

Based on panel data collected from providers of multi-shore research and show that providers (firms) that use deep-linked inter-organizational information systems are able to migrate their buyers away from costly synchronous channels of communication (telephone, in-person) towards asynchronous channels that are less costly and over a period of time, more effective. Finally, we also study the factors that are best predictors of what makes ad-hoc sourcers convert to contractual sourcing.

3 - Offshore Outsourcing of Services: A Model of the Extended Organizational Form and Survey Findings
Ying Liu, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, yliu@wharton.upenn.edu, Ravi Aron

We provide a game-theoretical model of the Extended Organizational Forms (EOF) when the buyer firm outsources processes to a provider with the attendant problems of moral hazard. Constructing all functional forms based on our survey of Business Process Outsourcing contracts in several labor regimes (including the US, UK, Singapore, Mauritius and India), we derive the Subgame-Perfect Nash Equilibrium solutions and comment on the welfare implications of the EOF.

4 - Multi-Shore Sourcing of Services: Impact of Technology on Sourcing Outcomes
Annapurna Valluri, Wharton School, University of Pennsylvania, Suite 500 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States, avalluri@wharton.upenn.edu

In this paper we use computational methods to investigate how firms allocate production of services between different wage regimes and service characteristics, namely, in-house, onshore, offshore and automated utility. Our model was motivated by a survey we conducted with executives at different Fortune 500 companies. We also study the impact of different service characteristics on the allocation of production across the different wage regimes.

■ WA24

Supply Chain Coordination

Contributed Session

Chair: Puneet Prakash Mathur, Doctoral Student, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, puneetp03@iimb.ernet.in

1 - A Supply Chain Model with Direct and Retail Channels
Aussadavut Dumrongsiri, Information Systems and Operations Management, University of Washington, Mkz 370, UW Business School, Box 35320, Seattle, WA, 98195-3200, United States, adumrong@u.washington.edu, Ming Fan, Apurva Jain, Kamran Moinzadeh

We study a dual channel supply chain where a manufacturer sells to a retailer and consumers. mfr. decides direct channel price and retailer decides price and quantity. The difference in costs of 2 channels and demand variability determine the existence of equilibrium. Under a centralized setting, adding a direct channel will increase the overall profit. The dual channel is preferred by mfr. when the retailer cost is high and wholesale price, consumer valuation and demand variability are low.

2 - Chaos in the Supply Chain
Christopher Rump, Assistant Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States, cmrump@cba.bgsu.edu, Anju Bhatt

We develop game-theoretic models of the interactions between agents in either competitive or cooperative (with alliances) supply chains. We examine the nonlinear dynamics of these interactions, focusing on the stability or possible chaotic instability of the equilibrium solutions in such environments. A computer simulation demonstrates the applicability of the results.

3 - A Supply Chain Network Dynamic Equilibrium Model
Cheng-Chang Lin, Professor, National Cheng Kung University, 1 University Road, Tainan, 701, Taiwan, cclin@mail.ncku.edu.tw, Terry Friesz, I-Chen Wu

Under the oligopolistic market, each firm is to unilaterally determine its dynamic prices and operating plans to gain its optimal profit over the planning horizon. The price does not reach an instant steady state due to time delay. We apply the optimal control theory to design a mathematical model to explore the price, flows and inventory trajectories over time. We propose a diagonalization

decomposition algorithm, and analyze the economic implications on how firm reacts on price signals.

4 - Suppliers' Pricing Game and Manufacturer's Sourcing Strategy Under Stochastic Reliability
Chengbin Zhu, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States, cbzhu@vt.edu, Ann Chan

We consider single period, multi-suppliers, single manufacturer system. The manufacturer sells the final products to the market with stochastic demand at a given price. The components for manufacturing the product are provided by the suppliers with stochastic reliability. Different component request and sourcing strategy are analyzed. We study the model in different operation mechanism: suppliers' coordination and suppliers' competition.

5 - Supply Chain Contracts with Two-Way Penalties
Puneet Prakash Mathur, Doctoral Student, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, puneetp03@iimb.ernet.in, Janat Shah

Various SC contracts show different coordination characteristics under forced and voluntary compliance regimes. Non-enforceability of quantity makes forced compliance an unrealistic assumption, whereas voluntary compliance is too conservative assumption. We propose price compliance regime where the price for non-compliance on quantity is enforceable on parties in form of penalties. We model two-echelon SC under price compliance regime and analyze impact of contract parameters on SC coordination.

■ WA25

Management of Technology II

Contributed Session

Chair: Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca

1 - Disruption Lies in the Eye of the Beholder: Differential Effects of Technological Disruption
Raja Roy, Assistant Professor, Tulane University, 605 Goldring Woldenberg Hall, 7 McAlister Drive, New Orleans, LA, 70118, United States, rroy@tulane.edu

I investigate technological changes in the global industrial robotics industry and suggest that "ability" of the firms play an important role in explaining firm failure during technological disruption. I suggest that whether a change is disruptive or sustaining depends on the overlap of a firm's technological capabilities with those that are needed to meet the demands of the market conditions.

2 - Structural Equation Model for the Evaluation of National Funding on R&D Project in Consideration with MBNQA Criteria
So Young Sohn, Professor, Yonsei University, Department of Industrial Engineering, Seoul, South Korea, sohns@yonsei.ac.kr, Yong Gyu Joo

Financial support on the R&D in Science & Technology for SMEs at the governmental level plays a crucial role on the improvement of the national competitiveness. In this paper, we propose a structural equation model (SEM) to evaluate the performance of KOSEF funding program in terms of three aspects: output, outcome and impact under given funding input, R&D environment of a recipient company, and external evaluation programs of funding organization.

3 - Research and Development Planning: Selecting and Scheduling Projects with Heuristic Methods
Kevin Gormley, The MITRE Corporation, 7515 Colshire Drive, M/S N370, McLean, VA, 22102, United States, kgormley@mitre.org, William Scherer

A multi-period technology roadmap of R&D projects with end technology goals is modeled as a Markov Decision Process. A dynamic program solves for the best initial portfolio of projects with anticipation of future project funding. Due to the "curse of dimensionality," states grow rapidly with problem size. Objective value and computation time performance are explored for three solution methods: state aggregation, decomposition into sub-problems, and a greedy expected utility heuristic.

4 - 'Shapeshifting' Gambits: Entrepreneurs' Industry Action - Evidence From Technology Standards Writing
Mike Provance, Doctoral Student, University of Maryland, 372 N Street SW, Washington, DC, 20024, United States, mprovanc@rhsmith.umd.edu

Entrepreneurs face decisions to allocate resources to industry actions such as involvement in technology standard setting early in their life cycles with profound implications for growth. Some entrepreneurs choose to shape their strategies to fit with the standards they are involved in writing. Others attempt to dominate standards writing in order to shift standards towards their strategies. When do entrepreneurs choose one path over the other? How does performance vary with this choice?

5 - Cross-Platform Mobility of IT Vendors: A Real Options Approach
Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca, Jing Li

We present a real-options model of IT application vendors considering adoption of new, emerging platforms. In the model, we consider the ratio of future compatibility cost relative to the current cost. We present the simulation results and discuss implications for both, application vendors and IT platform sponsors.

■ WA26

Applications of Data Mining in Exploratory Research

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Uzma Raja, University of Alabama, Box 870226, Tuscaloosa, AL, 35487-0226, United States, URaja@cba.ua.edu

1 - Building Predictive Models from Medical Records
Mike Hardin, Professor of Statistics, University of Alabama, Box 870226, Department of ISM, Tuscaloosa, AL, 35487, United States, mhardin@cba.ua.edu, Tyler Keenum, Jerry Oglesby, Timothy Day, Josh Hamilton, Tara Mitchell

The preliminary results of a project between the University of Alabama, the University of Alabama at Birmingham, and the SAS Institute are presented. This project examined text mining applied to medical records. The data were clinical notes; particularly, notes from pathology, radiology and discharge summaries. Using this data, we constructed a start list using the medication list from RxNorm and SNOMED CT(r). We then developed several predictive models.

2 - Underlying Themes in the Supply Chain Management Literature: An Initial Investigation
Jeremy Brann, PhD Candidate, Texas A&M University, 4217 TAMU, College Station, TX, 77843, United States, jbrann@mays.tamu.edu, Antonio Arreola-Risa

Supply Chain Management has varied definitions. As such, the extant literature is topically diverse with widespread target audiences. This paper utilizes text mining to attempt to uncover a set of major underlying themes within the Supply Chain Management literature. These themes are subsequently used to develop a framework for identifying areas within the literature that need further research.

3 - A Model for Open Source Project Performance Using Data Mining and Text Mining
Uzma Raja, University of Alabama, Box 870226, Tuscaloosa, AL, 35487-0226, United States, URaja@cba.ua.edu, Marietta Tretter

A model for identifying the factors that affect the performance of Open Source Software (OSS) projects was developed using Data Mining and Text Mining. The OSS project data from Source Forge repository was used to develop test and validate the model. The model was improved using new variables created by using Text Mining techniques.

■ WA27

Data Mining/Statistical Modeling and Process Monitoring

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Myong K. Jeong, Assistant Professor, University of Tennessee, 311 East Stadium Hall, Knoxville, TN, 37996, United States, mjeong@utk.edu

1 - Improved Detection of Out-of-Control Conditions in Multivariate Process Control
Amit Mitra, Associate Dean, Auburn University, Office of Dean, College of Business, Auburn, AL, 368495240, United States, mitra@business.auburn.edu

Process monitoring involving multiple variables using control charts has traditionally used a distance measure in the form of a T-squared chart. The measure has usually been based on process output variables. In this paper, we consider two categories of input variables that may impact the output variables; process regulatory variables and the uncontrollable noise factors.

2 - Kernel-Based Biomass Monitoring Based on NIR Spectroscopy in Forest Products Manufacturing Industry

Hyun-Woo Cho, Research Associate, University of Tennessee, 309 East Stadium Hall, Knoxville, TN, 37996, United States, hwcho@postech.ac.kr, Myong K. Jeong

Near infrared (NIR) spectroscopy has been used for the characterization of different forms of biomass. This work presents the kernel-based approaches combined with a signal filtering technique for biomass monitoring.

3 - A New Generalized Linear Model for Estimating Electric Power System Reliability

Seth Guikema, Texas A&M University, Department of Civil Engineering, 3136 TAMU, College Station, TX, 77843, United States, sguikema@civil.tamu.edu, Jeremy Coffelt

This talk presents a new GLM model based on the Conway-Maxwell-Poisson probability density function. It demonstrates the use of this model for estimating the impacts of tree trimming on electric power system reliability. The results from the new model are compared to the results from more standard models such as the Poisson and Negative Binomial GLMs.

4 - Feedforward Control of Multistation Assembly Processes Using Reconfigurable Fixtures

Luis E. Izquierdo, Graduate Research Assistant, University of Michigan, Mechanical Engineering, Ann Arbor, MI, 48109, United States, leiv@umich.edu, Jianjun Shi, S. Jack Hu

The use of feedforward control in multistation manufacturing systems has emerged as a promissory method to reduce product variation. Using process adjustment to compensate deviations in a part-by-part basis, final product quality can be significantly improved. This talk addresses the problem of designing a feedforward control strategy that considers: deviations estimation (from in-line measurements), process/parts constraints and variation propagation on determining the optimal control action.

■ WA28

Data Mining for Process Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hang Zhang, PhD Student, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu

1 - Data Mining and Causal Discovery for Process Control in Manufacturing Hot Rolling Processes

Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu, Ran Jin, Jianjun Shi

Massive data are collected in manufacturing hot rolling processes, which contain rich information on process and product quality conditions. In this study, data mining tools are used to analyze the data and discover the causal relationships for process control and root cause diagnosis.

2 - Identifying Outliers and Monitoring Process Profile Data

Hang Zhang, PhD Student, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu, Susan Albin

We propose a new method to identify outliers in a dataset that consists of profiles, that is, functions that characterize a product or process. The method can be used to remove out-of-control profiles in a baseline dataset or for monitoring purposes. We demonstrate the method on simulated and real application data.

3 - Statistical Modeling of Marketing Contact Effects

Dingxi Qiu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C-217, Evanston, IL, 60208, United States, d-qiu@northwestern.edu, Edward Malthouse, Ajit Tamhane

This study attempts to quantify the effect of a marketing contact on the future customer purchase behavior. While the direct effect is usually easy to compute; the indirect effect is hard to model. We analyze the marginal effect of an additional marketing contact based on the contact and transaction history in the database so that the on-line advertisers can dynamically determine whether to serve an individual prospect the commercial or not.

■ WA29

Patient Scheduling and Flow

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited Session

Chair: Mark Lawley, Associate Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, malawley@purdue.edu

1 - A Stochastic Overbooking Model for Outpatient Clinical Scheduling with No-Shows

Kumar Muthuraman, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, kumar@purdue.edu, Mark Lawley

We formulate a stochastic overbooking model and develop an appointment scheduling policy for outpatient clinics. Each calling patient has a no-show probability, and overbooking is used to compensate for patient no-shows. The scheduling objective captures patient waiting time, staff overtime, and patient revenue. We derive conditions under which the objective evolution is unimodal and we investigate the behavior of the scheduling policy under a variety of conditions.

2 - Blueprint for Effective Patient Flow

Renata Kopach, Doctoral Student and Graduate Researcher, Purdue University, 315 North Grant, West Lafayette, IN, 47906, United States, rkopach@purdue.edu, Narayanan Varadarajan, Imran Hasan

Patient flow impacts the delivery of care and a hospital's budget. The two primary factors impeding flow are the lack of real-time communication and inefficient bed assignment. In an effort to smooth patient flow 'state transparency' technology can be employed. Using trace data from this technology we seek to recreate representative patient care paths. Our objective is to develop a tool capable anticipating how the patient load will tend to change in the near future given the current flow.

3 - Focused Factories versus Service-Plexes: Comparison of U.S. Hospital Operations

Diwas Kc, Doctoral Candidate, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, diwas@wharton.upenn.edu, Christian Terwiesch

In this paper, we use operational metrics such as patient length of stay, quality of care, service levels, charges, capacity investments and utilization rates to compare cardiac specialty hospitals, which focus on a limited number of cardiac procedures, with general hospitals. To deal with selection bias, we stratify patients based on their pre-operative levels of risk.

4 - A Configurable Framework for Open Access Scheduling in Outpatient Clinics

Po-Ching DeLaurentis, Doctoral Student and Graduate Researcher, Purdue University, 315 North Grant, West Lafayette, IN, 47907, United States, chenp@purdue.edu, Kumar Muthuraman, Renata Kopach, Mark Lawley, Leyla Ozsen, Ronald L. Rardin, Xiuli (Shelly) Qu, Hong Wan

Open access scheduling has become a prevailing practice in outpatient clinics because it is believed to provide better access to care, better quality of care and ultimately optimize the use of urgent care and hospital resources. However, implementations have failed at many sites. Therefore, we propose a configurable framework of rough cut tools for open access scheduling design which can make open access scheduling effective and adaptable to a variety of outpatient settings.

■ WA30

Marketing I

Contributed Session

Chair: Tomoaki Tabata, Assistant Professor, Tokyo Fuji University, Shimoochiai 1-7-7, Shinjuku, Tokyo, 1618556, Japan, tabata@fuji.ac.jp

1 - Customer Portfolio Optimization

Tuba Pinar Yildirim, PhD Student, University Of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, tubapinar@gmail.com

Portfolio optimization has been used by investors as a major practical field of finance. Models to structure optimal portfolio have been successfully applied to areas other than finance, like marketing. In this study, we are investigating the strategic fit of portfolio selection models to customer selection models and derive the optimal customer portfolio, the group of highest return customers at a preset level of risk.

2 - Optimal Product Line Pricing for Two Customer Segments
Govind Daruka, PhD Student, University of Illinois at Urbana-Champaign, 406 TB, 104 S. Mathews Street, Urbana, IL, 61801, United States, daruka@uiuc.edu, Udatta Palekar

We consider the pricing problem for a product line with two customer segments. Customers can be grouped into segments based on the maximum acceptable price and the lowest product features acceptable, which is proportional to the cost of the item. Demand for an item is dependent on the price differential between the item and the next item with higher cost. Our mathematical analysis provides important insights to a retailer for assortment planning and pricing of a product line.

3 - Optimizing Product Assortment Under Customer-Driven Demand Substitution
Sibel Salman, Assistant Professor, Koc University, College of Engineering, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr, Eda Yucel, Metin Turkay, Fikri Karaesmen

The problem of product assortment and inventory planning under customer-driven demand substitution is analyzed. A stochastic programming model that maximizes expected revenue under uncertain demand with substitution is provided and compared with several other approaches in the literature with different consumer choice and demand substitution models.

4 - Pricing for Health Food Product
Tomoaki Tabata, Assistant Professor, Tokyo Fuji University, Shimoochiai 1-7-7, Shinjuku, Tokyo, 1618556, Japan, tabata@fuji.ac.jp, Takashi NAMATAME, Makoto Goto, Piyapong Chariyavilaskul

It is widely known that health food can help reduce risk for some diseases, result in lower expected value of medical expense or any cost occurred from illness. Therefore, consumers gain some benefit from health food products. We developed the model to evaluate the monetary benefit from health food product by financial engineering approach. Useful information can be obtained for product value evaluation process and also customer perception based pricing process.

■ WA31

Portfolio Optimization in Finance-Risk Management

Contributed Session

Chair: Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu

1 - An Optimal Policy for the Funding of Warranty Reserves
Cigdem Gurgur, Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States, cgurgur@mines.edu

Many companies create a reserve fund to cover future liabilities arising from product warranties. We use probabilistic dynamic programming with infinite horizon to determine the optimal warranty reserve policy a along two lines: 1) The amount of cash additions or subtractions at the beginning of each period; (2) The amount to contribute to the reserve after each sale. We also discuss extension of our model to multi-product case.

2 - Optimal Investment (via Dynamic Programming) Using Leveraged Assets
Sham Kakade, Assistant Professor, Toyota Technological Institute, 1427 E. 60th Street, Chicago, IL, 60637, United States, sham@tti-c.org, Dean Foster

We study the problem of investing for retirement, focusing on the risk/return tradeoff, using financial instruments which leverage. Such schemes include margin buying and financial options/futures. The core decisions are how much to save/spend and whether to work or not. Via dynamic programming techniques, we characterize many aspects of the optimal policy and we estimate optimal values. Calibrating ourmodel with historical data, we find that the optimal strategy is highly leveraged.

3 - A Learning Real Options Framework Applied to Capacity Expansion
Luke Miller, Assistant Professor, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, miller_l@fortlewis.edu

This paper studies the impact of learning on a multi-staged investment scenario and quantifies information acquisition by merging statistical decision theory with the real options framework. Using real data provided by a firm in the aerospace maintenance, repair, and overhaul industry, the methodology is used to guide a multi-phased irreversible investment decision involving process design and capacity planning.

4 - Control and Management of Financial Risks: A Quantitative Approach
Danilo Abril, Politecnico Grancolombiano, Calle 57 No. 3-00 Este, Bogotá, BO, Colombia, danabril@poligran.edu.co, Rodrigo Caliz, Jesus Velásquez

In this paper a generic stochastic optimization model for Colombian insurance enterprises including cVaR (Conditional Value at Risk) issues is presented. This model is the first quantitative approach that takes into account Enterprise Risk Management (ERM) as well as Asset and Liability Management (ALM) concepts to design new regulations including international standards for management and control of financial risks in Colombia.

5 - A Real Options Approach to Venture Capitalist Investment Decisions
Thomas Yeung, Assistant Professor, Department of Automation and Production, Ecole des Mines de Nantes, France, tyeung@uark.edu, Richard Cassady

Contingent claims analysis and options pricing theory are incorporated into stochastic optimization models for investment project capital budgeting under uncertainty. We formulate, design solution procedures for, and analyze the behavior of two optimization models. One is a capital budgeting optimization model to determine the optimal portfolio of options to purchase, and the other is a multi-period optimization model to determine which options to implement for each decision-making period.

■ WA32

Risk and Supply Chain Management

Contributed Session

Chair: Seong Hyun Nam, Associate Professor, University of North Dakota, PO Box 8377, Grand Forks, ND, 58202, United States, seong_nam@und.edu

1 - The Risk-Averse Newsvendor Problem with Coherent Risk Measures
Sungyong Choi, Rutgers University, 101 Bleeker Street #52, Newark, NJ, 07102, United States, sungyong@pegasus.rutgers.edu, Andrzej Ruszczynski

We shall consider the classical newsvendor problem, best in the risk-averse setting. Then, we shall use modern mean-risk models and coherent risk measures to derive the optimal policy of the risk-averse newsvendor. Next, we shall apply these results to derive risk-averse inventory policies when the demand is uncertain. The theoretical considerations will be accompanied by a simulation study and statistical analysis of the results.

2 - Optimal Operating Policies for a Multinational Company under Varying Market Economics
Shu-Chen Chang, Department of Business Administration, National Formosa University, 64 Wen-Hua Road, Huwei, Yunlin 632, Taiwan, shu-chen@nfu.edu.tw, Cheng-Ying Yang

While being different from other research methods which assume that both the market price of products and the exchange rate are static, our approach is based on two assumptions: (1) The market price of products is not static and mainly depends on individual market's demand; and (2) The exchange rate is dynamic and defined by a stochastic probability distribution function. Then, this paper develops and evaluates a mathematical programming model for the multi-national corporation operations.

3 - Load Dependent Lead Times in Tactical Production Planning
David Woodruff, Professor, University of California - Davis, Graduate School of Management, 155 AOB 4, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu, Julia Pahl, Stefan Voss

There have been only a few papers that describe models at the aggregate planning level that recognize the relationship between the planned utilization of capacity and lead times. In this paper we provide an in-depth discussion of the state-of-the art in this literature, with particular attention to those models that are appropriate at the aggregate planning level.

4 - Integrating Forest Bucking and Transportation
Satyaveer Chauhan, Bordeaux Business School, Domain de Raba - 680, cours de la Libération, 33405 Talence Cedex, France, satyaveer.chauhan@bordeaux-bs.edu, Luc LeBel, Sophie D'Amours, Jean-Marc Frayret

We consider timber supply chain in which the contractor wants to produce as much products as possible from the forest while minimizing production and transportation costs. Production cost which includes harvesting and bucking of trees, depends upon the variety of products produced in the forest while transportation cost depends upon the volume of the product and distance. A solution approach based on decomposition approaches and heuristic is developed and tested on the randomly generated data.

5 - Optimal Dynanic Pricing and Ordering Policy Under Supplier's Uncertain Environment

Seong Hyun Nam, Associate Professor, University of North Dakota, PO Box 8377, Grand Forks, ND, 58202, United States, seong_nam@und.edu, Hisash Kurata

This paper presents a model for analyzing the impact of joint decision policies on optimal pricing and order size over a given time interval in a system consisting of a supplier and buyers. The joint decision policies characterized by the unit selling price that reflect the supplier's uncertain environmental factors and order size under uncertain demand. We apply the stochastic optimal control to find strategic optimal decision for buyer's.

■ WA33

Estimation of Airport Capacity II

Sponsor: Aviation Applications
Sponsored Session

Chair: Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams Street, Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

1 - Estimating Runway Capacity with Simulation

John Barrer, The MITRE Corporation, 7515 Colshire Drive, N370, McLean, VA, 22102, United States, jbarrer@mitre.org

This paper describes a simulation technique for estimating the capacity and delay of a runway system. The process is unique in that the simulation code itself is controlled by a standardized set of parameters whose format remains the same for all airports in the world. This greatly reduces the time required to simulate an airport's runway system. The modeling technique is in use and has been successful for a wide range of airport operations.

2 - Airport Capacity: Aggregate vs. Disaggregate Modeling

Jasenka Rakas, University of California at Berkeley, NEXTOR, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Yu Zhang

We develop a comprehensive methodology for assessing airport performance and establishing airport efficiency metrics for runway and airport utilization using PDARS. We focus on the estimates of landing time intervals (LTIs) for each consecutive pair of aircraft for each runway and then aggregate micro aircraft-landing data to runway level, airport-configuration level and airport level for five major airports in the U.S. We discus the advantages of disaggregate airport capacity modeling.

3 - Transient States and Dynamics of Airport Runway Configurations

Jasenka Rakas, University of California at Berkeley, NEXTOR, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Yu Zhang

This study explores a dynamic behavior of an airport system by investigating changes in airport primary runway configurations and their intermediate transitions. We analyze the duration and operational performance of each runway configuration and its transition to a subsequent configuration by using a semi-Markov process. The results can be useful in predicting airport states and the expected airport performance and used in tactical decisions to avoid capacity congestion and expected delays.

■ WA34

Modeling and Analysis of Intra and Inter-Plant Logistical Problems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Sunderesh Heragu, Department of Industrial Engineering, J.B. Speed School of Engineering, University of Louisville, Louisville, KY, 40292, United States, s.heragu@louisville.edu

1 - Design of Multistage Pull Control Systems

Ronald Askin, Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287-5906, United States, Ron.Askin@asu.edu, Shravan Krishnan

A model is presented to guide the partitioning of multistage, multiproduct, stochastic, dynamic production systems into a series of control sections. Pull control is used to release jobs and coordinate between sections. Push control is used within sections in that released jobs flow without requiring additional authorizations. Flow time and inventory cost are minimized subject to service level constraints.

2 - Designing Supply Networks and Facilities with Robust Order-to-Delivery Capability

Benoit Montreuil, Professor, Laval University, CIRRELT, Pav. P. Prince, Office 2533, Québec, QC, G1K 7P4, Canada, benoit.montreuil@centor.ulaval.ca, Alain Martel, Marc Paquet

We present an optimization methodology for the design of supply networks and facilities operating in an assemble-to-order or make-to-order context, having the robust capability to deliver products to geographically distributed customers within a to-be-specified offer in each market segment, combining an order-to-delivery time and a service level, given that daily demand is stochastic and dependent on the offer.

3 - Bucket Brigade Dynamics for Discrete Tasks

Bryan A. Norman, PhD, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Natasa Vidic

We study throughput of a bucket brigade when tasks are discrete, production rates are worker/task dependent and workers are idle if blocked. We compare the bucket brigade line throughput with the throughput from a fixed assignment line and define conditions for which bucket brigades are more effective. We substantiate our proofs with numerical examples.

4 - Semi-Open Queuing Network Applications in Logistics

Sunderesh Heragu, Department of Industrial Engineering, J.B. Speed School of Engineering, University of Louisville, Louisville, KY, 40292, United States, s.heragu@louisville.edu, Jing Jia

In this paper, we illustrate applications for semi-open queuing network models in manufacturing and logistics. We solve some special cases of this model exactly using analytical matrix genometric methods and develop heuristic solution methods for others.

■ WA35

Urban Transportation Planning Models VIII: Trip Distribution and Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: James Moore, Professor and Chair, Epstein Department of Industrial & Systems Engineering, University of Southern California, GER 240; MC 0193, Los Angeles, CA, 90089, United States, jmoore@usc.edu

1 - A Comprehensive Approach for Estimating Freeway Time-Dependent O-D Demands

Pei-Wei Lin, Assistant Professor, University of Missouri at Kansas City, Department of Civil Engineering, Kansas City, MO, 64110, United States, linp@umkc.edu, Gang-Len Chang

We propose a comprehensive approach for estimating time-dependent origin-destination (O-D) distributions for a freeway corridor. The approach accounts for missing ramp traffic flows, an unavailable initial O-D set, and measurement errors. Numerical experimental results based on Maryland's I-95 freeway corridor reveal the robustness and effectiveness of the proposed approach.

2 - Determination of the Optimal Placement of Point Detectors on Virginia's Freeways

Praveen Edara, Research Scientist, Virginia Transportation Research Council, 530 Edgemont Road, Charlottesville, VA, 22903, United States, Praveen.Edara@VDOT.Virginia.gov, Brian Smith, Jianhua Guo, Cathy McGhee

A decision support tool to identify the best locations of a finite set of point detectors on a freeway corridor is developed in this research. The objective function, minimization of the travel time estimation error, is formulated as a combinatorial optimization program and solved for a good solution using metaheuristics.

3 - Traffic Assignment with Paired Alternative Segments

David Boyce, Department of Civil and Environmental Engineering, Northwestern University, 2149 Grey Avenue, Evanston, IL, 60201, d-boyce@northwestern.edu, Hillel Bar-Gera

Preliminary computational results for large-scale networks are presented for a new traffic assignment algorithm that maintains consistency among paired alternative route segments across all OD pairs. Consistency means route flow proportions on alternative subroutes are equal across OD pairs, which is a behavioral interpretation of the entropy maximizing route flows.

4 - Modeling the Effect of Traffic Congestion on Commuter Path Choices

Justin Yates, Department of Industrial and Systems Engineering, State University of New York at Buffalo, 415 Lawrence D. Bell Hall, Buffalo, NY, 14260-2050, jtyates@buffalo.edu, Mingzhe Li, Rajan Batta

The standard approach for modeling commuters is to assume that O-D travel is based on criteria like shortest time, number of turns, and number of intersections. We show a convergence scheme accounting for congestion effects on shared links. Computational examples are based on a sample road network in Northridge, California.

■ WA36

Analysis for Defense Transformation II

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Gregory.h.parlier@saic.com

1 - Developing Capabilities-Based Battle Command Training Centers for the Future Force

Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu, Gregory Boylan

Training the Army's future digital force has precipitated the need to assess the ability of current training facilities to meet the needs of the transforming force. Of interest are the Battle Command Training Centers (BCTCs) and their abilities to support the Army's training needs for this future force. This presentation addresses the systems engineering process used to determine essential requirements and the resulting model designed to validate the capabilities of prototype BCTC facilities.

2 - Transforming Army Logistics: A Supply Chain Approach

Greg Parlier, Gregory.h.parlier@saic.com

Fully engaged in the Golobal War on Terrorism, the US Army is also committed to a comprehensive and ambitious "Transformation" endeavor. This presentation summarizes a three-phase project, combining elements of classical inventory theory and large-scale supply chain management concepts with several innovative approaches, culminating in an "analytical architecture" to guide Logistics Tranformation for the US Army.

3 - Discerning Patterns of Aircraft Usage and Spare Parts Demands

George Kuhn, Senior Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, gkuhn@lmi.org

Report on research exploring whether patterns of aircraft (helicopter) usage and spare parts demands may be better described in order to support better forecasts. Progress toward greater differentiation among usage and spares behaviors, and away from traditional approaches relying on highly aggregated views, will be discussed.

4 - Enhancing Army Aviation Readiness

Stan Horowitz, shorowitz@ida.org, Daniel Levine, Christopher Hanks

This work examines two topics related to improving the readiness of Army helicopters. The first addresses the efficacy of special helicopter maintenance programs that are more extensive than normal depot overhaul. They will be evaluated in terms of how much mission capable rates improved. The second topic compares spares packages designed by several methodologies. Statistical analysis will attempt to show which approach is likely to yield the highest readiness.

■ WA37

Supply Chain Management II

Contributed Session

Chair: Anna Nagurney, John F. Smith Memorial Professor of Operations Management, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu

1 - Elements of VMI Systems

Sami Sarpola, Researcher, Helsinki School of Economics, PO Box 1210, FIN-00101 Helsinki, Helsinki, Finland, sami.sarpola@hse.fi, Katri Karjalainen, Sanna Laukkanen

Vendor Managed Inventory (VMI) systems have gained prominence during the last decade and a wide variety of them can be identified from the practice. To enable their evaluation and comparison six elements ñ inventory location, distribution model, inventory level monitoring and demand visibility, role of information systems, replenishment decision, and inventory ownership ñ are defined and combined to form a framework for the evaluation of VMI systems.

2 - Performance Analysis of Acyclic Supply Chains

Yao Zhao, Rutgers, The State University of New Jersey, 180 University Avenue, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

We analyze acyclic supply chains under the full backorder assumption. We present some unique system properties which lead to complexity reduction in network toplogy. Various supply systems, inventory policies and demand processes are considered.

3 - An Optimal Soft Order Revision Policy for a Vendor Facing Atypical Demand and Supply Uncertainty

Pundarikaksha Baruah, Student, Wayne State University, 4815 4th Street, Detroit, MI, 48201, United States, baruah@wayne.edu, Ratna Babu Chinnam

Atypical demands are highly volatile and unsuitable for regular forecasting. In such cases, vendors utilize market signals to do demand forecast updating. We determine an optimal soft order revision policy for a vendor facing atypical demand and supply uncertainty in a single selling season. The decision variables are soft orders and final firm order quantity to be transmitted to the supplier. We also demonstrate the value of supplier sharing order inventory information with the vendor.

4 - Financial Engineering of the Integration of Global Supply Chain Networks and Social Networks

Tina Wakolbinger, University of Massachusetts, Amherst, 121 H Brittany Manor Drive, Amherst, MA, 01002, United States, wakolbinger@som.umass.edu, Jose M. Cruz, Anna Nagurney

In this paper, we focus on the financial engineering of integrated global supply chain and social networks. Through a multilevel, dynamic supernetwork framework consisting of the global supply chain network with electronic commerce and the social network, we capture the multicriteria decision-making behavior of the various decision-makers (manufacturers, retailers, and consumers), which includes the maximization of profit, the maximization of relationship values, and the minimization of risk.

5 - Dynamic Electric Power Supply Chains and Traffic Networks as Evolutionary Variational Inequalities

Anna Nagurney, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States, zugang_liu@yahoo.com, Monica-Gabriel Cojocaru, Zugang Liu, Patrizia Daniele

We develop an electric power supply chain network equilibrium model and establish the supernetwork equivalence between the model and a transportation network model. This equivalence yields a new interpretation of electric power network equilibria in path flows. We exploit this equivalence to propose a dynamic electric power network model using an evolutionary variational inequality (EVI) formulation. Numerical examples are solved using the unification of EVI and projected dynamical systems.

■ WA38

Transportation Problems in Urban Planning

Contributed Session

Chair: Ozlem Yanmaz-Tuzel, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, yanmaz@rci.rutgers.edu

1 - Industrial Impact of a Suburban Transport System in Central Mexico

Juan Enrique Sandoval, Program Director, Univ Politecnica de Aguascalientes, Prol Mahatma Gandhi Km 2, San Francisco del Arenal, Aguascalientes, AG, 20280, Mexico, juan.sandoval@upa.edu.mx

This project evaluates economic implications of light suburban system in the Aguascalientes Region in central Mexico, using a model that includes routing variables, industrial costs, return over investment, timing and savings. We propose a method to grade how attractive will this system be in terms of investment.

2 - An Analysis of Improving Transit Accessibility in the In-city Village in China

Zhaoqiong Qin, Assistant Professor, Embry-Riddle Aeronautical University, College of Business, 600 S. Clyde Morris Boulevard, Datona Beach, FL, 32114, United States, qina50@erau.edu, Zheng Yang

The in-city village is special in the urbanization in China, which affected the implementation of city function and changed the city transit structure. In this paper, based on the characteristics in the in-city village in China, we proposed a model and methodology to improve the transit accessibility for the in-city village.

3 - An Approach to Solve Mixed Integer Linear Programming Formulations with Big-M Constraints

Archana Khurana, Lecturer, School of Basic and Applied Sciences, Guru Govind Singh Indraprastha University, Kashmere Gate, Delhi 110006, India, archana_maths@rediffmail.com, Iftekhar Karimi, Arul Sundaramoorthy

This paper addresses the impact of first level Reformulation Linearization Technique (RLT) and Reduced Reformulation Linearization Technique (RRLT) on Mixed Integer Linear Programs (MILP) with big-M constraints. Our approach has less number of variables and constraints and it is computationally more efficient than the existing approach. We solve a variety of problems such as flow-shop, job-shop and strip packing to illustrate the performance of the modified RLT and RRLT.

4 - Modeling of Commuters' Day-to-Day Learning Behavior: An Application to NJ Time-of-Day Pricing Program

Ozlem Yanmaz-Tuzel, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, yanmaz@rci.rutgers.edu, Kaan Ozbay

Stochastic Learning Automata (SLA) is used to model commuters' day-to-day learning behavior. Stochastic nature of the system and heterogeneity among users are considered by combining Bayesian Learning approach with the SLA.The proposed model aims to capture the commuters' departure-time choice learning behavior both under undisturbed and disturbed network conditions and to investigate responses to toll, travel-time, departure/arrival time restrictions while selecting their departure-times.

■ WA39

Ballroom B

Education and Discrete Optimization

Contributed Session

Chair: Torsten Reiners, University of Hamburg, Von-Melle-Park 5, Institut für Wirtschaftsinformatik, Hamburg, Germany, reiners@econ.uni-hamburg.de

1 - New Turnpike Theorems for Knapsack Problems

Ping Heidi Huang, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States, huang74@mgmt.purdue.edu, Thomas Morin

New and improved turnpike theorems for the knapsack problem are developed. Number-theoretic concepts are used to prove some of our results and several of our theorems subsume known results as special cases. A number of numerical examples are also given.

2 - A Statistical Heuristic for Designing Access Telecommunications Networks

Gnana Anandalingam, Professor, University of Maryland, Smith School of Business, Van Munching Hall 4365, College Park, MD, 20742, United States, ganand@rhsmith.umd.edu

We provide a heuristic based on statistical clustering for designing access telecommunications networks. The proposed heuristic combines iterative partitioning with a minimum spanning tree heuristic. We obtain very good results when applying our method to a real design problem that was part of a consulting project. We also compare our heuristic to a number of well-known methods for designing access networks, and show it is superior in both speed of computation and closeness to optimality.

3 - Boundary Critique: A Tool for Promoting Pratical Reason in OR/MS Projects

Luis Arturo Pinzon, Professor, Universidad de los Andes, Cra 1 Este No.18 A-10 Of. W506 UNIANDES, Calle 19A No.1-37 Este Of.W506 UNIANDES, Bogota, Colombia, lpinzon@uniandes.edu.co

Boundary critique is a critical systems thinking concept that OR/MS practitioners may use for executing or facilitating work in their research or consultancy projects. We illustrate the use of the boundary critique in a specific research project. Boundary critique may help to establish links between practical and instrumental in OR/MS projects given that OR/MS approaches have proved particularly strong and well-founded in the realm of instrumental reason.

4 - Adaptive Learning Paths to Support the OR-Education

Torsten Reiners, University of Hamburg, Von-Melle-Park 5, Institut für Wirtschaftsinformatik, Hamburg, Germany, reiners@econ.uni-hamburg.de

We developed an approach called configurable adaptation including the concept of individualized and adaptive learning paths. That is, for a course with algorithmic experiments, results are stored in a general content pool to be dynamically included in (individual) learning scenarios. Furthermore, courses are made personal by including results from previous course units and, therewith, increasing the motivation for off-line learning.

■ WA40

Logistics/Transportation Issues in Facility Location

Contributed Session

Chair: Vladimir Marianov, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuna Mackenna 4860, Santiago, RM, 782-0436, Chile, marianov@ing.puc.cl

1 - Genetic Algorithms for a Network Design Problem with Lead Time and Safety Stock Considerations

Karthik Sourirajan, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ksourira@us.ibm.com, Reha Uzsoy, Leyla Ozsen

We consider a production facility that replenishes a single product at retailers. The objective is to locate DCs such that the sum of the facility location, pipeline inventory and safety stock costs is minimized. We model the relationship between the flows in the network, lead times and safety stock levels. We examine the use of genetic algorithms to solve the model and found a novel chromosome representation that combines binary vectors with random keys to give a favorable solution quality.

2 - An Inventory-Location Model with Stochastic Capacity Constraints, Solved with Valid Inequalities

Pablo A. Miranda, Universidad Andres Bello, Sazie 2320, Piso 2, Santiago, 837-0149, Chile, pamiranda@unab.cl

We present a joint location-distribution-inventory model for a three layered supply chain, and an efficient heuristic solution approach. A firm must design a minimum cost system to supply commodities to a set of spatially distributed retailers, enforcing capacity constraints stochastically at each installed DC. The solution approach is based on Lagrangian Relaxation, improved with valid inequalities. These constraints represent the convex hull of demand mean and variance, faced by each DC.

3 - Multiple-Vehicle Routing Problem with Fixed Distribution and Optional Recollection

Gabriel Gutiérrez, PhD Student, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Macul, Santiago, 6904411, Chile, gegutier@ing.puc.cl, Vladimir Marianov

A model is proposed and solved for the multiple-vehicle routing problem with fixed distribution and optional recollection. The transportation cost is minimized and the revenue generated for attending recollection customers is maximized. The model can be applied to distribution systems in which customers and suppliers are visited, but suppliers are visited only they generate revenues. A branch and cut procedure is used to solve this problem, and computer experiences is provided.

4 - The Capacitated Hierarchical Path Problem

Macarena Donoso, PhD Student, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Macul, Santiago, 6904411, Chile, macarena.donoso@udp.cl, Vladimir Marianov

We formulate and solve the Capacitated Hierarchical Path Problem for a two-level distribution system. A path is built between two points of the network, and potential delivery routes that reach the clients start at each node of the path. We minimize the distribution cost of the system,considering the costs of the main path and the delivery routes. Applications are newspaper and courier distribution system. An integer programming formulation and computational experience are presented.

5 - Location of a Maximal Coverage - Minimum Cost or a Maximum Traffic - Minimal Cost Path on a Network

Vladimir Marianov, Pontificia Universidad Católica de Chile, Department of Electrical Engineering, Vicuña Mackenna 4860, Santiago, RM, 782-0436, Chile, marianov@ing.puc.cl, Gabriel Gutiérrez, Macarena Donoso, Carlos Obreque

A model is proposed and solved for locating a path on a network. The cost of the path is minimized (or constrained), while maximizing either coverage or traffic captured between pairs of nodes that are close to the path. Applications are metro or bus lines in a city, or telecommunications backbones. Reduced multicommodity formulations are offered, and computational experience presented.

WA41

Performance Bounds for Queueing Networks and Related MDPs

Sponsor: Applied Probability
Sponsored Session

Chair: Mike Veatch, Department of Mathematics, Gordon College, 255 Grapevine Road, Wenham, MA, 01984, United States, mike.veatch@gordon.edu

1 - Performance Bounds and State-Relevance Weights for Approximate Linear Programming

Daniela Pucci de Farias, pucci@mit.edu, Theophane Weber, David Jeria

The linear programming approach to approximate dynamic programming returns a solution that depends on the objective function coefficients, a result which contrasts with the case of LP for exact dynamic programming. In the general case of linear combination of features approximating the cost-to-go function, we prove the existence of objective coefficients ensuring an a priori bound on the quality of the resulting policy, in terms of the power of the approximation architecture.

2 - Dynamic Programming for the Crossbar Switch

Ciamac Moallemi, Graduate Student, Stanford University, Department of Electrical Engineering, Packard 274, Stanford, CA, 94305, United States, ciamac@stanford.edu, Sunil Kumar, Benjamin Van Roy

There are a number of heuristics based on generalized maximum-weight matching for scheduling in the crossbar switch. We interpret them in terms of dynamic programming; in particular, each heuristic can be viewed as a greedy policy with respect to an approximation of the value function. We apply an approximate dynamic programming algorithm to generate alternative approximations. We compare behavior and performance of resulting scheduling policies to those of the heuristics.

3 - Throughput Bounds for Closed Queueing Networks via Differential Cost Function Approximation

James R. Morrison, Assistant Professor of Electrical Engineering, Central Michigan University, Department of Engineering and Technology, ET 147, Mount Pleasant, MI, 48859, United States, morri1j@cmich.edu

We develop linear programming throughput bounds for Markov chain models of closed queueing networks operating under affine index control policies. The approach employs surrogates for the differential cost function in an inequality relaxation of the average cost equation. The surrogates considered include piecewise quadratics on polyhedral regions of the state space. Our throughput bounds are tighter than those of some previous approaches and require less computation than exact solution.

4 - Average Cost Bounds for Open Queueing Networks Via LPs

Mike Veatch, Department of Mathematics, Gordon College, 255 Grapevine Road, Wenham, MA, 01984, United States, mike.veatch@gordon.edu

The approximate LP method establishes lower bounds on optimal average cost of queueing network control problems. Numerical results are presented on the tightness of the bound when various value function approximations are used and the rate of convergence as the size of the LP increases. Comparisons with other LP bound are made using duals.

WA42

Scheduling and Network Optimization

Cluster: Scheduling
Invited Session

Chair: Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, HK, Hong Kong, ieemqi@ust.hk

1 - Equipment and Staff Scheduling Under Disruptions - An Application in USPS Mail Processing Facilities

Xinhui Zhang, Assistant Professor, Wright State University, 207 Russ Center, 3640 Colonel Glen Highway, Dayton, OH, 45435, United States, xinhui.zhang@wright.edu, Arvindkumar Chakravarthy

We address an equipment and staff scheduling problem under disruptions such as demand variation and staff absenteeism that arises in USPS mail processing facilities. The problem is modeled as an integer program, consists of lot sizing, shifting scheduling and overtime management modules, integrates seamless with other research studies. Results suggest financial saving in the tens of millions of dollars annually could be achieved when the model is implemented nationwide for USPS.

2 - Minimizing Class-Based Completion Time Variance in Single Machine Systems

Xueping Li, Assistant Professor, University of Tennessee, Knoxville, Xueping.Li@utk.edu, Yuerong Chen

This paper considers the problem of scheduling a set of simultaneously available jobs on one machine. The jobs come from several different classes of source. The problem is to determine a schedule to minimize the class-based completion time variance (CB-CTV) in which both earliness and tardiness are penalized. We prove that a CB-CTV problem can be transformed into a series of CTV problems and propose an algorithm to achieve differentiated mean completion time for different class of jobs.

3 - Online Network Synthesis

Donglei Du, Associate Professor, University of New Brunswick, PO Box 4400, Fredericton, NB, E3B 5A3, Canada, ddu@unb.ca, Santosh Kabadi

We consider on-line network synthesis problems. We distinguish between two on-line versions of the problem depending on whether the entire set of sites is known a prior or not. For the first version where the entire set of site is unknown, we present a best possible algorithm along with a matching lower bound. For the second version where the entire set of sites is known a priori, we present a best possible algorithm for nbbb=11.

4 - Scheduling with Outsourcing

Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, HK, Hong Kong, ieemqi@ust.hk, Huimin Wang

We consider a production scheduling problem where both in-house production and outsourcing can be used. For a given set of jobs, the problem is to determine which jobs to be processed by in-house production, and which by outsourcing. Job transportation has to be considered when the production schedule is to be made. We present algorithms for different objective functions, and discuss managerial issues for implementation.

WA43

Multi Criteria Mathematical Programming

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Ravi Ravindran, Professor, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States, aravi@psu.edu

1 - Automatic Target Adjustment for Goal Programming Problems

Glenn Kuriger, University of Oklahoma, 100 East Boyd, SEC, Suite R-208, Norman, OK, 73019, United States, kuriger@ou.edu, Hank Grant

An Automatic Target Adjustment (ATA) technique was developed that uses simulation optimization to automatically adjust the target levels of goal programming simulation optimization problems. The target levels were adjusted to ensure that the top two goals were satisfied and that all the goals were satisfied. The best target levels for each case were then selected and the goal programming simulation optimization problems were re-solved at these new target levels.

2 - Multi-Criteria Optimization of the Component-Based Software Systems

Soundar R. T. Kumara, Distinguished Professor, The Pennsylvania State University, 363 Leonhard Building, University Park, PA, 16802, United States, skumara@psu.edu, Seokcheon Lee

We consider a software system whose behavior can be controlled by resource allocation and algorithm selection. A problem is decomposed into root tasks and those tasks are propagated through a task flow structure. The service provided is to produce a global solution, an aggregate of partial solutions. The QoS depends on the quality of solution and the time for generating the solution. We provide a methodology to identify the decision sets that give non-dominated quality of services.

3 - A Stochastic Multi Criteria Model for Joint Inventory-Transportation Policies in Supply Chains

Ajay Natarajan, PhD Student, Penn State University, 445 Waupelani Drive, E 5, State College, PA, 16801, United States, azn110@psu.edu

This presentation deals with finding inventory policies for each company in a Single Warehouse Multi Retailer system under stochastic demand and stochastic lead times when transportation costs are considered. Each company follows a continuos review policy. Excess demand faced by the retailers and the warehouse is treated as lost sales. Service level constraint is treated as an independent criterion. The methodology is explained with the help of an example problem.

4 - Optimization Model for Outsourcing
Vijay Wadhwa, Student, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, vuw100@psu.edu

We model and solve the vendor selection problem in two steps. In first step cluster analysis is used to pre-classify the vendors as favorable or unfavorable. Detailed quantitative data is collected on favorable vendors. In second step multi-objective techniques are used to solve the supplier selection problem, with price, lead-time and quality as the three conflicting objective.

■ WA44

Combinatorics

Contributed Session

Chair: Bala Krishnamoorthy, Washington State University, 103 Neill Hall, PO Box 643113, Pullman, WA, 99164-3113, United States, kbala@wsu.edu

1 - Combinatorial Problems Related to Order Consolidation
June-Ho Chang, Student, POSTECH, SAN 31, Hyo-Ja Dong, Nam Gu, Pohang, 790-784, South Korea, junho@postech.ac.kr, Soo Y. Chang

The minimum batch cover problem for order consolidation is the problem of covering all orders with the minimum number of batches with a fixed capacity. Each batch may be composed of the whole or parts of multiple orders with similar characteristics. We prove that the problem is SNP-hard and develop an optimal algorithm to solve an important sub-class of problem.

2 - Two-Stage Stochastic Winner Determination Problem for Truckload Transportation Procurement with Shipment Uncertainty
Zhong Ma, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, zhongma@mie.utoronto.ca, Roy H. Kwon, Chi-Guhn Lee

A shipper wishes to procure truckload transportation services from third party carriers by combinatorial auctions. Generally, the auctioneer (shipper) announces expected shipment volumes on lanes for bid and solves a winner determination problem (WDP) to allocate the lanes, and tenders shipments during daily execution when the shipments realize. However, the realized shipments might be quite different, and the auctioneer may not find the best solution to move realized shipments. We propose a two-stage stochastic model for the WDP to hedge the shipper's risk and prove it is guaranteed to achieve at least the same allocation as the current models provided.

3 - P Equals NP: Linear Programming Formulation of the Quadratic Assignment Problem
Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269-1041, United States, moustapha.diaby@business.uconn.edu

In this talk, we will present a first linear programming formulation of the Quadratic Assignment Problem (QAP). The proposed linear program is a network flow-based model with $O(n^9)$ variables and $O(n^7)$ constraints, where n is the number of assignments. Hence, it provides for the solution of the QAP in polynomial-time. Computational testing and results will be discussed.

4 - Adaptive Knapsack Problem with Stochastic Rewards
Taylan Ilhan, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States, t-ilhan@northwestern.edu, Mark Daskin, Seyed Iravani

We study an adaptive knapsack problem, in which items with random rewards are inserted sequentially into a knapsack. We seek a policy to maximize the probability of reaching a predetermined target level while not violating the capacity constraint. We analyze the optimal policy and develop optimal and heuristic policies.

5 - An Integer Programming Model for Protein Sequencing using Mass Spectrometry
Bala Krishnamoorthy, Washington State University, 103 Neill Hall, PO Box 643113, Pullman, WA, 99164-3113, United States, kbala@wsu.edu, John Chuba

We present recent progress made using an IP model in the identification of amino acid sequence given the masses of a protein and several of its (overlapping) fragments. After finding the composition (counts of each of twenty amino acids) and the ion-type of fragments (b or y), the sequence order is obtained using an efficient enumeration algorithm. Compared to standard dynamic programming models, we add many more constraints, resulting in a major reduction in the number of possible solutions.

■ WA45

Tutorial: Approximate Dynamic Programming for Large-Scale Resource Allocation

Cluster: Tutorials

Invited Session

1 - Approximate Dynamic Programming for High-dimensional Applications
Warren B. Powell, Department of Operations Research and Financial Engineering, Princeton University, Princeton, NJ, 08544, powell@princeton.edu, Huseyin Topaloglu

We show how dynamic programming and math programming can be merged to solve very high-dimensional applications under the umbrella of approximate dynamic programming. Using a form of Bellman's equation constructed around the post-decision state variable, we obtain simple, scalable algorithms that have been applied to large scale, industrial applications. The techniques are illustrated using applications from transportation, supply chain management, financial portfolios and blood management.

■ WA46

Supply Chain Flexibility

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, IROM Department, McCombs School of Business, 1 University Station B6500, Austin, TX, 78712-0212, United States, Douglas.Morrice@mccombs.utexas.edu

1 - Inventory System Structure: Transshipment vs. Allocation
Uday Rao, Professor, College of Business, University of Cincinnati, Cincinnati, OH, 45221, United States, uday.rao@uc.edu, David Rogers, Claudia Rosales

We compare four inventory systems structures respectively with the following options: Only Allocation, Only Transshipment, Both, and Neither. We identify the effects of problem parameters such as mean and variability of demand, replenishment lead time, and differences between retailers on the relative performance of the four systems.

2 - The Value of Risk Pooling: Impacts of Order Quantity and Economic Parameters
Jun Zhang, Assistant Professor, Tulane University, A. B. Freeman School of Business, New Orleans, LA, 70123, United States, jzhang4@tulane.edu

We study the effects of the inventory level and economic parameters on the value of risk pooling. Our analysis demonstrates that for a given inventory level risk pooling achieves the maximum value when the inventory level is the demand mean. When the inventory level is set to maximize the expected profit, the value of risk pooling increases with both the underage cost and the overage cost; consequently, the value of the critical ratio is NOT an effective indicator for the value of risk pooling.

3 - Outsourcing of Warranty Contracts
Wei Huang, SAS, wei.huang@sas.com, Vidyadhar Kulkarni, Jay Swaminathan

Firms are outsourcing their business processes in order to gain greater flexibility in their supply chains. In this paper, we study a firm that is outsourcing its warranty services to vendors. We provide insights on alternative leadership, competition and contract settings.

4 - Managing Backlog and Capacity Flexibility in an Assemble-to-Order Production Environment
Douglas Morrice, Professor, The University of Texas at Austin, IROM Department, McCombs School of Business, 1 University Station B6500, Austin, TX, 78712-0212, United States, Douglas.Morrice@mccombs.utexas.edu, Fehmi Tanrisever, David Morton

We consider a multi-period planning problem in an assemble-to-order production environment in which multiple product families can be produced on multiple production lines. Given the demand distribution, assignment decisions are made in the first period. In subsequent periods as demand is realized it is allocated to production lines in order to minimze backlog.

■ WA47

Optimization Methods in Production Planning and Scheduling

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Andrew Miller, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, amiller@engr.wisc.edu

1 - Lot-Sizing with Minimum Order Quantity

Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

We study the deterministic lot-sizing problem under the assumption that in each time period either no order is placed or at least a certain given amount is ordered. We present two polynomially solvable cases and we develop a fully polynomial time approximation scheme.

2 - A Polynomial Time Algorithm for the Stochastic Uncapacitated Lot-Sizing Problem

Yongpei Guan, Assistant Professor, The University of Oklahoma, 202 West Boyd Street, Room 124, Norman, OK, 73019, United States, Yongpei.Guan-1@ou.edu, Andrew Miller

We analyze a path property of an optimal solution for the stochastic uncapacitated lot-sizing problem (SULS) and develop a backward recursion that shows the value function is piecewise linear and right-continuous. We use these properties to derive a polynomial time algorithm for the problem. Then, we show that the value function for the SULS problem without set-up cost is continuous, piecewise linear and convex and therefore, a more efficient algorithm is developed for this special case.

3 - Submodular Inequalities for Capacitated Lot Sizing with Backlogging

Alper Atamturk, Associate Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, atamturk@ieor.berkeley.edu, Laurence Wolsey

We describe an efficient computation of submodular valid inequalities for the capacitated lot-sizing problem with backlogging. We compare the inequalities with other related ones and show how to lift them sequence independently.

■ WA48

Operations Management in Commodity Markets

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

1 - Supply Management in Proportional Product Markets

Paul Kleindorfer, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, kleindorfer@wharton.upenn.edu, Onur Boyabatli

In several supply chains (fed-cattle, soybean, petrochemicals), where there are spot markets for inputs, one unit of input is processed to produce proportional amounts of multiple-outputs. Building on previous work on options-based approaches to supply chain coordination, this research investigates the implications of the proportional product model on the supply management, in particular optimal mix of long-term and short-term (spot) contracting decisions.

2 - Role of Commodity Markets in the Procurement and Distribution of Gasoline

Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu, Genaro Gutierrez

We incorporate the information on commodity market equilibrium in modeling procurement and distribution of gasoline under the framework of one-warehouse multi-retailer. Commodity can be procured through forward and spot contracts. In this research, we seek to understand how the term structure of the futures price at the market equilibrium can be used to obtain better procurement and distribution policies in order to enhance the efficiency of supply chains under centralized decision making.

3 - Valuation of LNG Supply Chains

Xiaofeng Wang, PhD Candidate, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, xiaofenw@andrew.cmu.edu, Nicola Secomandi, Alan Scheller-Wolf, Sunder Kekre, Christine Parlour

This talk illustrates a model to value liquefied natural gas (LNG) supply chains consisting of natural gas liquefaction, LNG shipping, storage and re-gasification, and natural gas sale into the wholesale market at the prevailing spot market price. We model this price using a mean reverting model with seasonality. We use a closed queuing network to represent LNG shipping. We then use a finite-horizon dynamic program to make price and inventory dependent sales and storage decisions.

■ WA49

Game-Theoretic Models in Closed-Loop Supply Chains and Reverse Logistics

Cluster: Closed-Loop Supply Chains and Reverse Logistics
Invited Session

Chair: Fuminori Toyasaki, Postdoctoral Research Fellow, McGill University, Faculty of Management, 1001 Sherbrooke Street West, Montreal, H3A 1G5, Canada, fuminori.toyasaki@mcgill.ca

1 - Operational Impacts of Monopolistic and Competitive WEEE Collection Schemes

Fuminori Toyasaki, Postdoctoral Research Fellow, McGill University, Faculty of Management, 1001 Sherbrooke Street West, Montreal, H3A 1G5, Canada, fuminori.toyasaki@mcgill.ca, Vedat Verter, Tamer Boyaci

This research investigates the operational efficiency of a monopolistic and a competitive collection system for WEEE from the perspective of EEE manufacturers and consumers. We assume that EEE manufacturers compete with each other strategically in a Bertrand oligopoly form. We assume that in the both systems the behavior of the EEE manufacturers and collection schemes can be represented by a leader-follower game.

■ WA50

Optimization Techniques I

Contributed Session

Chair: Deniz Kasap, Researcher, TUBITAK-TUSSIDE, Baris Mah. Kosuyolu Cad. No:48 PK.14, Gebze, Kocaeli, 41401, Turkey, dkasap@tusside.gov.tr

1 - A Column Generation Algorithm for the Split Delivery Vehicle Routing Problem

Mingzhou Jin, Assistant Professor, Mississippi State University, PO Box 9542, Mississippi State, MS, 39762, United States, mjin@ise.msstate.edu

A column generation approach is developed to solve the Split Delivery Vehicle Routing Problem (SDVRP) by using the minimal number of routes required. Besides the routes, the columns also include delivery amount information. A limited-search-with-bound (LSB) algorithm is developed to efficiently solve the pricing sub-problem. The numerical experiments show that the algorithm yields solutions better than the best-known solutions in the literature with regards to lower bounds and upper bounds.

2 - A Minimax Theorem with Applications to Machine Learning, Signal Processing, and Finance

Seung-Jean Kim, Consulting Assistant Professor, Information Systems Laboratory, Department of Electrical Engineering, Stanford University, 223 Packard, 350 Serra Mall, Palo Alto, CA, 94305, United States, sjkim@stanford.edu, Stephen Boyd

We consider a zero-sum game associated with a special type of Rayleigh quotient, which arises in several applications. We give a nonstandard minimax theorem for this game, and describe an efficient method for computing the saddle point, based on convex optimization. We describe applications in machine learning, signal processing, and finance.

3 - An Improved Cut and Reduce Algorithm for Reverse Convex Optimization

Khosrow Moshirvaziri, Professor, California State University, 1250 Bellflowe Boulevard, Long Beach, CA, 90840-8506, United States, moshir@csulb.edu, Mahyar A. Amouzegar

In this paper we derive a variation of an earlier cutting plane algorithm for the solution of linear reverse convex programs. The new method uses fewer iterations than the original algorithm and early computationally results on a set of test problems have been promising.

4 - On Solving a Dual Problem in Generalized Linear Fractional Programs

Kuang-Yao Wu, Associate Professor, Department of Business Management, National United University, No. 1 Lien-Da, Kung-ching Li, Miaoli, 360, Taiwan, kywu@nuu.edu.tw

This paper addresses the dual problem of minimizing the maximum of a finite number of linear ratios over a polytope. The dual is of the parametric optimization in which a parametric basic solution is defined by a system of parametric linear equalities. A simplex-type algorithm is proposed for exploring basic solutions iteratively, until the optimal point is reached. The dual approach appears to be highly adaptive to solve the primal fractional problem with a considerable number of linear ratios.

5 - Profits Maximization for Intermediaries in Telecom Networks Considering QoS and Capacity Constraints

Nihat Kasap, Assistant Professor, Sabanci University, Orhanli - Tuzla, Istanbul, 34, 34956, Turkey, nihatk@sabanciuniv.edu, Burcin Bozkaya

In this study, an optimization model is proposed to maximize the revenue of the intermediary providing video conferencing service to alternative demanding customers. The model also handles resource management of an intermediary by considering that the available capacity of the operator is only distributed for the video conferencing service users.

■ WA51

Aviation Applications

Contributed Session

Chair: Frederic Ferchaud, EUROCONTROL EC, Centre de Bois des Bordes BP15, Bretigny Sur Orge, 91222, France, fredferchaud@gmail.com

1 - Air Traffic Flow Management: An Adaptable Robust Approach

Constantine Caramanis, Assistant Professor, The University of Texas at Austin, ECE, 1 University Station, C0803, Austin, TX, 78712-0240, United States, cmcaram@ece.utexas.edu, Dimitris Bertsimas

We consider the global problem of scheduling ground delays, air delays, and dynamic route selection, subject to take off, landing, and sector capacity constraints. We take an Adaptable Robust Optimization approach, using Finite Adaptability to build a schedule that is robust to dynamically changing weather conditions, while controlling the degree of conservativeness. We test our framework on multi-sector, multi-airplane problems, demonstrating the advantages of finite adaptability.

2 - Productivity of U.S. Airports with Consideration of Undesirable Outputs

Somchai Pathomsiri, University of Maryland, 4309 Rowalt Drive #201, College Park, MD, 20740, United States, egspt@mahidol.ac.th, Ali Haghani, Robert J. Windle, Martin Dresner

Airport operation does create some undesirable outputs such as delays, noise, pollution and accident. Previous studies largely ignore these outputs when assessing airport productivity. This research considers delays and reassesses productivity of 56 major U.S. airports using a panel data during 2000 - 2003. The directional output distance function is used to analyze technical efficiency of airport operation. Comparisons of results between with and without consideration of delays are presented.

3 - Aviation Safety Oversight Aided by Decision Analysis

Larry Berk, Operations Research Analyst, The Volpe Center, U.S. DOT, RTV-5B/DTS-67, 55 Broadway, Cambridge, MA, 02142, United States, berkl@volpe.dot.gov, James Hallock

This talk describes grassroots research to introduce decision analysis to the FAA Aviation Safety organization (AVS), then structure and solve a multiple criteria decision problem with prototype software given a specific context; generating optimal airline surveillance plans for teams of AVS inspectors.

4 - Aircraft Delay and Throughput in ATFM Slot Allocation

Frederic Ferchaud, EUROCONTROL EC, Centre de Bois des Bordes BP15, Bretigny Sur Orge, 91222, France, fredferchaud@gmail.com, Alexandre D'Aspremont

We present an approach for optimizing aircraft slot allocation and air traffic flow planning in the presence of uncertainty. We use Chernoff Bounds to solve the problem of optimally allocating buffer slots to maximize throughput while satisfying capacity constraints with a given confidence level. We also study the trade-off between total throughput and slot reallocation time (or aircraft delay).

■ WA52

Bilevel Programming and Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Patrice Marcotte, Professor, University of Montreal, CP 6128, Succ. Centre-Ville, Montreal, QC, H3C3J7, Canada, marcotte@iro.umontreal.Ca

Co-Chair: Gilles Savard, Ecole Polytechnique de Montréal, CP 6079 Succursale Centre Ville, Montréal, QC, H3C3A7, Canada, gilles.savard@polymtl.ca

1 - A Tabu Search Heuristic for a Pricing Problem on a Network

Luce Brotcorne, Associate Professor, LAMIH-ROI, University of Valenciennes, Le Mont Houy, Valenciennes Cedex 9, F 59313, France, luce.brotcorne@univ-valenciennes.fr, Fabien Cirinei

We consider a bilevel pricing problem where a company (a leader) strives to maximize its revenue raised from tariffs imposed on a set of arcs while taking into account the cost minimizing behaviour of the customers. We propose a tabu search algorithm based on the characterization of feasible followers solutions as a set of paths. To assess the efficiency of the method, a comparison with previously proposed heuristics is made on instances solved to optimality.

2 - Global and Local Approaches to a Logit-Based Pricing Problem

Patrice Marcotte, Professor, University of Montreal, CP 6128, Succ. Centre-Ville, Montreal, QC, H3C3J7, Canada, marcotte@iro.umontreal.Ca, François Gilbert

The logit route choice model allows one to model commuter behavior in a network both realistically and in a computationally affordable way. We consider a network toll-setting problem based on a bilevel programming framework where the reaction of the commuters is modelized with a logit model. Observations will be made concerning the general features of the revenue function and a parallel with the deterministic toll setting problem established.

3 - Choice Models and Simultaneous Pricing-Inventory Control

Gilles Savard, Ecole Polytechnique de Montréal, CP 6079 Succursale Centre Ville, Montréal, QC, H3C3A7, Canada, gilles.savard@polymtl.ca, Jean-Philippe Côté, Alexandre Schoeb

The aim of this presentation is to present a unified framework that integrates simultaneously the inventory and pricing sub-problems faced by airlines and high-speed rail companies. The framework is based on the bilevel programming paradigm where the behavior of passengers is implicitly considered with the use of choice models. According to the selected choice models, algorithmic issues will be discussed. Numerical results on real life instances will be presented.

■ WA53

Supply Chain III

Contributed Session

Chair: Karthik Ayodhiramanujan, Graduate Research Associate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, karthik.ayodhiramanujan@okstate.edu

1 - The Effects of Paperless MIR in a Supply Chain

Shilei Yang, Washington State University, Department of Management & Operations, Pullman, WA, 99164, United States, yangstone@wsu.edu, Bintong Chen

Mail-in rebate has become a popular price discrimination device by providing discounts to the end customers. However, due to the hassles of paperwork, customers are getting frustrated and have no incentives to buy the product even with MIR. Now, some manufacturers provide online systems that allow customers to claim their rebates much easier. We show that as long as the actual redemption rate is lower than the perceived redemption probability, the paperless MIR can always benefit manufacturers.

2 - Success Factors in Strategic Supplier Alliances: A Decade Later

Loay Sehwail, Oklahoma State University, PO Box 406, Stillwater, OK, 74076, United States, loay.sehwail@okstate.edu, Ricki Ingalls

Supply chain alliances received considerable attention in the academic and business press. In light of the advances in information technology, the authors examine how time affected the factors attributed to the success of supply chain strategic alliances by re-testing the model developed by Monczka et al. (1998). The authors then compare their findings with the results of the study conducted a decade ago.

3 - Who Should Take Over Operations in a Supply Chain? The Effect of Efforts and Specificity
Santiago Kraiselburd, Executive Director, Zaragoza Logistics Center, Avda. Gómez Laguna, 25 1(tm) Planta, Zaragoza, 50009, Spain, skraiselburd@zlc.edu.es

When is having no previous contract better than having one, if ever? When should a manufacturer/retailer take over part (or all) of the other party's operation, instead of considering just a contract? This paper attempts to respond to these questions in the context of a supply chain under a single period scenario where both the manufacturer and the retailer can exert uncontractible effort that may or may not be specific to the relationship.

4 - Dynamics of Supplier Innovation
Arash Azadegan, PhD Student, Arizona State University, WP Carey School, Tempe, AZ, 85287, United States, arash.azadegan@asu.edu, Kevin Dooley

The Dynamics of innovation model has a user/manufacturer perspective. We view the innovation cycle from supplier's perspective. Questions on supplier innovation include: Whether supplier innovation shows a different pattern than manufacturers' and whether supplier innovation is driven by different forces at different phases of the cycle. The paper suggests that supplier innovations are mainly performed at the start and end of the innovation cycle and justified using resource based view.

5 - An Integrated Framework for Warehouse Performance Analysis
Karthik Ayodhiramanujan, Graduate Research Associate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, karthik.ayodhiramanujan@okstate.edu, Manjunath Kamath

Performance evaluation models of warehouse operations have focused on individual subsystems such as AS/RS systems. We discuss the development of analytical models that consider all key operations from receiving to shipping including material transport, storage/retrieval and cross-docking operations. Such models are useful at the tactical planning stage, and our approach builds on recent research in queueing and production-inventory networks.

■ WA55

Production & Scheduling III

Contributed Session

Chair: Thom Hodgson, James T. Ryan Professor, North Carolina State University, Fitts ISE Department, Raleigh, NC, 27695, United States, hodgson@ncsu.edu

1 - Controlling Stochasticity in the Execution of Production Plans
Karl Kempf, Intel Fellow, Intel Corporation, Decision Technologies, Chandler, AZ, 85226, United States, karl.g.kempf@intel.com, Kirk Smith, Gary Godding

Production planning matches supply and demand both containing various elements of stochasticity. A standard mechanism for addressing this situation is the inclusion of safety stocks in the plan. We have been exploring the application of real time feed forward feedback control to the execution of production plans as an additional mechanism for managing stochasticity. We will present results from both simulation and actual practice for a multi-echelon multi-product semiconductor production system.

2 - Integrating Production Planning and Safety Stock Determination
Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Ashwin Ravindran

We consider the problem of integrating production planning and safety stock determination using clearing functions to represent the capacity of a production resource. We present a linear programming model with chance constraints, and show that this model provides comparable service levels to existing models while holding significantly less inventory.

3 - Supply Chain Planning in a Foundry and Services Environment
Stuart Smith, IBM Systems and Technology Group, 1000 River Road, Essex Junction, VT, 05452, United States, stuarts1@us.ibm.com, Chih-Hui Chang, Chi-Tai Wang

Traditionally, products are planned via Make To Order (MTO) or Make To Stock (MTS). This talk describes how IBM Systems and Technology Group models the planning of products which have complimentary demands - that is demands which share both MTO and MTS aspects. This is handled through the integration of two linear programming models.

4 - The Value of Shared Information in a Multi-Plant Manufacturing Network
Thom Hodgson, James T. Ryan Professor, North Carolina State University, Fitts ISE Department, Raleigh, NC, 27695, United States, hodgson@ncsu.edu, Kristin Thoney, A. S. Peker, S. Nayak, Russell King

We address the value of shared information in a multi-plant network with scheduled inter-plant transportation, with detailed scheduling of facilities and transportation. A finite capacity multi-plant scheduling system is used in a simulated multi-plant manufacturing environment and is partially disabled when individual plants in the network do not share information, forcing it to operate in local mode. System performance is studied in terms of inventory cost and due date performance.

Wednesday, 10:00am - 11:30am

■ WB01

Algorithms, Games, and Computation

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Mohammad Mahdian, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, mahdian@gmail.com

1 - Steiner Tree Mechanisms and Prize Collection
Mukund Sundararajan, mukunds@stanford.edu, Tim Roughgarden

A cost-sharing mechanism is a strategyproof protocol that collects bids from a set of players, selects a subset of the players to receive a service (incurring a subset-dependent cost), and determines prices that recover the cost of the constructed solution. We show that previously proposed steiner tree mechanisms, which were not designed with social efficiency in mind, approximate a measure of social efficiency that is reminiscent of well studied prize-collecting objectives.

2 - Adwords Allocation Problem with Unreliable Estimates
Hamid Nazerzadeh, Stanford University, Stanford, CA, 94305, United States, hamidnz@stanford.edu, Amin Saberi, Mohammad Mahdian

Search engines such as Google, Yahoo!, or MSN use auction mechanism for allocating the advertisement space. In this work, our objective is to find an algorithm that uses given estimates of the frequencies of the queries to find a near-optimal allocation, while maintaining a good worst-case performance when the given estimates are inaccurate. In order to evaluate our algorithm, we present a bi-criteria framework, which also can be extended to design and analysis of other online algorithms.

3 - To Fill or Not to Fill: The Gas Station Problem
Azarakhsh Malekian, Graduate Student, University of Maryland, Room #1103, A.V. Williams Building, College Park, MD, 20742, United States, malekian@cs.umd.edu, Samir Khuller, Julian Mestre

In this work, we study some generalization of shortest paths and TSP. We consider a more general model that incorporates the actual cost in terms of gas prices and also tank capacity of the vehicle. The objective is to find the cheapest route to go from s to t, or the cheapest tour visiting a given set of locations. For the first problem, we develop a polynomial time algorithm. For most other versions, the problem is NP-complete and we develop approximation algorithms for them.

4 - Mechanism Design via Machine Learning
Maria-Florina Balcan, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3891, United States, ninamf@cs.cmu.edu, Avrim Blum, Yishay Mansour, Jason Hartline

We use techniques from sample-complexity in machine learning theory to reduce problems of incentive-compatible mechanism design to standard algorithmic questions, for a broad class of revenue-maximizing pricing problems. We apply our generic reductions to the problem of auctioning a digital good, to the attribute auction problem which (includes a wide variety of discriminatory pricing problems), and to the problem of item-pricing in unlimited-supply combinatorial auctions.

■ WB03

Sphere Packing

Sponsor: Optimization/ Global Optimization
Sponsored Session

Chair: Nick Sahinidis, Department of Chemical and Biomolecular Engineering, University of Illinois Urbana-Champaign, Urbana, IL, United States, nikos@uiuc.edu

1 - Circle Packing: A New Approach Based on Research Space Discretization
Raffaele Cerulli, Associate Professor, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, raffaele@unisa.it, Carmine Cerrone, Monica Gentili

The circle packing problem consists in finding a minimum diameter circle containing circles with diameter varying from 1 up to n. We present an efficient combinatorial heuristic algorithm based on the discretization of the search space that results to be competitive with the existing resolution approaches.

2 - Sphere Packings Using Global Optimization Software
János D. Pintér, President and Research Scientist, Pinter Consulting Services Inc., 129 Glenforest Drive, Halifax, NS, B3M 1J2, Canada, jdpinter@hfx.eastlink.ca, Frank Kampas

We discuss non-overlapping packings of uniform and non-uniform size spheres into containers. The generic objective is to provide "tightest possible" packings: this leads to context-dependent model forms. We present model variants and illustrative numerical results, using MathOptimizer Professional (MOP). MOP is our Mathematica package with an easy-to-use interface to the LGO global/local optimization solver suite.

3 - Heuristic and Exact Algorithms for Packing Discs in a Minimal Container Circle
Wei Xie, Graduate Student, Department of Chemical & Biomolecular, University of Illinois at Urbana-Champaign, 600 S. Mathews Avenue, Urbana, IL, 61801, United States, wxie@uiuc.edu, Nick Sahinidis

We address the problem of packing n discs of given radii in a way that minimizes the radius of a container circle. We present several greedy heuristics as well as branch-and-bound-based global optimization algorithms for this problem. Extensive computational results are presented for problems with up to 50 discs.

■ WB05

Machine Scheduling Problems

Contributed Session

Chair: Maria Vlasiou, Research Engineer, Georgia Institute of Technology, ISyE, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, vlasiou@eurandom.tue.nl

1 - Approximation Methods for the Standard Deviation of Flow Times in the G/G/s Queue
Xiaofeng Zhao, PhD Candidate, University of Tennessee, Department of Statistics, Operations, and Management Science, Knoxville, TN, 37916, United States, xzhao1@utk.edu, Kenneth Gilbert

In this research, we provide an approximation for the standard deviation of the time in system for a general multi-server queue with infinite waiting capacity (G/G/s). The approximation requires only the mean and standard deviation of the inter-arrival and service time distributions, and the number of servers. This approximate is simple enough to be implemented in manual or spreadsheet calculations, but in comparisons to Monte Carlo simulations has proven to give good approximations.

2 - Minimizing Total Flow Time on a Single Flexible Machine
Ibrahim Karakayali, Research Assistant, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611, United States, ibrahimk@ufl.edu, Meral Azizoglu

In this study, we address a job sequencing and tool switching problem arising in flexible manufacturing systems. We consider the single machine problem of minimizing the total flow time. We prove that the problem is NP-hard in the strong sense and show that the tool switching problem is polynomially solvable for a given sequence. We propose a branch-and-bound algorithm whose efficiency is improved by precedence relations and several lower and upper techniques.

3 - Minimizing Regular Performance Measures for Unrelated Parallel Machine Scheduling Problems
Yangkuei Lin, Arizona State University, PO Box 87590, Tempe, AZ, 85287, United States, yangkuei.lin@asu.edu, Michele Pfund, John Fowler

In this research, several heuristics and a Genetic Algorithm (GA) for scheduling unrelated parallel machine problems to minimize the makespan, total weighted completion time, and total weighted tardiness when each objective is considered individually are proposed. Computational results show that the proposed heuristics outperform the best existing heuristics from the literature for these objectives.

4 - Minimizing Total Earliness and Tardiness on a Single Machine
Rym M'Hallah, Associate Professor, Department of Statistics and Operations Research - Kuwait University, PO Box 5969, Safat 13060, Kuwait, mhallah@kuc01.kuniv.edu.kw

This paper proposes an approach that schedules jobs with different processing times and distinct due dates on a single machine with no inserted idle time as to minimize the sum of total earliness and tardiness. Computational results show that large problems can be solved efficiently.

5 - On Queues with Service and Interarrival Times Depending on Waiting Times
Maria Vlasiou, Research Engineer, Georgia Institute of Technology, ISyE, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, vlasiou@eurandom.tue.nl, Onno Boxma

We study a non-monotone Lindley-type recursion, which represents the waiting time in a FCFS queue in which the service times and interarrival times depend linearly on the waiting times. The model reduces either to Lindley's equation for the waiting time in G/G/1 or to the waiting time of the server in an alternating service model. We derive the waiting-time distribution when the interarrival time is either generally or exponentially distributed and the service time is either PH or deterministic.

■ WB06

Metaheuristics for Data Mining Problems

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Belén Melián, University of La Laguna, Dpto. E.I.O. y Computación, La Laguna, Spain, mbmelian@ull.es

1 - Multiobjective Clustering with Metaheuristic Technology
Manuel Laguna, Professor, University of Colorado, Leeds School of Business, 419 UCB, Boulder, CO, 80309, United States, laguna@colorado.edu, Rafael Marti, Julian Molina, Rafael Caballero

We develop a metaheuristic procedure for multiobjective clustering problems. Our goal is to find good approximations of the efficient frontier and provide a means for improving decision making in multiple areas of application and in particular those related to marketing. Clustering using multiple criteria and/or multiple data sources has received limited attention in the literature. Our procedure is general and tackles several problems classes within this area of combinatorial data analysis.

2 - Hybridizing Reactive Tabu Search with Simulated Annealing
Stefan Voss, Chair and Director of the Institute of Information Systems within the Faculty of Economics and Business Administration, University of Hamburg, IWI, Von-Melle-Park 5, Hamburg, HG, 20146, Germany, stefan.voss@uni-hamburg.de, Andreas Fink

Reactive Tabu Search aims at the automatic adaptation of the tabu list length. The idea is to increase the tabu list length when the tabu memory indicates that the search is revisiting formerly traversed solutions. Once too many repetitions are encountered an escape meachanism coonstituting a random walk is an essential part of the method. We propose to replace this random walk by a controlled simulated annealing. Excellent results are presented for various combinatorial optimization problems.

3 - Analysis of New Variable Selection Methods for Logistic Regression Models
Joaquin Pacheco, University of Burgos, Plaza Infanta Elena s/n, BURGOS, BU, Spain, jpacheco@ubu.es, Silvia Casado, Laura Nuñez

New methods to select variables for Logistic Regression are proposed. The aim is to find a smaller subset that built a good classification. Reducing dimensionality has advantages: less costs, better understanding and efficiency and efficacy. The problem consists in finding a subset of original variables that yields the greatest percentage of hits in Logistic Regression. A series of techniques based on metaheuristic strategies is proposed. They obtain better results than traditional methods.

4 - Feature Subset Selection as a Bi-Objective Optimization Problem
Belén Melián, University of La Laguna, Dpto. E.I.O. y Computación, La Laguna, Spain, mbmelian@ull.es, Marcos Moreno, Miguel García, Jose Moreno-Perez

In feature subset selection applied to supervised classification, given a set of labelled instances, a model is induced with a subset of features to classify new non-classified instances. In this work we use a scatter search metaheuristic to solve the feature subset selection problem, in which both the classification error and the features subset size have to be minimized.

■ WB07

Cyberinfrastructure and Integer Programming

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software
Sponsored Session

Chair: Jeff Linderoth, Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, jtl3@Lehigh.EDU

1 - Using Cyberinfrastructure Tools to Solve Bicriteria Integer Programs
Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States, tkr2@lehigh.edu

We discuss solution of several classes of difficult bicriteria integer programming problems on the computational grid using a parallel algorithm based on the weighted Chebyshev norm scalarization. The talk will focus on the cyberinfrastructure tools used, the challenges faced in parallelizing the algorithm, and the use of advanced methodology to improve soluton times.

2 - Solving Difficult Mixed-Integer Programming Problems Using GAMS and Condor
Michael Ferris, Professor, University of Wisconsin-Madison, 1210 W. Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Michael Bussieck

GAMS is a commercial modeling system for mathematical programming problems. Condor is a resource manager that delivers huge amounts of computing cycles from large collections of distributively owned computing resources. We describe new modeling features of GAMS and recent solver enhancements that allow us to harness the computational resources of Condor for solving difficult mixed-integer programs. We report on the solution of the MIPLIB problems timtab2, roll3000, a1c1s1 and swath.

3 - Distributed Decision-Making Methods for Collaborative Logistics Optimization
Andrew Miller, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, amiller@engr.wisc.edu, Sricharan Poundarikapuram, Dharmaraj Veeramani, Rao Panchalavarapu

We develop distributed decision-making methods that can provide optimal solutions during collaborative planning in logistics networks without disclosing significant private local information of the participating corporations (the players). We have tested our ideas by implementing them on a practical data sets from the logistics industry, and our implementation may point the way to how practically to use cyberinfrastructure to make practical decisions in collaboration.

4 - On Implementing a Parallel Integer Solver Using Optimization Services
Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60601, mehrotra@iems.northwestern.edu, Jun Ma, Huanyuan Sheng

We will present a framework for implementing a parallel integer solver using optimization services and standard instances. Depending on the progress computational results will be presented describing the viability of this approach for implementing parallel solvers for solving difficult integer programs within the IMPACT solver package.

■ WB08

RFID in Supply Chain and Services Management

Sponsor: Technology Management
Sponsored Session

Chair: Chris Forman, Assistant Professor, Information Systems, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, cforman@andrew.cmu.edu

1 - The Value to the Customer of RFID: A Taxonomy of RFID-Enhanced Service
Gregory Heim, Assistant Professor, Wallace E. Carroll School of Management, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, heimgr@bc.edu, William Wentworth

It is essential today for managers to determine the strategic implications posed by RFID. To the best of our knowledge, prior research has not analyzed how customer value will be provided via RFID, or what aspects of value customers might gain from RFID applications. We examine the customer value proposition of RFID within physical service environments. We develop a taxonomy of RFID applications in services, and use the taxonomy to examine survey data on value across the RFID application types.

2 - Inventory Management with Differential Pricing and RFID
Diego Klabjan, Associate Professor, University of Illinois at Urbana-Champaign, 1206 West Green Street, Urbana, IL, 61801, United States, klabjan@mit.edu

We study the inventory control problem of a single item, which is priced differently based on the added value. Radio frequency identification is an enabling technology for several new applications of this concept. We give results with respect to standard base-stock and (s,S) policies.

3 - RFID Adoption and Implementation in Supply Chains
Reyes Pedro, Assistant Professor, Hankamer School of Business, Baylor University, One Bear Place #98006, Waco, TX, 76798-8006, United States, pedro_reyes@baylor.edu

Like many other technologies of the past few decades, RFID technology in supply chain operations promises a variety of performance benefits and a powerful competitive weapon. While the ROI has been widely debated, we present findings based on secondary data collected on multiple international cases along with twelve field study interviews of RFID implementation in order to provide insights, identify implementation challenges, and highlight lessons learned.

4 - Assessing the Impact of RFID on Return Center Logistics
Nishtha Langer, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Posner #357, Pittsburgh, PA, 15213, United States, nishtha@cmu.edu, Chris Forman, Alan Scheller-Wolf, Sunder Kekre

RFID technology is being widely embraced in the supply chain, but there is a debate about its business value. To ascertain the real benefits of RFID, we conduct a field study with a third party logistics company that deployed RFID at one of its outbound logistics operations. After controlling for product, process and customer mix, we find that RFID not only provides operational benefits through improvements in productivity and process quality, but also moderates transaction costs.

■ WB09

Sustainable Development

Contributed Session

Chair: Ibrahim Dogan, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States, dogan@wayne.edu

1 - Using Emission Functions in Mathematical Programming Models for Sustainable Urban Transportation
S. Ilker Birbil, Associate Professor, Sabanci University, Orhanli-Tuzla, Istanbul, 34956, Turkey, sibirbil@sabanciuniv.edu, Ahmet Esat Hizir

There seems to be a lack of mathematical programming approaches to sustainable urban transportation problems. To demonstrate the possible applications of mathematical programming within sustainable urban transportation, we analyze emission functions in terms of traffic flow and incorporate these functions into toll pricing models. The proposed models are solved by a state-of-the-art solver. Our presentation ends with a discussion of solution effort as well as the interpretation of the results.

2 - A Real Options Approach to Value Sustainable Product Manufacturing

Bilsel Ragip Ufuk, The Pennsylvania State University, 215 W. Fairmount Avenue #514, State College, PA, 16801, United States, rub150@psu.edu, Harriett Nembhard, Tao Yao

We propose an analytical method to value environmental sustainability under uncertainty. Specifically, we use a discrete time model combining lattice analysis and simulation to determine the value of switching between ordinary and green product manufacturing. We will consider four different sources of uncertainty; due to price, output rate, variable costs and technological improvements. A numerical example will be presented to discuss application aspects.

3 - Creating a Marketplace for Development Projects: Combinatorial Auctions and Post-Conflict Aid

J.D. Lecy, Student, Maxwell School of Public Affairs, 200 Eggers Hall, Syracuse University, Syracuse, NY, 13244, United States, jdlecy@maxwell.syr.edu

Post-conflict aid enables more growth than other kinds of aid, but the mechanisms of allocation have yet to be studied. We present a framework for analyzing the effects of post-conflict aid, and a fully-implemented decision support system that allows donors to choose bundles of project contracts that optimize social benefit.

4 - Modeling Closed-Loop Supply Chains Using Dynamic Bayesian Networks

Ibrahim Dogan, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States, dogan@wayne.edu, Ratna Babu Chinnam

This study models a two-stage supply chain where a supplier remanufactures products under information asymmetry. We employ novel Dynamic Bayesian Networks (DBNs) to improve supplier's visibility for product returns as well as market demand and in turn improve supplier's operations. Our results show that, with this approach, supplier is able to estimate supply chain states more accurately.

■ WB11

Medical Decision Making

Contributed Session

Chair: George Miller, Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

1 - Technology Integration in Healthcare Organizations: Self Selection and Performance Implications

Asoke Dey, PhD Candidate, University of Minnesota, 321 19th Avenue South, Room 3-150, Minneapolis, MN, 55455, United States, adey@csom.umn.edu, Kingshuk Sinha

Though application of information technologies in healthcare firms has direct positive impacts on patient safety and business-process reengineering, inappropriate choice of technologies and lack of integration across these technologies have left much to be desired. This study develops a conceptual understanding of how firms select the multiple technologies, what factors are important for this selection, and how it affects the performance of these firms. We test empirically with healthcare data.

2 - Probabilistic Models for Analyzing the Effect of Data Quality on Clinical Decision Support Systems

Sharique Hasan, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, shasan@andrew.cmu.edu, Rema Padman

Clinical decision support systems have been advocated to improve patient safety by delivering guidance at the point-of-care. Recent literature shows, however, that these systems may also facilitate medical error. One class of errors may result from poor patient data quality. To analyze this problem we develop a mathematical model of system accuracy as a function of data quality. The methodology employs probabilistic graphical models to represent data, errors, and data use.

3 - Information Visualization and Meeting Physician Information Needs for Risk and Compliance Assessment

Christopher Harle, Carnegie Mellon University, Heinz School, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, charle@cmu.edu, Rema Padman

Electronic patient data is increasingly available to physicians. This trend is likely to continue with policy makers urging widespread adoption of EHRs. This presents an opportunity to provide physicians with critical information to improve decision making at the point of care. We establish physician information needs for assessing diabetes risk and guideline compliance. We then develop and evaluate multidimensional information visualization models for delivery of those needs.

4 - Information-Based Medicine Integrated with RFID Technology in a Health Evaluation Center

Hsueh-Ming Wang, Assistant Professor, Chang Gung University, 259 Wen Hua 1st Road, Kwei Shan, Tao Yuan, 333, Taiwan, steve@mail.cgu.edu.tw

This paper studies on a RFID prototype system that is integrated with mobile healthcare of health-section supply chain in a health evaluation center. The aims are to (i) Keep track of the locations of patients in the health evaluation processes, (ii) Provide greater visibility of the operations data, and (iii) Improve the control processes. The case study illustrates the advantages of using an RFID system, particularly its support of M-healthcare activities in the health evaluation center.

5 - Cost-Effectiveness of Disease Management: Modeling to Infer Long-term Results from a Clinical Trial

George Miller, Altarum Institute, PO Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org

We use a Markov chain model to extend the results of an 18-month clinical trial of disease management for congestive heart failure (CHF) patients. Our results suggest that disease management of CHF patients can be cost-effective if patients remain in the program for life and the effects observed in the trial continue in the long run. But accurate estimation of both the clinical and financial benefits requires an ability to project costs and effectiveness for the lifetime of the patients.

■ WB12

Enterprise-Wide Optimization: Process Industry Supply Chain

Cluster: Enterprise-Wide Optimization in the Process Industry
Invited Session

Chair: Iftekhar Karimi, Professor, Department of Chemical & Biomolecular Engineering, National University of Singapore, 4 Engineering Drive 4, Singapore, 117576, Singapore, cheiak@nus.edu.sg

1 - A Generalized Model for Supply Chain Redesign and Asset Management

Pavan Kumar Naraharisetti, Institute of Chemical & Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, 627833, Singapore, pavan_kumar@ices.a-star.edu.sg, Iftekhar Karimi, Rajagopalan Srinivasan

Organizations manage assets such as production & inventory holding facilities, raw materials, technological know-how and financial resources (capital from loans & bonds). Assets also include contracts to hedge the risk from uncertainties in material production and distribution. Optimal asset management (AM) involves investing and disinvesting in assets, leading to supply chain redesign (SCR), such that the NPV of the shareholder value is maximized. We present here a novel MILP model for SCR&AM.

2 - Merging Process Operations and Financial Analysis to Enhance the Supply Chain Management

Luis Puigjaner, Professor, Spain, luis.puigjaner@upc.edu, Gonzalo Guillén-Gosálbez, José Miguel La"nez

This work proposes a general framework for the design and retrofit of chemical supply chains which relies on the development of holistic models which merge process operations as well as financial variables and constraints. A mathematical formulation which utilizes mixed integer modeling techniques is derived and its advantages are highlighted through a case study in which a comparison with the traditional myopic approach, which neglects the financial side of the problem, is carried out.

3 - Distributed Modeling of Long-Term Production Scheduling in Multisite, Multiproduct Enterprise System

Steinar Hauan, Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States, steinhau@andrew.cmu.edu, Israel B Owusu

An agent based optimization approach is applied to enterprise optimization problems consisting of demand allocation and scheduling. The allocation problem is solved iteratively using agents with embedded heuristic and stochastic strategies to gerenate objectives for the scheduling subproblems. We implement the approach in a distributed computing environment and show multi-product literature example that has been expanded to cover multiple plants with different internal cost structures.

4 - Strategic Sourcing Based on Contract Selection
Jie Li, National University of Singapore, Singapore, 117576, Singapore, g0304872@nus.edu.sg, Mukta Bansal, Iftekhar Karimi, Rajagopalan Srinivasan

Selecting contracts for raw material purchases is an important problem, as raw material costs are significant for many companies and contracts allow risk sharing in the presence of uncertainties. However, contracts come with different terms & conditions, hence selection is a non-trivial problem. We consider the optimal selection of raw material contracts using a mathematical programming approach. We also treat procurement planning horizon as a potential decision.

■ WB13

Teaching Problem Formulation

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU

1 - Teaching Problem Formulation
Stephen Powell, Professor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States, Stephen.G.Powell@Dartmouth.EDU, Thomas Willemain

While formulating ill-structured problems is the biggest challenge in modeling, little is known about how to teach this skill. We have studied both expert and student modelers to uncover the heuristics used by experts and the dysfunctional behaviors of students. We will report on our research and explore its implications for teaching.

■ WB14

Auctions

Contributed Session

Chair: Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu

1 - Auction-Based Network Problem with Delayed Item Augmentation
Judy Doupu Geng, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, judygeng@mie.utoronto.ca, Roy H. Kwon

We consider an combinatorial auction based network problem with delayed item augmentation in which auctioneer gradually introduces items to bidders rather than put all items for sales at once. We prove the efficiency of this mechanism in terms of auctioneer's revenue and number of allocated bidders. Numerical results show that CA with delayed item augmentation outperforms CA of offering all times to bidder once.

2 - Welfare Maximization in Congestion Games
Liad Blumrosen, Microsoft Research, Silicon Valley, Mountain View, CA, United States, liad@cs.huji.ac.il, Shahar Dobzinski

Congestion games are non-cooperative games where the utility of a player from using a certain resource depends on the total number of players that are using the same resource. This paper studies centralized solutions for congestion games. We analyze the computational complexity of the welfare-maximization problem, and provide novel incentive-compatible mechanisms, approximation algorithms and lower bounds. We also characterize useful connections to combinatorial auctions.

3 - Modeling Agent-Based Auctions in Two Dimensions
Barin Nag, Professor, Towson University, Department of Management, Towson, MD, 21252, United States, bnag@towson.edu, Sungchul Hong, Dongqing Yao

In an agent-based auction environment, we consider matching buyer bids and seller offers in the two dimensions of quantity and price. The decision is a trade-off between the cost of accepting a part quantity versus carrying over the trade to the next period. Cooperation is permitted in matching quantities.

■ WB15

The Economic Theory of Auctions I

Cluster: Auctions and e-Commerce
Invited Session

Chair: Felix Brandt, University of Munich, Oettingenstrasse 67, Munich, 80538, Germany, felix.brandt@gmail.com

1 - Asymmetric Auctions with Resale
Isa Hafalir, Vijay Krishna

We study first- and second-price auctions in which, after the auction, the winner may resell the object to the other bidder. When bidders take resale possibilities into account, the first-price auction has a unique monotone equilibrium. The revenue from a first-price auction with resale exceeds that from a second-price auction.

2 - Reducing Costly Information Acquisition in Auctions
Kate Larson, University of Waterloo, Computer Science Department, klarson@cs.uwaterloo.ca

Most auction research assumes that potential bidders have private information about their willingness to pay for an item. In reality, bidders often have to go through a costly information-gathering process in order to learn their valuations. Recent attempts at modeling this phenomena has brought to light complex strategic behavior arising from information-gathering, and has shown that traditional approaches to auction and mechanism design are not able to overcome it.

3 - Internet Advertising and the Generalized Second Price Auction: Selling Billions of Dollars Worth of Keywords
Michael Ostrovsky, Stanford University, Ostrovsky@gsb.stanford.edu, Benjamin Edelman, Michael Schwarz

We investigate the "generalized second price" auction (GSP), a new mechanism which is used by search engines to sell online advertising that most Internet users encounter daily. GSP is tailored to its unique environment, and neither the mechanism nor the environment have previously been studied in the mechanism design literature. Although GSP looks similar to the Vickrey-Clarke-Groves (VCG) mechanism, its properties are very different. In particular, unlike the VCG mechanism, GSP generally does not have an equilibrium in dominant strategies, and truth-telling is not an equilibrium of GSP. To analyze the properties of GSP in a dynamic environment, we describe the generalized English auction that corresponds to the GSP and show that it has a unique equilibrium. This is an ex post equilibrium that results in the same payo.s to all players as the dominant strategy equilibrium of VCG.

4 - Spiteful Bidding in Sealed-Bid Auctions
Felix Brandt, University of Munich, Oettingenstrasse 67, Munich, 80538, Germany, felix.brandt@gmail.com, Yoav Shoham, Tuomas Sandholm

We derive Bayes Nash equilibria in 1st-price and 2nd-price sealed-bid auctions for agents who maximize the weighted difference of their own profit and their competitors' profit. It turns out that revenue equivalence only holds for auctions in which all agents are either self-interested or completely malicious.

■ WB16

Topics in Pricing

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Darius Walczak, Senior Scientist, PROS RM, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, dwalczak@prospricing.com

1 - Risk-Sensitive Strategies for Revenue Management Problems
Joern Meissner, Lecturer, Lancaster University Management School, Department of Management Science, Lancaster, LA, LA1 1YX, United Kingdom, joe@meiss.com

Revenue Management systems rely on the quality of forecasts, in particular if premium demand shows mainly close to the end of the planning horizon. We develop risk-sensitive strategies for the situation where some information is known about the quality of past forecasts.

2 - Dynamic Pricing with Online Learning and Strategic Consumers
Mikhail Nediak, Assistant Professor, School of Business, Queen's University, 143 Union Street, Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca, Yuri Levin, Tanya Levin, Jeffrey McGill

We study the problem of dynamic pricing when consumers are strategic and have unknown preferences. The company learns demand through successive observations (online) and incorporates it in pricing decisions. We formulate the consumer choice model as a stochastic dynamic game and study its structural properties. Learning is integrated via an aggregating algorithm. We study the effects of strategic nature of consumers on the pricing policy of the company, and report numerical experience.

3 - Dynamic Pricing Under Competition
Michael Li, Associate Professor, Nanyang Technological University, Nanyang Business School, Nanyang Avenue, Singapore, 639798, Singapore, ZFLI@ntu.edu.sg

In this paper, we will introduce a simple dynamic pricing model what incorporates the presence of competition.

■ WB17

Simulation of Service Chains and Health Care Systems

Contributed Session

Chair: David Hoffman, University of Alaska Anchorage, PO Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net

1 - A System Dynamics Model for Service Pricing

J.J. Jeng, Research Staff Member, IBM, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, jjjeng@us.ibm.com, Lianjun An

We propose a service pricing model in which the causality relationships among service metrics are captured via System Dynamic Model. We will demonstrated how to leverage SD modeling capabilities to help decision makers to make good pricing decisions. Weighting combination among pricing schemes would change as time progresses to achieve optimal profit margin. Focus shifting on pricing reflects balance change among market sharing, profit taking and customer satisfaction in the different stage.

2 - Simulation-Based Process Improvement at a Free Outpatient Clinic

Edward Padula, University of Pittsburgh, College of Business Administration, Pittsburgh, PA, 15260, United States, egp3@pitt.edu, Jonathan Petruch, Scott Shearer, Karolina Glowacka

In this work, we consider operations of a free outpatient clinic. We use simulation together with data mining techniques for patient categorization to evaluate multiple scheduling procedures and patient routing through the system. Based on our study we propose the configuration that best satisfies multiple performance criteria identified by the clinic.

3 - Impact of Variability in Arrivals and Service on Finite Waiting Lines

David Bandy, University of Wisconsin Oshkosh, College of Business, Oshkosh, WI, 54901, United States, bandy@uwosh.edu

Variability in waiting line processes with room for waiting for a limited number of entities is investigated. The impact of variability in both the arrival of entities and in service operations are evaluated with respect to three primary measures of performance: 1) Average flow rate through the process; 2) Average number of entities in the process; and 3) Average flow time for the entities. The analysis is based on Little's Law, which can be used to improve waiting line processes.

4 - A Predictive Model for H.I.V. Transmission

Jorge Diaz, Resident Agent, T.M. of Greater San Juan, Inc., PO Box #9300239, San Juan, PR, 00928, Puerto Rico, jdiaz_castro@hotmail.com

We propose an isomorphism between maps and graphs. For any given map, there is one representative graph. We consider for each nation an index of incidence, an index of prevalence, the birth rate, the mortality rate, the immigration rate and the emigration rate. By making calculations over a standard time period, we predict future indeces of incidence and of prevalence for a given disease. We chose H.I.V. because it has a large data set, and large indeces of prevalence and incidence.

5 - Assessing Project Risk by Using Simulation

David Hoffman, University of Alaska Anchorage, PO Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net, Jang Ra

Simulating project risk demonstrates the unique complexities found in project plans. Examples are simulated to show the effects of project task variances on estimates for completing a project. Merely applying PERT and CPM simplifies how project activities times, costs and dependencies interact, especially where there are near critical paths. Project Management simulation with Extend allows for mixed distributions, rework, feed-forward effects and the assessment of the "knock-on" effect.

■ WB18

Marketing II

Contributed Session

Chair: Sourav Ray, Assistant Professor, McMaster University, DeGroote School of Business, 1280 Main Street West, Hamilton, ON, L8S-4M4, Canada, sray@mcmaster.ca

1 - On Using Factor Analysis in Market Segmentation

Chaim Ehrman, Professor, Loyola University, 820 N. Michigan Avenue, Chicago, IL, 60611, United States, cehrman@luc.edu

Trans America Cable, Harvard Business Case # 9-583-150 deals with selling cable to residents in Southern Alabama. The data base that is provided can be used to run a Regression Model to identify which variables are significant to predict likelihood of purchase. If we use Factor analysis and then use the factor scores to identify likelihood of purchase, we get very different results. We show how Factor Analysis is the preferred way to go.

2 - Application of Product Life Cycle Model in Generational Sales Forecasting

Jian Yang, Director, Analytics Engineering, Rapt, Inc., 625 Second Street, San Francisco, CA, 94107, United States, jimmy.yang@rapt.com

Product life cycle model plays an important role in forecasting sales for generational products. Many different models have been proposed for product life cycles, both as a single generation and as successive generations. In this paper, we examine different types of product life cycles and generational patterns, apply different models to sales forecasting for both the existing generation and the new generation, and compare their results in terms of accuracy and stability.

3 - Customer Lifetime Duration and Discounted Expected Transactions: A Discrete-Time Based Data Analysis

Chao Wang, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, cwang.phd2004@london.edu, Ilaria Dalla Pozza

This study implements a stochastic model to estimate the lifetime duration and discounted expected transaction with standard discrete-time based transaction data, and identifies the exchange and demographic factors that have significant contributions in the explanation of the variance in customer lifetime duration and discounted expected transactions. Several important managerial implications are discussed to offer some insights for marketing managers and decision makers.

4 - Product-Launch Strategies in Fast-Changing, Technology-Intensive Industries

Ying Li, Assistant Professor, Texas A&M University, Mays School of Business, College Station, TX, United States, yli@mays.tamu.edu, Yanhong Jin

Firms utilize different launch strategies according to their own characteristics and market structures. For example, Apple replaces its current generation product as soon as the new product is technologically ready, while Dell is known for efficiently producing the current-generation products and avoiding R&D cost on new technologies. We model the launch time by incorporating launch costs and market structures. Preliminary results provide some insights into different product-launch strategies.

5 - Transshipment and Product Assortment Decisions in Distribution Channels

Sourav Ray, Assistant Professor, McMaster University, DeGroote School of Business, 1280 Main Street West, Hamilton, ON, L8S-4M4, Canada, sray@mcmaster.ca, Mohamed Mahaboob

A retailer facing an inventory shortage could transship products from another with excess stock. In principle, a proactive transshipment contract can benefit the channel by reducing the overall inventory costs. However, transshipment possibility may also fundamentally impact the variety of products carried by the channel. In this paper, we attempt to explore how transshipment might affect the channel's incentives to invest in the assortment of products.

■ WB19

Capacity and Transmission Expansions in Restructured Markets

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36849, United States, jvalenz@eng.auburn.edu

1 - Transmission Expansion Planning under Uncertainty in Restructured Markets

Chan Park, Professor, Auburn University, 201 Dunstan Hall, Auburn, AL, 36849, United States, park@eng.auburn.edu, Sevin Sozer, Jorge Valenzuela

In restructured markets, consideration of the economic impacts of congestion costs for transmission expansion planning is essential. The proposed transmission expansion planning approach for restructured markets considers uncertainty in power markets and minimizes the costs of investment and congestion, simultaneously. A numerical example will be used to illustrate the results.

2 - A Sustainable Capacity Expansion Model in Competitive Power Markets
Chung-Li Tseng, Associate Professor, University of Missouri-Rolla, Department of Engineering Management, Rolla, MO, 65409, United States, chungli@umr.edu

This paper addresses the capacity expansion process of generation and transmission under competition. A planning model is proposed for the Regional Transmission Organization, from a long-term and system-wide perspective, to achieve sustainable capacity expansion. The development cycle of the power market is formulated mathematically as a dynamic system. Sustainable equilibrium of the capacity expansion process will be defined and obtained through some numerical examples.

3 - A Numerical Comparison of Equilibria for Single Period and Multi-Period Games
Tapas K. Das, Professor, Department of Industrial & Management Systems Engineering, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States, das@eng.usf.edu, Vishnu Nanduri, Cihan Babayigit

A majority of the oligopolistic energy market models focus on obtaining equilibria for single period (one shot) games with constant demand. We develop a multi-period model capable of incorporating stochastic demand variations, and a simulation & learning based solution approach. A multi period equilibrium solution is developed for a sample network for which a single period game solution is available in literature. The solutions are compared for various numerical scenarios.

4 - Transmission Congestion and Competition on Power Generation Expansion
Pinar Kaymaz, Graduate Student, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, kaymapi@auburn.edu, Jorge Valenzuela, Chan Park

Generation expansion planning involves decisions on location and capacity of new generation, which may lead to add or relieve congestion in transmission lines and to increase or reduce competition in deregulated markets. In this paper, the interaction between competition and transmission congestion on power generation expansion is studied. Results from a 5-bus power network and the IEEE 24-Bus system are presented and discussed.

■ WB20

Solution Techniques I in Decision Analysis

Contributed Session

Chair: Toshikazu Aiyama, Tokyo Metropolitan University, tyaiyamajp@yahoo.co.jp

1 - On the Mathematical Foundations of Decision Theory
Jonathan Barzilai, Dalhousie University, PO Box 1000, Halifax, Canada, barzilai@dal.ca

The purpose of measurement is to enable the operations of addition and multiplication (such as m(3)=m(1)+m(2) and m(2)=5m(1) on a fixed mass scale). The applicability of such expressions in the case of a fixed utility scale was taken for granted by von Neumann and Morgenstern in their development of utility theory. We show that these operations are not applicable in the case of utility scale values or to any scale values that are based on the models of the classical theory of measurement.

2 - A New Constrained Multiple Response Surface Method Based on Necessary Conditions and Assumptions
Alicia Wilson, University of Central Florida, 10624 Sandridge Court, Orlando, FL, 32817, United States, awilson4195@cfl.rr.com, Robert Armacost

There are many advantages to utilizing a constrained methodology when evaluating multiple objectives. The necessary conditions and assumptions for constrained multiple response surface methods will be presented and contrasted to those required for combined methods. A new constrained multiple response surface method is proposed that improves decision-maker trade-offs among the multiple responses. Results will be compared to existing constrained methods.

3 - Developing a Tool for Justification of Advanced Technology
Sharon Ordoobadi, Professor, University of Massachusetts at Dartmouth, 285 Old Westport Road, N. Dartmouth, MA, 02747, United States, sordoobadi@umassd.edu

A model is developed to help decision makers with their investments regarding advanced technologies. The purpose is to complement the already existing evaluation techniques by adding intangible costs of adopting new technologies. The intangible costs (risks) of investing in a new technology are identified and a methodology is developed for evaluation of these costs.

4 - Dynamic Data Driven Decision Field Theory Extension (D4FTE)
Seungho Lee, The University of Arizona, 4513 E. Bellevue Street #9, Tucson, AZ, 85712, United States, mountlee@email.arizona.edu, Young-Jun Son

Decision Field Theory has been widely used for the cognitive decision making tasks. In this paper, we enhance it with dynamic update of the value matrix (evaluations of alternatives) using Bayesian Belief Networks. We also investigate the effect of dynamic update during the decision deliberation. The proposed model is validated against both the traditional Decision Field Theory as well as real human behaviors in the laboratory experiments. Initial results look quite promising.

5 - Population Equilibrium Methods for Medical Decision Making
Min Huang, Northwestern University, 2145 Sheridan Road, C210, Evanston, IL, 60208, United States, huangmin@northwestern.edu, Gordon Hazen

In Markov models of healthcare interventions, cohort methods are widely employed in cost-effectiveness analysis to calculate population QALYs and costs. However it is also useful to determine equilibrium population levels before and after an intervention and examine outcomes at the equilibrium level. We derive equilibrium distributions using population Markov models, present equilibrium measures to evaluate healthcare interventions and show how they differ from traditional cohort measures.

■ WB21

E-Business/Commerce II

Contributed Session

Chair: Daewon Sun, Assistant Professor, University of Notre Dame, 366 Mendoza CoB, Notre Dame, IN, 46556, United States, dsun@nd.edu

1 - Petri Net Analysis of RosettaNet Protocol Enabled Supply Chains
Andrew Feller, Research Associate, Intel Corporation & Arizona State University, 1201 E. Sea Breeze Drive, Gilbert, AZ, 85234, United States, andrew.feller@asu.edu

Templates for Petri Net translation of RosettaNet protocols exchanging business messages between trading partners generate P/T Nets that are analyzed to provide structural validation and performance simulation of the protocol's behavior under varying network and business process failure rates. Analysis includes RNIF provisions for retries, timeout and failure processing using exception-signal and notification-of-failure mechanisms with performance curves guiding improved protocol reliability.

2 - The Role of Customer Experience in Online Financial Service
Xin Ding, PhD Candidate, University of Utah, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States, pmgtxd@business.utah.edu

This study explores the relationships between service experience and customer satisfaction and loyalty. A model is proposed and tested within the context of online financial service. Results of this study indicate that while information and system quality affect customer satisfaction, the relationship is strongly mediated by customers' overall experience on the service site.

3 - Cross-Platform Mobility of Information Technology Vendors: A Real Options Analysis
Jing Li, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada, jingli@sfu.ca, Nilesh Saraf

We present a real-options model of IT application vendors considering adoption of new, emerging platforms. In the model, we consider the ratio of future compatibility cost relative to the current cost. We present the simulation results and discuss implications for both, application vendors and IT platform sponsors.

4 - Improving Web-Catalog Design for Easy Product Search
Manuel Nunez, Assistant Professor, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269-1041, United States, mnunez@business.uconn.edu, Robert Chiang

Building intuitive websites is important for online businesses. We incorporate browsing patterns to design a web catalog, and propose a two-stage optimization procedure to reduce click-count and page cluttering. Our analysis reveals that an optimized catalog is robust against shifts in browsing behavior and that simplistic interfaces are preferred.

5 - The Role of Stockless Operations in Electronic Retailing
Daewon Sun, Assistant Professor, University of Notre Dame, 366 Mendoza CoB, Notre Dame, IN, 46556, United States, dsun@nd.edu, Jennifer Ryan

Due to the proliferation of electronic commerce and the development of Internet technologies, many firms have considered new pricing-inventory models. In this paper, we study the role of stockless operations in online retailing by considering duopoly competition in which two retailers compete to maximize profit by jointly optimizing their pricing and inventory decisions. In our model, the retailers are allowed to choose either an in-stock policy or stockless operations with a discounted price.

■ WB22

Naval Applications

Sponsor: Military Applications
Sponsored Session

Chair: Robert Taft, Lead Scientist, NSWCDD, PO Box 1497, Dahlgren, VA, 22448, United States, robert.l.taft@navy.mil

1 - Rapid Re-Planning of a Launch Schedule

Thomas Turner, Scientist, NSWCDD, Code B32, 17320 Dahlgren Road, Dahlgren, VA, 22448, United States, Thomas.G.Turner@navy.mil

The planned firing schedule of cruise missiles from a platform is often perturbed at the last minute to accommodate over-water routing constraints and coordinated fires desires. The issues involved in rapidly re-planning the firing schedule are examined and an integer programming formulation to solve the problem is proposed.

2 - Estimation of Marine Rifle Squad Load Weight

Christopher Zaffram, Operations Research Analyst, MCCDC, 3300 Russell Road, Quantico, VA, 22134, United States, ZafframCD@mccdc.usmsc.mil

To clearly state requirements for transport, an accurate definition of the combat loaded Marine is needed. We discuss estimates calculated using weight data from Marine forces conducting combat and peacekeeping operations in OPERATION ENDURING FREEDOM and OPERATION IRAQI FREEDOM in Afghanistan and Iraq during the spring and summer of 2004. We also discuss a tool developed for determining individual and group squad member weight for any billet combination.

3 - Finding Three Good Alternatives in a Multi-Criteria Decision Problem

Robert Taft, Lead Scientist, NSWCDD, PO Box 1497, Dahlgren, VA, 22448, United States, robert.l.taft@navy.mil

The Pareto Boundary Explorer (ParBoX) is an architecture and implementation using mathematical programming, expert systems, and statistical discrimination to nominate a handful of significantly different non-dominated solutions to multi-criteria decision problems. Problems examined include notional theater level planning for cruise missile strikes and selecting a college semester schedule.

■ WB23

Panel Discussion: Managing Global Human Resources

Cluster: Global Services Sourcing
Invited Session

Chair: Yael Ravin, Program Director, IBM, TJ Watson Research Center, 19 Skyline Drvie, Hawthorne, NY, 10542, United States, ravin@us.ibm.com

1 - China's Evolving Talent Pool: A Strategic Perspective

Cong Cao, Senior Research Associate, Levin Institute, Cong.Cao@suny.edu

In 2005, China graduated over 800,000 engineers from its universities. Spending on science and technology is increasing at a faster rate than overall economic growth. Many of the world's most innovative companies have established R&D centers to develop new products and services for global markets and the Chinese domestic market. Once considered one of the more backward developing countries, today China stands at becoming one of the world's major economic and technological forces. Underlying these transitions is the emergence of a large, increasingly well educated talent pool. Building upon significant investments to modernize and upgrade the country's higher education system and R&D infrastructure, China hopes to harness its major resource - people - to close the technological gap between itself and the West. The launch of a new Medium-to-Long Term Plan for Science and Technology in 2006 further reflects this commitment to bring China into a leadership position in the 21st century. At the heart of the debate about whether China's potential can be realized, lie a number of issues related to the quantity/quality of China's scientific and technical workforce. Will China have sufficient talent to compete with the US and other leading technological nations? How will demographic trends in China affect the supply of college age candidates for university enrollment? What has been the impact of Chinese scientists and engineers who have been trained abroad and have returned to China? And, what factors in the changing complexion of the Chinese economy will affect the supply and demand for high-end talent?

2 - Offshore Operations: Strategic Positioning to Address Skill Gaps

Jeanette Harrison, Vice President, American Express Learning Network, American Express, 777 American Expressway, MS 05-01-4, Fort Lauderdale, FL, 33337, United States, jeanette.k.harrison@aexp.com

Skills gap, industry growth and technological advances have in part driven companies to develop off shore operations. Offshore centers provide enormous opportunity but require careful planning and cultural awareness in order to obtain benefit from the world's labor pool. This paper will address the cross cultural issues attendant to offshore operations.

3 - Global Resourcing: Today's Reality and Tomorrow's Challenges

Kellar Nevill, Vice President, Global Delivery BTO HR, IBM, 11 Brook Hollow Lane, Trophy Club, TX, United States, knevill@us.ibm.com

Global resourcing has become prevalent in the services industry. If it can be digitized, it can be offshored. In this session we will discuss today's issues that effect this practice and tomorrow's challenges that are inevitable as the practice grows. How you hire, train, retain and enable qualified human capital.

4 - Strategic Expertise and Leadership Development in the "BRIC" Countries

Rahul Singhal, IBM, rsinghal@us.ibm.com

This presentation will discuss macro trends in the development of talent and leadership that IBM has observed in the "BRIC" countries (Brazil, Russia, India, China), and describe challenges these workforces pose for managers. Potential actions as they relate to delivering business strategy will be discussed as well.

■ WB24

Supply Chain Competition and Coordination

Contributed Session

Chair: Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu

1 - Coordinating a Constrained Channel

Navid Sabbaghi, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 32D-712, Cambridge, MA, 02139, United States, sabbaghi@mit.edu, John Tsitsiklis, Yossi Sheffi

Linear wholesale-price contracts are considered incapable of coordinating a newsvendor's procurement decision for a 1 supplier/1 newsvendor supply channel. Consequently, more complex contracts have been studied. We show that when a newsvendor is capacity-constrained there is a set of wholesale prices that coordinate his ordering decision. We prove this for multiple-supplier channels, assuming independent demand for each product. We analyze both negotiation and equilibrium settings.

2 - Coordinating Serial Supply Chains under Different Information Regimes: Batch vs. Periodic Ordering

Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States, khshang@duke.edu, Sean Zhou

Coordination mechanisms for batch ordering models have been studied extensively in the literature. In this talk, we present exact and heuristic coordination mechanisms for periodic ordering models under local and echelon information regimes. We discuss implementation issues and system performance for batch ordering and periodic ordering models.

3 - Joint Inventory and Pricing Decisions in a Consignment Channel with Competing Suppliers

Dengfeng Zhang, The University of Iowa, S210 PBB, Iowa City, IA, 52242, United States, dengfeng-zhang@uiowa.edu, Renato de Matta

We consider a supply chain with two suppliers of substitutable products on consignment to a single retailer. The retailer (Stakelberg leader) sets the revenue share, while the suppliers (followers) decide on the product prices and inventory levels. We develop equilibrium model solutions to investigate how channel decisions and changes in exogenous parameters affect channel profits. Other channel settings such as exclusive retailer channel and wholesale channel are also explored and compared.

4 - Supply Chain Coordination with Generalized Forced Quantity Incentives

Yuanjie He, Assistant Professor, California State Polytechnic University, 3801 W. Temple Avenue, Pomona, CA, 91768, United States, he@csupomona.edu, Hassan Halati

This paper examines the use of generalized forced quantity incentive to coordinate inventory decisions in a decentralized supply chain. We first consider the finite horizon, periodic review inventory model with fixed costs and prove that for an independent retailer, a generalized (s, S) policy is optimal. We investigate the performance of a two-stage decentralized supply chain and show that under this generalized forced quantity incentive, the optimal strategy results in centralized profit.

5 - Using Market Information to Coordinate Distribution of a Commodity in a Decentralized System.
Goel Ankur, University of Texas-Austin, CBA 5.202 IROM Department, Austin, TX, 78712, United States, goel@mail.utexas.edu, Genaro Gutierrez

We model the distribution of a commodity in a decentralized two-echelon multi-period framework. Cost of commodity procurement is determined by spot and forward markets. Procurement of the commodity, and value adding activities are performed at the higher echelon and then it is shipped to fulfill orders of the lower/retailer echelon. We propose channel coordination mechanisms using functions of market prices as a coordinating lever. We examine symmetric and asymmetric information scenarios.

■ WB25

Innovation/Entrepreneurship

Contributed Session

Chair: David Güemes-Castorena, Professor & Researcher, Tec of Monterrey, Av. Eugenio Garza Sada 2501 Sur, Col. Tecnológico, Monterrey, NL, 64898, Mexico, guemes@itesm.mx

1 - The Theory of Entrepreneurial Policy Alignment: A Newer Institutional Economics
Keenan Yoho, Associate Researcher, The RAND Corporation, 1776 Main Street, Santa Monica, CA, 90401-3208, United States, kdyoho@gmail.com, Solon Simmons

A Theory of Entrepreneurial Policy Alignment is proposed. Central to the theory is the concept of the policy as the strategic lever of entrepreneurial action. Analysis of policy draws attention to the Schumpeterian dynamics of competing supply chains operating in environments far from equilibrium, and can be seen as a movement through transaction cost economics. Application of the theory in a supply chain setting is discussed.

2 - Strategic Operations Alignment for Global Entrepreneurs
Yasemin Aksoy, Associate Professor, Tulane University, A.B. Freeman School of Business, New Orleans, LA, 70118, United States, professor@stropa.com

New start-ups are in a unique position to employ operations research tools as they align their operations strategy with their global operations. I believe there is a strong need for offering courses that will help entrepreneurs to make the right decisions at the early stages of their business. This presentation offers a framework and a course design to that end.

3 - The Impact of Peer Ratings and Make Effect on Consumers Willingness to Pay for IT Products
Chin-I Wang, Avio Corporation, 10 Brockton, Irvine, CA, 92620, United States, cwang@aviocorp.com, Yu-Ming Wang

In the absence of perfect information regarding product quality, support and reliability, the make of an IT product may be used by consumers as a proxy. Similarly, the various ratings of a product by consumers are likely to influence the perceived quality and thus value of such product. Using an experimental design, this study assesses the extent of peer ratings and brand effect on consumers' willingness to pay for IT products using laptop PC purchasing decision as a context.

4 - Institutional Semiotics: Meaning and Markets
Roy Suddaby, Pearson Faculty Fellow, School of Business, University of Alberta, 2-32E Business Building, Edmonton, AB, T7Y 1b, Canada, roy.suddaby@ualberta.ca

This paper focuses on the rhetorical and semiotic strategies used by publicly traded companies to communicate to market actors; competitors, regulators, shareholdeers, employees and other market participants. We draw from rhetorical theory, semiotics and neo-institutional theory to demonstrate how organizations use public market disclosure mechanisms to code and deploy rhetorical "signals" simultaneously to multiple audiences.

5 - Innovative Capability and Competitive Intelligent Practices of Medium & Small Companies in Mexico
David Güemes-Castorena, Professor & Researcher, Tec of Monterrey, Av. Eugenio Garza Sada 2501 Sur, Col. Tecnológico, Monterrey, NL, 64898, Mexico, guemes@itesm.mx

This study sheds some light on the technological innovation framework being used by the medium and small Mexican companies by providing with information on their competitive intelligent practices: information culture, management style, knowledge of sources of information, its systematic use, evaluation and analysis, diffusion, and the use to make decisions in the company. The results are contrasted with a self-evaluation of the innovative capability.

■ WB26

Data Mining, Knowledge Management and Applications

Sponsor: Data Mining
Sponsored Session

Chair: Bill Tseng, Assistant Professor, Department of Mechanical and Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968, United States, btseng@utep.edu

Co-Chair: Chun-Che Huang, Professor of Information Management, National Chi Nan University, Department of Information Management, Pu-Li, Na-Tau, 545, Taiwan, chuang@im.ncnu.edu.tw

1 - Applying a Hybrid Data Mining Approach in Machining Operation for Surface Quality Assurance
Bill Tseng, Assistant Professor, Department of Mechanical and Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968, United States, btseng@utep.edu, Hansuk Sohn, Chun-Che Huang, Johnny Ho

Little work has been devoted to the development of the automated decision support for machining operation, to support surface roughness quality control when qualitative data is taken into consideration. This presentation demonstrates a data mining based hybrid approach to control surface quality while qualitative data is involved. The approach consists of a novel rough-set algorithm for feature selection and an enhanced binary-class support vector machines (SVMs) method for accurate prediction.

2 - Business Intelligence: Analytical Knowledge Warehousing
Chun-Che Huang, Professor of Information Management, National Chi Nan University, Department of Information Management, Pu-Li, Na-Tau, 545, Taiwan, chuang@im.ncnu.edu.tw, Bill Tseng

In this presentation, an "analytical knowledge warehousing" approach is proposed to apply business intelligence, and solve the knowledge management and diffusion issues for decision-making. The solution approach includes conceptual framework of analytical knowledge, analytical knowledge externalization, design and implementation of analytical knowledge warehouse. The methodology has integrated with multi-dimensional analytical techniques to efficiently search analytical knowledge documents.

3 - E-Quality for Manufacturing (EQM) Integrated with Web-Enabled Production System
Yongjin Kwon, Assistant Professor, Applied Engineering Technology, Drexel University, 3001 Market Street, Suite 100, Philadelphia, PA, 19104, United States, yk73@drexel.edu, Mira Lalovic-Hand

This study investigates the feasibility of integrating internet-based remote quality control using a web based vision system and an assembly robot. The web-based quality control presents an opportunity for many key improvements such as ubiquitous access, monitoring capability, and integration of production equipment into information networks for improved efficiency and product quality within the framework of Concurrent Engineering and Design for Manufacturing.

4 - Advanced Demand Forecasting for Call Centers
Roger R. Gung, VP for Research and Technologies, ac2 Solutions, Inc., 935 Route 34, Suite 3A, Matawan, NJ, 07747, United States, rogergung@ac2solutions.com, Turgut Aykin

Call volume and service time forecasts have been most critical inputs to call center workforce management. Because of the existence of multi-level seasonality and special event days, it is very difficult to accurately forecast these two inputs for intervals, such as 15 and 30-minute intervals or even 1-day. This talk will discuss new methods that significantly improve forecast accuracy despite of being based on traditional statistical models.

■ WB27

Recent Advances in Computer Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, Department of Statistics at the University of Wisconsin-Madison, 1220 Medical Sciences Center, Madison, WI, 53706, United States, zhiguang@stat.wisc.edu

1 - Orthogonal-Maximin Latin Hypercube Designs
Ying Hung, Georgia Institute of Technology, yhung@isye.gatech.edu, Roshan Vengazhiyil

A randomly generated Latin hypercube design (LHD) can be quite structured. There are procedures to find good LHDs by minimizing the pairwise correlations or maximizing the inter-site distances. In this article we have shown that these two criteria need not agree with each other. Therefore, we propose a multi-objective optimization approach to find good LHDs. Several examples are presented to show that the new algorithm is fast and that the optimal designs are good in terms of both criteria.

2 - Blind Kriging
Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu, Ying Hung, Agus Sudjianto

Kriging is a useful method for developing meta-models for product design optimization. However, the commonly used kriging predictor has some problems; it is not easy to interpret, not robust to the misspecifications in the correlation parameters, and in some cases may lead to poor predictions. In this article, we propose a modified kriging method that overcomes the foregoing problems. The usefulness of the proposed method is illustrated with several examples.

3 - Gaussian Process Models for Computer Experiments With Qualitative and Quantitative Factors
Zhiguang Qian, Assistant Professor, Department of Statistics at the University of Wisconsin-Madison, 1220 Medical Sciences Center, Madison, WI, 53706, United States, zhiguang@stat.wisc.edu, Jeff C. F. Wu, Huaiqing Wu

Modeling experiments with qualitative and quantitative factors is an important but unsolved issue in computer modeling. Some Gaussian process models that can accomodate both qualitative and quantitative facotors are proposed. A real example for modeling the thermal distribution in a data center is used to illustrate the proposed models.

■ WB28

Accelerated Testing and Testing Plans

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Haitao Liao, Assistant Professor, Wichita State University, Industrial & Manufacturing Engineering, Wichita, KS, 67260, United States, haitao.liao@wichita.edu

1 - HASS or Non-HASS for Printed Circuit Board Manufacturing - How to Breakeven in MTBF vs. Cost
Tongdan Jin, Teradyne, Inc., 300 Riverpark Avenue, MS 3001-14, North Reading, MA, 01864, United States, tongdan.jin@teradyne.com

Electronic products usually exhibit early life profiles. Highly accelerated stress screening (HASS) can help weed out the early failures. However, many practitioners are cautious of HASS, particularly for capital-intensive electronic equipment manufacturers. In this paper a mathematical model is developed to address the benefit in improving MTBF of printed circuit boards vs. the investment in HASS. The model helps reliability engineers achieve the high reliability with a minimum cost.

2 - Effects of Missing Data in Competing Risks on Accelerated Life Testing
Rong Pan, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, rong.pan@asu.edu

It is important to consider the change in relative prevalence of the failure modes and the change in the dependence structure as the stress increases. The dependence structure of competing failure modes as their relative dominance change with the increase of the applied stress is studied in this research. Another objective of this research is to evaluate the impact of missing data at high stress levels during accelerated life testing on the extrapolation to normal working conditions.

3 - Optimal Design of Accelerated Testing Plans Considering Maintenance Requirements
Haitao Liao, Assistant Professor, Wichita State University, Industrial & Manufacturing Engineering, Wichita, KS, 67260, United States, haitao.liao@wichita.edu, Murad Hamada

Accelerated life tesing (ALT) is usually conducted to predict the reliability of a product and optimize the maintenance activity. In many cases, however, maintenance requirements have been given in advance by some mandatory regulations. In this paper, the maintenance-oriented optimal design of ALT plans is presented. The goal of this research is to provide a new set of optimal testing plans under a variety of maintenance requirements.

4 - Equivalence of Accelerated Testing Plans
Elsayed Elsayed, Professor, Department of Industrial and System Engineering, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, elsayed@rci.rutgers.edu, Hao Zhang, Haitao Liao

In this presentation we present approaches for assessing the equivalence between two different accelerated test plans. We focus on constant stress plans and the simple step-stress test plans and determine the parameters of each plan that will make the two plans equivalent. The parameters include the stress levels, allocations of test units to the applied stresses and the duration of the test.

■ WB29

Constraint Programming

Contributed Session

Chair: John Mittenthal, The University of Alabama, Box 870226, Tuscaloosa, AL, United States, jmittent@cba.ua.edu

1 - Chance-Constrained Semidefinite Programming: A Definition
Yuntao Zhu, Arizona State University, Math Sciences and Applied Computing, Phoenix, AZ, 85069-7100, United States, Yuntao.Zhu@asu.edu, K. A. Ariyawansa

Recently, Ariyawansa and Zhu have defined an extension of semidefinite programs termed {\em stochastic semidefinite programs with recourse} to deal with uncertainty in data defining semidefinite programs. In this talk we introduce an alternative extension of semidefinite programs termed {\em chance-constrained semidefinite programs} for handling uncertainty in data defining semidefinite programs, and indicate an application of chance-constrained semidefinite programs.

2 - Logic-Based Optimization for Interdependent Layered Networks (ILN) Problems
Jing Gong, Rensselaer Polytechnic Institute, CII 8225, 110 8th Street, Troy, NY, 12180, United States, gongj@rpi.edu, Earl Lee, William Wallace, John Mitchell

The paper discusses the application of incorporating constraint programming into mathematical programming for ILN problems. This methodology can be used to model interdependent infrastructures, such as power, telephone, and transportation. A realistic problem of managing disruption to the critical infrastructure systems in the area south of 60th street, Manhattan region of New York is discussed. A restoration model is developed in OPL and solved by ILOG Solver and Hybrid.

3 - Hurricane Evacuation of the Rio Grande Valley of Texas
Robert Webb, University of Texas-Brownsville (Student), 521 Zapata, Rancho Viejo, TX, 78575, United States, robert.b.webb@lmco.com

This presentation will review a Maximal Flow Analysis of the routes of evacuation from the Rio Grande Valley of Texas (Brownsville-Harlingen-McAllen-Edinburg). Additional contraints to the analysis will be: a) Homeland Security (Border Patrol) checkpoints 70 miles beyond the U.S border which will impede flow, and b) Accommodation of Mexican citizens who may no other evacuation route except through the United States which will increase the flow.

4 - The Just-in-Time Assembly Line Balance Problem
John Mittenthal, The University of Alabama, Box 870226, Tuscaloosa, AL, United States, jmittent@cba.ua.edu

This problem, based on the traditional Assembly Line Balancing (ALB) problem, is motivated from manufacturing environments where fabrication and assembly operations are coordinated. Integer and constrained programming models are presented for the JIT-ALB problem. Solution results are presented for a set of publicly available test problems.

■ WB30

Optimization Techniques

Contributed Session

Chair: Svyatoslav Trukhanov, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, slavik@tamu.edu

1 - Robust Stochastic Games

Erim Kardes, PhD Candidate, University of Southern California, Industrial and Systems Engineering, 1651 S. Wilton Place, Los Angeles, CA, 90019, United States, kardes@usc.edu, Fernando Ordonez

In this paper, two-player non-zero sum, finite state/action, discounted stochastic games with uncertainty in transition probabilities and payoffs are considered, where at least one player adopts a robust optimization approach to data uncertainty. We call such games robust stochastic games. We first prove existence of equilibrium points, and then reformulate this problem as a nonlinear, non-convex problem using duality.

2 - A Comparative Study of Disjunctive Cuts for Two-Stage Stochastic Mixed-Binary Programs

Matthew Tanner, Graduate Student, Texas A&M University, 1703 Langford Street, College Station, TX, 77840, United States, wileytanner@gmail.com, Lewis Ntaimo

Recent results seem to indicate the effectiveness of disjunctive cuts in solving large-scale stochastic mixed-binary programs. In this talk we present a comparative study of the disjunctive decomposition (D2) method of Sen and Higle and the lift-and-project cut method of Caroe. In both methods, the cuts are generated for an individual scenario and then translated so that they are valid for all scenarios. However, Caroe's method generates cuts in a higher dimensional space than the D2 method.

3 - Robust Optimization for Least Squares Estimation

Laura Wynter, Research Scientist, IBM Research, PO Box 218, Yorktown Heights, NY, 10598, United States, lwynter@us.ibm.com, Cathy Xia, Fan Zhang

We analyze an existing method called robust least squares on a parameter estimation problem arising in queueing network inference and show that it is inferior to a different method, which we construct based upon the simplest superefficient estimator.

4 - Stochastic Optimization via Robust Parameter Design

William McDaniel, Marriott International, Marriott Drive, Department 51/954.04, Washington, DC, 20058, United States, bill.mcdaniel@hotmail.com

Optimization via simulation techniques attempt to account for variability through stochastic approximation or random searches. We present a response surface approach incorporating Taguchi robust parameter design principles to determine the optimal answer in the presence of this noise, accounting for both the objective function and the certainty of the answer.

5 - Adaptive Multicut Aggregation in Solving Stochastic Linear Programs with Recourse

Svyatoslav Trukhanov, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, slavik@tamu.edu, Lewis Ntaimo, Andrew Schaefer

Outer linearization methods such as the L-shaped method for stochastic linear programs generally apply a single cut on the nonlinear objective at each major iteration, while the multicut version allows for several cuts to be placed at once. The L-shaped tends to have more major iterations than the multicut method. This talk presents an adaptive multicut method that dynamically adjusts the aggregation level of the master program optimality cuts to gain in computation time over the two methods.

■ WB31

Portfolio Construction in Finance-Risk Management

Contributed Session

Chair: Kathryn Kaminski, Massachusetts Institute of Technology, ORC E40-149, Cambridge, MA, United States, katykam@mit.edu

1 - Alternative Approaches to Compute Value-at-Risk

Taposhri Ganguly, Research Student, CARISMA, Brunel University, Department of Mathematical Sciences, John Crank Building, Uxbridge, Middlesex, UB8 3PH, United Kingdom, taposhri.ganguly@brunel.ac.uk, Gautam Mitra, Paresh Date

Value-at-risk is a commonly used measure of market risk for a portfolio. In this paper, an algorithm for computing VaR using fractional Fourier transformations (FRFT) is developed. The computation of VaR for non-linear portfolios with non-normal returns is compared using copula/EVT based approach and fractional FFT approach.

2 - Portfolio Construction Using Variance and CVaR

Diana Roman, PhD Student, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, diana.roman@brunel.ac.uk, Ken Darby-Dowman, Gautam Mitra

We propose a model for portfolio optimisation, in which distributions are described and compared using 3 statistics: mean, variance and CVaR. The purpose is to improve on mean-variance and mean-CVaR efficient distributions. The problem is multi-objective and transformed into a single objective one in which variance is minimised and constraints imposed on mean and CVaR. In case of scenario models, the problem is a quadratic program. The model is tested on real data drawn from the FTSE 100 index.

3 - Portfolio Optimization with Higher Moment Risk Measures

Paul Krokhmal, Assistant Professor, University of Iowa, 2403 SC, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

The paper considers modeling of risk-averse preferences in stochastic programming problems using risk measures. By representing risk measures via solutions of specially constructed stochastic programming problems, we introduce a new family of higher-moment coherent risk measures (HMCR). It is demonstrated that the HMCR measures are compatible with utility theory, and can be efficiently used in portfolio optimization, especially by investors with aggressive risk preferences.

4 - Investment in Operational Attributes: System Dynamics Approach to Training Services

Kalyan Pasupathy, University of Missouri, 311 Clark Hall, Columbia, MO, 65211, United States, pasupathyk@missouri.edu

Managers in organizations make operational attribute investment decisions all the time. These decisions have an impact on the bottom-line profits and on the market penetration of the organization. This research develops a dynamic model to evaluate investments made in operational attributes and determine the behavior of customer perceptions, loyalty, profit, market penetration and marginal rate of return over time.

5 - When Do Stop-Loss Rules Stop Losses?

Kathryn Kaminski, Massachusetts Institute of Technology, ORC E40-149, Cambridge, MA, United States, katykam@mit.edu, Andrew Lo

Stopping strategies, policies to close out positions after reaching a certain threshold of losses, are commonly used by retail and institutional investors to manage portfolio risks. However, under certain conditions, stop-loss policies can significantly alter an underlying strategy and thus impact long term portfolio performance. We derive analytical and numerical implications of stop-loss policies on portfolio performance when they are applied to common investment strategies.

■ WB32

Supply Chain Management with Disruptions

Contributed Session

Chair: David Heimann, Professor, Management Sciences & Information Systems Department, University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA, 02125, United States, david.heimann@umb.edu

1 - Coordinated Sourcing Models for Coping with Disruptions

Amy Zeng, Associate Professor, Worcester Polytechnic Institute, 100 Institute Road, Department of Management, Worcester, MA, 01609, United States, azeng@wpi.edu

In this paper we focus on designing an effective coordinated sourcing model for coping with disruptions that will break down a buying firm's primary supplier. Two models are examined and compared: the first is a single sourcing model with a secondary supplier, and the second is an order-split dual sourcing approach. We report our results on the critical factors affecting the decision, the feasibility of the two models, and the sensitivity of their decision parameters.

2 - Supply Contracts with Weather-Related Recourse

Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu, Frank Chen

Demands for many products are highly correlated with weather metrics such a temperature or amount of snowfall. Both retailers and manufacturers are beginning to offer rebates that depend upon weather metrics that are reported by independent third party sources. We analyze contracts with weather-related recourse, focusing on supply chain coordination and division of profits between the parties.

3 - The Benefit of Time-Dependent Ordering Policies Under Cyclic Supply Disruptions

Ying Rong, PhD Student, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, yir204@lehigh.edu, Lawrence Snyder, Andrew Ross

We consider ordering policies in a single-stage inventory system with cyclic supply disruptions. We compare a range of policies, some of which are time dependent while others are stationary. We perform an extensive numerical study to identify the value of implementing a time-dependent policy and to determine the added value of implementing more complex policies as opposed to simpler ones. We also investigate the robustness of the time-dependent policies to errors in the supply parameters.

4 - A Closed-Form Approximate Inventory Model with Supply Disruptions & Non-ZIO Reorder Policy

David Heimann, Professor, Management Sciences & Information Systems Department, University of Massachusetts Boston, 100 Morrissey Boulevard, Boston, MA, 02125, United States, david.heimann@umb.edu, Frenck Waage

This paper considers a supply chain problem where the supplier, when receiving the order from the producer, is either capable of shipping the order at once or not, according to a Markov process. We develop an approximating cost function whose minima can be obtained in closed form. The tradeoff between the order quantity q and the reorder point r ≥ 0 (a non-ZIO reorder policy) can therefore be addressed explicitly. Numerical examples based on realistic data are provided.

■ WB33

Indicative Trends in the National Airspace System (NAS) Performance

Sponsor: Aviation Applications
Sponsored Session

Chair: Dave Knorr, Manager, Forecasting and Operations Analysis, FAA Air Traffic Organization, AJP-2, 800 Independence Avenue SW, Washington, DC, 20591, United States, dave.knorr@faa.gov

1 - Delay Trend Assessment for Future NAS Using Weather-Impacted Traffic Index

Alexander Klein, George Mason University, Fairfax, VA, United States, aklein1@gmu.edu

Weather-Impacted Traffic Index (WITI) is a useful metric for quantifying inclement weather impact on NAS operations, with Delay as the measure of NAS response. We use WITI for assessing delay trends for future-NAS projections in 2010 and 2015, compared to base year, 2004. Three different traffic samples, each representing a busy weekday in the respective year, are used. We apply an entire convective season's weather to the base day, with day-of-the-week traffic demand fluctuations.

2 - Very Light Jet (VLJ) Operational Impact Analysis

Tony Dziepak, Federal Aviation Administration, Office of Strategy, 800 Independence Avenue SW, Washington, DC, 20591, United States, tony.dziepak@faa.gov

Very light jet (VLJ) operations contribute the greatest uncertainty to the FAA forecast. The impact of this new class of small business jets hinges on two factors: the success or failure of the on-demand air taxi business model, and at what altitude these VLJs will choose to fly. This study explores the impact of VLJ operations on air traffic workload, in the en route phase of flight, for each of these scenarios. Preliminary results indicate more impact for higher altitudes.

3 - Operational Errors and Traffic Levels: A Challenge for NAS Growth

Gerald Shapiro, CNA Corporation, Gerald.CTR.Shapiro@faa.gov

An operational error occurs when separation rules and procedures are not followed due to equipment or human error. Currently, operational errors are rare events; however, our analysis shows that the number operational errors increases faster than the growth in air traffic operations. We examine some implications, and the potential for automated tools to ameliorate the problem.

4 - En Route Trends in the National Airspace System

Antoine Charles, Antoine.Charles@faa.gov

En Route metrics are pivotal to understanding the performance of the NAS (National Airspace System). Critical decisions must be made about capacity and workload, and reliable data is required to support these decisions. We will observe NAS trends, measure changes within the NAS, and identify the driving factors of change. Using the Enhanced Traffic Management System (ETMS), we measure changes in the NAS, as a whole, and proceed to observe changes its components.

■ WB34

Urban Transportation Planning Models IX: Fuel Infrastructure

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yueyue Fan, University of California, Davis, yyfan@ucdavis.edu

1 - Optimal Infrastructure for Waste Biomass-Based Hydrogen

Nathan Parker, ncparker@ucdavis.edu, Yueyue Fan

Waste biomass-based hydrogen is an attractive alternative fuel but faces logistical challenges in siting and sizing facilities, and choosing delivery mode to minimize cost. This study uses mixed-integer nonlinear programming to solve for the optimal number, location, and size of conversion facilities as well as hydrogen delivery mode.

2 - Transition Challenges for Alternative Fuel Vehicle and Transportation Systems

Jeroen Struben, Postdoctoral Associate, MIT Sloan School of Management, E53-364A, 30 Wadsworth Street, Cambridge, MA, 02139, United States, jjrs@mit.edu

Successful diffusion of alternative fuel vehicles is complex as it requires the coevolution of the installed base, technology, technology spillovers, driver behavior, and complementary resources. We present a dynamic behavioral model captures these interactions, including spatial coevolution of fueling infrastructure and driver behavior. We discuss critical obstacles to and levers for sustained adoption.

3 - The Hydrogen Infrastructure Transition Model: A State-Filter Dynamic Programming Approach

David Z. Lin, University of California, ITS-Davis, zlin@ucdavis.edu

This research focuses on building an optimal transition model for future hydrogen infrastructure development. Dynamic programming is used to model this large-scale multistage planning problem and a state-filter approach is exploited to reduce the dimensionality of this problem. Policy implications are discussed using a case study in Beijing.

■ WB35

Dynamic Routing Problems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maciek Nowak, mnowak@georgiasouthern.edu

1 - A Dynamic Driver Management Scheme for Less-than-Truckload Carriers

Burak Karacik, bkaracik@isye.gatech.edu, Martin Savelsbergh, Michael Hewitt, Alan Erera

We describe a scheme for the management of linehaul drivers developed for the one of the largest U.S. LTL carriers. The scheduling problems faced by transportation service providers are complicated by time-constrained vehicle operators that can be renewed only after resting. LTL driver scheduling is further complicated by the fact that trucking moves are generally not scheduled. We develop a driver dispatch scheme that combines greedy search with enumeration of time-feasible driver duties.

2 - Solution Approaches for the Probabilistic Traveling Salesman Problem with Deadlines

Barrett Thomas, Assistant Professor, Department of Management Sciences, University of Iowa, 108 John Pappajohn Business Building, Iowa City, IA, 52242, United States, barrett-thomas@uiowa.edu, Ann Campbell

Time definite services are the fastest growing segment of the transportation industry. Yet, little research has explored the impact these time constraints place on delivery problems. This talk describes solution approaches to variants of the probabilistic traveling salesman problem that incorporate deadline constraints. The effects of using approximate cost and probability distributions in local search are discussed, and different neighborhood structures in local search are explored.

3 - Dynamic Routing and Scheduling in Drayage Operations

Guangming Zhang, g-zhang@northwestern.edu, Karen Smilowitz

This research explores modeling and solution techniques for dynamic routing and scheduling problems in drayage operations. In intermodal drayage applications, it is typical that about 60% of task requests are known before the day of operation and the remaining 40% become known over the day.

4 - Pickup and Delivery with Split Loads
Maciek Nowak, mnowak@georgiasouthern.edu, Özlem Ergun, Chip White

Splitting a load such that the delivery of that load may be completed by multiple vehicles results in numerous opportunities for cost reduction. We present an upper bound on this cost reduction. We also discuss the problem characteristics that allow for the most benefit and those market sectors that may find split loads to be most useful.

■ WB36

Risk Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Greg Brouillette, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, brouillg@lanl.gov

1 - An Architecture for Hybrid Reasoning in Risk Analysis
John Ambrosiano, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, ambro@lanl.gov, Randy Roberts

Risk analysis has changed considerably. The complexity of systems under consideration is very high, often requiring simulations to predict consequences. The nature of uncertainty has broadened to include vagueness and ignorance as well as random variation. This often exceeds the traditional scope of probabilistic risk assessment. We present a hybrid architecture for risk assessment able to combine diverse methods like probability, approximate reasoning, and simulation within the same framework.

2 - A Comparison of Various Modeling Approaches for a Network Security Model
Gregory Chavez, PhD Student, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, gregchavez@lanl.gov, Brian Key

For a particular event, the risk is a function of the likelihood and the consequences of the outcome. Both the likelihood and the consequences are uncertain quantities; therefore, risk is inherently uncertain. The likelihood and the consequence may be expressed either numerically or linguistically. We determine an aggregate risk result for a network security model using only linguistic values and compare this result to the value of risk determined from only numerical values.

3 - Risk Assessment of GPS Spoofing
Mihaela Quirk, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, pal@lanl.gov, Roger Johnston, Jon Warner, Edward Bitzer

Civilian Global Positioning System (GPS) receivers may be subjected to attacks such as blocking, jamming, and spoofing. This paper gives a methodolgy to assess the risk of GPS spoofing. Probabilistic estimation is employed to process historical data on technology development. The data on GPS spoofing is sparse, hence expert elicitation embeded into an approximate reasoning engine is used for risk evaluation.

4 - Managing a Complex System Architecture Through the Use of Knowledge Modeling
Andrew Koehler, Technical Staff Member, Los Alamos National Laboratory, PO Box 1663, MS 603, Los Alamos, NM, 87545, United States, akoehler@lanl.gov, Ben Bigelow, Mihaela Quirk, Thomas Dufresne, Greg Brouillette

As part of preventing WMD attacks on US forces, the DoD and IC are changing how they gather and analyze data. This paper discusses a set of methodological tools and processes being developed to support this technology analysis and forecasting challenge. Focusing on the creation of a flexible technology knowledge base, this paper will also discuss future trade-space and real-time decision support capabilities that may ultimately be linked to this knowledge base.

5 - Using Approximate Reasoning To Evaluate Terrorist Intent
Stephen Eisenhawer, President, Logic Evolved Technologies, Inc., PO Box 1807, Santa Fe, NM, 87504-1861, United States, seisenhawer@logicevolved.com, Terry Bott, Markus Binder, Gary Ackerman

The likelihood that a terrorist group mounts an attack is a function of intent and capability. An approximate reasoning-based (AR) model to evaluate intent is presented. In AR inferences are made with rule bases and variables are linguistic. The model here is a rational choice (RC) representation of terrorist decision-making. We discuss RC in the AR context and present illustrative results. Revisions to include expressive factors such as ideological obsessions are examined.

■ WB37

Supply Chain Management for Manufacturing

Contributed Session

Chair: Kumar Satyam, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, satyak@rpi.edu

1 - Loop Length Trade-Offs in Pull Systems with Product Variety
Ananth Krishnamurthy, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, krisha@rpi.edu, Kumar Satyam

Node decomposition approaches are developed to evaluate the performance of closed queuing network models of multi-product systems operating under card-based pull control policies. The models are used to examine how the length of the card loops for different products need to be set in order to optimize various performance measures.

2 - Queuing Models for Multi-Product Fabrication/Assembly Systems
Ram Ramakrishnan, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, ramakr@rpi.edu, Ananth Krishnamurthy

Fabrication/Assembly systems with end assemblies composed of multiple components are considered. Unlike prior research, the fabrication lines supplying the components could be shared or dedicated facilities. The system is modeled as a multi-class closed queuing network with fork/join stations. Parametric decomposition based methods are developed for performance evaluation.

3 - Event Time Models in Supply Chain Scheduling
Omer Benli, California State University, Long Beach, Department of Information Systems, Long Beach, CA, 90840-8506, United States, obenli@csulb.edu

It has long been recognized that scheduling was not a visible problem in many enterprises because other parts of the enterprise have absorbed much of the impact of poor scheduling. This is especially true in current supply chains. In this presentation, after reviewing the current literature in the area, an "event-time" model for supply chain scheduling will be presented. It is based on lot streaming paradigm and makes use of the basic modeling framework of constraint programming.

4 - Surviving the Evolution of a Supply Network
Surya Pathak, Vanderbilt University, 6501 Harding Road, Apt. A-22, Nashville, TN, 37205, United States, surya.pathak@vanderbilt.edu, David Dilts

Supply networks can be conceptualized as complex adaptive systems that constantly evolve over time. Our research investigates factors that appear to affect survivability of individual firms in such networks. Additionally, survivability may significantly affect the eventual supply network topology, so we briefly address the interactions between survivability and topology.

5 - Node Decomposition Based Approaches for Multi-Class Closed Queuing Networks
Kumar Satyam, Rensselaer Polytechnic Institute, 110 8th Street, Department of DSES, Troy, NY, 12180, United States, satyak@rpi.edu, Ananth Krishnamurthy, Manjunath Kamath

Two new approaches for analyzing general multi-class non-product form closed queuing networks are compared. Both approaches are based on node-decomposition techniques and use two-moment approximations for performance measures. The approaches differ in the way in which network characteristics are incorporated into the computation of waiting times at individual stations.

■ WB38

Vehicle Routing

Contributed Session

Chair: Malini Natarajarathinam, PhD in Operations Management, University of Alabama, 361 Stadium Drive Box 870226, Tuscaloosa, AL, 35401, United States, mnataraj@cba.ua.edu

1 - A Fast Solution on Time-Dependent Discrete Shortest-Path Problems
Jian Hu, University of Arkansas at Little Rock, System Engineering Department, 2801 S. University Avenue, Little Rock, AR, 72204, United States, jxhu@ualr.edu, Yupo Chan

A solution is proposed for the all-to-one discrete-time fastest path and minimum cost problem in a dynamic network. The algorithm is based on the general Bellman's principle of optimality and applies to the real-valued arc travel times. The complexities of early studies are discussed and the new algorithm has a great improvement theoretically.

2 - Flexibility in Dynamic Vehicle Routing
Thomas Huth, Dipl. Wirt.-Inform., Technical University Braunschweig, Abt-Jerusalem Strasse 4, Braunschweig, Germany, t.huth@tu-bs.de, Dirk C. Mattfeld

In recent years, emphasis has been put on dynamic problems in transportation. We deal with customer orders occurring dynamically overtime. This talk sketches the basic idea of decomposing a pickup and delivery problem. Furthermore we survey methods for solving dynamic transportation problems. Finally, we present a framework for adapting the model to the needs of dynamism including a flexibility term in the objective function. The resulting heuristic will anticipate dynamic events this way.

3 - Stochastic Vehicle Routing to Minimize Unmet Demand
Zhihong Shen, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, United States, shenz@usc.edu, Maged Dessouky, Fernando Ordonez

Most vehicle routing problems (VRPs) are aimed at minimizing the total travel distance. However, in some applications there is such a large demand, tight deadlines, and significant uncertainty that it becomes impossible to service all nodes. For such problems a more appropriate primary objective is to satisfy as much demand as possible. In this work, we propose a Stochastic VRP to minimize unmet demand, present a constructive tabu heuristic and present results in an emergency situation.

4 - The Multiple Vehicle Routing Problem with Stochastic Demands under a Dynamic Approach
Clara Novoa, Assistant Professor, Texas State University, 601 University Drive, Engineering and Technology Department, San Marcos, TX, 78666, United States, cn17@txstate.edu

We develop and compare two rollout-based algorithms for solving the multiple vehicle routing problem with stochastic demands under an approximate dynamic programming approach. The models take ideas from the "cluster-first-route-second" and "route-first-cluster-second" methodologies for solving deterministic VRP. We also compare our solutions to a static or "here-and-now" approach.

5 - The Stochastic Inbound Inventory Routing Problem
Malini Natarajarathinam, PhD in Operations Management, University of Alabama, 361 Stadium Drive Box 870226, Tuscaloosa, AL, 35401, United States, mnataraj@cba.ua.edu, Charles Sox

We consider a situation where parts from different suppliers have to be picked up for an assembly plant. The demand at the assembly plant is stochastic and the trucks have limited capacity. We propose a heuristic that groups suppliers on a route and calculates base stock policies for each part to be picked up. We also quantify the effectiveness of the heuristic with a lower bound.

■ WB39

Ballroom B

Forecasting

Contributed Session

Chair: Baris Tan, Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr

1 - On S-Curves and Tipping Points
Fred Phillips, Professor & Associate Dean, Maastricht School of Management, PO Box 1203, Maastricht, 6201 BE, Netherlands, phillips@msm.nl

Kurzweil and Gladwell describe but do not identify points where a growth curve accelerates and sustains itself. We look for tipping points in three growth models, and resolve some paradoxes in the literature.

2 - Interval Regression Analysis with Piecewise-Linear Underestimation
Chia-Hui Huang, Research Scholar, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109-2117, United States, leohuang@umich.edu, Han-Ying Kao

The interval regression model is regarded as the simplest version of possibilistic regression analysis with interval coefficients. Based on an approach proposed by Mangasarian et al., a method for evaluating the interval regression model with piecewise-linear underestimation is presented. For finding an accurate estimate, this study underestimates the nonconvex objective function by a piecewise-linear function and search the global minimum of the underestimator.

3 - Forecasting the Impact of Special Events in Timeseries
Konstantinos Nikolopoulos, Assistant Professor in Decision Sciences, Manchester Business School, Booth Street West, Manchester, M156PB, United Kingdom, kostas.nikolopoulos@mbs.ac.uk

Quantitative methods are very successful for producing baseline forecasts of time series; however fail to forecast neither the timing nor the impact of special events such as promotions or strikes. Forecasters prefer to use their own judgment for adjusting for forthcoming special events, but humans' efficiency in such tasks has been found to be deficient. This study after examining the relative performance of Artificial Neural Networks and Multiple Linear Regression proposes an expert method.

4 - An Estimation Method for Stock-Out Based Substitution Rates by Using Point-of-Sales Data
Baris Tan, Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr, Selcuk Karabati, Omer Cem Ozturk

Empirical studies in retailing suggest that stock-out based substitution rates must be taken into consideration when product-assortment and inventory decisions are given. We present a state-space based method to estimate substitution rates by using point-of-sales data only. We first cluster POS data according to different substitution scenarios and then estimate substitution rates by incorporating the consolidated sales information in a fluid model and solving an optimization problem.

■ WB40

Applications

Contributed Session

Chair: Imdat Taymaz, Assistant Professor, Sakarya University, Engineering Faculty, Esentepe Campus, Adapazari/Sakarya, 54187, Turkey, taymaz@sakarya.edu.tr

1 - Developing an Electricity Price Model with Uncertain Demand and Fuel Costs
H. Hakan BALCI, PhD Candidate, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, balcihh@auburn.edu, Jorge Valenzuela

In this study, we develop a price model with the consideration of uncertain electricity demand and fuel costs. The market is governed by the Cournot model. The price is modeled with a bottom-up approach that it strategic bidding and load elasticity into account.

2 - The Impacts of Compliance Choices under Market-Based Environmental Regulation
James Kroes, Student, Georgia Institute of Technology, 5559 Glenridge Drive NE, Apt. 2405, Atlanta, GA, 30342, United States, james.kroes@mgt.gatech.edu, Ravi Subramanian

We examine the relationship between compliance choices and environmental performance at the generating sites of publicly traded utility firms regulated by the US Acid Rain Program. We then investigate the impact of environmental performance on firms' market valuation. We find evidence of the ability of several compliance options to effectively reduce SO2 emissions. We also find a moderately significant relationship between higher SO2 emissions and higher Tobin's q.

3 - Performance Simulation of a Hybrid Vehicle
Imdat Taymaz, Assistant Professor, Sakarya University, Engineering Faculty, Esentepe Campus, Adapazari/Sakarya, 54187, Turkey, taymaz@sakarya.edu.tr, Kemal Cakir

Conventional vehicles play a big role in city transportation. Hybrid electrical vehicles gain a great importance with their environmental friendship and efficient usage of fuel. In this study, a computer program was created for road simulation of the vehicles. The road simulations show that the mixed hybrid system has high performance and low fuel consumption values then the conventional vehicles.

■ WB41

Recent Trends in Make-to-Stock Queue Modelling

Sponsor: Applied Probability
Sponsored Session

Chair: Baris Balcioglu, Department of Mechanical & Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca

1 - Optimal Control of Assembly Systems with Multiple Stages and Multiple Demand Classes
Saif Benjaafar, Professor & Director, Division of Indusrial & Systems Engineering, University of Minnesota, 111 Church Sreet SE, Minneapolis, MN, 55419, United States, saif@umn.edu, Mohsen Elhafsi, Weihua Zhou, Chung-Yee Lee

We consider the optimal production and inventory control in a multi-stage assembly system with multiple demand classes. Each assembly stage consists of a production facility with finite production rate. Demand classes differ in their demand rates and their shortage costs. We formulate the problem as a Markov Decision Process (MDP) and characterize the structure of an optimal policy.

2 - The Structure and Sensitivity of Dynamic Pricing and Replenishment Policies in a Production System

Lerzan Ormeci, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, TR, 34450, Turkey, lormeci@ku.edu.tr, Jean-Philippe Gayon, Isilay Degirmenci, Fikri Karaesmen, Eren Basar Cil

A production system which controls both pricing and replenishment dynamically is modeled as a make-to-stock queue. The potential demand is generated by a Markov-modulated Poisson process, where the actual demand depends on the offered price. We obtain results on the structure of the optimal replenishment and pricing policies. The effects of dynamic and static pricing are compared in a numerical study. The sensitivity of the optimal policies with respect to certain parameters is also explored.

3 - Imperfect Demand Information in Production-Inventory Systems with Multiple Customer Classes

Francis de Vericourt, Associate Professor, Duke University, 1 Towerview Road, Durham, NC, 27708, United States, fdv1@mail.duke.edu, Jean-Philippe Gayon, Saif Benjaarfar

We consider a make-to-stock supplier with limited capacity serving different customer classes, some of which share advance demand information with the supplier by announcing their orders ahead of their due date. The supplier is faced with a joint production control and inventory allocation problem. We formulate the problem as an MDP and characterize the optimal policy. From numerical results, we obtain several insights into the value of advance demand information for both supplier and customers.

4 - Scheduling Policies in the M/G/1 Make-to-Stock Queues

Baris Balcioglu, Department of Mechanical & Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, Canada, baris@mie.utoronto.ca, Nima Sanajian

We exploit the distributional Little's law to obtain the exact numerical solution for the M/G/1 system size distribution. Considering multiple-demand types, we explore the performance of three static scheduling rules, namely, FCFS, non-preemptive and preemptive priority rules. We provide the conditions to see when a make-to-order queue would be the optimal discipline. Finally, we extend our analysis by adjusting a well-known dynamic scheduling policy, i.e. myopic-T, for the M/G/1 queue.

■ WB42

Production & Scheduling

Contributed Session

Chair: Priyantha Devapriya, PhD Candidate, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States, ddevapr@clemson.edu

1 - Group Identification Techniques to Help Solve the Multipurpose Machines Scheduling Problem

Amit Garg, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, United States, amit.garg2@case.edu, Dale Flowers

We studied a scheduling problem in a multipurpose machine environment with the objective of minimizing make-span. We developed a group identification scheme to exploit the structure of this problem. This group identification scheme improved the efficiency of our optimal branch and bound algorithm under certain conditions. We performed computational experiments to measure the benefits of our group identification scheme.

2 - Impact of Separable Setups and NIQ on Mean Flowtime

Edward Stafford, Professor of Management Science, University of Alabama in Huntsville, College of Administrative Science, Room 355 Administrative Science Building, Huntsville, AL, 35899, United States, staffoef@uah.edu, Fan Tseng

The impact of Separable, Sequence-Independent Setup Times (SSIST) and the NIQ restriction on the mean flowtime performance measure for MxN flowshop problems is examined. Identical problems are solved under four scenarios: (Regular or NIQ)x(SSIST or NSIST). Problem sizes range from MxN = (5x6) to (9x14). Solution time experiences with LINDO and LINGO are reported.

3 - Modelling an Ice Cream Factory for De-Bottlenecking

Bas Bakker, Process & Spuply Chain Design, Unilever Food & Health Research Institute, Olivier van Noortlaan 120, 3133 AT Vlaardingen, Netherlands, bas.bakker@unilever.com, Peter Bongers

The output of Unilevers factory in Hellendoorn, needed to increase by 30%. For this a multi-scheduling model of the factory (equipment and working procedures) has been designed. Using the model, scenario's where evaluated. The most important conclusion was that in the current situation, the requested volumes are not feasible. A number of main modifications have been proposed based on the simulations. As a result, non-operational time reduced to 12% and feasible factory schedules made.

4 - Multi-Level Just-in-Time Scheduling Problem with Workload Smoothing Goal

Mesut Yavuz, Assistant Professor, University of Florida, 1350 N. Poquito Road, Shalimar, FL, 32579, United States, yavuzm@ufl.edu

Two major goals considered in scheduling mixed-model assembly lines under just-in-time principles are (1) Smoothing the workload on each workstation on the assembly line, and (2) Keeping a constant usage rate of all parts fed into the assembly line. In the literature, a few papers are concerned with achieving both of these goals at the same time. However, they ignore the processing time requirements of the parts at the sub-levels. We propose a new model that bridges this.

5 - Multi-Plant Integrated Production and Distribution Scheduling Problem for a Perishable Product

Priyantha Devapriya, PhD Candidate, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States, ddevapr@clemson.edu, William G. Ferrell

We solve the fleet selection problem of an integrated production and distribution scheduling problem for a perishable product with multiple plants. A heuristic based on evolutionary algorithms is given 1) To assign each customer to a distinct plant 2) To find out production schedules and efficient routes to minimize the total cost while the total demand is satisfied within a given planning horizon.

■ WB43

Multiple Criteria Routing for Business Applications

Cluster: Multi-Criteria Decision Making

Invited Session

Chair: Hyun Kim, Graduate Student, Case Western Reserve University, 10900 Euclid Avenue Olin 611, Cleveland, OH, 44106, United States, hsk5@cwru.edu

1 - A Multiobjective Planner for Intensity Modulated Radiation Treatment Planning of Cancers

Vira Chankong, Professor, Case Western Reserve University, 10900 Euclid Avenue Olin 708, Cleveland, OH, 44106, United States, vira@case.edu

We describe a goal programming based planning system to generate IMRT treatment plans that are robust against patient movement during treatment. The medial line core of an object is used to capture morphological information of each target and OAR. The weight of each voxel is calculated using its distance from the core and is employed into the dose-volume objective functions to steer the local dose distribution. We show the clinical benefits of this planning system dealing with difficult cases.

2 - Multiple Criteria Decision Analysis: Two Business Applications

Gina Beim, Senior Consulting Engineer - Marketing, Pile Dynamics, Inc., 4535 Renaissance Parkway, Cleveland, OH, 44128, United States, gina@pile.com, Moren Levesque

Multiple Criteria Decision Analysis (MCDA) is an Operations Research methodology that help people and organizations make better decisions. It is most valuable in instances where tradeoffs, subjectivity, and accountability exist. We test the feasibility of using MCDA to aid in two business situations with no previous applications of this methodology: selection of a country where to launch a new venture, and selection of business plans to receive funding from a venture capital fund.

3 - DA-MLAR-AXP: Directional Antenna Multi-Path Location Aided Routing with Adjustable X-Mission Power

Sanjaya Gajurel, Graduate Student, Case Western Reserve University, 2463 Overlook Road, Apt #11, Cleveland, OH, 44106, United States, sxg125@case.edu, Hyun Kim, Limin Wang, Behnam Malakooti

This paper presents an adjustable transmission power capability for our Directional Antenna Multi-path Location Aided Routing (DA-MLAR) and provides analysis of energy consumption of fixed and adjustable transmission power modes. Through simulations, we demonstrate that adjustable transmission power capability in DA-MLAR improves its packet delivery ratio by up to thirty percent.

4 - A Multi Attribute Model for Supplier Performance for an Industrial Equipment Manufacturer

Richard J. Titus Jr., Industrial Engineering Department, The Pennsylvania State University, University Park, PA, 16802, rjt186@psu.edu

An empirical study of an industrial equipment manufacturer's supplier quality and delivery performance against select supplier attributes such as quality certifications (ex. ISO9000, etc.), the use of quality techniques (such as Statistical Process Control), financial ratings, product complexity, product differentiation, supplier size, distance between supplier and customer location and financial leverage or purchasing power was performed in order to evaluate the relationship of these key attributes to supplier performance.

■ WB44

Networks & Graphs

Contributed Session

Chair: Holly Waisanen, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-760D, Cambridge, MA, 02139, United States, waisanh@mit.edu

1 - Local Search in Maximum Flow Network Interdiction

Doug Altner, Graduate Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, daltner@isye.gatech.edu, Nelson Uhan, Özlem Ergun

We investigate the effectiveness of local search for the Maximum Flow Network Interdiction Problem (MFNIP). Our goal is to develop methods that consistently obtain good solutions over a range of interdiction budgets in a timely fashion. Two main kinds of variable-depth neighborhoods are used: neighborhoods based on cut-sets and neighborhoods based on simple arc exchanges. We present implementations, computational results, and discuss generalizations to natural extensions of MFNIP.

2 - Facility Protection Optimization Using Stochastic Network Interdiction

Patrick Hester, Vanderbilt University, 729 William Howard Place, Nashville, TN, 37209, United States, patrick.hester@vanderbilt.edu, Sankaran Mahadevan

This paper develops a methodology to solve facility protection optimization problems for cost and performance objectives using stochastic network interdiction. The method extends current network interdiction capabilities to problems where interruption probability is the parameter of interest, while including timely detection, an improved method of candidate path selection, and comprehensive stochastic consideration. A discussion of the developed method is provided along with a numerical example.

3 - Random Graphs and Restricted Second Order Logic

Kemal Gursoy, Kean University, Willis Hall 305-G, 1000 Morris Avenue, Union, NJ, 07083, United States, kgursoy@kean.edu

One randomly build a graph, where nodes are natural numbers. At each node, the person will flip a coin to connect this node to the other nodes. This probabilistic construct provides a structure to extend the first order logic to the restricted second order logic, which is restricted to the subsets of the universe. An application of this extension would be constrained databases.

4 - Synchronization of Networks for Discrete Complex Systems

Rex Kincaid, Professor, College of William and Mary, Department of Mathematics, Williamsburg, VA, 23185, United States, rrkinc@wm.edu, Michael Holroyd

Synchronization is critical in communication and transportation networks as well as in neuron respiratory systems. The first non-trivial eigenvalue of a network's Laplacian matrix provides a quantifiable measure of synchronizability. The utility of this approach for the design and management of networks where synchronization is desirable (respiration networks), or detrimental to network performance (router networks) is explored. An example is given for a neuron respiratory system.

5 - The Dynamic Pickup and Delivery Problem Under Information Constraints

Holly Waisanen, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-760D, Cambridge, MA, 02139, United States, waisanh@mit.edu, Devavrat Shah, Munther Dahleh

In the multi-vehicle Dynamic Pickup-Delivery vehicle routing problem, messages arrive to the system sequentially in time and must be picked up and delivered such that the average delay between arrival and delivery is minimized. We obtain analytical lower bounds on the delay performance under both full and limited information, demonstrating the importance of information to this dynamic multi-vehicle problem. We also provide policies that prove these lower bounds are achievable up to a constant.

■ WB45

Tutorial: Multi-Echelon Production/Inventory Systems: Optimal Policies, Heuristics, and Algorithms

Cluster: Tutorials

Invited Session

1 - Multi-Echelon Production/ Inventory Systems: Optimal Policies,Heuristics, and Algorithms

Geert-Jan Van Houtum, Associate Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, NB, 5612AZ, Netherlands, g.j.v.houtum@tm.tue.nl

The development of the theory of multi-echelon production/inventory systems started almost 50 years ago. Planning concepts based on this theory are increasingly incorporated into the practice of supply chain management. In this tutorial, we focus on optimal policies and key insights for serial, assembly, and distribution systems. In particular, we demonstrate why generalized forms of basestock policies are optimalfor many systems. We also present applications of multi-echelon theory.

■ WB46

Managing Risks and Cost Benefits in Complex Supply Chains

Cluster: Supply Chain and Operations Engineering

Invited Session

Chair: Kathryn Stecke, Professor, University of Texas at Dallas, School of Management — SM30, PO Box 830688, Richardson, TX, 75083-0688, United States, KStecke@utdallas.edu

1 - Evaluating the Performance of Multi-Stage Supply Chains Under Disruptions and Random Customer Demand

Sanjay Kumar, PhD Student, University of Texas at Dallas, School of Management, PO Box 830688, SM30, Richardson, TX, 75083, United States, skumar@utdallas.edu, Fred Glover, Kathryn Stecke, Thomas Schmitt

Uncertain demand and periodic disruptions pose critically important challenges to effective supply chain management. We test the performance of such supply chains under various scenarios relating to costs, expediting, and length of disruptions. The study also employs search routines to find order-up-to quantities that minimize total supply chain costs.

2 - Lead Time and Price Quotation Mode Selection: Uniform or Differentiated?

Xuying Zhao, University of Texas at Dallas, School of Management, Richardson, TX, 75080, United States, kxz024000@utdallas.edu, Ashutosh Prasad, Kathryn Stecke

Firms in make-to-order industries often provide lead time and price quotations to customers. When a firm offers a single lead time and price, it is called uniform quotation mode. The differentiated quotation mode is when a firm offers a menu of lead times and prices for customers to choose from. By modeling, analyzing, and comparing these two quotation modes, we provide guidelines for a manager to choose a suitable mode for his/her firm.

3 - Transshipment Policies of Independent Retailers

Nagihan Comez, PhD Student, University of Texas at Dallas, United States, nagihan@utdallas.edu, Metin Cakanyildirim, Kathryn Stecke

We study a decentralized system of two retailers selling a substitutable product. In case of a stock-out, an item can be transshipped to a stocked-out retailer from the other one. Customers can also move with a demand overflow probability. The model is characterized by two decisions: the transshipment and the initial replenishment decision which is a game. Our work combines pooling and demand substitution in a single model, where retailers use transshipment voluntarily under demand overflow.

■ WB47

Models and Algorithms for Complex Inventory Problems

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Eda Kemahlioglu-Ziya, Kenan-Flagler Business School, University of North Carolina, CB # 3490, Chapel Hill, NC, 27599, United States, Eda_KemahliogluZiya@unc.edu

1 - A Non-Parametric Approach to Stochastic Inventory Planning with Lost Sales
W. Tim Huh, Assistant Professor, Columbia University, 500 W. 120th Street, MC4704, New York, NY, 10028, United States, th2113@columbia.edu, Paat Rusmevichientong

We study stochastic inventory planning systems with lost sales and censored demand under stationary and non-stationary settings. Contrary to classical inventory theory, we assume that no knowledge of demand is initially available, and lost sales in each period are unobservable. We take a non-parametric approach and propose adaptive inventory policies that generate a sequence of ordering decisions over time.

2 - Approximation Algorithms for the One-Warehouse Multi-Retailer Problem
Retsef Levi, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, BDG E53-389, 30 Wadsworth Street, Cambridge, MA, 02139, United States, retsef@mit.edu, Maxim Sviridenko

We consider the classical one-warehouse multi-retailer inventory model with discrete and finite horizon, and with determinitic but time-dependent demands. The problem is known to be NP-Hard. We use modern linear-programming-based approximation techniques to derive approximation algorithms for the problem that have constant worst-case guarantees. That is, for each instance of the problem the solution we produce is guaranteed to be within constant times the optimal cost.

3 - Inventory Management under a Broad Class of Stochastic Leadtimes
Alp Muharremoglu, Columbia Business School, 3022 Broadway, 410 Uris Hall, New York, NY, 10027, United States, alp2101@columbia.edu, Nan Yang

We introduce a quite general class of stochastic leadtime processes for inventory systems. This class includes models from literature (e.g. Kaplan's leadtimes with no order crossing or i.i.d. leadtimes with order crossing) and new situations, such as a model with congestion dependent leadtimes. We provide a method to compute base stock levels. The method finds the optimal levels for single stage systems and near optimal levels for multi-echelon systems.

■ WB48

Information and Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Holly Lutze, Assistant Professor, University of Texas, PO Box 830688, SM 30, Richardson, TX, 75083, United States, hlutze@utdallas.edu

Co-Chair: Ozalp Ozer, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305, United States, ozalp@stanford.edu

1 - Advance Orders and Market Segmentation in a Multi-Product Supply Chain
Holly Lutze, Assistant Professor, University of Texas, PO Box 830688, SM 30, Richardson, TX, 75083, United States, hlutze@utdallas.edu, Ozalp Ozer

We consider a multi-product manufacturer with multiple retail customers, each placing advance orders with a particular demand lead time. We determine an optimal menu of demand lead times and payments to maximize the manufacturer's benefit from advance orders. By choosing among menu options, retailers segment themselves according to the service level each provides his end customers. We explore how postponement and retailer markets affect this optimal menu and resulting supply chain performance.

2 - Bayesian Inventory Replenishment and Audit Policies When Records Are Inaccurate
Adam Mersereau, Assistant Professor, University of Chicago GSB, Chicago, IL, United States, amersere@chicagogsb.edu

When inventory records do not reliably match physical inventory levels, a retailer may form a Bayesian belief of her inventory position for inventory management purposes. We examine optimal replenishment and audit policies in a lost sales environment based on such a belief, isolating a "learning effect" on replenishment decisions.

3 - Improving Consumers' Product Valuation Under Consumer Search
Olga Perdikaki, Kenan-Flagler Business School, 3490 McColl Building, Chapel Hill, NC, 27599, United States, olga_perdikaki@unc.edu, Jay Swaminathan

Several practices implemented by retailers are aimed towards providing consumers with more information about their offerings in order to increase their valuation. We examine a stylized model with two stores where consumers have an opportunity to learn from one store and buy from another and provide managerial insights on the optimal effort, pricing and profits in a monopoly and duopoly setting.

4 - Periodic Review Inventory with Pilferage/Spoilage
Mariana Olvera-Cravioto, Columbia University, New York, NY, United States, marianao@stanford.edu, Ozalp Ozer, Peter W. Glynn

We consider a single product periodic review inventory with lost sales with unrecorded pilferage and/or spoilage. As a consequence, the actual and the recorded inventory levels might disagree, but managerial decisions, such as ordering products or performing inventory counts, must be made based solely on the recorded inventory level. We present a model which reduces the problem of finding the optimal counting/ordering policy to that of solving a two-dimensional MDP with perfect information.

■ WB50

Optimization Techniques II

Contributed Session

Chair: Joon-Yeoul Oh, Assistant Professor, Texas A&M-Kingsville, MSC 184, 700 University Boulevard, Kingsville, TX, 78363, United States, kfjo000@tamuk.edu

1 - Resource-Constrained Shortest Path Sub-Problems on Acyclic Graphs in a Column-Generation Context
Wilbert Wilhelm, Barnes Professor, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu, Xiaoyan Zhu

Our three-stage approach comprises stages 1 (preprocessing) and 2 (set up), which are implemented one time, and stage 3 (iterative solution), which is implemented at each column-generation iteration to solve transformed sub-problems, each time with different arc costs. We present preprocessing and setup techniques, worst-case complexity analyses, and computational evaluation.

2 - Dynamic Programming in Models with Both Continuous and Discrete Variables
Christopher Raphael, Associate Professor, Indiana University, 1900 E. 10th Street, Bloomington, IN, 47406, United States, craphael@indiana.edu

We present an extension of dynamic programming to functions involving both discrete and continuous variables. The functions we treat are locally composed and quadratic in the continuous variables, given any configuration of discrete variables. From an analytic point of view, it is unclear if the proposed optimization technique is computationally tractable in general. We demonstrate an application to musical rhythm recognition in which we identify a globally optimal solution.

3 - Searching the Best Fitting Solution for the Location of Mobile Telephone Switching Office
Joon-Yeoul Oh, Assistant Professor, Texas A&M-Kingsville, MSC 184, 700 University Boulevard, Kingsville, TX, 78363, United States, kfjo000@tamuk.edu, Hyunju Oh, Eunjin Lee

The cellular telecommunication network system often encounters capacity inadequacy issues due to the increased subscribers and data traffic. Installing a Mobile Telephone Switching Office (MTSO) is a method to increase the network capacity. Because of the installation cost and call routing, selecting the location of MTSO is critical. Based on the analytical results of the test cases, this paper suggests a method of selecting MTSO location along with the effectiveness of the method.

4 - Complexity of the Inverse Shortest Paths Lengths Problems
Tingting Cui, University of California, Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, tingting@ieor.berkeley.edu, Dorit Hochbaum

The Inverse Shortest Paths Lengths Problem (ISPL) looks for a arc weight assignment to a graph such that the shortest paths lengths between a collection of source-sink pairs equal some prescribed values and the total deviation from the original weight is minimized. We identify polynomial and NP-complete cases for ISPL and provide solution techniques for the general and specially structured problems.

5 - A Flexible Approach to Robust Optimization via Convex Risk Measures

David Brown, Assistant Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, dbbrown@duke.edu, Dimitris Bertsimas, Aharon Ben-Tal

We develop a flexible approach to robust optimization based on risk preferences of the decision-maker in which one specifies not only the values of the uncertain parameters for which feasibility should be ensured, but also the degree of feasibility. We apply our approach to a real-world portfolio optimization problem and show promising results that it can yield significant improvements in downside risk protection at little or no expense in expected performance compared to traditional methods.

■ WB51

Scheduling in Aviation Applications

Contributed Session

Chair: Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx

Co-Chair: Jenny Diaz-Ramirez, I.E. PhD Candidate, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, Colonia San Antonio Buenavista, Toluca, 50110, Mexico, jenny.diaz@invitados.itesm.mx

1 - Connection Fixing Strategy for Crew Pairing Problems

Curt Hjorring, Carmen Systems, Odinsgatan 9, Göteborg, SE41103, Sweden, curt.hjorring@carmensystems.com, Lennart Bengtsson, Johan Ivarsson

The integrality strategy within the Carmen column generator for the crew pairing problem is based on Ryan-Foster constraint branching. It focuses on finding high quality solutions quickly, rather than finding provably optimal solutions. We present the strategy, including details such as how it interacts with a specialized IP heuristic (paqs) that is run during the whole run.

2 - Grouping and Staffing with Passenger Threat Attributes

Xiaofeng Nie, PhD Candidate, Department of Industrial & Systems Engineering, SUNY at Buffalo, 438 Bell Hall, Buffalo, NY, 14260, United States, xnie2@buffalo.edu, Rajan Batta

We extend the passenger grouping model of Babu etc. to consider both passenger threat attributes and staffing of screeners. Here, several types of passengers with different risky characteristics are considered. A linear program is formulated to determine the assignment of every passenger type and the staffing of each check station.

3 - Dynamic Assignment of Aircraft Services Using Online Flight Information

Rob Broekmeulen, Technische Universiteit Eindhoven, PO Box 513, Pav E10, Eindhoven, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tm.tue.nl, Koray Hakan, Will Bertrand

We develop models and methods to improve the reliability of the ground time management processes. We use a dynamic vehicle routing approach for the aircraft services to respond to changes in arrival times. Experiments, using six weeks data from a major European hub, show that the number of flight delays can be reduced significantly.

4 - Simultaneous Aircraft and Crew Scheduling for Small Airlines

Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx, Jenny Diaz-Ramirez

From the practical point of view, this simultaneous approach can be applied to small airlines, where the resulting instances could be still computationally manageable. It is expected to get more adapted solutions with objective values at least as good as the current available ones. This work is inspired on small Mexican Airlines.

■ WB52

Pricing in Networks

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Johanne Cohen, CNRS, LORIA, 615 rue du Jardin Botanique, Villers les Nancy, 54602, France, Johanne.Cohen@loria.fr

1 - Trunk Reservation Revisited: On Price-Driven Storage Allocation in a Peer-to-Peer Network Federation

Peter Reichl, Key Researcher, Telecommunications Research Center Vienna (ftw.), Donaucitystrasse 1, Vienna, A-1220, Austria, reichl@ftw.at, Barbara Emmert, Sandford Bessler

This paper deals with federations of peer-to-peer networks and proposes a price-driven mechanism for matching available free storage capacity with respective demands. The scheme is based on "trunk reservation" as an optimal capacity allocation strategy for loss networks with two different classes of requests. We compare this approach with two other simple allocation schemes and demonstrate to which extent it is able to provide incentives for the individual domains to cooperate with each other.

2 - Grid Economics: A New Perspective for Yield Management Techniques

Yezekael Hayel, IRISA, Campus Universitaire de Beaulieu, 35042, Rennes, France, yhayel@irisa.fr, Parijat Dube

With the rapid deployment of infrastructure supporting high speed communications, grid services such as grid computing, is becoming a business reality. Several interesting problems in the domain of grid services, including resource allocation, dynamic pricing and capacity planning, find parallelism in other contexts where the use of YM techniques have been successfully employed.

3 - Economically Efficient Capacity Planning for Grid Computing

Jörn Altmann, Professor, School of Information Technology, International University of Bruchsal, Campus 3, Bruchsal, 76646, Germany, jorn.altmann@acm.org, Jun Shu

An open issue about Grid computing is the lack of tools for capacity planning. We present a model for capacity planning that takes into consideration costs of contributions of different providers. This includes pricing of servers, possible congestion charges, and the risk of unavailable resources. The model is expected to provide answers to under what set of constraints fine-grained resource allocation is economically efficient and what kind of strategy to apply for capacity planning.

4 - Transit Prices Negotiation: Repeated Game Approach

Loubna Echabbi, INRIA/LORIA, 615 Rue du Jardin Botanique, Villers Les Nancy, 54602, France, Loubna.Echabbi@loria.fr

We present a game theoretic approach for the transit price negotiation problem in the interdomain routing framework. We analyze the behavior of providers on a specific scenario mainly by considering the simple but not simplistic case of one source and one destination.

■ WB53

Quality Issues in Supply Chain Management

Contributed Session

Chair: Xiaowei Zhu, Assistant Professor, West Chester University of Pennsylvania, West Chester, PA, 19383, United States, xiaoweiusa@yahoo.com

1 - Quality Cost-Sharing Contracts and Pricing Strategies

Gary Chao, Northwestern University, 2145 Sheridan Road C223, Evanston, IL, 60208, United States, garychao@iems.northwestern.edu, Seyed Iravani, Canan Savaskan

We evaluate the profitability of quality cost-sharing contracts in the monopoly and duopoly markets where the market share is determined by the product quality and sales price. In addition to optimal quality improvement effort, we obtain optimal sale prices for different contracts and market situations in order to maximize the manufacturer's final profit. Our results suggest that manufacturers, especially with low quality product, should adopt the contract with the selective root cause analysis.

2 - Quality Risk In Outsourcing: An Empirical Study

Aleda Roth, Arizona State University, W.P. Carey School of Business, Main Campus, PO Box 874706, Tempe, AZ, 85287, United States, Aleda.Roth@asu.edu, John Gray, Brian Tomlin

We first present theoretical arguments that explain how manufacturing outsourcing poses a potential quality risk to the buying firm. We then introduce our central hypothesis derived from this theory: contract manufacturers' plants will pose a higher finished-product quality risk than internal plants. Next, we introduce our plant-level measure of quality risk. This measure utilizes multiple years of Food and Drug Administration inspection data. Finally, we present the results of the study.

3 - A Supplier Selection Model with Quality and Capacity Constraints

Abraham Mendoza, Graduate Student, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, aum144@psu.edu, Jose Ventura

This paper presents a new procedure to solve the supplier selection problem. This procedure includes a preliminary ranking method to reduce the number of potential suppliers to a manageable size. Then, a non-linear integer programming model is used to complete the supplier selection process and determine the individual order quantities. The model minimizes procurement and inventory costs under quality and capacity constraints.

4 - Models of Spot Markets and Longer Term Contracts
Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta GA 30332, United States, anton@isye.gatech.edu, Yi He

This work considers a setting in which products can be bought and sold on a spot market or by entering into contracts in advance of demand realization. Various people have studied the interaction between contracts and spot markets. We consider the effect of different market structures, and of spot market participation rates, on the amounts transacted via contracts and on the spot market, and on the surpluses of the sellers and buyers.

5 - Optimum Quality and Pricing in Call Center Operations
Xiaowei Zhu, Assistant Professor, West Chester University of Pennsylvania, West Chester, PA, 19383, United States, xiaoweiusa@yahoo.com, Samar Mukhopadhyay

Outsourcing is fast becoming an important strategy for firms to reduce cost. We use the call center as an example to study optimal outsourcing contracts where the offshore firm has private cost information for quality improvement giving rise to information asymmetry. We use a game theoretic model to derive optimal contracts under both full and asymmetric information. We derive optimal quality strategy and the value of information, and present several managerial insights.

■ WB54

Product and Service Development for New Markets

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Cheryl Druehl, University of Maryland, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu

1 - A Theoretical Framework for Managing the NPD Portfolio: When and How to Use Strategic Buckets
Raul Chao, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, United States, raul.chao@mgt.gatech.edu, Stylianos Kavadias

Developing the "right" new products is critical to firm success and is often cited as a key competitive dimension. This paper addresses the link between new product development (NPD) portfolio strategy and firm performance. We first develop a general theoretical framework for resource allocation and NPD portfolio strategy. We then apply our framework to analyze a popular practice in NPD portfolio management: the use of strategic buckets.

2 - Why Don't We Live in a Modular World?
Sezer Ulku, Assistant Professor, Georgetown University McDonough School of Business, Washington, DC, 20057, United States, SU8@georgetown.edu, Glen Schmidt

To deal with uncertainty and technological change, the prescription is often to use modular product architectures. However, the evolution of products in the electronics market sometimes tells a different story. For instance, Handspring had conceived a modular platform that would accomomdate new applications through an expansion port. But more recent versions have adopted a more integral architecture that does not allow expansion. We seek to explain anomalies such as this.

3 - Strategies for Encroaching on the Low End of Existing Markets
Cheryl Druehl, University of Maryland, 4318 Van Munching Hall, College Park, MD, 20742, United States, cdruehl@rhsmith.umd.edu, Glen Schmidt

Kodak's early digitals were expensive cameras that appealed to tech-savvy males. Instead, maybe Kodak should have initially pursued cheaper, simpler digitals. We compare and contrast these two possible strategies, developing an analytical framework that relates these strategies to the notions of disruptive innovation, blue oceans, and willingness to cannibalize. We discuss the link between Kodak's encroachment strategy and its operational and marketing capabilities.

■ WB55

Scheduling

Contributed Session

Chair: Jun Zhang, PhD Student, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47906, United States, zhang28@purdue.edu

1 - Order Acceptance Using Genetic Algorithms
Walter Rom, Cleveland State University, 1860 East 18th Street, Cleveland, OH, 44114, United States, w.rom@csuohio.edu, Susan Slotnick

We solve the joint order-acceptance problem and job-sequencing problem for a firm that has a known pool of potential orders, for which it knows processing time, delivery date, and customer weights. The objective is to maximize profit (revenue minus weighted tardiness). We test a genetic algorithm against previous methods.

2 - Single Machine Scheduling with Preventive Maintenance Activities
Sakine Batun, Research Assistant, Middle East Technical University, Middle East Technical University, Industrial Engineering Department, Ankara, 06531, Turkey, sakine@ie.metu.edu.tr, Meral Azizoglu

This study considers a single machine total flow time problem that is subject to preventive maintenance activities of known starting times and durations. We propose a branch and bound algorithm to find the optimal solution of the problem and show that our algorithm can solve large-sized problem instances in reasonable times.

3 - Production Planning for Tissue-Engineered Biomaterial Manufacturing
Jun Zhang, PhD Student, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47906, United States, zhang28@purdue.edu, Yuehwern Yih

Reducing cost of health care is an attactive research topic. Since the pharmaceutical is an important component of health care costs, it has been considered as a potential source of cost reduction. Although many factors contribute to pharmaceutical costs, production operations are significant.This research studies the tissue-engineered biomaterial manufacturing and proposes a model for production planning in order to reduce the operations cost as well as provide high service level.

Wednesday, 1:30pm - 3:00pm

■ WC01

Online Optimization

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Adam Kalai, Assistant Professor, Toyota Technological Institute, Chicago, IL, United States, kalai@tti-c.org

1 - Games, Optimization, and Online Algorithms
Martin Zinkevich, Department of Computing Science, University of Alberta, 2-21 Athabasca Hall, Edmonton, AB, Canada, maz@cs.ualberta.ca

Texas Hold-em is a huge multi-agent, partial information game. While an equilibrium exists, this is not the best strategy against non-equilibrium play. I will present a novel way of finding an approximate equilibrium involving approximately solving a linear program (previously considered intractable) such that "experts" that can be useful against suboptimal strategies can be extracted from the solution.

2 - (Exponentiated) Stochastic Gradient Descent for L1 Constrained Problems
Sham Kakade, Assistant Professor, Toyota Technological Institute, 1427 E. 60th Street, Chicago, IL, 60637, United States, sham@tti-c.org, Eyal Even-Dar, Dean Foster

Convex optimization problems with L1 constraints often underly such tasks as feature selection and obtaining sparse representations. We show the exponentiated gradient algorithm is effective as a stochastic gradient descent algorithm under general convex loss functions when there are many irrelevant dimensions - requiring a number of gradient steps only logarithmic in the number of dimensions. This includes supervised learning problems under the square, hinge, logistic, and absolute loss.

3 - Approximate Online Optimization
Katrina Ligett, PhD Student, Carnegie Mellon University, katrina+@cs.cmu.edu, Sham Kakade, Adam Kalai

We show how to convert nearly any offline approximation algorithm into an online approximation algorithm that can applied to a sequence of optimization problems. In particular, given a polynomial-time offline approximation algorithm with approximation ratio R, we show how to solve the sequential online decision version of the problem in polynomial time, achieving competitive ratio R+eps, for arbitrarily small eps.

4 - Approximation and Online Algorithms for Item Pricing
Avrim Blum, Professor, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Ave, Pittsburgh, PA, 15213-3891, United States, avrim@cs.cmu.edu, Maria-Florina Balcan

We consider the problem of a seller with various goods attempting to set prices to maximize revenue, when customers have valuations over sets of items. Our main result is a simple O(k) approximation for the case of single-minded bidders who each want at most k items, improving on the O(k^2) bound of Briest and Krysta. We also show how our algorithms can be combined with results of [BH05,KV03] to achieve good performance in the online setting.

■ WC02

Game Theory II

Contributed Session

Chair: Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

1 - Mixed Strategies in Combinatorial Agency

Moshe Babaioff, University of California Berkeley, School of Information, Berkeley, CA, 94720-4600, United States, moshe@sims.berkeley.edu, Michal Feldman, Noam Nisan

We study a setting where a principal needs to motivate a team of agents whose combination of hidden efforts stochastically determines an outcome. In a companion paper we devise and study a basic ``combinatorial agency'' model for this setting, where the principal is restricted to inducing pure Nash equilibria. Here, we show that the principal may possibly gain from inducing mixed equilibria, but this gain can be bounded for some technologies. We also present a sufficient condition for no gain.

2 - Social Learning Dynamics and the Distribution of Information

Ilan Lobel, MIT, Operations Research Center, Cambridge, MA, 02139, United States, lobel@mit.edu, Asuman Ozdaglar, Munther Dahleh, Daron Acemoglu

Present models of social learning either assume all previous actions are observable or assume agents are not fully rational. We provide a new model for social learning in a network of rational agents and characterize the equilibrium behavior of the players given certain information structures. We also characterize the long-term dynamics of play in such networks and we consider the effects of changing the information structure on the learning dynamics.

3 - Continuous Movement in Noniterated Social Dilemmas

Gregory Jones, Faculty Research Fellow, Georgia State University, 2792 Crown Mill, Marietta, GA, 30068, United States, gtjones@gsu.edu, Reidar Hagtvedt

Previous social simulation studies have often relied on computational automata on discrete torii. Continuous movement on a continuous torus provides more realistic opportunities for multiple interactions, unique behaviors, and a qualitatively different approach to equilibrium selection. Here we present a noniterated prisoner's dilemma where cooperation evolves without the adaptive improbability of projection strategies or the demanding cognitive overhead of detection strategies.

4 - Pricing of Over-The-Counter Hedging Contracts for Real Investments

Jianer Zhou, Simon School of Business, University of Rochester, Carol Simon Hall, Rochester, NY, 14627, United States, zhouj2@simon.rochester.edu, Nils Rudi

To offset the risk of his real investment, a firm buys from an issuer a hedging contract with an underlying payoff correlated with the demand uncertainty. The issuer lays off her risk through her financial portfolio or by writing another hedging contract. We characterize the contract pricing mechanism in the framework of Stackelberg game and price equilibrium. We also define two benchmark cases and show that the issuer plays an important role in sharing the risk by numerical experiments.

5 - Knowledge Flows and Modeling Competition Among Multinational Enterprises

Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

This research develops a location-allocation, mixed integer linear program that evaluates multi-national enterprises location and control configurations to yield optimal networks, considering R&D, production and marketing facilities, produced in-house and/or outsourced, as well as intra-firm and inter-firm knowledge flows. A second stage game permits price competition for end customers and their effect on the first stage network cost minimization and the overall Nash-Bertrand equilibrium.

■ WC03

Discrete Optimization

Contributed Session

Chair: Jonathan Turner, Student, Purdue University, 2353 Yeager Road, Apt. 1, West Lafayette, IN, 47906, United States, jonathan-turner@northwestern.edu

1 - LP-Based Solution Methods for the Asymmetric TSP

Vardges Melkonian, Ohio University, Department of Mathematics, Athens, OH, 45701, United States, vardges@math.ohiou.edu

We consider an LP relaxation for ATSP. We introduce concepts of high-value and high-flow cycles in the basic solutions and show that the existence of this kind of cycles would lead to constant-factor approximation algorithms for ATSP. The existence of high-flow cycles is motivated by computational results and theoretical observations.

2 - Transposition Search for Optimal Graph Embedding

George Popescu, ACM, 5 Wild Rose Road, Westport, CT, 06880, United States, george.popescu@acm.org

Distributed indexing networks are networks defined by a set of connectivity rules on node indices. Construction of distributed indexing networks can be formulated as an optimal graph embedding, with a cost function defined over graph weights. We propose here efficient search algorithms based on the idea of transposing vertex indices. We compare local search and stochastic gradient descent algorithms and provide an asymptotic analysis of their performance.

3 - A Branch-and-Price Algorithm for Optimizing the Share-of-Choice Product Line Design Problem

Xinfang Jocelyn Wang, PhD Student, Department of QAOM, College of Business, University of Cincinnati, 501 Carl H. Lindner Hall, PO Box 210130, Cincinnati, OH, 45221, United States, wangfx@email.uc.edu

In this paper, we focus on solving the share-of-choice product line problem. Previous contributions to this NP-Hard problem include a series of ever improving heuristics. We present a new algorithm that embeds a column generation procedure within branch-and-bound to obtain exact optimal integer solutions. The initial computational results using large simulated dataset demonstrate that the algorithm is capable of identifying provably optimal solutions very quickly.

4 - Branch, Bound, and Remember Algorithms for the Simple Assembly Line Balancing Problem

Edward Sewell, Professor, Southern Illinois University Edwardsville, Department of Math and Statistics, Edwardsville, IL, United States, esewell@siue.edu, Sheldon Jacobson

We present heuristic and exact algorithms for the assembly line balancing problem. They can find and verify the optimal solution for every problem in the combined benchmarks of Hoffman, Talbot, and Scholl in less than one second per problem, on average, including two problems that have remained open for 10 years. The previous best algorithm was reported to solve 245 of the 269 benchmarks. Both algorithms are based on a branch & bound method that uses memory to eliminate redundant subproblems.

5 - Mitigating Shortage and Distribution Costs in Damaged Water Networks

Jonathan Turner, Student, Purdue University, 2353 Yeager Road, Apt. 1, West Lafayette, IN, 47906, United States, jonathan-turner@northwestern.edu, Dulcy Abraham, Mark Lawley, Jean-Philippe Richard, Jianhong Qiao

Intentional attacks and natural disasters may expose or exploit vulnerabilities in public infrastructures. Water networks are very critical infrastructures for which the consequences of a disaster are severe. If a disaster occurs, the right response strategy can minimize water shortage and distribution costs while the network is being repaired. We present a problem formulation and solution methodology will find this strategy quickly.

■ WC06

Advances in Heuristic Methods

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Bob Storer, Professor, ISE Department, Mohler Lab 200, Lehigh University, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

1 - Determining Fueling and Servicing Feasible Locomotive Plans

Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ahuja@ufl.edu, Larry Shughart, James Orlin, Balachandran Vaidyanathan

The locomotive planning problem consists of assigning locomotives to a weekly train schedule so that each train receives sufficient tonnage and horsepower. Several approaches have been proposed in the literature for locomotive planning but none of these approaches produces a fueling and servicing feasible plan. This presentation will describe an integer programming-based heuristic to obtain such a locomotive plan.

2 - Sampled Fictitious Play Heuristics for Discrete Optimization Problems

Marina Epelman, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, mepelman@umich.edu, Robert Smith, Archis Ghate

Sampled Fictitious Play is a heuristic for solving large-scale discrete optimization problems. We consider both traditional large-scale discrete problems, and problems modeling "complex systems." We describe several versions of the algorithm, discuss their theoretical convergence guarantees, and demonstrate their computational efficiency on various problems, with applications ranging from transportation and operations management, to finite horizon, Markov decision problems.

3 - A Very Large Scale Search Algorithm for General Balancing Problems

Bob Storer, Professor, ISE Department, Mohler Lab 200, Lehigh University, Bethlehem, PA, 18015, United States, rhs2@lehigh.edu

We discuss a Very Large Scale Neighborhood search algorithm for solving a generalized balancing problem. At each iteration an extension of the number partitioning problem is solved. This work extends a previous, quite successful algorithm for the rotor blade balancing problem.

■ WC07

Computational Systems for Distributed Optimization

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software

Sponsored Session

Chair: Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu

1 - Extensions to an Optimization Services Instance Language

Robert Fourer, Professor, Department of Industrial Engineering & Management Sciences, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Jun Ma, Kipp Martin

Optimization problems of interest today go beyond the traditional linear, integer, quadratic, and smooth nonlinear types. A language for problem instances must be extended accordingly. This presentation describes prospective extensions to OSiL, our proposed language standard, in such areas as combinatorial optimization and constraint programming, stochastic programming, and semidefinite and cone programming.

2 - A Result Language (OSrL) and Solver Option Language (OSoL) for Distributed Optimization

Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu, Robert Fourer, Jun Ma

We present an XML-based result language (OSrL) and an XML-based solver option language (OSoL) for distributed optimization systems. We also describe associated in-memory objectes OSResult and OSOption that are used in a library to support client-solver communication in a system based on Web Services.

3 - Impact Solver for Optimization Services

Huanyuan Sheng, Northwestern University, Tech C231, 2145 Sheridan Road, Evanston, IL, 60208, United States, h-sheng@northwestern.edu, Sanjay Mehrotra, Jun Ma

We improve our IMPACT solver for broader range of optimization problems. New algorithms are being developed and tested for large scale mixed nonlinear integer problems. Combining with Optimization Services(OS) protocols, we plan to provide a robust solver service for applications of mathematical programming.

4 - An Enterprise Computational System Built on the Optimization Services (OS) Framework and Standards

Jun Ma, Postdoctoral Fellow, Northwestern University, Department of Industrial Engineering & Management Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu

Optimization Services (OS) is a unified framework and a set of open source standards (under the CPL license) for building Comutational and Optimization software both as standalone and over distributed systems. In this talk we present an professional implementation and deployment of large scale enterprise computational system that is based on the OS standards and fit for scheduling computational jobs over both Internet and Intranet.

■ WC08

Panel Discussion: Service Industry -The Next Frontier for Technology Management

Sponsor: Technology Management

Sponsored Session

Chair: Tugrul Daim, Portland State University, Portland, OR, 97201, United States, tugrul@etm.pdx.edu

Co-Chair: Paul P. Maglio, IBM Almaden Research Center, Almaden Research Center, 650 Harry Road, San Jose CA 95120, United States, pmaglio@almaden.ibm.com

1 - Panel Discussion: Service Industry -The Next Frontier for Technology Management

Moderator: Daniel Berg, Rensselaer Polytechnic Institute, Troy, NY, 12180, United States, bergd@rpi.edu, Panelists: Dundar Kocaoglu, James C. Spohre, Arnold Reisman

Service industry represents 75% of the U.S. economy today; and its backbone is technology. Yet, while the manufacturing sector has improved impressively through proper application of technology management concepts and methodologies, the service industry has lagged behind manufacturing very badly in that context. This panel will explore the ways technology management can and should be applied to the health, financial, educational, government and other sectors of the service industry.

■ WC09

Flexible Manufacturing Systems

Contributed Session

Chair: Larry Stapleton, Assistant Professor, Millikin University, 1184 W. Main Street, Decatur, IL, 62522, United States, lstapleton@millikin.edu

1 - Planning for Manufacturing Flexibility in the Automotive Industry

Jorge Arinez, Senior Research Engineer, General Motors R&D Center, MC 480-106-359, 30500 Mound Road, Warren, MI, 48090, United States, jorge.arinez@gm.com, Stephan Biller

Automotive companies operate in a capital intensive environment where investment decisions are made years in advance of highly uncertain revenue streams. In addition, manufacturing allocation decisions must also be made well before refined product definition and specific market demand knowledge exists. This presentation describes a quantitative approach to evaluate flexibility decisions for a portfolio of manufacturing plants designed to respond to future market uncertainties.

2 - Global Capacity Investment Strategies for Product Variants

Chen Xiang, PhD Candidate, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ccx@andrew.cmu.edu, Bahar Biller

We study the optimal capacity investment decision faced by a global firm that has to customize its product to satisfy product regulations in different markets. We derive the structure of the optimal strategy, identify the optimal and investigate the changes in the optimal strategy when the demands are perfectly correlated. We conclude with a case study demonstrating how a manager could use our optimal strategy characterization for making robust investment decisions in global settings.

3 - The Role of Common Product Architecture in Creating Manufacturing Flexibility

B. Joon Park, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, jpark@smu.edu.sg, Soumen Ghosh

Many firms have now started to adopt the strategy of enhancing manufacturing flexibility by exploiting common design platforms among its products. Using smart product platform design strategies - using common product architecture and standardised manufacturing processes - is to attain higher levels of manufacturing flexibility. In this research, we explore how common product architecture can enhance the effectiveness of manufacturing flexibility.

4 - Implementation Guidelines for Robust Supervisors in Automated Manufacturing

Shengyong Wang, School of Industrial Engineering, Purdue University, 148-11 Arnold Drive, West Lafayette, IN, 47906, United States, wangs@purdue.edu, Mark Lawley, Song Chew

In this research, we seek to propose implementation guidelines for robust supervisors in flexibly automated manufacturing systems with unreliable resources. We first review a number of supervisory controllers that we developed in previous work. A simulation study of performance of the above controllers in systems with various design parameters is conducted. Based upon the results, we propose implementation guidelines for these controllers in systems under various settings.

5 - Flexible Manufacturing System Buffer Optimization Using Simulated Annealing and Genetic Algorithm
Larry Stapleton, Assistant Professor, Millikin University, 1184 W. Main Street, Decatur, IL, 62522, United States, lstapleton@millikin.edu

This study compares two metaheuristic approaches (Simulated Annealing and Genetic Algorithm) and two traditional scheduling approaches (Longest Processing Time and Due Date) in defining which approach minimizes the makespan time and the number of pallets required (Buffer). This study focuses on the scheduling of low rate and bottleneck part types on a 5 station FMS, in an aerospace company. A Lagrangian Relaxation objective function is used.

■ WC11

Radiation Therapy Planning

Contributed Session

Chair: Dionne Aleman, University of Florida, 303 Weil Hall, Gainesville, FL, 32605, United States, daleman1@ufl.edu

1 - New Approaches to the Leaf Sequencing Problem in IMRT Treatment Planning
Zeki Caner Taskin, PhD Student, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, taskin@ufl.edu, H. Edwin Romeijn, J. Cole Smith, James F. Dempsey

Intensity modulated radiotherapy (IMRT) is a powerful technique for radiotherapy treatment delivery. We discuss the problem of efficiently delivering a given beam intensity profile using a so-called multi-leaf collimator system. In particular, we need to decompose the intensity profile into a set of beam shapes and associated intensities. We propose new methods to solve this problem under different efficiency criteria and delivery constraints and compare their performance using clinical data.

2 - Incorporating Delivery Efficiency into Radiotherapy Treatment Plan Optimization
Chunhua Men, PhD Student, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, chhmen@ufl.edu, Zeki Caner Taskin, H. Edwin Romeijn, James F. Dempsey

We use an aperture modulation approach to Intensity Modulated Radiotherapy (IMRT) treatment plan optimization. In contrast with traditional approaches, we directly optimize apertures (beam shapes) and their intensities. This allows us to improve the quality of the dose model and thereby the planning process by explicitly accounting for transmission effects as well as a bound on the total beam-on-time. We test our models on clinical data and under different classes of deliverable apertures.

3 - Accounting for Fractionation in Fluence Map Optimization in IMRT
Dionne Aleman, University of Florida, 303 Weil Hall, Gainesville, FL, 32605, United States, daleman1@ufl.edu, H. Edwin Romeijn, James F. Dempsey

The majority of IMRT treatment plans are not delivered in a single session, but rather as several daily treatments (fractions) over an extended period. The current practice of transforming a single FMO solution into fractionated solutions is suboptimal. We formulate and solve a model that simultaneously optimizes one fluence map per prescription dose level by treating each beamlet in each fraction as a variable and incorporating artificial doses to account for previously delivered fractions.

■ WC12

Enterprise-Wide Optimization: Robustness and Uncertainty

Cluster: Enterprise-Wide Optimization in the Process Industry
Invited Session

Chair: Ignacio Grossmann, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, 15213, United States, grossmann@cmu.edu

1 - Uncertainty in Process Scheduling Using Parametric Programming
Marianthi Ierapetritou, Associate Professor, Department of Chemical and Biochemical Engineering, Rutgers University, Piscataway, NJ, 08854, United States, marianth@soemail.rutgers.edu, Zukui Li

The consideration of uncertainty in process scheduling is of great importance to preserve plant feasibility during operations. We have recently proposed an approach to deal with demand uncertainty based on the ideas of parametric mixed-integer linear programming. In this work we are extended this work to address (a) The issue of infeasibility prior to the implementation of parametric MILP algorithm, and (b) The consideration of uncertainty in prices and processing times.

2 - Medium-Term Planning and Scheduling Under Uncertainty for BP Chemicals
Andrew Schaefer, Assistant Professor, University of Pittsburgh, Department Industrial Engineering, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu, Mehmet Demirci, Gorkem Saka, Anastasia Vaia, Norman F Jerome

We extend BP Chemicals' medium-term operations planning model which represents global production assets, distribution system for some of their chemical businesses and uses forecasts of the future economic environment. Our goal is to develop a multi-stage stochastic integer program through extending their model so it will explicitly account for the uncertainty in forecasts. We present a 2-stage stochastic LP where the operating policy for first month constitutes the first-stage decision variables

3 - Short-Term, Medium-Term, and Reactive Scheduling of an Industrial Batch Plant
Christodoulos Floudas, Professor, Princeton University, Department of Chemical Engineering, Princeton, NJ, 08544, United States, floudas@titan.princeton.edu, Stacy Janak, N. Vormbrock, J. Kallrath

The medium-term production scheduling of a multipurpose, multiproduct industrial batch plant is modeled using a novel continuous-time mathematical formulation first developed. The methodology consists of the decomposition of the whole scheduling period into successive short horizons of a few days. Computational studies on short-term, medium-term and reactive scheduling of a large scale industrial batch plant will be presented.

4 - Quantifying Supply Chain Risks Using Methods from Process Safety
Pavan Kumar Naraharisetti, Institute of Chemical and Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, Sg, 627833, Singapore, naraharisetti_pavan_kumar@ices.a-star.edu.sg, Rajagopalan Srinivasan, Arief Adhitya, Iftekhar Karimi

Risk and disruption management has become imperative for today's supply chains. Quantifying risks in terms of potential loss of money, time, or material provides a basis for evaluating the efficacy of risk management strategies. To achieve this, we build on well-developed quantitative methods from chemical process risk management and extend them to the supply chain context.

■ WC13

Automation for Homework and Exams

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu

1 - Web-Based Homework in Introductory Statistics Courses
Scott Stevens, Professor, Computer Information Systems & Management Science Department, James Madison University, Harrisonburg, VA, 22807, United States, stevensp@jmu.edu, Susan Palocsay

Three online homework systems (ALEKS, PH-Assist, and custom online quizzes) were compared to traditional (textbook) homework assignments for undergraduates taking an introductory statistics course, then student performance on a standardized exam was used to compare these options. Multiple regression analysis results of the factors that were found to be important in student performance will be presented and discussed.

2 - Semi-Automated Grading of Online Exams and Assignments
Armann Ingolfsson, Associate Professor, University of Alberta School of Business, 4-30K Business Building, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca

We have given online assignments and exams in several management science courses for about 10 years, using custom-designed web tools. The presentation will focus on semi-automated marking of complicated problems, where students report an array of numerical values, e.g., decision variables for an optimization problem. We will describe a structured way of giving partial credit for such problems, based on consistency, feasibility, and optimality.

■ WC14

Cost/Performance Analysis

Contributed Session

Chair: Joost Santos, Research Assistant Professor, University of Virginia, 112 Olsson Hall (400736), Charlottesville, VA, 22901, United States, jrs8e@virginia.edu

1 - Performance of Private Sector Auditors in Public Sector Audit Engagements

Arvind Patel, Associate Professor, University of the South Pacific, School of Accounting and Finance, Faculty of Business and Economics, Suva, LA, Fiji, patel_a@usp.ac.fj, Sharon Wati

The objective of this paper is to examine the difference in the performance of private sector auditors engaged in public sector audits and vice versa. Auditors were required to complete a case study with a series of questions. The results show that private sector auditors performance were significantly less accurate compared to pubic sector auditors in the pubic sector audit task. Similarly, private sector auditors significantly outperformed public auditors in the private sector audit task.

2 - Inoperability Input-Output Model (IIM) with Multiple Expert Distributions

Joost Santos, Research Assistant Professor, University of Virginia, 112 Olsson Hall (400736), Charlottesville, VA, 22901, United States, jrs8e@virginia.edu

The IIM is a tool for analyzing perturbations to a given system and the associated ripple effects. In this paper, the IIM is extended to address perturbations that comprise of multiple expert distributions. The probability densities of ripple effects are generated via Monte Carlo simulation; hence, providing estimates of the mean and extreme values of economic losses and corresponding levels of system inoperability. The method is demonstrated through an oil and gas infrastructure case study.

■ WC15

The Economic Theory of Auctions II

Cluster: Auctions and e-Commerce

Invited Session

Chair: Octavian Carare, The University of Texas at Dallas, carare@utdallas.edu

1 - Discriminatory Pricing Schemes in Ascending Auctions with Anonymous Bidders

Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com, Mohammad Mahdian, K. Talwar, A. Karlin

An auctioneer is selling an unlimited supply of goods to bidders with unit demand through ascending auctions and would like to maximize his profit. We show that discriminatory pricing can not significantly increase the revenue of the seller when bidders are ex-ante identical even if their values are interdependent.

2 - Winner Determination Under Uncertainty

Roy H. Kwon, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, rkwon@mie.utoronto.ca

We consider the winner determination problem under uncertainty for combinatorial auctions. The WD problem under uncertainty is formulated as a multi-stage stochastic integer program. We present both approximation heuristics with worst-case guarantees as well as a novel exact approach based on dual decomposition and column generation.

3 - Monotonicity and Selection of Bidding Equilibria

Vladimir Mares, MARES@WUSTL.EDU

In second price common-value auctions we can identify a continuum of equilibria. This paper identifies conditions under which the set of equilibria is monotone. This allows us to construct selection criteria which identify equilibria for asymmetric cases. The criterion uniquely selects the symmetric equilibrium the symmetric case.

4 - Reserve Prices in Repeated Multi-Unit Auctions: Theory and Estimation

Octavian Carare, The University of Texas at Dallas, carare@utdallas.edu

We estimate the distribution of bidders' valuations for a high-tech product and the sellers' optimal stationary reserve price. A model of search is used to evaluate the effect on bidding of imposing a reserve price. The revenue gain from a reserve price is 25% for a subsample of our auctions.

■ WC16

Revenue Management in the IT Industry

Cluster: Dynamic Pricing and Forecasting

Invited Session

Chair: Laura Wynter, Research Scientist, IBM Research, PO Box 218, Yorktown Heights, NY, 10598, United States, lwynter@us.ibm.com

1 - Revenue Management for the e-Service Industry: Price and Service Level Segmentation

Tieming Liu, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, tieming.liu@okstate.edu, Parijat Dube, Laura Wynter

We study a joint pricing and capacity allocation model for an e-service provider facing multi-type of demands and competitors. We apply the Logit model to describe demand diversions among different service classes and different periods, and we use recent results in queueing theory to approximate the QoS of each service class. Computational analyses are provided to develop insights into the benefits of the yield management model, as well as the impacts of service capacity and demand structure.

2 - Real-Time Yield Management of e-Services

Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, pdube@us.ibm.com, Yezekael Hayel

We propose a framework for real-time yield management of e-services. The framework employs demand forecasting, yield management and customer behavior monitoring modules. The quality of service measure is the expected delay and using queueing theory we model the dependence of the expected delay on the demand, customer choices and providers' capacity. Using numerical examples we show the gain in revenue that can be realised by firms in markets with different buying power of customers.

3 - Offerings and Investment Strategy

Chuck Maniaci, Senior Financial Analyst, IBM Global Technology Services, One Michigan Avenue, Lansing, MI, 48933, United States, cmaniaci@us.ibm.com

We discuss important steps in developing market-based price for IT services. These involve identifying target markets for different types of offerings and then determining customer's willingness-to-pay through market studies. This is then used to construct a market-based price for the offering. We also describe how the on demand pricing structure can provide considerable savings to the customers on their overall IT spending through a case study employing a TCO financial estimate.

■ WC17

Simulation II

Contributed Session

Chair: Javier Faulin, Associate Professor, Public University of Navarra, Department Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es

1 - A Framework for the Modeling and Simulation of Post-Merger Workforce Integration Strategy

Terrill Frantz, Carnegie Mellon University, 5000 Forbes Avenue, School of Computer Science, Pittsburgh, PA, 15213, United States, terrill@cs.cmu.edu

This paper develops a framework for modeling and simulating the integration of two distinct organizations transforming from a pre-merger state to a merged organization. The political and operational structures of the pre-merger groups are captured, then an integration strategy is applied in a stochastic process for the qualitative evaluation of the strategy.

2 - A Simulation of IS Security with Variable Attacker Populations

Norman Pendegraft, University of Idaho, College of Business and Economics, Moscow, 83844-3161, United States, norman@uidaho.edu, Mark Rounds

A simulation of the interaction between an information system, its users, and its attackers is presented. The model extends our earlier work to allow the number of attackers to vary over time. The model displays three types of response: value (the key metric) declines over time, increases over time, or oscillates. There are circumstances in which increasing enforcement is a superior policy to increasing perimeter security.

3 - Overlapping Folded Variance Estimators for Stationary Simulation Output

Melike Meterelliyoz, Graduate Research Assistant, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, mmeterel@isye.gatech.edu, Christos Alexopoulos, Dave Goldsman

We propose a new class of estimators for variance parameter of a steady-state simulation output process. The estimators are computed by averaging "folded" versions of the standardized time-series corresponding to overlapping batches. We establish the limiting distributions of the proposed estimators as the sample size tends to infinity. The new estimators have almost the same bias but smaller variance than their counterparts. Finally, these estimators can be computed with order-of-sample-size work.

4 - Synthesis and Recognition of Malicious Simulation Inputs
Thomas Willemain, Professor, Rensselaer Polytechnic Institute, 2520 Peters Lane, Niskayuna, Niskayuna, NY, 12309, United States, willet@rpi.edu

Simulation inputs can be designed to serve as probes to detect system vulnerabilities. In an offensive mode, one could discover those portions of the input space that would degrade or destroy enemy systems. In a defensive mode, one would like to be the first to discover vulnerabilities in one's own systems to redesign them to be more robust and/or to be able monitor inputs in real time to recognize and thwart attacks. We illustrate these ideas with simulations of simple queues.

5 - Using Discrete Event Simulation to Develop Academic and Research Projects in the Computer Networking
Javier Faulin, Associate Professor, Public University of Navarra, Department Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Joan M. Marques, Norbert Martinez, Angel A. Juan, Alejandro G. Del Valle

This article describes some academic and research experiences, related to the computer network simulation area, that have been developed at the Open University of Catalonia. Firstly, we describe how discrete event simulation can help students to model complex computer networks (including protocols, queuing policies, etc.). Finally, we present a research project where a real network has been simulated with OPNET in order to improve its performance according to the manager specifications.

■ WC18

Risk Analysis

Contributed Session

Chair: Manpreet Hora, Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, N6A 3K7, Canada, mhora@ivey.uwo.ca

1 - Study on a Risk of RFID Technique Innovation
Se Kyoung Youm, Dongguk University, 26,3Pil-Dong, Chung-Gu, Seoul, South Korea, skyoum@dongguk.edu, Sung Ku Cho

So many Companies think that all problems are solved and companies can get economic benefit by introducing RFID technology. However it is impossible for RFID technology to introduce to existing system. In this paper, we study on the risk or barrier elements according to the introducing of RFID system. And we define detail activities about that. It minimizes the risk and offer a strategy of gradual migration and the guide line for construction RFID system.

2 - Strategic Risk Management Framework for Long-Term Service Agreements
Aparna Gupta, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, guptaa@rpi.edu, Chaipat Lawsirirat

Long-term service agreements provided for high-cost and high-tech equipment are getting increasingly popular, however they expose the provider to multiple sources of risks. We develop a strategic risk management framework for assessment and management of risks from single as well as a portfolio of long-term service agreements from a provider's perspective.

3 - Applying Risk Theory and Optimization to Physical Security Decisions
Greg Graves, LTC, U.S. Military Academy, Department of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, gregory.graves@us.army.mil

Physical security systems should prevent or mitigate potentially catastrophic consequences. We present a risk theoretic approach to the selection from among alternative configurations of safeguards. The problem of determining a clear preference among alternatives without a unique probability measure on risk events is considered. Through a novel application of linear programming and sensitivity analysis, insights are gained regarding vulnerability and priorities for information acquisition.

4 - Assessing Construction Defect Risks
Tony Cox, President, Cox Associates, 503 Franklin Street, Denver, CO, 80218, United States, tcoxdenver@aol.com

Construction defects in housing developments can take years to become apparent, yet pose hard-to-estimate threats to human safety, quality of life, and real estate property values. We discuss statistical methods and models for using the partial information available from inspections and failure histories to estimate present and probable future defect rates and to optimize inspection and remediation decisions.

5 - Association Between Non-Recurrent Operational Failures and Performance
Manpreet Hora, Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, N6A 3K7, Canada, mhora@ivey.uwo.ca

The risk of operational failures in firms arises from external events or internally from failure of processes, people and systems. This study focuses on the negative consequences of such failures on performance. Specifically, this study examines non-recurrent events like failed or delayed ERP/CRM/SCM implementations. Using an event study methodology, the results show a significant negative association between these failures and financial performance.

■ WC19

Economic Models of Distributed Energy Resources

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Chung-Li Tseng, Associate Professor, University of Missouri-Rolla, Department of Engineering Management, Rolla, MO, 65409, United States, chungli@umr.edu

1 - Distributed Generation Benefits Under Various Tariff Structures
Ryan Firestone, Research Assistant, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS90R4000, Berkeley, CA, 94720, United States, rmfirestone@lbl.gov, Chris Marnay

The on-site cogeneration of electricity and heat can benefit individual adopters, utility electricity providers, and the greater customer base. However, the benefits are dependent on how the co-generation is dispatched. Economically optimal dispatch, in turn, will depend on both energy prices and tariff structure. This research is a study of the effects of electricity tariff structure on the optimal dispatch of a cogeneration system at an industrial facility in Southern California.

2 - Investing in a Wind Farm Under Electricity Price Uncertainty
Stein-Erik Fleten, Associate Professor, NTNU Norway, IÿT, Alfred Getz v. 3, Trondheim, NO, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Per Christian L Torgersrud, Kim Kross¯y, Bernhard Kvaal

A company holding a license to build a wind farm has the right, but not the obligation, to build a certain capacity of wind power. Assuming that long term electricity prices follow a Brownian motion dynamics, with parameters estimated by considering forward prices of the Nordic electricity market, the value of the investment flexibility is estimated. Investment decisions and wind power values are discussed in terms of a case study from a Norwegian energy company.

3 - Valuing a Natural Gas Storage Facility via a Real Options Approach
Youyi Feng, Associate Professor, The Chinese University of Hong Kong, The Department of SEEM, R609, M. W. Mong Engineering Building, Hong Kong, Hong Kong, yyfeng@se.cuhk.edu.hk, Zhan Pang

We consider valuing a storage facility for an independent and risk-neutral natural gas marketer who plans to own or rent the facility for facilitating gas trading in an energy commodity exchange. We optimize the integrated decisions on gas trading and storage operations over a finite or an infinite horizon by switch-curve policies. We assess the capacity investment of a storage and a long-term renting agreement with the storage owner, respectively.

■ WC20

Solution Techniques II in Decision Analysis

Contributed Session

Chair: Xiongfei Zhang, National Defense University, Haidian District, Red Hill A3, Beijing, China, zhang.xiong.fei@163.com

1 - Quantifying and Mitigating Splitting Biases in Value Trees
Sarah Jacobi, PhD Candidate, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, skjacobi@jhu.edu, Ming-Che Hu

Two models are used to estimate and correct splitting biases resulting from value tree weight elicitation. The models assume subjects use the "anchor-and-adjust" heuristic. Using two trees, two weight sets are elicited from electric utility managers. Both models support the hypothesis that splitting biases exist, but they result in different sets of corrected weights. Implications for rankings are analyzed.

2 - Dynamic Pricing and Warranty Policies for Products with Fixed Lifetime
Sherry Z.F. Zhou, Assistant Professor, City University of Hong Kong, 83 Tat Chee Avenue, Kowloontong, Kowloon, Hong Kong, zhefzhou@cityu.edu.hk

Product warranties have been an integral part of production and marketing strategies for a manufacturer to gain market shares and control quality related costs. Effective design of warranty policies is crucial for a manufacturer to succeed in today's competitive world. In our paper, we develop a mathematical model to investigate a policy that jointly considers dynamic pricing and warranty length for a repairable high-tech product over its effective lifetime.

3 - Group Information Seeking Behavior in Emergency Response
David Mendonca, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States, mendonca@njit.edu, Qing Gu

Emergencies require coordination and shared responsibility by response personnel in order to find information and make decisions, often under conditions of risk and time pressure. This paper develops a theory that explains how risk, time pressure, and differential distribution of information influence how groups seek for and process information during emergency response, leading to a model that yields a set of testable propositions for future research.

4 - Product Introduction with Options of Information Acquisition and Market Withdraw
Yongquan Li, Hong Kong University of Science & Technology, IELM, HKUST, Clear Water Bay, Kowloon, yqli@ust.hk, Kaijie Zhu

We consider a company that plans to introduce a new product but faces much uncertainty about the market demand. Because costly forecasts are available from outside experts, to balance the benefit and the cost of acquiring such forecasts, the company needs to determine the number of experts to hire. We analyze and compare two approaches: The company decides the number all at once or hires experts sequentially and makes a decision on whether to hire an additional one.

5 - Research on the Coordination Models of Organizational Decision
Xiongfei Zhang, National Defense University, Haidian District, Red Hill A3, Beijing, China, zhang.xiong.fei@163.com, Shaojun Liu

The integration of decision making is the requirement of the advanced organizational decision, and the coordination of decision making is the direct way to the integration. We investigated the bi-level structure of the organizational system. Based on the information exchange among the two levels and different components in the lower level, we constructed four basic models and one popular transformation of the coordination of organizational decision.

■ WC21

Hypergame Theory - Reasoning and Context

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Russell R. Vane III, Senior Researcher, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, russ.vane@gd-ais.com

1 - Hypergame Normal Form
Russell R. Vane III, Senior Researcher, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, russ.vane@gd-ais.com

An extension of original hypergame theory is presented in a normal form for recording competitive problem semantics. These semantics include: possible situations and "own" options, surmised contexts of the other players, as well as our beliefs about evidence and expected outcomes. The result is an effectiveness measure, Hypergame Expected Utility (HEU), for all "own" options over uncertainty.

2 - Using Hypergames to Analyze Situations Involving Denial and Deception
Michael Bennett, Principal Analyst, Jasmah Consulting, Inc., VA, United States, cynicalmass@verizon.net

The aim of strategic and tactical deception operations is to distort the target's perceptions of reality in order to influence his actions in a way that benefits the deceiver. Using the Fall of France in World War II as an example, this presentation examines the use of Vane's hypergame approach as a means of modeling situations that involve strategic deception and demonstrates how hypergames can be used both as an aid to deception planning and as a counterdeception tool.

3 - Methodological Issues for Hypergames
Douglas Griffith, Cognitive Scientist, GDAIS, 1400 Key Boulevard, Arlington, VA, 22209, United States, douglas.griffith@gd-ais.com

This presentation provides an overview of common human information processing biases that can adversely affect Hypergame inputs. It provides methodologies for mitigating or eliminating these biases. The techniques vary depending upon the time and resources available. Even with simple techniques, Hypergames provide a useful analytic tool. However, the quality of Hypegame outputs should vary as a function of the quality of the inputs.

4 - The Hyper-Hypergame and Evidence-Based Evaluation
Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

As models' complexity approaches that of the actual systems of interest, traditional methods of validation are often ineffective or ethically indefensible. These difficulties force us to reconstitute our methods of assessing the quality of models and evidence. Extending hypergame analysis and integrating it with recent advances in philosophy of science help to address such issues.

■ WC22

Analysis for Defense Transformation I

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, SAIC, Gregory.h.parlier@saic.com

1 - Recruiter Selection Model and Implementation within the United States Army
John Halstead, Assistant Professor, U.S. Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, john.halstead@usma.edu

MG Bostick, Commanding General of the U. S. Army Recruiting Command, began a new method of selecting individuals from within the Army for recruiting duty. Previously, the Army assigned successful Non-Commissioned Officers, regardless of inherent sales and marketing skills, into the recruiting force. The new selection model applies statistical learning using NLSI and biographical data to determine the best Non-Commissioned Officers for recruiting duty.

2 - Army Process Optimization Model - Active Enlisted (APROM-AE)
BJ Thornburg, President, MAT Inc., 5 Pritchard Court, Stafford, VA, 22554, United States, ThornBJ@mat-inc.net

The Army Accessions Command (USAAC) was established with to manage soldier accessions from "First Handshake" to "First Unit." USAAC's mandate is to make the process more efficient and effective to field an Army transforming while at war. The APROM-AE models the enlisted accessions process with unique characteristics of each process to optimize enlisted recruiting and initial training. It is designed to enable USAAC to evaluate business policies and practices to improve the accessions system.

3 - Posttraumatic Stress Disorder (PTSD) Treatment Algorithm
Dean Hartley, Principal, Hartley Consulting, 106 Windsong Lane, Oak Ridge, TN, 37830, United States, DSHartley3@comcast.net

PTSD affects both civilians and military personnel and is of concern to the international health community. The International Psychopharmacology Algorithm Project (IPAP) is using OR in creating treatment algorithms for mental disorders, including PTSD. The PTSD algorithm will be described, along with lessons learned about the algorithm creation process.

4 - U.S. Army Deploys Lean Six Sigma
Doug Matty, US Army, 101 Army Pentagon, Suite 5D562, Washington, DC, 20310, United States, douglas.matty@us.army.mil

As part of the U.S. Army's business transformation, Lean Six Sigma is being used as a forcing function to drive increased operational performance and efficiency. This is the largest organizational deployment of analysis-based operational excellence in the history of management science. This presentation will focus on the organizational infrastructure and policy that guides this critical imperative for the success of the Army in accomplishing its missions.

■ WC23

Semiconductor Manufacturing

Contributed Session

Chair: Banu Gemici, PhD Candidate, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, bag4@lehigh.edu

1 - Throughput Capacity Analysis of AMHS in 300mm Wafer Fabs
Dima Nazzal, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, dnazzal@isye.gatech.edu, Leon McGinnis

We explore analytical models useful in the design of vehicle-based Automated Material Handling Systems to support semiconductor manufacturing. This analysis proposes a computationally effective analytical approach to multi-vehicle AMHS performance modeling. A probabilistic model is developed, based on a description of AMHS operations, and the system is analyzed as an extended Markov chain. The model tracks the operations of vehicles on the loop considering the possibility of vehicle-blocking.

2 - Data-Driven Queueing Models of Semiconductor Manufacturing Systems

Shengwei Ding, Post-Doc, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, dingsw@cal.berkeley.edu, George Shanthikumar, Mike Zhang

Classical queueing models built on independence and stationary assumptions have not been accurate in estimating the cycle time in semiconductor manufacturing. Due to the complexity in the production process, the general assumption of the independence between the arrival and the service process is violated. We use real fab data to analyze the correlations between these two processes and their impact on cycle time. We then bring forward a new model to estimate the cycle time more accurately.

3 - Evaluating Lot Allocation Policies in Semiconductor Supply Chains

Yang Sun, PhD Candidate / Research Associate, Department of Industrial Engineering, Arizona State University, PO Box 87-5906, Tempe, AZ, 85287, United States, yang.sun@asu.edu, John Fowler, Dan Shunk

A set of composite-allocation-rule-based procedures is evaluated for the generalized lot allocation problem in semiconductor supply chains in order to improve service quality and to reduce allocation cost. The composite allocation rule is parameterized via a statistical model. The procedures are compared with optimization-based allocation methods as well as elementary heuristics. Computational experimental results are reported to illustrate the quality, cost and robustness of the solutions.

4 - Hidden Efficiency in Vehicle Dispatching for a Semiconductor FAB

Jae-joon Shin, Graduate Student, POSTECH, IME, San 31 Hyoja-Dong, Pohang, 790-784, South Korea, redguy@postech.ac.kr, Sangwon Jeong, Byung-In Kim

Reassignment based vehicle dispatching rules are proposed for a semiconductor FAB, which consists of 18 bays, 468 equipments and uses more than 150 overhead hoist transporters. The rules are designed to reduce the average lead time of load transfer and the variation of lead time. The proposed rules compare much favorably with traditional dispatching rules such as shortest travel distance first rule, in the number of vehicles required, the average lead time, and the variation of the lead time.

5 - RD Project Portfolio Analysis for the Semiconductor Industry

Banu Gemici, PhD Candidate, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, bag4@lehigh.edu, Jeffry Moore, Jeff Linderoth, David Wu

We introduce a three-phase, decision support system for a U.S. major semiconductor manufacturer's strategic project selection problem. Key characteristics of our DSS are 1) Qualitative data and foresight of high-level executives are input to portfolio selection problem, 2) A multistage stochastic program is solved to obtain the best portfolio and optimal level of resources for the horizon, and 3) Optimal portfolio is constructed considering risk of the projects.

■ WC24

Supply Chain Inventory Management

Contributed Session

Chair: Richard Cho, Assistant Professor, University of New Brunswick, Faculty of Business, PO Box 5050, Saint John, NB, E2L 4L5, Canada, rcho@unbsj.ca

1 - Shelf Space Management Through Retailer-Manufacturer Coordination

Ajay Mishra, Associate Professor, SUNY Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

Shelf space in a store is a scarce resource that a retailer must use well for higher profit and customer satisfaction. Manufacturers market their products aggressively to get more space for their product line. A retailer must assign shelf space to the assortment in a category by balancing the many marketing and operations constraints. We study how a retailer makes room on the shelf for a product while coordinating with a manufacturer.

2 - Retailer Inventory Reporting in Inventory-Replenishment and Allocation Decisions

Xin Zhai, Krannert School of Management, Purdue University, West Lafayette, IN, 47907, United States, xzhai@purdue.edu

We study retailer inventory reporting in a one-warehouse N-retailer distribution system, particularly retailer truth-telling at the times of allocation and system replenishment, under different information scenarios. We compare the incentives of independent retailers attempting to minimize their expected costs with those in a centralized system. We also develop an efficient mechanism to induce retailer to tell the truth so that the system best can be achieved in the decentralized system.

3 - Approximate Dynamic Programming for Optimal Material-Dispatching in Vendor-Managed Inventory Systems

Abhijit Gosavi, Assistant Professor, University at Buffalo, SUNY, 317 Bell Hall, Buffalo, NY, 14260, United States, agosavi@buffalo.edu, Zheng Sui, Li Lin

We develop an approximate dynamic programming approach to solve the problem of dynamically selecting the optimal number trucks in a vendor-managed inventory system. The underlying semi-Markov decision problem, whose transition probabilities are hard to determine, is solved via a reinforcement learning (approximate dynamic programming) algorithm that employs a vanishing discount factor.

4 - Coordination Between a Retailer and a Manufacturer Under the Price-Dependent Demand

Jungkyu Kim, Doctoral Student, Division of Mechanical and Industrial Engineering, Postech, San 31, Hyoja, Pohang, 790-784, South Korea, m819@postech.ac.kr, Yushin Hong

We study pricing and lot-sizing policies between a retailer and a manufacturer. Demand at the retailer is constant over time, but it is decreasing in retail price. A procedure is developed for finding the optimal retail price and lot-sizings for the manufacturer and the retailer.

5 - The Effect of the Inventory Reduction Level on the Supply Chain Profit Under the VMI Contract

Richard Cho, Assistant Professor, University of New Brunswick, Faculty of Business, PO Box 5050, Saint John, NB, E2L 4L5, Canada, rcho@unbsj.ca

The VMI contract changes the inventory strategy for SCM. A big retailer deals with many items and simply uses the VMI to reduce its inventory burden. Thus, the big retailer which plays a buyer's role is not tempted to introduce an ambiguous coordination scheme when it moves to a new VMI system. Instead, the retailer enforces the reduced maximum inventory level to the supplier. This research determines the effect of the enforced reduction of inventory level on the profit of buyer and supplier.

■ WC25

Industry Applications II

Contributed Session

Chair: Moshe Rosenwein, Novartis, One Health Plaza, East Hanover, NJ, United States, moshe.rosenwein@novartis.com

1 - Pallet Tracking Method Based on RFID

Hye-Jin Lee, Researcher, ETRI, Postal Technology Research Center, 161 Gajeong-dong, Yuseong-gu, Daejeon, 305-700, South Korea, lhjin@etri.re.kr, Hong-Suk Hu

In this paper, pallet tracking method utilizes patterns and rules about trajectories of the pallet. The trajectories are created by predefined query about RFID data. The patterns are extracted from the trajectories and the rules are applied to the patterns. This method enables efficient and intelligent management of pallet without intervention of manager. Also it reduces false-dispatch and false-arrival since it can monitor real-time state of pallet.

2 - Robust Design Methodology and Applications of Automobile Occupant Restraint System Design

Yan Fu, Technical Expert, Ford Motor Company, 2101 Village Road, MD 2115, RIC-2112, Dearborn, MI, 48124, United States, yfu4@ford.com

With emphasis on product quality and consistency of product performance, variations in modeling, simulation, and manufacturing, need to be considered for product development in the automotive industry. This paper will present an integrated robust design methodology, which takes advantages of design of experiments, variable screening, meta-modeling, and genetic algorithm. A real world case study on occupant restraint system design is used as an example to demonstrate the methodology.

3 - Forecast Support Systems for Intermittent Demand Items

Aris Syntetos, Assistant Professor, University of Salford, Salford Business School, Maxwell Building, Salford, M5 4WT, United Kingdom, a.syntetos@salford.ac.uk, Kostas Nikolopoulos, I John Boylan, Robert Fildes, Paul Goodwin

This study evaluates the forecasting and stock control implications of judgementally (qualitatively) adjusting statistical forecasts. In particular, the case of intermittent demand items is considered, where demand occurs at random with some time periods showing no demand at all. The empirical database used for simulation purposes consists of the demand histories of 138 SKUs.

4 - Applications of Management Science in the Pharmaceutical Industry
Moshe Rosenwein, Novartis, One Health Plaza, East Hanover, NJ, United States, moshe.rosenwein@novartis.com

The pharmaceutical industry spends billion of dollars annually on sales force and marketing promotions. Measurement of each tactic's return on investment is critical to resource allocation decision making. This talk reviews common pharmaceutical marketing and sales business decision problems such as sales force call planning, TV direct-to-consumer (DTC) advertising effectiveness, and physician (customer) segmentation. These problems lend themselves to management science models and methods.

■ WC26

Data Mining in RFID Applications

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Bruno Agard, Assistant Professor, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, QC, H3C 3A7, Canada, bruno.agard@polymtl.ca

Co-Chair: Martin Trépanier, Department of Mathematical and Industrial Engineering, Polytechnique Montréal, martin.trepanier@polymtl.ca

1 - Mining Weather Influence on Transit Travel Behaviour
Bruno Agard, Assistant Professor, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, QC, H3C 3A7, Canada, bruno.agard@polymtl.ca, Catherine Morency, Martin Trépanier

The authors propose to link information contained in Smart Card Automated Fare Collection Systems with meteorological data to see if weather influences the use of public transportation. To better understand these impacts, a 10-month period of city bus network data (6 millions boardings) is analyzed using various data mining techniques.

2 - Data Mining Scheduling Data: Identifying Best Practices
Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu, Xiaonan Li

To compliment traditional scheduling models, data mining can be used to discover new knowledge directly from production schedules that are created by expert schedulers. However, to achieve the full benefits only the best scheduling practices should be used. In this talk we show how to combine optimization and data mining to identify best practices from which new scheduling knowledge can be discovered.

3 - A Data Mining Methodology for Product Design Support
Rakesh Nagi, Professor, Department of Industrial & Systems Engineering, 438 Bell Hall, University at Buffalo (SUNY), Buffalo, NY, 14260, United States, nagi@buffalo.edu, Carol Romanowski

Product designers often end up "reinventing the wheel" because they cannot find previous work that would aid in designing a new product. These challenges can be met by employing data mining methods on existing documents such as bills of material. We present a manufacturing case study using tree mining, tree union procedures, and constrained XML for information modeling. We also identify new research directions for data mining motivated by engineering design and information technology.

■ WC27

Joint Session QRS/Health Applications: Quality and Statistical Decision-Making in Healthcare Applications IV

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Research Assistant, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, jinglz@engin.umich.edu

Co-Chair: Julie Simmons Ivy, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, jsimmons@bus.umich.edu

Co-Chair: Nicoleta Serban, Assistant Professor, ISyE, Georgia Institute of Technology, 755 Ferst Drive NE, Atlanta, GA, 30332, nserban@isye.gatech.edu

1 - Nursing Home Quality Assessment Scorecard
Jenya Antonova, University of Wisconsin-Madison, 1175 WARF Building, 610 Walnut Street, Madison, WI, 53726, United States, Jenya_Antonova@chsra.wisc.edu, David Zimmerman

Quality of care scorecards are increasingly used as part of an overall Balanced Scorecard approach to nursing home performance. The concept of a multi-dimensional nursing home Quality of Care Scorecard is introduced. Illustrative data from several nursing home networks are presented.

2 - Improving Quality of Care and Revenue Management at the Indiana University Medical Group
John Norris, Doctoral Candidate, Purdue University, Krannert School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, norrisjb@purdue.edu, Herb Moskowitz, Suresh Chand, Deanna Willis

With healthcare costs exceeding 15% of the US economy and rising and unpaid medical bills the leading cause of personal bankruptcy in America, costs are reaching epidemic proportions; yet some facilities are not fully utilized. Scheduling physicians and reserving appointments to meet demand can both improve care by providing care when it is needed and reduce costs by better utilizing existing resources. Historical registration data of demand patterns and simulation models will be discussed.

3 - Reducing Infection Transmission in the ICU: Using a System Level Model
Shreyas Limaye, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98116-2650, United States, shreyas@u.washington.edu, Christina Mastrangelo

This study takes a systemic view at the operational level of ICU in order to reduce transmission of Hospital-associated infections. It suggests an integrated methodology that combines cognitive modeling, simulation, risk analysis and generalized linear models to improve the quality of healthcare provided at the Children's Hospital, Seattle.

4 - Machine Maintenance and The Optimal Scheduling of Drug Therapies
Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca, Andrew Schaefer, Matthew Bailey

We begin by describing a machine maintenance problem that seeks to extend the lifetime of a system with one vital component and a finite number of iid spares. We then extend the framework to consider a patient faced with a finite number of drug therapies which may not be identically distributed. We discuss structural properties of the problem and a dynamic programming algorithm for finding the optimal sequencing of therapies and time to spend on each therapy.

■ WC28

Sensor Systems II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, szhou@engr.wisc.edu

1 - Sensor Fault Detection in Presence of Model Specified Manufacturing Process Faults
Shan Li, University of Iowa, Department of Mechanical and Industrial Engineering, Iowa City, IA, 52242, United States, shanli@engineering.uiowa.edu, Yong Chen

This paper proposes a W control chart to detect the sensor mean shift faults in discrete manufacturing processes based on a linear fault-quality model. The sensitivity of the W chart to the occurrence of sensor faults is studied. A parameter called sensitivity preserving ratio (SPR) is used to evaluate the sensitivity of the control chart. In comparison with the control chart directly monitoring the product quality characteristics, our W chart can separate sensor faults from the process faults.

2 - Influence of Sensor Noise in Regression Adjustment Method for Quality Control
Li Zeng, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Mechanical Engineering Building, Madison, WI, 53706, United States, lzeng1@wisc.edu, Shiyu Zhou

In the regression adjustment method, one can choose to monitor the residual resulted from the adjustment for all possibly related variables or monitor that from the adjustment for an directly influential subset identified through a model selection procedure. In this paper, it is shown theoretically that when sensor noise is negligible, these two kinds of adjustment are equivalent. Otherwise the first adjustment will lead to higher false alarming rate and lower detection rate.

3 - Route Discovery and Throughput Capacity of Ad Hoc Wireless Networks

Eugene Perevalov, eup2@lehigh.edu, Rick Blum, Xun Chen

Throughput capacity of large ad hoc networks has been shown to scale adversely with the size of network. However the need for the nodes to find or repair routes has not been analyzed in this context. In this paper, we explicitly take route discovery into account and obtain the scaling law for the throughput capacity under general assumptions on the network environment, node behavior, and the quality of route discovery algorithms.

4 - Blind Sequential Identification of Manufacturing Variation Sources

Dan Apley, Associate Professor, Northwestern University, IE/MS, 2145 Sheridan Road, Evanston, IL, 60208, United States, apley@northwestern.edu, Xuemei Shan

Blind source separation is a new tool for identifying and eliminating major sources of variation in multivariate manufacturing processes. One recent algorithm combines different separation criteria to minimize mean square error. We propose a sequential method for separating the sources that achieves better estimation accuracy than the optimal "all-at-once" approach.

■ WC29

Continuous Optimization

Contributed Session

Chair: Ronny Luss, Princeton University, Department of Operations Research & Financial Engineering, Engineering Quadrangle, Princeton, NJ, United States, rluss@princeton.edu

1 - An Analytic Center Cutting Surface Method: Complexity and Application

Mohammad Oskoorouchi, Assistant Professor, California State University at San Marcos, 333 Twin Oaks Valley Road, San Marcos, CA, 92081, United States, moskooro@csusm.edu, John Mitchell

We present an analytic center cutting surface algorithm that uses multiple second-order cone cuts. Theoretical issues and applications of this technique are discussed. We discuss the complexity of recovering the analytic center after adding multiple second-order cone cuts, and show that the overall algorithm is fully polynomial. Computational experience with randomly generated problems of moderate to large size are presented and compared with that of SDPT3.

2 - Some Recent Results on Merit Functions for the Second-Order Cone Complementarity Problem

Jein-Shan Chen, Assistant Professor, Department of Mathematics, National Taiwan Normal University, 88 Sec. 4, Ting-Chou Road, Taipei, 11677, Taiwan, jschen@math.ntnu.edu.tw

Like the nonlinear complementarity problem (NCP) and the semidefinite complementarity problem (SDCP), a popular approach to solving the second-order cone complementarity problem (SOCCP) is to reformulate the SOCCP as an unconstrained minimization problem via certain merit functions. In this talk, we will study some merit functions for the SOCCP and their related properties including error bounds and bounded level sets.

3 - A Derivative-Free Trust-Region Method for Engineering Optimization

Rommel Regis, Cornell Theory Center, 626 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, rgr6@cornell.edu, Stefan Wild, Christine Shoemaker

We implement a derivative-free trust-region optimization method that utilizes a radial basis function (RBF) interpolation model. We compare the performance of our algorithm to alternative optimization methods on several test problems and on an environmental engineering application.

4 - Matrix Exponential Computations for Semidefinite Programming

Ronny Luss, Princeton University, Department of Operations Research & Financial Engineering, Engineering Quadrangle, Princeton, NJ, United States, rluss@princeton.edu, Alexandre D'Aspremont

We examine a first order method for solving semidefinite programs which arise in relaxing the hard sparsity constraint in sparse PCA. Matrix exponentiation is the most computationally intensive step in the method and, when results do not require machine precision (as is the case here), the common Pade approximation to the exponential may not be the most competitive method. We discuss Pade and two additional approximations - partial eigenvalue decompositions and Pade-Chebyshev approximations.

■ WC30

Queueing & Stock Models

Contributed Session

Chair: Kai Huang, Research Associate, University of Arizona, Room 111, 1127 E. North Campus Drive, Tucson, AZ, 85721, United States, kaih@tucson.sie.arizona.edu

1 - Flexible Servers in Non-Markovian Lines with Finite Buffers

Eser Kirkizlar, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, eser@gatech.edu, Sigrún Andradóttir, Hayriye Ayhan

We study the assignment of flexible servers to stations in tandem lines with finite intermediate buffers and service times that are not necessarily exponentially distributed. We obtain theoretical results for systems with two stations and two or three flexible servers. For bigger systems, we propose several heuristic server assignment policies and show that they yield near optimal performance for different service time distributions.

2 - Sensitivity in Retrial Queues Under QED Scaling

Rui Kang, Lehigh University, 2 Duh Drive, Apt. 224, Bethlehem, PA, 18015, United States, ruk2@lehigh.edu, Andrew Ross

We study sensitivity to distribution changes in multiserver retrial queues under QED (square-root) scaling. We focus on M/M/s+PH-retrials and M/PH/s+M-retrials systems. We find counterintuitive behavior for the blocking probability—it can get better as the retrial distribution increases in variance, for some retrial rates.

3 - Recent Proceedings on the Probabilistic Traveling Salesman Problem

Zehra Akyurt, Graduate Student, University of Maryland, 3116 Gershwin Lane, Silver Spring, MD, 20904, United States, zakyurt@umd.edu

The Probabilistic Traveling Salesman Problem (PTSP) assigns an apriori tour to a finite group of nodes within a bounded region whose occurrences are known only probabilistically beforehand. We show that the a priori tour is asymptotically as reliable as a reoptimization scheme, and we extend previous results to include asymptotic analysis of situations with non-identical node occurrence probabilities.

4 - Stochastic Application in the International Shipping Environment

Wen Chen, PhD Student, Rutgers Business School, 2nd Floor, 617 Central Avenue, Harrison,, NJ, 07029, United States, echodrawing@yahoo.com, Michael Katehakis

The research discusses stochastic application in the international shipping environment. Random demands generates in USA. Companies put their production section in China. The price of products will be decreased with the waiting time of customers because of modern rough business competition. Our research forces on finding the optimal shipping time.

5 - Partially Observable Network Interdiction Problem

Kai Huang, Research Associate, University of Arizona, Room 111, 1127 E. North Campus Drive, Tucson, AZ, 85721, United States, kaih@tucson.sie.arizona.edu, Suvrajeet Sen

We study a network interdiction problem where the attacker does not have the same information as the defender of the network. The attacker has the option to obtain more information at a cost. This problem can be modeled using alternative paradigms, such as multistage stochastic programming and Markov Decision Processes. Comparisons between these approaches are discussed.

■ WC31

Finance-Risk Management II

Contributed Session

Chair: Mohamed Wahab Mohamed Ismail, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, wahab@mie.utoronto.ca

1 - Dynamic Financial Planning for a Household in a Multiperiod Optimization Approach

Norio Hibiki, Associate Professor, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, 223-8522, Japan, hibiki@ae.keio.ac.jp, Katsuya Komoribayashi

Financial planning tools can be used for giving a financial advice for a household. We describe the multiperiod optimization model to determine an optimal set of asset mix, life insurance and fire insurance in conjunction with wage income, survivor's pension, consumption, home buying strategy, and life plan of a household. Some practical examples are solved to illustrate optimal financial plans.

2 - Integrating Optimal Annuity Planning with Consumption-Investment Selections in Retirement Planning

Zhisheng Li, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, liz4@rpi.edu, Aparna Gupta

This paper develops a framework which merges annuity purchase decisions with consumption-investment selections in retirement planning. A multi-period wealth evolution model is constructed based on an annuity pricing model, a benefit payment model, and an income model. An optimization problem is formulated with an objective of maximizing life time utility of consumption and wealth.

3- On Loan-to-Value Ratios of Inventory Financing with Doubly Stochastic Poisson Default Processes

Yixue Li, School of Management, Xi'an Jiaotong University, 1679 Mailbox, Xi'an Jiaotong University, Xi'an, 710049, China, liyixue@mail.xjtu.edu.cn, Gengzhong Feng, Yu Xu, Wenqiang Dai

This paper assumes that the default of the enterprise is exogenous and follows a doubly stochastic poisson process, and then provides a model on the determination of loan-to-value ratios for banks. In this model, some factors, such as risk appetite of banks, frequency of marking to market and maturity time of loan, are considered synthetically, so banks may determine appropriate loan-to-value ratios of particular inventory financing operation to keep the level of taken risk consistent.

4 - Swing Option Valuation in Electricity Market

Mohamed Wahab Mohamed Ismail, PhD Student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, wahab@mie.utoronto.ca, Zhijian Yin

The spot electricity market is very volatile. The time series of the daily averaged electricity price are characterized by the seasonality, mean reversion, jumps, and regime-witching process. In this paper, first we develop a lattice approach to model the daily averaged price of electricity with a regime-switching process that utilizes three regimes, which consist of Brownian motions and a mean reverting process. We then present some numerical examples.

■ WC32

Supply Chain Risk Management I

Contributed Session

Chair: Laird Burns, Michigan State University, N370 North Business Complex, Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu

1 - The Loss-Averse Newsvendor Problem

Charles Wang, Assistant Professor, SUNY at Buffalo, 326 M Jacobs Management Center, Buffalo, NY, 14260, United States, cxwang@buffalo.edu, Scott Webster

This research models manager's decision-making behavior in the single-period newsvendor problem within the Prospect Theory framework. We find that if shortage cost is not negligible, then a loss-averse newsvendor may order more than a risk-neutral newsvendor. We also find that the loss-averse newsvendor's optimal order quantity may increase in wholesale price and decrease in retail price, which can never occur in the risk-neutral newsvendor model.

2 - Measuring Risk in Operational Hedging

Rockey Myall, PhD Student, Lehigh University, 200 West Packer Avenue, Room 354, Bethlehem, PA, 18015, United States, rrm204@lehigh.edu, Aurelie Thiele

We investigate models of operational hedging for a multinational company subject to demand and exchange rate uncertainty. We study how the choice of the risk measure impacts the decision-maker's strategy when the underlying probabilities are available and extend the analysis to the case where the distributions are not known precisely.

3 - Optimal Dynamic Procurement Portfolio with Capacity Options Contracts

Huifen He, Chinese University of Hong Kong, Chiangs Building Room 2703, Hong Kong, Hong Kong, hfhe@se.cuhk.edu.hk, Youyi Feng

This paper studies a multi-period inventory system that replenishes its stock by ordering one-period forwards and if necessary one-period-expiry options contracts. We explore how the inventory system and its supplier under consideration optimize their operations decisions respectively over the planning horizon while the parameters of the options contracts are prespecified. Then, we discuss how the options contracts can be sealed in a mutually agreeable manner.

4 - Multi-Period Risk-Averse Inventory Models: Fast Operational and Slow Financial Reporting Cycles

Lijun Ma, PhD Candidate, Department of Systems Engineering & Engineering Management, The Chinese University of Hong Kong, Hong Kong, Hong Kong, ljma@se.cuhk.edu.hk, Houmin Yan

We study a multi-period risk-averse inventory model with an additive utility function where the inventory decision is faster than the financial reporting cycle. We study the problem under both accrual- and cash-basis accounting schemes. We prove that the optimal inventory policy under accrual-basis accounting is state- dependent base-stock policy. We then show that the complexity of the optimal policy under cash-basis accounting.

5 - Visibility in Demand and Supply Networks: Effects of Risk Propagation on Firm Performance

Laird Burns, Michigan State University, N370 North Business Complex, Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu

Visibility in demand and supply networks has important information effects in variance reduction. Research on the role visibility plays in mediating firm performance is limited. This study uses empirical case research and agent based modeling to investigate the effects of risk factors on firm performance within multi-echelon networks, based on modularity and interactive effects from the literature. A framework is developed to build theory on properties of risk propagation in such networks.

■ WC33

Airline Industry Applications II

Sponsor: Aviation Applications

Sponsored Session

Chair: Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams Street, Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

1 - Aircraft Boarding Strategies: A Simulation Study

Massoud Bazargan, bazargam@erau.edu, Victor Cole, Juan Ruiz

This paper simulates the boarding strategies in use today by major airlines. To properly simulate the boarding process, the simulation model accounts for passenger interferences, baggage stowage, and the passenger arrival rate. We applied our simulation model to study the AirTran Boeing 737-700 short haul aircraft. We looked at five major boarding strategies from random to the customary back to front. Our analyses identifies that the arrival rate has an effect on the total boarding time and that the reverse pyramid and window middle aisle were among the efficient boarding strategies.

2 - Equitable Airport Flight Scheduling Using Airline Costs

Maarten Soomer, PhD Student, Vrije Universiteit, Amsterdam, the Netherlands, National Aerospace Laboratory NLR, Amsterdam, Netherlands

Arrival and departure delays have a large impact on airline operations. There is dependency between arriving and departing flights (crew, aircraft and transfers). We introduce a model to tactically schedule flights on an airport. Airlines provide cost functions related to delays and to represent the dependency between their flights. A scaling method for the costs is introduced to ensure equity. Our formulation will assign landing and take-off times to the flights, while taking costs into account.

3 - Solving Airline Scheduling Problems with Benders Decomposition

Yufeng Yao, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, Özlem Ergun, Ellis Johnson

One of the major objectives for airline scheduling is to cover all customer demand with minimum operating costs and high utilization of its resources. We propose an integrated model and solution methodology to simultaneously solve the fleet assignment, aircraft routing, and crew scheduling problems. For small size instances, column generation can be used. However, for larger size instances, the Benders decomposition gives more efficient and effective results.

■ WC34

Dynamic Traffic Network Modeling Advances I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafatas@gmail.com

1 - A Graph Theoretic Version of the Cell Transmission Model: The Single Destination Case
Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafat@purdue.edu, Srinivas Peeta

The cell transmission model (CTM) has been used in the past to develop a linear formulation for the single destination dynamic traffic assignment problem, and show the existence of a minimum cost flow sub-structure. Here, the fundamental equations of the CTM are revisited to develop a complete graph structure. The trade-offs between modeling accuracy and computational benefits are highlighted and key properties like uniqueness are addressed in graph theoretic terms.

2 - A Graph Theoretic Version of the Cell Transmission Model: The Multiple Destination Case
Georgios Kalafatas, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States, gkalafatas@gmail.com, Srinivas Peeta

The existence of a graph theoretic version of the cell transmission model has shown the potential of significant computational benefits for the single destination case. In order to model multiple destinations for different user classes, the FIFO property has to be "strongly" satisfied at the expense of computational complexity. The new formulation corresponds to a mixed-integer multiple destination network design problem.

3 - Traffic Assignment Subjected to Additional User Constraints
Deepak Kumar, dkumar@mail.utexas.edu, S. Travis Waller

This paper studies the traffic assignment problem subjected to additional user constraints. In this problem, the additional constraints imposed by the users are the deadlines for reaching their respective destinations. A simple attempt to solve the problem includes using the time constrained shortest path problem as the subproblem under frank wolfe algorithm. The properties of the problem will be discussed and the preliminary results obtained will be presented.

■ WC35

Urban Transportation Planning Models X: Day-to-Day Planning Models

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu

1 - On the Stability of User Equilibria in Static Transportation Networks with Fixed Demand
Wen-Long Jin, Associate Professor, University of Science and Technology of China, Department of Automation, PO Box 4, Hefei, AH, 230027, China, wljin@ustc.edu.cn

The stability of a user equilibrium determines whether it can be realized or sustained in a transportation network. Based on a simple deterministic dynamical system model of the traffic assignment problem, we present a systematic approach to analyzing asymptotic stability and instability of user equilibria in static transportation networks with fixed demand and discuss an example of a non-monotone multiclass traffic assignment problem. The results are consistent with those in the literature.

2 - Modeling of Commuters' Learning Behavior: An Application to NJ Time-of-Day Pricing Program
Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu, Ozlem Yanmaz-Tuzel

Stochastic Learning Automata (SLA) is used to model commuters' day-to-day learning behavior. Stochastic nature of the system and heterogeneity among users are considered by combining Bayesian Learning approach with the SLA. The proposed model aims to capture the commuters' departure-time choice learning behavior both under undisturbed and disturbed network conditions and to investigate responses to toll, travel-time, departure/arrival time restrictions while selecting their departure-times.

■ WC36

Military Applications I

Contributed Session

Chair: Niki Goerger, ERDC Research Associate at USMA, Engineer Research and Development Center, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu

1 - A Planning and Control Architecture for Multi-Element Defensive Systems
George Mayernik, Manager III Systems Engineering, Raytheon Company, 235 Presidential Way, MS 26/3127, Woburn, MA, 01801-1060, United States, George_E_Mayernik@raytheon.com, Jarrod Kallberg

This paper discusses the applicability of deliberate, reactive, and hybrid planning methodologies commonly used in robotics to planning for military defense systems. Much like modern robots, defense systems must interact with the world in real time and must deal with plans that go awry. Furthermore, both are becoming more complex, flexible, multi-function, and interconnected. In addition to theoretical concepts, example applications are presented for single systems and "systems-of-systems".

2 - BotEC - Back of the Envelope Calculations
William West, Weapon Delivery, Air Force SEEK EAGLE Office, 205 West D Avenue, Suite 348, Eglin AFB, FL, 32542-6865, United States, william.west@eglin.af.mil, Jeff Ward

The Guided Weapon Trajectory Software (GWTS)computes three-degree-of-freedom trajectories for laser-guided weapons. GWTS solves for the collection of weapon launch locations known as the Launch Acceptability Region. GWTS computes expeditiously these LARs. The search algorithm was developed and optimized over nearly a decade of dedicated application for laser guided weapons.

3 - Analysis of the Effects of Information Asymmetry in the Shortest Path Network Interdiction Problem
Halil Bayrak, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, hab8@pitt.edu, Matthew Bailey

We consider the shortest path network interdiction problem. We investigate the effects of information asymmetry between the interdictor and the evader. We compare models based on worst-case scenario (symmetric information), best-case scenario (asymmetric information), and a combination of both (asymmetric information with a risk criterion). We show that the interdictor can benefit by including the information asymmetry in the model.

4 - Assessing Situational Awareness in Networks of Cooperating Entities: A Mathematical Approach
Herman Monsuur, Netherlands Defense Academy, PO Box 10.1000, 1780 CA Den Helder, Netherlands, h.monsuur@kim.nl

We assess situational awareness (SA) of nodes in military networks. To study the influence of the network topology, we consider two methods. The first method is in terms of updating information using the network and the second is interpreted as a steady state of information flowing through the network. These network values are combined with given characteristics to obtain SA. We introduce a performance metric that can be used to compare various competing alternative network configurations.

5 - Defining Meaningful Metrics for this New Century - A Condition-Based Maintenance Example
Simon Goerger, Assistant Professor & ORCEN Director, Department of Systems Engineering, Building 752 (Mahan Hall), United States Military Academy, West Point, NY, 10996, United States, Simon.Goerger@usma.edu, Ernest Wong

Metrics play a key role in organizational performance, and good metrics help to drive improvement. Leaders are, thus, concerned about what gets measured. In its infant stages, the CBM paradigm for U.S. Army aviation is resulting in new technologies and processes to improve warfighting capability. CBM intends to improve operational readiness, reduce maintenance down time, and provide cost savings. In order to evaluate CBM's viability, we examine new more meaningful metrics for consideration.

■ WC37

Supply Chain Practice I

Contributed Session

Chair: H. Alan Love, Professor, Department of Information & Operations Management, Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States, alove@tamu.edu

1 - A Fuzzy Decision Support System Design For Supplier Selection in Manufacturing Industries

Nevin Karaarslan, Maltepe University, Maltepe Universitesi Endustri Muh. Bol., Istanbul, Turkey, nevink@maltepe.edu.tr, Hasan Kacamak, Hayrettin Evirgen

The question of "who to buy from?" is simply the supplier selection that every firm faces. Many business decisions, including supplier selection, involve preferences. In edition, in many of there activities, exact information is either not available, or very difficult to get. Fuzzy logic allows computing with imprecise terms and fits well into the goals of the decision. Therefore, a software program implements the concepts in the model and fuzzy logic technique is developed.

2 - Valuing Corporate Social Performance in the Supply Chain

Amrou Awaysheh, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N6A3K7, Canada, aawaysheh@ivey.ca, Robert Klassen

Research is only beginning to explore how a firm's management systems and relationships with suppliers and customers incorporate social issues - a critical dimension of sustainable development. Social issues are defined to encompass product and process characteristics that affect the quality of life for a wide range of stakeholders: customers, employees (both direct and indirect), and communities. To contribute to this emerging debate, results from an event study are presented.

3 - A Performance Driven Mechanism for Supply Chain Transformation

Changrui Ren, Staff R&D Engineer, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, 100094, China, rencr@cn.ibm.com, Hongwei Ding, Wei Wang, Jin Dong

A performance driven mechanism for supply chain transformation is presented, which includes the steps of "measure", "diagnose", and "improve". By leveraging the advantage of industry standard SCOR (Supply Chain Operations Reference) model and performance analysis methods, both qualitative and quantitative approaches are designed to power the whole transformation process. A software workbench, which can support all these transformation efforts, is also introduced.

4 - A SCOR-Based Formulation of the Supply Chain Multi-Objective Optimization Problem

Jaime Mora, Head of the Graduate Program in Industrial Enginnering, ITESM CEM, Carr. Lago de Guadalupe km 3.5, Atizapan, 52926, Mexico, jmora@itesm.mx, Cesar Martinez

As many of today's supply chain inter-functional elements have been studied separately for years and traditional supply chain optimization problems consider either the cost or the time (or both) as the elements to be optimized, there is a need for a formulation that at the same time it includes all the inter-functional elements of the supply chain, it optimizes the attributes that guarantee total customer satisfaction such as flexibility, reliability, and responsiveness.

5 - Entry Effects on Strategic Input Procurement Competition

H. Alan Love, Professor, Department of Information & Operations Management, Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States, alove@tamu.edu, Diana Burton

Limited production substitution possibilities for strategic inputs often result in concentrated downstream processing. In such environments, a potential entrant into a processing sector will intensify competition for inputs and therefore must consider the impact entry will have on input price. A method is demonstrated whereby strategic input price change and profit impacts of entry can be evaluated before a new downstream processor enters a supply area where processors are already operating.

■ WC38

Operations Management I

Contributed Session

Chair: Carlos Oliveira, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu

1 - Analyzing Compound Causes of Bullwhip Effect

Xiaolong Zhang, Assistant Professor of Quantitative Methods, Department of Finance and Quantitative Analysis, Georgia Southern University, College of Business Administration, Statesboro, GA, 30460, United States, xzhang@georgiasouthern.edu, Gerard Burke

This paper investigates compound causes of the bullwhip effect. We consider a distribution system with cross-correlated demand streams. We examine a baseline scenario in which only forecasting causes the bullwhip effect and then introduce other sources including order batching, price variations, and shortage rationing into the problem. The compounded effects are decomposed and their manitudes are examined in relation to the parameters of the model.

2 - Nurse Triage Line: Value of Information and Strategic Implementation Policies

Xiaofang Wang, Tepper School of Business, Carnegie Mellon University, NSH 1502G, Robotics, 5000 Forbes Avenue, Pittsburgh, United States, xiaofanw@cs.cmu.edu, Laurens Debo

Health insurance companies need well-informed consumers. They have invested in some information services such as nurse triage line to support consumers' treatment decisions. Thus motivating consumers to fully use the information service becomes a key question. We develop an analytical model to study this question. We analyze demand patterns of health care services and propose possible solutions for the insurer's profit optimization problem.

3 - Capacity Decision Under Bass-Type Demand Dynamics

Bo Hu, PhD Candidate, The Simon School, University of Rochester, PhD Program, 4th Floor, C.G.Simon Hall, University of Rochester, Rochester, NY, 14627, United States, hub1@simon.rochester.edu, Nils Rudi, Harry Groenevelt

We study a profit-maximizing firm's capacity decision. Demand dynamics exhibit Bass-type diffusion (satisfied demand spreads positive word-of-mouth). The optimal capacity decreases with capacity and capital cost; increases with margin. When anticipating a "weak" competitor, the optimal capacity increases in hope of expelling the competitor from the market, but a "strong" competitor leads to sharing the market and lower capacity.

4 - Employee Turnover Intentions: A Review of Literature, Empirical Studies, and Contributing Factors

Kelly Weeks, Jackson State University, 1300 Lynch Street, Jackson, United States, wally188188@yahoo.com

This exploration contemplates the notion that there are moderating factors that affect employee turnover intentions when analyzing Organizational Citizenship Behavior (OCB). It is this paper's contention that in order to be able to forecast or minimize employee turnover, one must understand all the variables and interactions. So, to that effect, this paper offers the possibility that satisfaction plays a moderating role when viewing turnover intentions in relation to OCB.

5 - Equipment Schedule and Optimization with Backup Capacity Constraints

Carlos Oliveira, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, coliv@okstate.edu, William Giffen, Ricki Ingalls

We consider equipment schedule models with backup provisions for operations in the oil industry. A set of machines with different capacities is given. Each machine can be assigned to at most one job in an oil well, and jobs require a set of machines with capacity to handle its demands. Each job requires levels of machine backup. An MIP model is derived and a system of backup levels is determined. Experimental results show the efficiency of the models on real instances of the problem.

■ WC39

Ballroom B

Linear Programming

Contributed Session

Chair: John Butler, Assistant Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States, butler.267@osu.edu

1 - A Complete Closed-Form Solution to Stochastic Linear Programs with Fixed Constraint Coefficients

Elmor Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, NC, 27609, United States, elpeterson@alumni.cmu.edu

Given a fixed but arbitrary constraint coefficient matrix A and a meaningful input probability distribution that jointly describes both the other input constraint data b and the objective-function data c and d, explicit formulas are given for the induced output probability distributions that individually describe problem consistency, problem boundedness, and problem optimality.

2 - Constraint Optimal Selection Techniques (COSTs) for a Class of Linear Programming Problems

H.W. Corley, Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, corley@uta.edu, Jay Rosenberger, Tai-Kuan Sung

We present two classes of Constraint Optimal Selection Techniques (COSTs) and develop a new algorithm in each class for solving nonnegative linear programming problems. We describe the geometric interpretation of these new algorithms and give computational results for some large-scale problems.

3 - Infinite Linear Programs

Archis Ghate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, archis@umich.edu, Robert Smith

We provide conditions for existence of extreme point optimal solutions, weak duality, complementary slackness, and absence of a duality gap for the class of countably infinite linear programs. Moreover, we show that a characterization of extreme points through positive "basic" variables can be developed under a strictly positive support condition. We explore the implications for developing a simplex method in the presence and absence of this condition.

4 - Assigning Priests to Parishes in West Texas

John Butler, Assistant Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States, butler.267@osu.edu, Leon Lasdon, Jim Dyer, Les Maiman

This presentation describes a decision support system to assist short and long term assignment of priests in the Roman Catholic Diocese of San Angelo, Texas. The mixed-integer programming formulation was implemented in GAMS with an Excel interface. This system has been adopted for further studies by the diocese's Chancellor and Priest Personnel Board.

■ WC40

Environment, Energy, and Natural Resources

Contributed Session

Chair: Shalini Vajjhala, Fellow, Resources for the Future, 1616 P Street, NW, Washington, DC, 20036, United States, shalini@rff.org

1 - Market Power Mitigation at the Midwest ISO

Peter Whitman, Potomac Economics, 4029 Ridge Top Road, Suite 350, Fairfax, VA, 22030, United States, pwhitman@potomaceconomics.com

Along with the introduction of restructured electricity markets came the increased potential for market abuses. Market monitors, as described in Order 2000, are an import safeguard to maintain efficiency and reduce the exercise of market power. The Midwest ISO has an Independent Market Monitor to identify, report and initiate market power mitigation in accordance with the MISO tariff. We present one aspect of the market power mitigation: the conduct-impact test in the MISO Real Time Market.

2 - New Developments in ISO Power Markets in the United States

Jonathan Jacobs, Managing Consultant, PA Consulting Group, 75 Nova Drive, Piedmont, CA, 94610, United States, jon.jacobs@paconsulting.com, Alasdair Turner, John George

Independent System Operators (ISOs) in the United States have recently begun implementing spot markets that feature combined optimization of energy and reserves, with locational detail. At least one ISO has also implemented a forward auction for operating reserves. We will describe how these markets are being conducted, and how one tests and certifies the details of the software implementations.

3 - R&D Portfolio Investment under Uncertain Carbon Tax

Ekundayo Shittu, Research Assistant, University of Massachusetts, Amherst, MA, 01003, United States, eashittu@engin.umass.edu

Just as environmental damage can be partially or totally irreversible, so is the optimal abatement investment decision a firm makes. In this paper, we explore the profile of a firm's portfolio of energy R&D technology investment under an uncertain carbon tax. We model the uncertain tax as a stochastic jump process with random timing and magnitude. The optimal path of investment decisions in a two-technology portfolio is examined.

4 - Siting Difficulty and Renewable Energy Development

Shalini Vajjhala, Fellow, Resources for the Future, 1616 P Street, NW, Washington, DC, 20036, United States, shalini@rff.org

Renewable energy projects in sensitive, isolated environments face increasing siting constraints. Using GIS and statistical analysis, this research examines the relationships between U.S. wind, solar, and geothermal resources and a constructed measure of state-level transmission line siting difficulty. Results reveal significant interstate variation in resource availability and siting difficulty with policy implications for meeting state Renewable Portfolio Standards and regional energy plans.

■ WC41

Queueing Applications in Manufacturing and Services

Sponsor: Applied Probability

Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

1 - Learning and Resource Allocation in Service Networks

Kevin Ross, Assistant Professor, University of California Santa Cruz, 1156 High Street, SOE3, Santa Cruz, CA, 95064, United States, kross@soe.ucsc.edu, Geoffrey Ryder

Service networks such as call centers rely on scheduling people with various skill levels among multiple tasks. Further, their skills evolve as they gain experience in each task. We analyze resource allocation in this environment, where immediate delay and buffer penalties are traded off against long term service capacity. We find that queued jobs should sometimes be served by slower workers when this leads to service rate progress along a typical learning curve.

2 - Dimensioning the Repairman Problem with Spares

Isilay Degirmenci, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, it@duke.edu, Otis Jennings, Francis de Véricourt

Consider the repairmen problem with spares consisting of n machines that breakdown, s repairmen and m spare machines. As a function of n, we set a staffing (of repairmen) and stocking (of spares) policy pair. Each element of the policy falls into one of three limiting regime categories: efficiency-driven, quality-driven or quality- and efficiency-driven. For each valid regime combination, we prove many-server limit theorems. Selection of the policy is accomplished through constraint satisfaction or cost minimization.

3 - Staffing to Maximize Revenues with Alternate Service Level Agreements

Joseph Milner, Professor, milner@rotman.utoronto.ca, Opher Baron

We determine the profit maximizing staffing policy for alternate service level agreements for an outsourced call center operating in an environment with uncertain demand and abandonment. In a new heavy traffic regime, we approximate the probability of abandonment and of meeting a service level measured by the percentage of customers served within the acceptable delay. We compare staffing to maximize profits dependent on service failure penalties over alternate time periods and draw conclusions.

4 - Law for the i^{th} Waiting Time in a Busy Period of a G/M/1 Queue

Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

We use induction to derive the distribution of the waiting time of the i^{th} waiting customer in a busy period for a G/M/1 queue with a first come, first served service. We use the Lindley recursion to relate our result to a conditional distribution of random walk and a one-sided regulated random walk.

■ WC42

Scheduling Applications II

Contributed Session

Chair: Ozay Ozaydin, Research Assistant, Dogus University, Acibadem, Zeamet Sokak No: 21, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr

1 - Two-Machine Flowshop Scheduling Problem with Random Processing Times

Hossein Soroush, Associate Professor, Department of Statistics & Operations Research, Kuwait University, PO Box 5969, Safat, 13060, Kuwait, hsoroush@kuc01.kuniv.edu.kw

The available literatures on the stochastic two-machine flowshop scheduling problem, in which job processing times are random variables, utilize the expected makespan criterion. In this paper, we study a stochastic two-machine flowshop problem with distinctly distributed processing times to determine a schedule that minimizes the expected total completion times of all jobs. In particular, we explore three scenarios of the problem when processing times are normally distributed.

2 - Tabu Search Heuristics for the Group-Scheduling Problems in PCB Manufacturing

Cumhur Gelogullari, Operations Research Analyst, American Airlines, 4333 Amon Carter Boulevard MD 5358, Fort Worth, TX, 76155, United States, Cumhur.Gelogullari@aa.com, Rasaratnam Logendran

We address the multi-machine flowshop group-scheduling problem with carryover sequence-dependent setup times in PCB manufacturing. To minimize the mean flow time of this strongly NP-hard problem efficiently and effectively, we develop different tabu search (TS) algorithms, each consisting of two layers of search. The applicability of the algorithms is demonstrated on an example problem, and the experimental results obtained confirm the high quality of the TS solutions.

3 - Collaborative Vessel Scheduling in Semi-Liner Shipping Operations

Chunxing Fan, Rutgers, The State University of New Jersey, 180 University Avenue, PhD Program, Newark, NJ, 07102, United States, cxfan@andromeda.rutgers.edu, Lei Lei, Maria Boile, Sotirios Theofanis

We mathematically model and empirically investigate the operational performance of vessel schedules under three management policies: the non-collaborative, the slot-sharing, and the total-sharing. Empirical results from over 900 randomly generated test cases under different problem settings are reported. We observed that without partner carriers' willingness to fully share the demand and the resources in a flexible manner, the promise of collaborative planning cannot be fully delivered.

4 - A Crew Scheduling Decision Support Model for a Local Airline

Ozay Ozaydin, Research Assistant, Dogus University, Acibadem, Zeamet Sokak No: 21, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr, Ilker Topcu

Airline crew scheduling is concerned with finding a minimum cost assignment of flight crews to a given flight schedule while satisfying related restrictions. In this study, a decision model is proposed for creating possible flight series composed of various flight legs covering the flights in schedule and assigning the airline crew to the optimum series among possible ones. The model is utilized for a national airline company.

■ WC43

Multicriteria Decision Making I

Contributed Session

Chair: Igor Linkov, Senior Scientist, Cambridge Environmental Inc., 58 Charles Street, Cambridge, MA, 02141, United States, ilinkov@yahoo.com

1 - Multicriteria Decision Making Under Uncertainty and Risk

Sundeep Samson, Graduate Student, Clemson University, O-106 Martin Hall, Box 340975, Clemson, SC, 29634, United States, ssamson@clemson.edu, James Reneke

Decision problems under conditions of uncertainty and risk are challenging. The decomposition methodology to be presented exploits separable stochastic approximations of random fields and the functional representations of risk. This methodology has the potential of resolving complex problems such as multicriteria real portfolio selection and engineering design problems.

2 - Multi-Criteria Decision Support for Public Project Selection

Peter Kelle, Professor, Louisiana State University, ISDS Department, Baton Rouge, LA, 70803, United States, qmkell@lsu.edu, Helmut Schneider

In the selection of public projects several objectives must be considered besides profit maximization. Our methodology can be applied where tens of projects are to be selected out of hundreds or thousands of potential projects and the selection have to be based on difficult to compare multi-criteria objectives. A case study of selecting highway improvement projects demonstrates the decision support process.

3 - Multi-Scenario Multi-Objective Optimization with Applications in Engineering Design

Margaret M. Wiecek, Professor, Clemson University, Department of Mathematical Sciences, O-106 Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, wmalgor@clemson.edu

A theoretical and methodological framework for handling decision-making problems represented as collections of multi-objective problems is proposed. Two research issues arise in this context: the modeling of decision maker's preferences over a collection of problems and the development of solution approaches to finding a preferred feasible solution for the collection. Findings are illustrated with mathematical examples and case studies from engineering design.

4 - New Preference Models for Decision Problems with Multiple Objectives

Alexander Engau, PhD Candidate, Clemson University, Department of Mathematical Sciences, O-106 Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States, aengau@clemson.edu, Margaret M. Wiecek

The assessment and modeling of preferences are important for both theory and real-life applications of multicriteria decision making. Revealing drawbacks of the classic but static Pareto concept, we use a framework of general preference cones to propose alternative models that allow for changing preferences. Examples of practical relevance are given.

5 - Use of Multi Criteria Decision Analysis (MCDA) to Prioritize Small Arms Technology Gaps

Igor Linkov, Senior Scientist, Cambridge Environmental Inc., 58 Charles Street, Cambridge, MA, 02141, United States, ilinkov@yahoo.com, John Edwards, F. Kyle Satterstrom, George Fenton

This presentation reports MCDA approach and implementation for prioritizing 72 capability gaps identified by Joint Small Arms Capability Analysis. To elicit decision-makers' preferences, a survey was developed and administered to representatives of Army, Navy, Marines, Air Force, SOCOM and Coast Guard. Comparison of the consensus and individual branches' prioritization showed the two to be quite similar, with differences explained by service branches' specific concerns.

■ WC44

Use of Optimization in Networks & Graphs

Contributed Session

Chair: Marcus Volz, Department of Electrical & Electronic Engineering, The University of Melbourne, Victoria, 3010, Australia, m.volz@ee.unimelb.edu.au

1 - Integer Programs for Modularity Maximization

Yiming Yao, Lawrence Livermore National Lab, 7000 East Avenue, Livermore, CA, 94550, United States, yyao@llnl.gov, Tracy Hickling, William Hanley

We formulate the problem of finding community structure in graphs as an integer program (IP) that attempts to maximize Newman's modularity. Though the optimal solution to the IP model is possible only for small graphs, it can serve as a verification tool for heuristic algorithms. We present IP solutions on some graphs in the research literature and compare them with results obtained from a well known heuristic algorithm.

2 - Least-Squares Network Flow Algorithm

Seunghyun Kong, PhD Student, Georgia Institute of Technology, 251 10th Street NW, D-305, Atlanta, 30318, United States, konggas@gmail.com, Ellis Johnson, Joel Sokol

When least-squares primal-dual algorithm is applied to network flow problem, there are good properties to enhance the performance of the algorithm. The algorithm is compared to other network flow algorithm citing its advantages and disadvantages. Some ideas to overcome the computational bottleneck and to decrease the number of iterations are also explained. The computational result is compared with CPLEX.

3 - Multi-Depot Multi-Vehicle-Type Vehicle Scheduling Problem: TSN vs. CBN

Cheng-Kang Chen, Associate Professor, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Road, Taipei, Taiwan, ckchen@cs.ntust.edu.tw, Cheng-Huang Hung

Two different formulations, which are time-space network (TSN) and connection-based network (CBN), are constructed and analyzed for the multi-depot multi-vehicle-type vehicle scheduling problem (MDMV-VSP). A key feature differentiating our paper from extant literature is that the task cost is considered to be dependent on the vehicle type assigned to the task. By utilizing the optimization software CPLEX to compare TSN and CBN formulations, several interesting observations are obtained.

4 - Pseudoflow-Push Algorithms for the Maximum Flow Problem
Cenk Caliskan, Assistant Professor, University of Delaware, Department of Business Administration, 211 Alfred Lerner Hall, Newark, DE, 19716, United States, caliskanc@lerner.udel.edu

We introduce a class of pseudoflow-push algorithms for the maximum flow problem with the same worst-case time as their augmenting path counterparts. Pseudoflow-push algorithms differ from augmenting path algorithms in the sense that feasibility is obtained at termination, but they are also similar because flows are pushed on paths. We present the generic pseudoflow-push algorithm, as well as the shortest balancing path and capacity scaling versions of it.

5 - The Gradient-Constrained Fermat-Weber Problem with Applications to Underground Mine Design
Marcus Volz, Department of Electrical & Electronic Engineering, The University of Melbourne, Victoria, 3010, Australia, m.volz@ee.unimelb.edu.au

In this paper we introduce the gradient-constrained Fermat-Weber problem and provide a general method for solving the three-dimensional case. We demonstrate the efficiency of the algorithm using a computer program. We discuss applications of this work to the optimal design of underground mines and present an industry case study.

■ WC45

Tutorial: Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power

Cluster: Tutorials
Invited Session

1 - Complementarity-Based Modeling of Electric Power Markets: Transmission Constraints and Market Power
Benjamin Hobbs, The Johns Hopkins University, Dept. Geography & Env. Engineering, Baltimore MD, United States, bhobbs@jhu.edu

I discuss the modeling of power market games using this powerful and flexible approach. Such models can represent large systems, including thousands of generators and transmission lines, while accounting for peculiarities of particular market designs. I review models of perfect competition and Cournot competition, and their use in evaluations of market designs, merger proposals, and transmission reinforcements. Multilevel games, represented as MPECs and EPECs, are also discussed.

■ WC47

Supply Chain Risk Management II

Contributed Session

Chair: Jack Crumbly, Doctoral Student, Jackson State University, 1711 Melrose Place, Clinton, MS, 39056, United States, jackcrumbly@hotmail.com

1 - Analysis of Supplier's Downside Risk Aversion in a Supply Chain with a Risk Neutral Retailer
Sudarsan Rangan, Student, The University of Alabama, 361 Stadium Drive, Box 870226, Tuscaloosa, AL, 35487, United States, srangan@cba.ua.edu, Charles Sox

Here we consider a supply chain with a downside risk averse supplier and a risk neutral retailer. We analyze the supplier's downside risk in some common supply contracts in vogue. We also try to propose a risk sharing contract to coordinate the channel.

2 - Strategic and Tactical Risks of Supply Chain Disruption
Zigeng Yin, PhD Student, Northwestern University, 2145 Sheridan Road, C231, Evanston, IL, 60208, United States, z-yin@northwestern.edu, Seyed Iravani, Wally Hopp

Disruption of a supply chain due to a supplier problem, political event or natural disaster can result in both short-term tactical costs and long-term strategic consequences. We develop a framework to consider both types of risks and discuss methods for reducing risk exposure. We find that while redundancy policies, using inventory and capacity, can be effective in reducing tactical risk, strategic risk is better addressed via organizational preparation and speed of response in a crisis.

3 - The Impact of Customer Returns on Optimal Pricing and Inventory Policies
Jing Chen, PhD Candidate, Ivey School of Business, the University of Western Ontario, 279G, Windermere Road, London, ON, N6G 2J7, Canada, jchen@ivey.uwo.ca, Peter Bell

We investigate decisions on price and inventory policies for the firm facing selling a product with customer returns that depend on sales volume and/or prices. We derive optimum solutions for single period and multi-period deterministic and dynamic problems and use these results to draw conclusions on how the practice of revenue management is affected by the presence of customer returns.

4 - Input Price Hedging with Futures in Newsvendor Models under Conditional Value-at-Risk Criterion
Ke Huang, Graduate Student, SEEM, The Chinese University of Hong Kong, PGH1, CUHK, Shatin, N.T., Hong Kong, khuang@se.cuhk.edu.hk

In this paper we consider the newsvendor model with demand and input price uncertainty. In addition to make order decision, a risk-averse processor uses futures to hedge the input price uncertainty. For a single selling season, we use the Conditional Value-at-Risk risk measure as well as the tradeoff between the expected revenue and the Conditional Value-at-risk as the optimality criteria of the risk-averse processor.

5 - Organization Structure for Disaster Response: Building Dynamic Capability through Structural Changes
Jack Crumbly, Doctoral Student, Jackson State University, 1711 Melrose Place, Clinton, MS, 39056, United States, jackcrumbly@hotmail.com, Samhita Shah, Rupak Rauniar

The beginning of 2000 has seen catastrophic incidents that have impacted business operations for firms. As firms build and sustain capabilities to implement operations policies for the disaster handling, an approach to incorporate structural changes can lead businesses to turn such environmental threats into opportunities. Drawing from Burgleman (1984), the present study proposes a theoretical matrix to align operational relatedness and strategic importance for its product and services.

■ WC48

Price and Lead Time Decisions

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Esma Gel, Arizona State University, Department of Industrial Engineering, PO Box 5906, Tempe, AZ, 85287, United States, esma.gel@asu.edu

Co-Chair: Pinar Keskinocak, Associate Professor, ISYE, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, pinar@isye.gatech.edu

1 - Integrated Production Planning and Pricing with Congestion-Prone Production Resources
Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Abhijit Upasani

We present an integrated production planning and pricing model where demand is determined by both price and lead time, and production resources are subject to congestion. We examine the relationship between lead times, prices and demand characteristics and provide numerical examples comparing the results to those from a fixed lead time model that does not capture the relationship between resource loading and lead times.

2 - Dynamic Pricing and Leadtime Quotation in a Make-to-Order Queue
Costis Maglaras, Associate Professor, Columbia University, Graduate School of Business, 409 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, c.maglaras@gsb.columbia.edu, Sabri Celik

We study a profit maximizing make-to-order manufacturer that offers multiple products to a market of price and delay sensitive users. Our model captures three aspects of interest: 1) The joint use of dynamic pricing and leadtime quotation controls; 2) The ability to expedite orders at a cost; and 3) The interaction of the demand controls with sequencing and expediting decisions that the firm must employ to optimize profits and satisfy the quoted leadtimes.

3 - Value of Considering Service-Sensitive Demand in Customer Acceptance Decisions
Serhan Duran, Graduate Research Assistant, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, gtg865i@mail.gatech.edu, Julie Swann, Altan Gulcu, Pinar Keskinocak

We investigate a manufacturer's customer acceptance decisions when past performance in meeting quoted leadtimes affects the future arrivals of customers. We focus on finite capacity under an industry-dictated leadtime. We investigate the conditions under which the optimal accept decision is structured with respect to service level. We compare the manufacturer's profit from the service-savvy policy to one in which a manufacturer is ignorant of the impact of past performance.

4 - Joint Price and Lead-Time Quotation in Make-to-Order Systems
Esma Gel, Arizona State University, Department of Industrial Engineering, PO Box 5906, Tempe, AZ, 85287, United States, esma.gel@asu.edu, Pinar Keskinocak, Ozgun Bekki

We consider the problem of dynamically quoting price and lead-time to arriving customers. The facility operates in a make-to-order mode with a limited buffer area. We formulate the problem as an MDP to maximize the expected total discounted profit and show various characteristics of an optimal policy. We demonstrate the value of price and lead time quotation flexibility through numerical analysis and provide results on a simple heuristic to determine effective quotes.

■ WC50

Supply Chain Practice II

Contributed Session

Chair: Hongwei Ding, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, 100094, China, dinghw@cn.ibm.com

1 - A Rule-Based Available-to-Promise (ATP) System for MTO/ATO Manufacturing Company
Emin Gundogar, Sakarya University, Sakarya Universitesi Bilgi Islem, D. Bsk., Esentepe Kampusu, Adapazari 54 54187, Turkey, gun@sakarya.edu.tr, Yavuz Burak Canbolat, Baha Guney

Manufacturing companies just want to give their customers reliable quote lead times and delivery dates. But it is a hard process in a firm having various configures of products and final assembly groups. Therefore, the system should make automatically the needed and proper modifications when they are input. In this study, a rule based expert available-to-promise (ATP) system in ERP, which was developed and applied for a MTS/ATO manufacturing company, is presented.

2 - Integrated Statistical Data Modeling and Stochastic Optimization for Dynamic Supply Chain Planning
Viji Krishnamurthy, Product Engineer - Supply Chain Optimization, Philips Lumileds Lighting, 370 West Trimble Road, San Jose, CA, 95131, United States, viji.krishnamurthy@philips.com

This paper develops an approach for supply chain planning of a multistage production-inventory system where each stage is characterized by stochastic process parameters, supply and demand. We solve each stage using a combination of statistical analysis that derives nonlinear regression models, and stochastic optimization that uses decomposition and hybrid heuristic methods. We show an iterative approach for integrating stage optimization modules to derive aggregate planning for the supply chain.

3 - Classification of Quick Response Supply Networks
Nan Wang, Institute for Manufacturing/University of Cambridge, 16 Mill Lane, Cambridge, CB2 1RX, United Kingdom, nw259@cam.ac.uk, Yongjiang Shi

This study investigates response capability as a key competitive advantage to tackle business environmental uncertainty and complexity. We propose a framework grounded from case studies of top international clothing companies. The framework integrates quick response components and processes from the best practices in global operations. It builds upon a synthesis of three types of responses from alternative supply chain configurations.

4 - Integrated Supply Chain Network Optimization and Analysis
Hongwei Ding, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang West Road, Haidian District, Beijing, 100094, China, dinghw@cn.ibm.com, Jin Dong, Wei Wang, Changrui Ren

An integrated workbench for supply chain network optimization and analysis is proposed to facilitate decision-making on sourcing and distribution strategies, transportation volume allocation and service territory assignment. Mixed integer programming, linear programming, heuristics and simulation are employed to enable the workbench, with a graphic interface. The workbench is applied in a hi-tech manufacturing company to help supply chain mangers define their sourcing and assembly strategy.

■ WC51

Scheduling/Maintenance in Aviation Applications

Contributed Session

Chair: Gizem Keysan, Georgia Institute of Technology, 58 6th Street NE, Unit 2201, Atlanta, GA, 30308, United States, gkeysan@isye.gatech.edu

1 - Itinerary Design and Airline Scheduling for Small Airlines in Mexico
Federico Trigos, LSOG/BIE Chairman, ITESM Campus Toluca, Eduardo Monroy Cardenas 2000, San Antonio Buenavista, Toluca, Mx, 50110, Mexico, ftrigos@itesm.mx

Most of the research in Airlines has been paid by big companies and therefore those developments have been designed for very big models. We study two of the most important steps in the operations of a single fleet airline. Our model works in an integral form and makes the decision of where to fly and the weekly route of the aircrafts involved. Maintenance and regular operational issues are also taken into consideration. Numerical experimentation is based on real instances.

2 - The Tail Assignment Problem - A Hybrid Column Generation and Constraint Programming Approach
Mattias Grönkvist, Carmen Systems AB, Odinsgatan 9, Göteborg, SE-41103, Sweden, mattias.gronkvist@carmensystems.com, Sami Gabteni

Tail Assignment is the problem of assigning flights to aircraft while satisfying all operational constraints, and optimizing some objective function. We present a hybrid column generation and constraint programming solution approach. This approach can be used to quickly produce solutions for operations management, and also to produce close-to-optimal solutions for long and mid term planning scenarios. We present computational results which illustrate the practical usefulness of the approach.

3 - Scheduled Maintenance Planning for an Air Taxi Service
Gizem Keysan, Georgia Institute of Technology, 58 6th Street NE, Unit 2201, Atlanta, GA, 30308, United States, gkeysan@isye.gatech.edu, Martin Savelsbergh, George Nemhauser, Renan Garcia, Faramroze Engineer

We study a scheduled maintenance planning problem for a per-seat on-demand air transportation service. The aim is to use the maintenance cycle of each jet as efficiently as possible while providing a smooth workflow into the maintenance facility and ensuring the capacity of the facility is never exceeded. We use a look ahead strategy over a rolling time horizon to determine which jets are to be sent to maintenance and the itineraries assigned to each jet in the fleet.

■ WC52

Data-Driven Research on Pricing and Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Itir Karaesmen, Assistant Professor of Management Science, University of Maryland, Robert H. Smith School of Business, Decision and Information Technologies, College Park, MD, 20742, United States, ikaraes@rhsmith.umd.edu

1 - Predicting Price in Concurrent Online Auctions
Wolfgang Jank, Assistant Professor, University of Maryland, 4322 Van Munching Hall, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Galit Shmueli

Several hundred even thousand concurrent auctions for the same or similar item take place on eBay every day. We investigate the question whether concurrency has an effect on an auction's price. We propose a spatio-temporal semiparametric model. The spatial model component accounts for item similarity. The temporal component accounts for correlation in price over time. The flexible semiparametric approach results in high prediction accuracy. We illustrate our model on a set of laptop auctions.

2 - Intertemporal Price Discrimination with Forward-Looking Consumers: The Market for Video-Games
Harikesh Nair, Assistant Professor of Marketing, Stanford University, 518 Memorial Way, Graduate School of Business, Stanford, CA, 94035, United States, Nair_Harikesh@gsb.stanford.edu

We develop a framework to investigate empirically intertemporal price discrimination policies by firms selling durable-good products. Prices in the model are equilibrium outcomes of a game played between strategic forward-looking consumers and firms. We present methods to infer estimates of demand under such dynamic consumer behavior, and to compute optimal prices. An empirical application to the market for video-games is presented.

3 - Consumer Price Sensitivities Across Categories
Sri Devi Duvvuri, Assistant Professor, Tippie College of Business, University of Iowa, Iowa City, IA, 52242, United States, sri-duvvuri@uiowa.edu, Thomas Gruca

A Hierarchical Bayesian factor analytic approach is used to explore how market structure affects the relationships among consumer price sensitivities for categories that are related - substitutes or complements. The factor structure allows estimation of higher-order factors so complex and managerially important patterns of covariation in price sensitivities can be deduced. The model is empirically tested using scanner panel data.

4 - Integrating Revenue Management Systems with Recommendation Engines: An Application for Sheraton
Senthil Veeraraghavan, Wharton School, Philadelphia, PA, 19104, senthilv@wharton.upenn.edu, Christian Terwiesch

A hotel room is an experience good: the customers do NOT know the product before arriving at the hotel. Sheraton does not know the customer and the purpose of her visit; this makes it difficult to recommend a room. A customer who is interested in exploring a range of options is likely to do so by going to expedia; however, this will make the customer search ACROSS hotels. The study addresses the three shortcomings in the hotel's RM system which has to be coordinated with customer search.

■ WC53

Information Sharing in Supply Chain Management

Contributed Session

Chair: William Sawaya, Cornell University, Civil and Environmental Engineering, Hollister Hall, Ithaca, NY, 14853-3501, United States, wjs32@cornell.edu

1 - A Markov Decision Model for Supply Chain Information Sharing
Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 404 McNair, Greensboro, NC, 27411, United States, lbdavis@ncat.edu, Russell King, Thom Hodgson

A two-stage serial supply chain, where the retailer shares information with the supplier, is modeled as a Markov Decision Model. A completely observable MDP represents the case when full information sharing occurs. The case of no information sharing is modeled as an MDP with restricted observations. We characterize the structure of the optimal policy with and without information sharing and quantify the cost associated with sharing information.

2 - Effect of Information Sharing on Supply Chain Stability and the Bullwhip Effect
Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu

This paper analyzes the bullwhip effect in multi-stage supply chains with shared information (i.e., orders and inventories at all stages). The paper (i) Characterizes orders placed at any supplier stage for known and ergodic customer demand processes; and (ii) Derives robust analytical conditions to predict and bound the bullwhip effect, independent of the customer demand. It is shown as a special case that sharing customer demand information reduces but does not eliminate the bullwhip effect.

3 - Retail Promotions: The Value of Information Sharing Up the Supply Chain
John Aloysius, Associate Professor, University of Arkansas, WCOB 204 University of Arkansas, Fayetteville, AR, 72701, United States, aloysius@uark.edu, Travis Tokar, Matthew Waller

Information regarding retail promotions can improve the quality of replenishment decision making. We present four dynamic programs that analyze the optimal replenishment strategies in the 2X2 cases when information regarding the timing and the magnitude of promotions are available/not available in the beer distribution game, a simulated supply chain. We report the results of two controlled experiments in which we manipulate information regarding timing and magnitude of promotions.

4 - Upstream Information Sharing in a Serial Supply Chain with Supplier Random Yields
Hyun-Cheol Choi, Doctoral Student, Indiana University, 2451 E. 10th Street #714, Bloomington, IN, 47408, United States, hyunchoi@indiana.edu, Srinagesh Gavirneni, J. Doug Blocher

We look at the benefits of a supplier sharing its upstream production information with its customers in a two-stage supply chain where the supplier's processes have uncertain yields. Our computational study shows that information is more beneficial when the lead time from the supplier to its customer is short, when the uncertainty in the supplier's yield is high, when customer demand variances are low, and when the stock-out penalty to holding cost ratio is high.

5 - Agent-Based Simulation of Point-of-Sale Information Sharing in a Heterogeneous Distribution Network
William Sawaya, Cornell University, Civil and Environmental Engineering, Hollister Hall, Ithaca, NY, 14853-3501, United States, wjs32@cornell.edu

The impact of sharing point-of-sale data is investigated using an empirically-motivated, agent-based simulation of a distribution network. Each DC faces empirically-based, non-normal, heterogeneous demand and has stochastic and heterogeneous transportation times, each also passes POS data to the manufacturer daily. Findings indicate that even in this setting and with relatively large coefficients of variation, the sharing of point-of-sale information leads to system-wide cost reductions.

■ WC54

Strategic Planning

Contributed Session

Chair: Jun Ma, Xi'an Jiaotong University, 28 Xianning Road, Xian, Shaanxi, Xian, Shaanxi, 710049, China, junma@mail.xjtu.edu.cn

1 - First Stage of the Risk Management: Identify Risks
Deniz Kasap, Researcher, TUBITAK-TUSSIDE, Baris Mah. Kosuyolu Cad. No:48 PK.14, Gebze, Kocaeli, 41401, Turkey, dkasap@tusside.gov.tr, Murat Kaymak

Risk identification is the first step in the risk management process. Before risk can be managed, it must be identified. Stating and analyzing these identified risks clearly will lead to more effective decision making in various steps of the projects. In this study, we our goal is to determine basic risks especially in long-term projects.

2 - Signpost Approach to Strategic Decision Support
Ruoyi Zhou, Research Staff Member, IBM Research, Almaden Research Center, 650 Harry Road, San Jose, CA, 95120, United States, ruoyi@us.ibm.com, Ray Strong

We describe a novel signpost-based approach to enterprise contingency planning at the strategic initiative level. A signpost is a recognizable potential future event that signals a change of significance to the enterprise. Our focus will be on techniques for generating high quality signposts.

3 - Reorganization of Global Supply Chains: A Mathematical Framework and Applications
Baptiste Lebreton, Postdoctoral Research Fellow, INSEAD, 19, Boulevard de Constance, Fontainebleau, 77300, France, baptiste.lebreton@insead.edu, Luk N. Van Wassenhove

Global manufacturers often face the issue of closing current capacities while opening new ones in emerging countries. Nevertheless, we observe that the current literature on strategic network planning does not particularly address this issue as the models generally assume a greenfield situation. Therefore, we present a dedicated network planning model whose relevance is illustrated with help of two practical cases studies (chemical industry and consumer goods).

4 - Product Portfolio Strategies: The Case of Multi-Function Products
Asoo Vakharia, Professor, University of Florida, 355D Stuzin Hall, PO Box 117169, Gainesville, FL, 32611, United States, asoov@ufl.edu, Aydin Alptekinoglu, Yuwen Chen

Product portfolio decisions are one of the most strategic commitments made by a firm. Motivated by the proliferation of multi-function products in consumer markets, we investigate product portfolio decisions for a single firm. Notable among industries where multi-function products are making a major impact is consumer electronics (e.g. cell phones and PDAs).

5 - Cognition and Experiential Learning: The Evolution of Organization with Different Tasks
Jun Ma, School of Management, Xi'an Jiaotong University, Xi'an, Shaanxi, Xi'an, 710049, China, majun@mailst.xjtu.edu.cn, Youmin Xi, Hua Zhang

Organizational capabilities research have paid much attention on the routine-based evolution of capabilities but largely ignored the roles played by cognition. We use the OrgAhead model to introduce experiential learning and cognition to the organization capability. We compared the different model's performance and present the proper models for diversely complex tasks.

■ WC55

Information Systems

Contributed Session

Chair: Li-Lin Liu, PhD Student, FIU, 9631 Fontainebleau Boulevard, Apt# 515, Miami, FL, 33172, United States, lliu005@gmail.com

1 - A Navigation System Using Mobile Database
Kyounghwan An, ETRI, 161 Gajeong-dong, Yuseong-gu, Daejeon, South Korea, mobileguru@etri.re.kr, Juwan Kim

Currently, a navigation system uses a proprietary file format on an external device like PDA or an embedded device like telematics terminal. However, the system is very difficult to update the stored map incrementally and to combine the navigation service with other services. This paper solves the problems by using mobile database. The suggested mobile database provides additional structures and algorithms to manage map data and network data for vehicle routing.

2 - Exclusive Licensing in Complementary Network Industries
Ravi Mantena, Assistant Professor, University of Rochester, Carol Simon Hall 3-318, PO Box 270100, Rochester, NY, 14627, United States, mantena@simon.rochester.edu, Ramesh Sankaranarayanan, Siva Viswanathan

This study seeks to understand the drivers and consequences of exclusive licensing in network industries, with a specific focus on the video-gaming industry. We derive conditions that lead to regimes of exclusivity and non-exclusivity and examine their implications for the competitive outcomes for console manufacturers and game publishers.

3 - Open Source Business Models
Evangelos Katsamakas, Fordham University/School of Business, 113 West 60th Street, 625A, New York, NY, 10023, United States, katsamakas@fordham.edu

The emergence of open source software movement has driven the creation of new business models in the software industry. This paper provides a classification of these models, and analyzes pricing, profitability and competition. The analysis is based on game-theoretic economic models, and supplemented with simulations.

4 - The Association Between Knowledge Management System, Strategic Orientation, and Firm Performance
Li-Lin Liu, PhD Student, FIU, 9631 Fontainebleau Boulevard, Apt# 515, Miami, FL, 33172, United States, lliu005@gmail.com, Sheng-Ying Tseng

This paper attempts to examine the association between KMS adoption, strategic orientation, level of innovation and firm performance. Hopefully, the findings can provide some new insights into the productivity paradox associated with KMS adopters as well as some significant implications to both IS researchers and practitioners regarding the decisions of KMS investments. A regression method will be employed to conduct the analysis and to test for the ten hypotheses proposed.

Wednesday, 3:30pm - 5:00pm

■ WD01

Solution Techniques in Integer Programming

Contributed Session

Chair: Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu

1 - A Dual Decomposition Method for Stochastic Uncapacitated Facility Location Problems
Cheng (Marshal) Wang, University of Toronto, 915-30 Charles Street West, Toronto, M4Y1R5, Canada, cwang@mie.utoronto.ca, Roy H. Kwon

We consider stochastic uncapacitated facility location problem (UFLP) as two and three stochastic linear programs. We develop a dynamic dual decomposition method. Moderate sized deterministic equivalent MIPs couldn't be solved by CPLEX 9.0 MIP solver directly. We consider semi-equivalent MIPs that could be solved by CPLEX to the same integer solutions. The proposed method is found to be effective in numerical experiments and outperforms CPLEX on semi-relaxed versions of the problem.

2 - Implementation Issues of Flow Cover and Flow Path Separation Algorithms in a General MIP-Solver
Philipp Christophel, DS&OR Lab, University of Paderborn, Warburgerstrasse 100, Paderborn, 33098, Germany, christophel@dsor.de, Uwe H. Suhl, Leena Suhl

Although the theory of flow cover cuts is very well studied, a straight forward implementation tends to give results that may be far from an optimum. This talk discusses some changes to the cover finding method and other parts of the algorithm as implemented in MOPS. The second part of the talk deals with the implementation of flow path cuts. These are so far not very well studied and the talk shows alternatives to traditional implementations and evaluates them.

3 - A Metaheuristic Algorithm for the Steiner Problem in Graphs
Minseok Seo, Penn State University, 1400 Martin Street, Apt. 2025, State College, PA, 16803, United States, mxs713@psu.edu, Jose Ventura

The Steiner problem in graphs is concerned with finding the shortest tree containing a subset of nodes, called terminal nodes, in an undirected graph. We propose an ant colony algorithm which was the Takahashi and Matsuyama's heuristic method to generate improved trees iteratively by adjusting edges' pheromone values until an optimal or near-optimal solution is obtained.

4 - A Theoretical and Computational Comparison Between GDP Cuts and Disjunctive Cuts
Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu, Ignacio Grossmann

We report some exciting insights and connections between Disjunctive Programming (Balas) and Generalized Disjunctive Programming (GDP, Raman & Grossmann), emphasizing fundamental understanding of their corresponding cutting planes, specifically the connections that exist between GDP cuts and disjunctive and lift and project cuts. We present a unified framework for this development through Balas' concept of reverse polar, and present examples that demonstrate the efficiency of both methods.

■ WD02

Economics

Contributed Session

Chair: Matthew O'Connor, Professor of Finance, Quinnipiac University, 275 Mount Carmel Avenue, Hamden, CT, 06518, United States, matthew.oconnor@quinnipiac.edu

1 - Economic Impact of the Thai Canal on Asean and the World
Nuansri Erbkamol, Assistant Professor, King Mongkut's Institute of Technology North Bangkok, 1518 Pibulsongkram Road, BangSue, Bangkok, 10800, Thailand, erbkamol@kmitnb.ac.th, Satapon Keovimol

The Thai Canal will be like a large stream passing Thailand, connecting the two coasts of Thailand together, creating an economical route and generating a flow of money from countries around the world to Thailand directly, creating jobs, income, a tourism attraction, a business center and a source of industries.

2 - What Will Thailand Benefit from the Thai Canal Project?
Satapon Keovimol, Associate Professor, King Mongkut's Institute of Technology North Bangkok, 1518 Pibulsongkram Road, Bang Sue, Bangkok, 10800, Thailand, keovimol@hotmail.com, Thanakorn Kiatbanlue

If Thailand builds a Thai Canal, it would be a new route for ships that shortens the trips. Thailand will become an important centre for international sea transport, Many nations along the coasts of the Indian and Pacific oceans will have complement advantages with Thailand's advantages, especially tourism.

3 - The Impacts of Complementarity/Substitutability of Goods on Bundling Strategy
Young Sok Bang, Graduate School of Management, KAIST, 207-43, Cheongyangri 2-Dong, Dongdaemun-Gu, Seoul, South Korea, buffett0112@hanmail.net, Jae-Hyeon Ahn, Dong-Joo Lee

We analyze the bundling strategy in the presence of a complementarity or substitutability between goods under different industry structures. We find, contrary to the common perspective that bundling benefits from complementarity of goods, that bundling can be an optimal strategy even under substitutability, and that the competition in the industry increases the firm's incentive of bundling with relatively more complementary goods compared to the monopoly case.

4 - Algorithms for Rationalizability and CURB Sets
Michael Benisch, PhD Student, School of Computer Science, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mbenisch@cs.cmu.edu, Tuomas Sandholm, George Davis

The concepts of rationalizability and CURB (Closed Under Rational Behavior) sets have not been studied from a computational perspective. We describe an LP-based polynomial algorithm that finds all strategies that are rationalizable against a mixture over a given set of opponent strategies. We describe a series of polynomial algorithms for finding minimal CURB sets. Finally, we give theoretical showing that finding a Nash equilibrium can be exponential only in the size of the smallest CURB set.

5 - The Question of Tenure: A Dynamic Cost Minimization Model
Matthew O'Connor, Professor of Finance, Quinnipiac University, 275 Mount Carmel Avenue, Hamden, CT, 06518, United States, matthew.oconnor@quinnipiac.edu, Mario Norbis

We develop an N-period dynamic optimization model to explain the rational allocation of tenure and non-tenure track positions subject to a university's course coverage and research output requirements. We find that is optimal for a cost minimizing university to include tenure track positions in the faculty mix.

■ WD03

Discrete Optimization via Integer Programming

Contributed Session

Chair: Mohammad S. Sabbagh, Professor, Isfahan University of Technology, University Boulevard, Isfahan, 84154, Iran, sabbagh@cc.iut.ac.ir

1 - Linear Forms of Nonlinear Expressions: New Insights on Old Ideas
Richard Forrester, Assistant Professor, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States, forrestr@dickinson.edu, Warren Adams

We examine recent linearization strategies for mixed 0-1 polynomial programs and show how they can be improved and unified through an intepretation of a classical strategy introduced 30 years ago. Furthermore, we show that the classical approach provides more concise forms and theoretically tighter relaxations. Computational experience demonstrating a reduction in both the number of nodes explored and CPU execution times are presented for randomly generated test problems.

2 - A Tour Improvement Algorithm for the Asymmetric Traveling Salesman Problem
Mohammad S. Sabbagh, Professor, Isfahan University of Technology, University Boulevard, Isfahan, 84154, Iran, sabbagh@cc.iut.ac.ir

We use heuristic methods to get, in little time, a good tour for large asymmetric traveling salesman problem (ATSP). Suppose we have a tour. The question now is how this tour can be improved further. This paper presents a heuristic method for improving such a tour by utilizing some necessary conditions of tour optimality that limits the search space to some edges that have the potential to improve the current tour. We coded the method in C++ and improved tours of all ATSP benchmarks problems.

■ WD06

Metaheuristic Development Framework (MDF)

Sponsor: INFORMS Computing Society/Heuristic Search
Sponsored Session

Chair: Kamran Fatahi, Lecturer, Amirkabir University of Technology, No. 424, Hafez St., Tehran, TH, Iran, k_fatahi@aut.ac.ir

1 - MDF
Kamran Fatahi, Lecturer and PhD Candidate, Amirkabir University of Technology, No. 424, Hafez Street, Tehran, Iran, k_fatahi@yahoo.com

Combinatorial optimization problems (COP) play great role in academy and industry and in the past thirty years, many metaheuristics which most of them inspired by nature like genetic algorithm, simulated annealing, tabu search, ant colony systems and evolutionary algorithms have been developed to solve them. These algorithms use different methods such as guided strategies for search of solution space and work very good.

2 - Optimization Software Class Libraries - An Update of Research
Stefan Voss, Chair and Director of the Institute of Information Systems within the Faculty of Economics and Business Administration, University of Hamburg, IWI, Von-Melle-Park 5, Hamburg, HG, 20146, Germany, stefan.voss@uni-hamburg.de

Just as metaheuristics provide flexible and extensible methods of solving optimization problems, class libraries provide flexible and extensible building blocks for creating software to implement metaheuristics. We provide an update of research regarding class libraries and frameworks in the metaheuristics domain. This includes a survey of some of the more general metaheuristics class libraries and some examples of specific uses.

3 - Multi-Start Tabu Search and Diversification Strategies for the Quadratic Assignment Problem
Tabitha James, Pamplin College of Business, Business Information Technology, Blacksburg, VA, United States, tajames@vt.edu, Cesar Rego, Fred Glover

We introduce several multi-start tabu search variants and show the benefit of utilizing strategic diversification approaches within the tabu search framework for the QAP. Results on a set of instances from QAPLIB demonstrate the improvement of our TS multi-start variants over the classic tabu search approach widely used for the QAP. We also show that our new procedures are highly competitive with the best recently introduced methods from the literature, including more complex hybrid approaches.

4 - Scheduling English Football Matches Over Holiday Periods
Graham Kendall, University of Nottingham, School of Computer Science & IT, Nottingham, NO, NG9 2JB, United Kingdom, gxk@cs.nott.ac.uk

In English football, each divison holds a double round robin tournaments but the scheduling for one division cannot be done in isolation, due to the constraints between them. Over the Christmas period, every team has to play two matches (one at home and one away), and the distance they travel should be minimised. We present an overview of the problem, the data collection that we have undertaken, our algorithm and the results, which show that it is possible to produce high quality schedules.

■ WD07

Tuning, Pre- and Post-Processing in Conic Optimization

Sponsor: INFORMS Computing Society/Optimization: Computational Optimization and Software
Sponsored Session

Chair: Yuriy Zinchenko, AdvOL, CAS, McMaster University, 1280 Main Street W, ITB 221, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca

1 - On Solving Specially Structured Large SDP's
Bharath Rangarajan, University of Minnesota, Minneapolis, MN, 55455, United States, bharathr@me.umn.edu

The stability conditions for spatially-distributed systems give rise to large semi-definite programs with very special structure. In this presentation, gradient and interior-point algorithms along the lines of a Dantzig-Wolfe method are explored. The gradient techniques, while slower than interior-point methods, have the additional capability of being distributed in computation. The interior-point techniques promise a faster asymptotic convergence and an improvement in overall complexity.

2 - Parameter Tuning and Adaptive Techniques in SeDuMi
Imre Pólik, PhD Student, McMaster University, 1280 Main Street W., Department of Mathematics, Hamilton, ON, L8S 4K1, Canada, poliki@mcmaster.ca, Tamás Terlaky

Most optimization solvers use a set of default parameters. While these values are rarely optimal, most users can not change them. In this talk we present some techniques to remedy this situation. Both offline and online solutions are discussed, involving optimization and learning techniques. The methods will be illustrated with the SeDuMi package.

3 - Projective Preconditioners for Improving the Practical Performance of IPMs for Conic Programming
Alexandre Belloni, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, belloni@mit.edu, Robert Freund

The traditional strategy for speeding up the performance of IPMs for conic optimization problems has been to focus on pre-conditioners to try to improve the numerical performance of the equation system solved at each iteration. In contrast, we present a methodology for mapping the entire problem to one that is better behaved in order to actually reduce the number of IPM iterations that are required to solve the problem. We report our latest computational results.

■ WD08

Technology Management and Service Industry

Sponsor: Technology Management
Sponsored Session

Chair: Tim Anderson, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, tima@etm.pdx.edu

1 - Intellectual Property Rights and the Service Industry
Arnold Reisman, Reisman and Associates, Shaker Heights, OH, 44122, United States, reismana@cs.com

Tradition recognizes manufacturing, public, and services. Thus, service sector subsumes both the knowledge and entertainment industries (K&EI). Each K&EI firm is much more dependent on protection of its intellectual property (IP) rights than are companies or agencies in the other sectors. Because IP protection is an emerging domain, there is no general theory, model, or structure, for this field. Using a taxonomic approach this paper views the broad field of IP protection as a tapestry.

2 - Can Service Industry Learn Technology Management from Manufacturing?
Antonie Jetter, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, jettera@cecs.pdx.edu

Many firms in the service industry still lack systematic approaches to technology evaluation and selection, to new product development, and to providing organizational structures that foster innovation. This paper highlights the differences between manufacturing and service industries and discusses which of the technology management approaches currently employed by the most productive and innovative manufacturing firms can be successfully adopted by the service sector.

3 - Exploratory Evaluation of University Technology Transfer Efficiency
Tim Anderson, Department of Engineering & Technology Management, Portland State University, Portland, OR, 97207, United States, tima@etm.pdx.edu, Francois Lavoie, Tugrul Daim

Services represents largest part of the US economy. One great example is IBM that has long been more of a services company than a computer company. Services can be difficult to analyze and outputs may not be tangible products as units may not be easily converted to dollars. Universities are also considered a part of the service economy. They provide education as well as innovations resulting from research. This paper focuses on the service of transferring research results into the other sectors.

4 - Of People, By People, and For People: A Pragmatic View of Business Service Engineering Acceptance
William "Ike" Eisenhauer, Assistant Vice President of Loss Mitigation and Equity Operations, Wells Fargo CCG, ike@techsensei.com

Engineering of business processes, in general, and servicing processes, specifically, are experiencing a resurrection in the United States. This effort, typically done to remain competitive and customer orientated, has brought with it a new exposure to operations research and its tools. This exposure has done a great deal to bring potential optimization and streamlining of labor intensive and costly servicing activities. However, too many times this potential, however justified by "the data" is never reached or even attempted by the business channel. We explore the typical barriers to acceptance of operations research and process engineering efforts in the "real world" and what can be done to overcome them. In addition, some suggested and proven methods are presented to assist and ease the integration of operations research and management science in to the day to day operations of servicing organizations. Examples presented are primarily in the financial services industry, but are applicable to any servicing industry.

■ WD09

Manufacturing

Contributed Session

Chair: Fong-Yuen Ding, Department of Industrial and Information Engineering, University of Tennessee, Knoxville, TN, 37996, United States, fding@utk.edu

1 - Grouping of Manufacturers Based on their Manufacturing Goals
Deepak Subedi, Assistant Professor, Marshall University, One John Marshall Drive, CH 423, Huntington, WV, 25705, United States, deepak_subedi@yahoo.com

For manufacturers, cost, quality, flexibility, delivery speed and new product development (NPD)are the major priorities. Cluster analysis was conducted based on the importance manufacturers attach to each of the priorities. They formed two clusters. Cost and quality are important for the first group, while NPD is the priority of the second. First group seeks profit by improving productivity in their plants; the second group emphasizes on growth.

2 - Machinery Asset Monitoring Using Bayesian Networks
Tim Lund, Software Engineer, Quantum Leap Innovations, 3 Innovation Way, Suite 100, Newark, DE, 19711, United States, thl@quantumleap.us

We describe a mechanism to monitor large scale mechanical systems using Bayesian models relating live sensor data to machine state. This enables real-time feedback of probabilities of potential problems, thereby allowing early diagnosis, preventative maintenance, and mean-time-to-failure projections. The system uses existing sensor deployments and middleware collection software. We describe the system architecture and a real-world deployment example in the area of heavy rotating machinery.

3 - Workload-Dependent Capacity Control in Make-to-Order Production
Gergely Mincsovics, Technische Universiteit Eindhoven, PO Box 513, Eindhoven, NB, 5600MB, Netherlands, g.z.mincsovics@tm.tue.nl, Nico Dellaert

We investigate adaptive capacity planning in make-to order situations. We introduce a set of Markov chain models to represent workload-dependent capacity control policies and show two analytical approaches to evaluate the policies' due-date performance, capacity, capacity switching, and lost sales costs. We give a comparison with fixed capacity planning rules.

4 - Process Improvement
Ashima Gupta, Student, NSIT, A-5/B 381 Paschim Vihar, New Delhi, 110063, India, ashima_nsit@yahoo.co.in, Pradeep Khanna, Richa Rastogi

In the current market scenario, as the sale of cars climbs up, the net output capacity of engines (cylinder head, cylinder block, crank, cam etc) has to be increased. The process improvement of crank line to increase the productivity without installing a new line is the aim of our study, conducted in Maruti Udyog Ltd. For that purpose a detailed study of processes was done, cycle time split up evaluated, bottleneck machines found and rectifications incorporated to achieve the target cycle time.

5 - A Heuristic Procedure to Solve the Generalized Car Sequencing Problem
Fong-Yuen Ding, Department of Industrial and Information Engineering, University of Tennessee, Knoxville, TN, 37996, United States, fding@utk.edu, Jingxu He

In sequencing an automobile assembly line, many car options often need to be considered, for example, objectives that consider a fixture pattern, blocking, spacing, and smoothing of options. A heuristic sequencing procedure is developed to obtain an initial sequence constructively, then swap orders and perform resequencing. The procedure was shown to improve initial sequences by swapping and resequencing. Solutions from the heuristic procedure were compared to those from simulated annealing.

■ WD11

Novel Applications

Contributed Session

Chair: Mike O'Leary, Associate Professor, Towson University, Department of Mathematics, Towson, MD, 21252, United States, moleary@towson.edu

1 - Scheduling in Cellular Manufacturing

Jose Ribeiro, Professor, University of Sao Paulo, USP CP668 Sao Carlos SP Brazil, Av. T Neves 457 641 Sao Carlos SP Brazil, Säo Carlos, Brazil, jffr@uol.com.br

A method for scheduling workshop tasks is presented in this article. The method uses a partition of the workshop in manufacturing cells for solving the global problem in a decomposed manner. The scheduling are determined by a heuristic procedure that solves the job shop disjunction while taking into account the release and due dates. The proposed method allows us to efficiently solve some large size examples and works in real time, despite the non-polynomial nature of the problems studied.

2 - Closed Loop Queueing Model for Material Handling Systems

Narasimhan Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, gu, 380015, India, nravi@iimahd.ernet.in

Motivated by a real life application we develop a queueing model to optimise the resources to handle a specified volume of material on a given time period. Given the complex nature of the situation approximate anlytical solutiuon and simulation results are compared. The sensitivity of various parametres in the system on the total resource required is studied. Based on the results a resource allocation policy to improve system parameters is suggested.

3 - Application of Optimization to Value-Based Pricing

Rongzeng Cao, IBM China Research Lab, Zhong Guan Cun Software Park, 19# Building, Beijing, 100094, China, caorongz@cn.ibm.com, Wei Ding, Chunhua Tian

Recently buyers and suppliers of IT services are increasingly moving toward more flexible contract structures built around a value-focused approach based on usage or defined service-level objectives. In this paper, we focus on some analysis and optimization technologies together with some cases used in this new application by optimizing various proportions and configuring a pricing schedule from a set of pricing models such as: fixed fee, performance fee, usage fee, and shared benefit.

4 - An Interpersonal Influence Representation in Social Network Flow Modeling

Jonathan Hamill, USAF/AFIT, 2950 Hobson Way, WPAFB, OH, 45434, United States, thehamills@yahoo.com, James Chrissis, Robert Mills, Richard Deckro

Methods to measure the strength of interpersonal ties among individuals in a social network as well as a means to mathematically characterize source-dependent influence are presented. These techniques lend themselves to use of classic network flow formulations, to include a new centrality measure based upon generalized network flows.

5 - Finding the Optimal Search Area for a Serial Criminal

Mike O'Leary, Associate Professor, Towson University, Department of Mathematics, Towson, MD, 21252, United States, moleary@towson.edu, Melissa Zimmerman, Ruozhen Yao

We describe a new method to find the optimal search area for a serial criminal committing crimes like burglary, arson, and rape. Our method accounts for simple geographic features like jurisdictional boundaries and the presence of bodies of water, and can be extended to account for additional features. This is done by writing the problem as a maximum likelihood estimate problem, and using nonlinear optimization to find the required parameters.

■ WD12

Enterprise-Wide Optimization: Process Scheduling

Cluster: Enterprise-Wide Optimization in the Process Industry
Invited Session

Chair: Andrew Bringhurst, IT Associate, Decision Sciences, Air Products and Chemicals, Inc., 7201 Hamilton Boulevard, Decision Sciences, A5238, Allentown, PA, 18195, United States, BRINGHA@airproducts.com

1 - Task Selection, Assignment and Sequencing in Multistage Batch Processes

Christos Maravelias, Assistant Professor, Department of Chemical and Biological Engineering, University of Wisconsin at Madison, 1415 Engineering Drive, Madison, WI, 53706, United States, christos@engr.wisc.edu, Pradeep Prasad

We propose a novel MIP model for the scheduling of multistage batch processes with parallel units of different capacities. The problem is difficult because orders cannot be a priori assigned to batches. Thus, selection, as well as assignment and sequencing decisions are required. To solve large instances we develop an algorithm that lends itself to parallelization.

2 - Optimal Planning and Scheduling for Multiproduct Batch Plants with Parallel Lines

Muge Erdirik Dogan, PhD Student, Carnegie Mellon University, Department of Chemical Engineering, Doherty Hall, Pittsburgh, PA, 15213, United States, muge@cmu.edu, Ignacio Grossmann, John Wassick

An integrated approach is presented for optimal planning and scheduling of batch reactors operating in parallel that involve intermediate storage and sequence dependent changeover times. A continuous time MILP model based on slot time representation is proposed for scheduling, while a tight STN relaxation model where the detailed timing constraints and changeovers are replaced by time balances is proposed for planning.

3 - Easing Rescheduling Complexity for a Bulk Gas Production and Distribution Problem

Wasu Glankwamdee, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, wag3@lehigh.edu, Jeff Linderoth, Jierui Shen, Jackie Griffin

This paper demonstrates the impact of different planning models within a large industrial gas company for its production and distribution during the course of a month. We build an optimization model approximating the model in place at the company and a simulation mechanism that allows us to create instances of varying time-granularities. Computational results are given to reveal the best course of action that minimizes the frequency and severity of intra-month schedule adjustments.

4 - Optimal Crane Scheduling

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Ionut Aron, Latife Genc, Iiro Harjunkoski, Marco Fahl

We present an algorithm for scheduling cranes in a factory or mill. The cranes operate on a single track and cannot bypass each other. Each job to be scheduled consists of a sequence of pickup and delivery stops at predetermined locations and a time window. We combine a local search heuristic for assigning jobs to cranes and sequencing them with a dynamic programming algorithm that finds an optimal space-time trajectory for each crane.

■ WD13

Innovative Approaches to Bringing Communication into Engineering and Business Undergraduate Courses

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Judith Shaul Norback, Director of Workforce & Academic Communication, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu

1 - Integrating Workforce Communication into an Engineering Introduction to Statistics Course

Judith Shaul Norback, Director of Workforce & Academic Communication, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu, Nicoleta Serban

More and more employers are expecting engineering graduates to have excellent workforce communication skills. And of course universities have responded to ABET2000 by incorporating more communication skills in their undergraduate curricula. At the Georgia Tech H. Milton Stewart School of Industrial and Systems Engineering, we have identified the needed workforce communication skills by interviewing practicing engineers, supervisors and senior executives in companies employing many engineers. The skills have been integrated through the use of projects into Introduction to Statistics. We will describe the very positive preliminary student feedback and how to implement the process at other universities.

2 - Effective Managerial Presentations of Analytical Work

Thomas Grossman, Associate Professor of Information & Decision Science, School of Business and Management, University of San Francisco, 2130 Fulton Street, San Francisco, CA, 94117, United States, tagrossman@usfca.edu, Judith Shaul Norback

Business students struggle to give effective managerial presentations of analytical work, tending to discuss their model and their spreadsheet rather than the model outputs and resulting business insights. We integrate empirical research (from the

Workforce Communication Program at Georgia Tech's H. Milton Stewart School of Industrial & Systems Engineering) with observations of business student analytical presentations to identify twelve presentation skills that can usefully be taught in the business school management science course. The process of implementing these skills in business and engineering courses at several universities will be described.

3 - Using Science Fiction to Teach Leadership and Communication in an Undergraduate Information Systems Course

Brian Butler, Associate Professor of Business Administration, Katz Graduate School of Business, University of Pittsburgh, 226 Mervis Hall, Pittsburgh, PA, 15260, United States, bbutler@katz.pitt.edu, Michelle M. Butler

Undergraduates often have difficulty understanding the complexity involved with implementing information systems in organizations. Even when they comprehend the technical issues, they often miss the human and organizational issues, and as a result find it difficult to understand the importance of communication and leadership skills in the success of these efforts. Well written science fiction can make the human and social challenges associated with technology more concrete, providing both context and grounding for efforts to incorporate communication and leadership into traditional information systems courses. We will report on experience from a joint Science Fiction/Information Systems course. Consideration will be given to ways in which the readings, discussions, and assignments worked together to increase student understanding of language, audience, and imagination and their role in effective organizational communication and leadership. Particular emphasis will be placed on ways the techniques and materials could be used to supplement more traditionally organized courses in information systems and engineering management.

■ WD14

Metaheuristics

Contributed Session

Chair: Funda Samanlioglu, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 406 McNair, Greensboro, NC, 27411, United States, fsamanli@ncat.edu

1 - C-GRASP Heuristic for Identification of Adverse Drug Reactions

Michael Hirsch, Raytheon, Inc. and University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, mjh8787@ufl.edu, Michelle Ragle, Claudio Meneses, Panos Pardalos, Mauricio Resende

Adverse drug reactions (ADRs) are estimated to be one of the leading causes of death in the United States. Many national and international agencies have set up databases of ADR reports for the express purpose of determining these relationships. We formulate the drug-reaction relationship problem in the framework of text categorization. We utilize a new C-GRASP heuristic to recover the relationship. Our approach is applied to cardiovascular-type reactions reported in the ADRAC database.

2 - A Hybrid Metaheuristic Approach For Solving The Course Scheduling Problem

Carlos Osorio Ramirez, Politecnico Grancolombiano, Calle 57 No. 3-00 Este, Bogota, BO, Colombia, caosorio@poligran.edu.co, Danilo Abril

The course scheduling problem of large size, or the timetabling problem, is known to be NP-hard, and as such only combinatorial optimization techniques should obtain an optimal solution. In this paper, we present a metaheuristic hybrid approach based on Local Search, Tabu Search and Genetic Algorithms, applied to the course scheduling process in a colombian higher education institution.

3 - Unrelated Parallel Machines Scheduling with Ready Times and a Total Weighted Tardiness Objective

Dong-Gil Na, Electronics and Telecommunications Research Institute, 161 Gajeong-dong, Yuseong-Gu, Daejeon, 305700, South Korea, dgna@etri.re.kr, Hoon Jung, Dong-Won Kim, Jong Heung Park

This paper addresses the batch scheduling for parallel unrelated machines using search heuristics. The problem accounts for allotting batched work parts to the unrelated parallel machines. The objective is to minimize the total weighted tardiness for the unrelated parallel machine scheduling with ready-times. Two search heuristics are suggested for the problem.

4 - Algorithms for Data Association in Multi-Target Tracking

Dimitri Papageorgiou, The Raytheon Company, 235 Presidential Way, Woburn, MA, 01801, United States, Dimitri_J_Papageorgiou@raytheon.com

Multi-target tracking hinges upon the solution of a data association problem, which can be formulated as a maximum weight independent set problem or as a multi-dimensional assignment problem. We discuss the leading algorithms for these two approaches and compare their performance.

5 - An Interactive Genetic Algorithm with Random-Keys Representation for a Symmetric Multi-Objective TSP

Funda Samanlioglu, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, 406 McNair, Greensboro, NC, 27411, United States, fsamanli@ncat.edu, William G. Ferrell

This research focuses on incorporating user preferences interactively in terms of classification of objective functions into five classes and specification of optional weighting coefficients, bounds, and especially optional upper bounds on "indifference trade-offs" with a hybrid random-key genetic algorithm, in order to find preferred (approximate) (weakly) Pareto optimal solutions to a symmetric multi-objective traveling salesman problem.

■ WD15

Auction Theory

Cluster: Auctions and e-Commerce

Invited Session

Chair: Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

1 - Characterizing Optimal Keyword Auctions

Anuj Kumar, Industrial Engineering & Operations Research Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States, ak2108@columbia.edu, Garud Iyengar

We present a variety of models for keyword auctions used for pricing advertising slots on the search engines (Google Inc., Yahoo! Inc. etc.). First, we present a compact characterization of the set of all deterministic incentive compatible direct mechanisms in a model with slot dependent valuations. Next, we study two interesting cases of this model: slot independent valuation and constant valuations up to a privately known slot and zero thereafter.

2 - Optimality of (s,S) Replenishment Policies for Inventory Systems with Heterogeneous Sales

Ganesh Janakiraman, Assistant Professor, Stern School of Business, New York University, 44 West 4th Street, New York, NY, United States, gjanakir@stern.nyu.edu, W. Tim Huh

A multi-period model of a firm that replenishes inventory periodically and conducts auctions within each period to sell the product was recently studied by Van Ryzin and Vulcano (2004). In the absence of fixed costs for replenishment, they showed that the optimal replenishment policy has the order-up-to structure. With fixed costs, we show that the optimal inventory replenishment policy is of the (s,S) type. We also present extensions to other types of sales channels.

3 - Simplified Bidding and Solution Mechanisms for VCG Combinatorial Auctions

Damian Beil, Assistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, dbeil@bus.umich.edu, Amitabh Sinha, Amy Cohn

Combinatorial auctions' applicability in practice has been limited by the need for bidders to bid on an exponential number of bundles and for the auctioneer to solve an exponentially large winner-determination problem. We present a new bidding approach to address these challenges for a broad class of VCG combinatorial auctions. In our approach, the bidders' true-cost types are explicitly incorporated within a mathematical program that is used to solve the winner-determination problem.

4 - Vendor Selection Mechanisms

Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

We use a math programming model to characterize the optimal mechanism for a set of adverse selection problems. We characterize using duality, conditions under which auction type mechanisms are either optimal or perform well. We also provide conditions under which certain bargaining games dominate auctions. In this process we use inner approximation techniques to approximate the infinte dimesnional linear program, thereby demonstrating strong convergence properties of auction type mechanisms.

■ WD16

Revenue Management & Its Application

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Jian Wang, Vice President, R&D, RainMaker Group, 1000 Holcomb Woods Parkway, Suite 114, Roswell, GA, 30076, United States, JWang@letitrain.com

1 - Market Segmentation in the Car Rental Industry
Darren Arrington, Director, Revenue Management Science, Dollar Thrifty Automotive Group, 5330 E 31st Street, 3W2, Tulsa, OK, 74135, United States, Darren.Arrington@DTAG.Com

Discuss Market segmentation methods and their uses in Demand Forecasting and Pricing Optimization systems.

2 - Dynamic Pricing and Optimal Development Stragegy in Presales Housing Market
Youyi Feng, Associate Professor, The Chinese University of Hong Kong, The Department of SEEM, R609, M. W. Mong Engineering Building, Hong Kong, Hong Kong, yyfeng@se.cuhk.edu.hk, Zhan Pang

We consider a house developer who designs an options contract in a presales (sales-before-completion) housing market. The spot price in the housing market is random and is assumed to be a diffusion process. The demand approaches housing systems as a Poisson stream and the arrival rate is sensitive to the premium and affected by spot price. The premium of each house is dynamically adusted. Finally, we discuss the optimal contract design issue and the optimal capacity investment decison.

3 - An Observation of Optimization Horizon Impact on Apartment RM Pricing
Montgomery Blair, AVP, Archstone-Smith, MBlair@archstonesmith.com, Jian Wang

Optimization horizon is often pre-specified in many applications of revenue management (RM). Different selection of optimization horizons has significant effects on dynamic pricing behaviors. Little theoretical research has been done on how to determine an "optimal" horizon in published literatures. Based on a real apartment RM system, we simulated how rental pricing changed to a wide range of optimization horizon selections, and suggested some criteria to pick the "proper" horizon.

■ WD17

Simulation of Supply Chain Systems

Contributed Session

Chair: Brian Neureuther, SUNY Plattsburgh, School of Business, Plattsburgh, NY, United States, sdbrian@isugw.indstate.edu

1 - Web-Based Oil Supply Chain Game
Samik Raychaudhuri, Decisioneering, Inc., 9100 E. Florida Avenue, Apt. 17-207, Denver, CO, 80247, United States, samik@freeshell.org

We present an interactive web-based gaming mode simulation model of a multi-echelon oil supply chain. The top echelon (Refineries) and the bottom echelon (Retail Outlets) are controlled by the computer, and the players take decisions at Storage Points and Depots, trying to minimize total cost. The game also provides ways of simulating different decision strategy (order-supply strategy) combinations. Players physically apart can participate in the simulation through LAN or Internet.

2 - System Dynamics Modeling for Biodiesel Supply Chain Management
Denis Borenstein, Universidade Federal do Rio Grande do Sul, R. Washington Luis 855, Porto Alegre, RS, Brazil, denisb@ea.ufrgs.br, Luciano Ferreira

Supply chain modeling has received an increasing attention from researchers in recent years. However, very few attempts have been made to develop formal models applied to the biodiesel supply chain. This work presents a system dynamics model for the analysis and evaluation of biodiesel supply chains. The model focuses not only on logistical costs, but also on the social impacts related to the location of biodiesel plants.

3 - Agent-Based Computational Framework for a Complex Multi-Product Supply Chain
Partha Priya Datta, Cranfield University School of Management, Wharley End, Cranfield, MK43 0AL, United Kingdom, parthapriya.datta@gmail.com, Peter Allen, Martin Christopher

Traditional mathematical modelling approaches are ineffective in dealing with dynamic complex supply chains. An agent-based computational framework is developed for studying a complex supply chain that provides managerial insights on how to improve operational resilience by drawing on results from multiple scenario simulation.

4 - Port Simulation Using Arena
Marcos Antonio Masnik Ferreira, System Analyst, Central Bank of Brazil, Rua Camoes 175, ap32 Cristo Rei, Curitiba, PR, 80050-290, Brazil, masnik@gmail.com

One of the most challenging obstacles when carrying on a simulation project in a harbor environment is how to implement and simulate the arrival process of trucks and trains. Those arrivals have at same time a stochastic and a deterministic behavior that must be appropriately modeled. In addition, the cargo must be sent prior to the ships arrivals. Nevertheless, the amount of cargo that can be sent, in advance, to the port depends on the available space in the port storage facilities.

5 - Simulating Complexities in Semiconductor Manufacturing
Brian Neureuther, SUNY Plattsburgh, School of Business, Plattsburgh, NY, United States, sdbrian@isugw.indstate.edu

One of the most challenging environments to develop a validated simulation model is in the semiconductor manufacturing process. Numerous simulations have been developed for specific operations within the manufacturing process, but few have been developed for the entire front-end. A simulation model is developed and the complexities involved in the simulation of the semiconductor manufacturing process are discussed.

■ WD18

Reliability

Contributed Session

Chair: Md. Rezaul Karim, JSPS Postdoctoral Research Fellow, The University of Electro-Communications, Department of Systems Engineering, 1-5-1 Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, mrezakarim@yahoo.com

1 - Cost and Availability as Effectiveness Metrics for Maintained Systems
Geoffrey Okogbaa, University of South Florida, 4202 E. Fowler Avenue, FAO 274, Tampa, FL, 33620, United States, okogbaa@ibl.usf.edu, Sulabh Jain, Wilkistar Otieno

Several maintenance policies have been proposed to minimize systems maintenance cost. However, most of them fail to consider systems in transient state. In the proposed paper, a simulation of a multi-unit transient state system with n economically dependent components is used to evaluate the efficacy of opportunistic and preventive maintenance policies using cost and availability as metrics.

2 - Estimation Methods for Lifetime Data Under Random Right Censoring
Jonathan Bates, Lieutenant, U.S. Coast Guard, 2217 Spring Circle, Cocoa, FL, 32926, United States, jbates@cgcconfidence.uscg.mil

David Reineke completed a study in 1998 that examined estimation methods for data under random right censoring. This study adds to this earlier work by examining the Kaplan-Meier Estimator, Maximum Likelihood Estimator, Földes, Rejtı, and Winter Estimator, Piecewise Exponential Estimator, and the Klein, Lee, and Moeschberger Estimator for levels of censoring above 75%, values of n from 5-100, and various Weibull shape parameters to determine the best performing method for each case.

3 - Nonparametric Degradation Inference from Highly Censored Exceedance Data
Hui Fan, Rensselaer Polytechnic Institute, 110 8th Street, CII 5015, DSES Department, Troy, NY, 12180, United States, fanh2@rpi.edu, Thomas Willemain, Brock Osborn, Pasquale Sullo

We consider the problem of analyzing degradation data censored to reveal only the times at which a performance variable exceeds a threshold. We evaluate the use of traditional nonparametric methods of detecting deterioration by developing power curves for simple models of the deterioration process. We also develop a new test method based on Markov chains and compare it with traditional nonparametric test methods. This work was motivated by study of exhaust gas temperatures in jet engines.

4 - Optimization of Warranty Costs with Different Repair Options
Raja Jayaraman, Graduate Research Assistant, Department of Industrial Engineering, Texas Tech University, PO Box 43061, Lubbock, TX, 79409, United States, r.jayaraman@ttu.edu, Dr. Timothy I Matis

We study warranty policies consisting of Free Replacement (FRW) and Pro-Rata (PRW) policies of systems subject to random breakdowns. The manufacturer can perform different strategies from minimal repair to replacement upon failure, and these strategies will have different cost implications. We derive expressions for expected profit to the manufacturer in a product purchase and long run average profit in the product life cycle under each option employed.

5 - Reliability Analysis of Automobile Component with Covariates During the Warranty Period

Md. Rezaul Karim, JSPS Postdoctoral Research Fellow, The University of Electro-Communications, Department of Systems Engineering, 1-5-1 Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, mrezakarim@yahoo.com, Kazuyuki Suzuki

In warranty database, the information on covariates associated with reliability-related factors is unknown for the censored automobiles, which makes it difficult to estimate the reliability as a function of such covariates. This presentation deals with this problem and models the lifetime of automobile component to estimate some quantities of interest that are applicable in assessment of reliability and predicting warranty claims and costs. An example based on real field data is given.

■ WD20

Decision Support Systems

Contributed Session

Chair: Ram Pakath, Gatton Endowed Research Professor of DSIS, University of Kentucky, School of Management, 425 C.M. Gatton College of Business, Lexington, KY, 40506, United States, pakath@uky.edu

1 - Distributed Quantitative Proactive Risk Analysis

Salah Benabdallah, Director, Institute of Technology in Communications (ISET'Com), Parc Technologique,El Ghazala, Ariana, 2088, Tunisia, sba@supcom.rnu.tn, Mohamed Hamdi, Noureddine Boudriga, Wafa Jridi

The objective of this paper is to present an approach for transforming the developed mono pro-active RA process into a distributed process which could be used by a team of experts simultaneously. A set of mathematical methods have been used to merge the different experts opinions. In addition a set of experts weights have been introduced to guarantee the best interaction between the team members and consequently the consistency of the RA process.

2 - Agent-Based Simulation Model for Disaster Management Decisions

Shengnan Wu, PhD Candidate, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, SHW14@pitt.edu, Carey Balaban, Bopaya Bidanda, Matthew Kelley, Larry Shuman, Ken Sochats

The last few years have revealed the importance and need for intelligent control systems to deal with unanticipated events including disasters. In this paper, the authors describe the general framework for a simulation-based decision support system for disaster management. The built-in simulation model fully applies the multi-agent systems ideas, interfaced with a real-time GIS database, a rule-based decision module which contains standard treatment rules for emergency and a rule optimizer.

3 - A Framework for Branch Internal Optimization

Xinxin Bai, R&D Engineer, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, BJ, China, baixx@cn.ibm.com, Wenjun Yin, Ming Xie, Jin Dong

With the rapid change of market environment, optimization of internal resources allocation is rather critical for branches to achieve strategic goals. A branch internal optimization methodology with a series of analysis and optimization models is presented. By multi-dimensional analysis of transaction history, bottlenecks can be mined rapidly; besides, simulation-based optimization can help executives get better understandings on the effects of new resource allocations.

4 - Determining an Optimal Selling Price for a Product in a Bidding Competition

Haleh Valian, PhD Student, Rutgers University, 703 Bevier Road, Piscataway, NJ, 08854, United States, valian@eden.rutgers.edu, Davood Golmohammadi

In this paper, finding an optimal price for selling a product in a bidding competition is discussed. Optimal price is determined by maximizing expected profit, and computed probability of wining the bid as a price function and other bid features. Feature selection techniques are applied for gaining more information. The bid outcome is predicted and the results are compared with the database of bid transaction history of the product. Also some techniques for the classification of patterns such as the Bayes classification model, neural networks, and k nearest-neighbor method are applied.

5 - Adaptive Decision Support Systems: A Critique

Ram Pakath, Gatton Endowed Research Professor of DSIS, University of Kentucky, School of Management, 425 C.M. Gatton College of Business, Lexington, KY, 40506, United States, pakath@uky.edu, Shashank Rao

Attempts at articulating a category of Decision Support Systems (DSS), called Adaptive DSS, date back to the late 80s. These attempts differ in their views of what constitutes "adaptation," the targets of adaptation, and in the means used to achieve adaptation capabilities. We seek to critically examine and contrast these various perspectives with the aid of representative implementations to help better comprehend the paradigm and to help set the stage for further exploration and refinement.

■ WD21

DA Arcade 4

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Alessandra Cillo, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, Alessandra.CILLO@insead.edu

1 - Applying Multi-Criteria Decision Analysis for Student Admission in the Case of a Magnet High School

Marina Polyashuk, Northeastern Illinois University, 5500 North St. Louis Avenue, Chicago, IL, 60625, United States, M-Polyashuk@neiu.edu

The problem of student admission to a college preparatory high school with selective enrollment is considered as a multiple criteria decision making problem. After formulating the problem, which includes defining decision space and criteria space, setting feasibility constraints and relationships among the criteria, different multi-criteria methods of student selection are discussed.

2 - A Quantitative Measurement of Regret Theory

Alessandra Cillo, INSEAD, Boulevard de Constance, Fontainebleau, F-77300, France, Alessandra.CILLO@insead.edu, Han Bleichrodt, Enrico Diecidue

This paper presents a quantitative measurement of regret theory. Our method is choice-based and requires no assumptions about the shape of functions reflecting utility and regret. The event-splitting effects could not confound our results. Our findings are consistent with the assumptions of regret theory although some deviations are found.

3 - Multi-Attribute Choice with Ordinal Information: A Comparison of Different Decision Rules

Paula Santos, Escola Superior de Tecnologia de Viseu, Departamento de Matemática, ESTV, Campus Politécnico de Viseu, Viseu, 3504-510, Portugal, psarabando@mat.estv.ipv.pt, Luis Dias

In the context of additive multi-attribute aggregation, we consider problems with ordinal information, namely considering a ranking of the scaling coefficients and a ranking of the value of each alternative on each criterion. Monte-Carlo simulation was used to compare how different choice rules compare, aiming also to provide guidelines about how to use these rules. The compared rules include ROC weights, minimum value, maximum loss of value, quasi-dominance and quasi-optimality.

4 - Utility Theory in a Networked Environment of Local Managers

Steven Harper, Research Scientist, National Center for Supercomputing Applications, University of Illinois Urbana-Champaign, 1205 W. Clark Street, Room 1008, Urbana, IL, 61801, United States, srharper@uiuc.edu

This study examined strategic investment alternatives for a networked system of managers producing a common product. Utility analysis, modeling and simulation, and game theory were applied by individual manages in there decision analysis with varied success. Results indicate that when smaller managers make changes there is little effect on the environment, whereas when larger manages make changes, the environment is changed, thus requiring updating of the managers' probability beliefs.

■ WD22

Informing Infrastructure Decisions

Sponsor: Military Applications
Sponsored Session

Chair: Patrick Driscoll, Professor, U.S. Military Academy, Department of Systems Engineering, Building 752, Mahan Hall, West Point, NY, 10996, United States, patrick.driscoll@usma.edu

1 - Analytical Framework for Assessing Physical Security Systems

Greg Graves, LTC, U.S. Military Academy, Department of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, gregory.graves@us.army.mil

Security systems seek to prevent or mitigate potentially catastrophic consequences. We present an analytical framework for the assessment of alternative security systems. The problem of separating preferences among alternatives without a unique probability distribution on reward is considered. Through a novel application of linear programming and sensitivity analysis, insights are gained regarding vulnerability and priorities for information acquisition.

2 - Decision Support Model for Metropolitan Disaster Response Planning

Niki Goerger, ERDC Research Associate at USMA, Engineer Research and Development Center, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Niki.Goerger@usma.edu, Patrick Driscoll

Terrorist attacks and natural disasters pose significant threats to metropolitan areas. Their ability to recover quickly is key. Determining how to respond and assess progress after such events offer serious challenges for decision makers. In light of this, we present a problem formulation for decision support for metropolitan emergency disaster response planning. The model is based on critical infrastructure states, interdependencies, and response over time.

3 - Linear Stochastic Systems Model for Counter-Insurgency Strategies

Patrick Driscoll, Professor, U.S. Military Academy, Department of Systems Engineering, Building 752, Mahan Hall, West Point, NY, 10996, United States, patrick.driscoll@usma.edu, Niki Goerger

We introduce a linear dynamic model that uses the evolving effects of system inter-dependencies on state and process conditions to suggests effective alternative counter-insurgency strategies based on stochastic intertemporal effects.

■ WD23

Service Industry Applications

Contributed Session

Chair: Divya Tiwari, Student, IIM,Bangalore, FPM office, IIMB, Bannerghatta Road, Bangalore, Ka, 560076, India, divyat00@iimb.ernet.in

1 - Manpower Planning for Call Centers with Learning Curves and Random Shocks

Tom Robbins, Penn State University, 462A Business Building, University Park, PA, 16803, United States, trr147@psu.edu, Terry Harrison

We examine the issue of short and medium term manpower planning for a call center where worker productivity is subject to learning curve productivity improvement. We consider the case where random shocks may impact both demand and productivity such as the operation of a software support desk when a new version of software is rolled out. We examine the types of shock that may occur and investigate approaches for mitigating the operational impact.

2 - Measuring Service Work: An Information Economic Perspective

John H. Lundin, Assistant Professor, San Jose State University, MIS Department BT 250, One Washington Square, San Jose, CA, 95192-0244, United States, lundin_j@cob.sjsu.edu, Paul P. Maglio

We develop a foundation for determining the work done by service providers to create services in three categories of the goods-services continuum: material, process, and information. Work occurs in each category directly, indirectly, and administratively. The metrics to quantify service work combine financial, benefit, worth, and resource measures. This method of measuring work aims to capture the full extent of what is needed to create services in an expanding service organization or economy.

3 - Service Quality Effort and Contract Renewals

Kuo-Ting Hung, Assistant Professor, Suffolk University, 8 Ashburton Place, Boston, MA, 02108, United States, khung@suffolk.edu, Jafar Manar, Hasan Arslan

We model the service relationship between a supplier and its customer over a single period. The customer experiences the service provided by the supplier over the single period and decides either to continue or shift to a competing supplier at the end of the period. We propose a service delivery policy that maximizes the supplier's profit and customer retention.

4 - Resource Planning for Software Service Industry

Divya Tiwari, Student, IIM,Bangalore, FPM office, IIMB, Bannerghatta Road, Bangalore, Ka, 560076, India, divyat00@iimb.ernet.in, Janat Shah, Jishnu Hazra, Shubhabrata Das

Two primary issues with the Software Service Industry are high demand uncertainty and supply crunch leading to resource uncertainty. The attempt is to develop an optimal resourcing policy: "how much to hire, when and what type-lateral vs fresher ratio". Typically freshers require longer lead time for training etc whereas laterals which are "of the shelf" type are scarce hence there is uncertainty about their timely availability. The firm has to strike a balance between these two uncertainties.

■ WD24

Supply Chain Optimization II

Contributed Session

Chair: Xuemei Su, University of Wisconsin, Milwaukee, PO Box 742, 53201-0742, Milwaukee WI 53201, United States, xuemeisu@uwm.edu

1 - Supply Chain Coordination Under Multiple Objectives

Chunming Shi, Washington State University, Department of Management and Operations, Pullman, WA, 99164, United States, cshi@mail.wsu.edu

Supply chain coordination has been studied extensively under the objective of expected profit maximization. In this paper, we focus on supply chain coordination where different agents may have different and/or multiple obectives, including the objective of maximzing the probability of achieving some predetermined performance level. We adopt the defintion of coordinating contracts which can lead to Pareto-optimal payoff for each agent in the supply chain.

2 - Capacity Allocation Using Past Sales: Turn-and-Earn in a Product Line

Debu Purohit, Professor, Duke University, Fuqua School of Business, Box 90120, Durham, NC, 27708, United States, purohit@duke.edu, Dinah Vernik

In the short run, if a supplier's capacity and prices are fixed, then a low demand realization leaves the manufacturer with unused capacity, while a high demand realization leaves retailers with limited supply. In this paper we generalize Cachon and Lariviere (1999) by analyzing the case where a manufacturer sells a product line and the demand for the products is interrelated. We find that turn-and-earn across items in a product line leads to higher profits for the manufacturer.

3 - Supply Chain Coordination Contracts with Warranty

Wan-Ting Hu, LeBow College of Business, Drexel University, Academic Building, 2nd Floor, Decision Sciences, Philadelphia, PA, 19104, United States, wh52@drexel.edu, Hande Benson

We consider the wholesale and revenue sharing contracts between one supplier and one retailer, where the supplier offers free replacement warranty to the end customers with warranty length elastic demand. The chain is coordinated if the channel optimal production amount and warranty length are reached while each party maximizes own profit. We show that coordination only occurs if both revenue and warranty cost are shared, with the share of the warranty cost equal to the share of the profit.

4 - Motivating Retail Marketing Effort: Optimal Contract Design

Xuemei Su, University of Wisconsin, Milwaukee, PO Box 742, 53201-0742, Milwaukee, WI, 53201, United States, xuemeisu@uwm.edu, Samar Mukhopadhyay

We study a scenario where the manufacturer relies on the retailer for investing in marketing effort to boost demand. The retailer's cost of marketing is private. To motivate the retailer to provide desired level of marketing effort, the manufacturer offers a menu of contracts, hoping to invoke the "revelation principle" when the retailer accepts a certain contract from that menu. We find both a two part tariff price schedule and a cost plus contract schedule will coordinate the channel.

■ WD25

Industry Applications III

Contributed Session

Chair: Renata Maciel, 1, Universidade Federal de Pernambuvo, Rua AcadÍmico Hélio Ramos, s/n, CEP 5074, Recife, PE, 51021190, Brazil, remaciel@hotmail.com

1 - An Analysis on Optimal Operating Conditions at Automatic Delivery Sequencing in Korea
Seong-Joon Lee, Electronics and Telecommunications Research Institute, POB 106, Yuseong-gu, Daejon, 305-600, South Korea, sungjun2@etri.re.kr, Seung-Jin Wang

The purpose of this paper is an attempt to solve the optimal operating conditions from experimental results during the field test period of the delivery sequence sorting machines at Korean postal service.

2 - An Estimation of Management Excellence Criterion Weights: The Case of Turkish Public Institutions
Fethullah Caliskan, Senior Researcher, TUBITAK TUSSIDE, Baris M. Kosuyolu Cad., No:48 P.K.14 Gebze, Kocaeli, 41401, Turkey, fcaliskan@tusside.gov.tr

In order to answer the question of whether or not it makes any sense to compare all organizations according to an common weight structure of an excellence management model, an empirical test is required. We first examined the criterion weightings of the EFQM and BQA excellence models. Then, a criterion weights estimation procedure was applied on data obtained from self assessment studies of very diverse set of public institutions with the perceptions of more than 10,000 employees.

3 - Bin Packing with Flexible Bin Sizes
Danny Myers, Department of Applied Statistics and Operations Research, Bowling Green State University, Bowling Green, OH, 43403, United States, myers@cba.bgsu.edu, Michael Jacob

The basic bin packing problem assumes a supply of uniformly dimensioned containers. We present an industrial bin packing application in which a variety of container sizes are available. In addition, one dimension of the containers can be viewed as flexible in that some of the packed items may extend beyond the container boundaries.

4 - Methods to Minimize Coil Marks
Hoyeon Chung, Professor, Jeonju University, 3Ga 1200, Hyoja-Dong, Wansan-Gu, Department of Industrial Engineering, Jeonju-Si, 560-759, South Korea, hychung@jj.ac.kr

Coil marks are generated by steel mill manufacturing, slit processing, material handling, and a variety of other causes. If these bad raw material coils with coil marks would be used in car part manufacturing these marks would diminish the exterior quality of the finished cars. In this study we recommend a method using sponge pads to prevent coil marks from occurring during the manufacturing process and also a device to minimize coil marks from occurring during the material handling process.

5 - The Implementation Model of Quality Management System (Qms) Based on Iso 9001:2000 in the Civil Construction Sector
Renata Maciel, 1, Universidade Federal de Pernambuvo, Rua AcadÍmico Hélio Ramos, s/n, CEP 5074, Recife, PE, 51021190, Brazil, remaciel@hotmail.com, Denise de Medeiros

The focus of the work is on the process of implementation of the system of Quality Management (SQM) in the Civil Construction sector. The model was constructed, called Key Points for the Implementation Process, with eleven steps towards helping companies implement SGQ or to evaluate their current systems efficiently.

■ WD26

Improving Decision Tree Induction/Information Theory and Data-Mining Applications

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Sigurdur Olafsson, Assistant Professor, Iowa State University, Department of Industrial and Manufacturing Systems Engineering, Ames, IA, 50011, United States, olafsson@iastate.edu

Co-Chair: Shuning Wu, Iowa State University, IMSE, Ames, IA, 50010, United States, wsn97@iastate.edu

Co-Chair: Irad Ben-Gal, Dr., Tel Aviv University, Faculty of Engineering, Tel Aviv, Israel, Bengal@eng.tau.ac.il

1 - Post-Pruning in Regression Tree Induction: An Integrated Approach
Kweku-Muata Osei-Bryson, Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States, kmuata@isy.vcu.edu

A regression tree (RT) tree is a decision tree in which the target variable is continuous. The RT induction process involves the growth phase and the pruning phase. The pruning phase aims to generalize the RT that was generated in the growth phase.In this paper we present an integrated approach that also accomodates multiple relevant RT quality measures (e.g. accuracy, stability, simplicity).

2 - A Context Tree Method for Multistage Fault Detection and Isolation
Pierre Brice, Stevens Institute of Technology, Castle Point on Hudson, Hoboken NJ 07030, United States, pjbrice@stevens.edu, Wei Jiang

This paper proposes a generic system model based on context trees to predict system behaviors for the purpose of fault detection and isolation in a multistage software system. The approach consists of learning multistage model structures by capturing the expected statistical distribution of input/output at different stages and detecting departures from the expected model structures.

3 - Reinforcement Learning with Sub-Action Abstraction
Shahar Cohen, Tel Aviv University, Tel Aviv, Israel, shaharco@post.tau.ac.il, Evgeni Khmelnitsky, Oded Maimon

Representation abstraction in reinforcement learning enables the agent to ignore irrelevant aspects of the underlined task. The learning process, when incorporating representation abstraction, can be made faster and easier. The literature on reinforcement learning has only focused on a single form of representation abstraction, widely-known as state abstraction. In this work we propose a new form of representation abstraction.

4 - Multivariate Perturbation Trees: Protecting Privacy Against Record Linkage Attacks
Xiaobai Li, University of Massachusetts Lowell, College of Management, Lowell, MA, 01854, United States, Xiaobai_Li@uml.edu

We propose a tree-based data masking method for protecting privacy against record linkage attacks. The method recursively splits a dataset into smaller subsets such that data records within each subset are more homogeneous after each partition. The partition is made at the maximum variance dimension represented by the first principal component of the data at each partition. The confidential attribute values of a record in a subset are then masked using a rank-based swapping method.

■ WD27

Studies of Multi-Stage and Multi-Level Complex Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu

1 - Variation Source Identification in Manufacturing Using Nonlinear Measurements
Jean-Philippe Loose, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States, jploose@wisc.edu, Shiyu Zhou, Darek Ceglarek

This paper presents a variation source identification procedure in the presence of nonlinear measurements, which refers to the measurements that are related with the process variation sources through a nonlinear function. In the proposed procedure, the joint probability density of the measurements is determined as a function of the process parameters; then, series of statistical tests are performed to identify the variation source. A case study is used to illustrate the procedure.

2 - Impact of Product Variety on Manufacturing Complexity in Automobile Mixed-Model Assembly
Xiaowei Zhu, PhD Candidate, University of Michigan, 2415 Laurelwood Circle, Ann Arbor, MI, 48108, United States, xwzhu@umich.edu, S. Jack Hu, Yoram Koren

Automobile mixed-model assembly lines become very complex when the number of product variants is large, which, in turn, may impact quality and productivity. The paper considers the variety induced manufacturing complexity in manual assembly lines where operators must make choices in assembly. A complexity measure is proposed, and models are developed to evaluate the complexity at each station, then for the entire line. Complexity can be minimized by making systems design and operation decisions.

3 - Supply-Chain Oriented Robust Parameter Design
Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu, Lingyan Ruan, Na An, David Rosen

This article introduces game theory commonly used in supply-chain analyses to solve potential conflicts between manufacturing partners at various process stages. Through our methods, the partners collaboratively decide settings of controllable variables to make product less sensitive to process noises, especially variations propagated from upstream processes. Modeling and solution strategies of this new research topic are provided along with illustrated examples and comparison studies.

4 - Coordinated Inventory Allocation-Facility Location Problem
Divya Mangotra, PhD Student, Georgia Institute of Technology, School of Industrial and Systems Engineering, Campus Box 0205, Atlanta, GA, 30022, United States, divya@gatech.edu, Jye-Chyi (JC) Lu

We propose a two-phase approximation method for solving a multi-echelon inventory coordination-facility location problem. Our model integrates facility, inventory and transportation costs with service levels and supply-demand variability. We present a numerical study and compare results for the coordinated and uncoordinated model. These results are generated for two cases - identical and non-identical retailers.

■ WD28

Quality Applications and Methods

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Theodore Allen, Associate Professor, Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43221, United States, prodec@ameritech.net

1 - Meso-Analysis Analysis of Six Sigma Projects and Resilience Modeling
Jason Schenk, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, schenk.32@osu.edu, James Brady, Theodore Allen

39 six sigma projects were performed at a Midwest manufacturer. This paper describes attempts to mine data about the financial performance data of these projects to support decision-making about how the six sigma program should be run, i.e., meso-level decision support. We also describe future research related to resilience modeling.

2 - Multi-Fidelity Inverse Engineering With Nanotechnology and Other Applications
Ravi Rajagopalan, Graduate Teaching Associate, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, vioravis@gmail.com, Theodore Allen, Deng Huang

Inverse design is the selection of inputs to match a desired output pattern. Multi-fidelity kriging optimization offers much promise to do this accurately compared with approaches that calibrate metamodels and then abandon experimental data. We proposed new methods incorporating discrete inputs and explore a variety of applications. We compare the proposed approaches with alternatives from the design literature.

3 - Optimal Focus Group Design to Augment Demand Data
Shih-Hsien Tseng, Graduate Research Associate, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, shih_hsien@mail2000.com.tw, Theodore Allen

Focus groups facilitate forecasting of the demand for a new product. We explore the optimal planning of which prototypes to build and which questions to ask to augment data about demands for existing products. Also, the relationship of this problem with multifidelity modeling and accelerated testing is discussed.

4 - High Quality Voting Machine Allocation Applied in Ohio
Theodore Allen, Associate Professor, Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States, allen.515@osu.edu, Mikhail Bernshteyn, Steven Hertzberg

In the past, machines were allocated in a way that failed to account for variable ballot lengths resulting in systematic unfairness. This presentation focuses on defensible allocation of machines for a real world application in Cuyahoga, Ohio. Issues including variable arrival rates, machine capacity, and empirical service distributions are addressed.

■ WD29

Dynamic Programming/Control

Contributed Session

Chair: Matthew Henry, University of Virginia, 111 Olsson Hall, Charlottesville, VA, 22904, United States, mhenry@virginia.edu

1 - An Approximate DP Approach to Pharmaceutical R&D Funding Decisions
Pinar Keles, ISE Department, Lehigh University, 1063 Mosser Road V203, Breinigsville, PA, 18031, United States, pik2@lehigh.edu, Joseph Hartman

We model a pharmaceutical R&D portfolio management problem as a dynamic, stochastic knapsack problem with dynamic programming where the budget is renewed at the end of each cycle and expected returns are delayed due to long development times. We present an approximate DP approach to solve this complex problem.

2 - Efficient PAC Learning for Episodic Tasks with Acycilc State Spaces
Spiridon Reveliotis, Associate Professor, ISyE, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye.gatech.edu, Theologos Bountourelis

We consider the problem of computing the optimal policy for a task that evolves in an episodic manner over an acyclic state space, under incomplete knowledge of the (i) Action branching probabilities and (ii) The underlying cost structure. A novel efficient algorithm for this problem is proposed, and its convergence properties and computational complexity are rigorously characterized in the formal framework of computational learning theory.

3 - Optimal Node Visitation in Acyclic Stochastic Digraphs
Theologos Bountourelis, PhD Student, ISyE, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, tbountou@isye.gatech.edu, Spiridon Reveliotis

Given a stochastic, acyclic, connected digraph with a single source node that is traversed repetitively by a control agent, we seek a control policy that will enable the visitation of the terminal nodes a certain number of times, while minimizing the expected number of the graph traversals. We formulate this problem as an MDP, derive a lower and an upper bound to the value of the optimal policy, and develop an asymptotically optimal randomized policy of polynomial complexity.

4 - Modelling the Reset Decision Embedded on Segregated Funds with Stochastic Dynamic Programming
Socratis Tapeinos, Doctorate Researcher, The University of Edinburgh, 49 Cotton Avenue, London, W3 6YE, United Kingdom, s.tapeinos@sms.ed.ac.uk, Tom Archibald

The reset option on the maturity guarantee of segregated funds is modelled as a Markov decision process. We model the tradeoff the policyholder faces: whether to rollover the current option or to exercise the reset right and substitute it with another whose maturity is farther in the future and whose exercise price is higher. We examine the effect of management fees, number of reset opportunities and level of maturity guarantee on the return to the policyholder.

5 - MODP Mechanism Design in Stochastic Decision Processes for Cyber Risk Management in SCADA Networks
Matthew Henry, University of Virginia, 111 Olsson Hall, Charlottesville, VA, 22904, United States, mhenry@virginia.edu, Yacov Haimes

This work extends the envelope approach to multi-objective dynamic programming [1] to permit sequential Pareto-optimization of multiple objectives in a decision process with non-differentiable formulation. Decisions are mapped to the parameters of a stochastic shortest path decision process, driving evolution of the equilibrium solution. The model is applied to SCADA network security risk assessment and management.

■ WD30

Supply Chain Applications

Contributed Session

Chair: Rahul Marathe, Iowa State University, 2019, Black Engineering Building, Ames, IA, 50011, United States, rahulm@iastate.edu

1 - Multistage Stochastic Programming Approach in the Planning of Process Networks with Uncertain Yields
Bora Tarhan, PhD Candidate, 5000 Forbes Avenue, Department of Chemical Engineering, Carnegie Mellon University, Doherty Hall, Pittsburgh, PA, 15213, United States, btarhan@andrew.cmu.edu, Ignacio Grossmann

We consider a network of processes over multiple time periods in which product demands are specified. Major uncertainties are yields of each process, which can be reduced investing in pilot plants. Uncertainties in the yields decrease with time. Problem consists of process selection, capacity expansions, and investment in pilot plants to maximize expected net present value. A mixed-integer/disjunctive programming model is proposed and solved with a duality-based branch and bound method.

2 - A Novel Primal Decomposition Approach for the Supply Chain Network Design Problem under Uncertainty

Ayman Ragab, Department of Industrial & Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77845-3131, United States, ayman@tamu.edu, Lewis Ntaimo, Brett Peters

This talk presents a multi-stage stochastic programming model for the supply chain network design problem. The model involves three interrelated strategic decision sets: facility location, capacity acquisition and technology selection. To solve this problem, we derive a novel primal decomposition approach that exploits the special structure in the problem and uses column generation to guide the convergence of the iterative solutions towards optimality.

3 - Optimal Firm Investment and Exit with Random Demand

Dharma Kwon, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, dharma.kwon@gmail.com, Steven Lippman

We study the optimal re-investment and exit decision rule for the operation of a production plant with stochastic demand in a declining industry. In the model, a decision-maker has three options: (1) To continue operation, (2) To stop and exit the industry, and (3) To re-invest in the capital and boost the profit rate. We find the optimal threshold values of the profit rate for reinvestment and exit.

4 - Dynamic Inventory Allocation Under Imperfect Information and Capacitated Supply

Sylvana Saudale, University of Houston, E224 Engineering Building 2, Houston, TX, United States, ssaudale@uh.edu, Maher Lahmar

We consider a distribution system made of limited-capacity supplier that serves a sequence of retailers with stochastic demand. The supplier has limited information and sequentially decides on the amount to allocate to each retailer. We formulate the problem as a MDP and discuss optimal replenishment policies. We develop efficient heuristics to solve for homogenous retailers case and benchmark performance of our heuristics to optimal solution and other solution approaches.

5 - Meeting a Capacity Service Level Constraint for Uncertain Demand with Lead Times

Rahul Marathe, Iowa State University, 2019, Black Engineering Building, Ames, IA, 50011, United States, rahulm@iastate.edu, Sarah Ryan

A service provider determines timing and sizes of capacity expansions by a stationary policy to minimize infinite time horizon cost under a service level constraint. When the demand follows a geometric Brownian motion and there is a fixed expansion lead time, the service level can be found by methods to evaluate partial barrier options. Numerical optimization shows that accumulating shortages before the expansion start is optimal for low growth, low volatility demand; and for smaller lead times.

■ WD31

Simulation-Optimization

Contributed Session

Chair: Mohamed Ahmed, Professor, Kuwait University, Faculty of Science, Safat Box 5969, Kuwait, ku, 13060, Kuwait, wakeel@kuc01.kuniv.edu.kw

1 - A Modification of the Simulated Annealing for Discrete Stochastic Optimization

Talal Alkhamis, Associate Professor, Kuwait University, Faculty of Science, Safat 5969, Kuwait, 13060, Kuwait, alkhamis@kuc01.kuniv.edu.kw

In this paper we present a modification of the simulated annealing algorithm (SA) for solving discrete stochastic optimization problems where the acceptance probability depends on whether the objective function values indicate statistically significant difference at each iteration. We show that the proposed modification converges almost surely to the set of optimal solutions.

2 - Optimal Pricing Policies for Bundles of Products and Services with Customer Down-Payments

Juan-Carlos Ferrer, Assistant Professor, P. Universidad Católica de Chile, Casilla 306 Correo 22, Santiago, Chile, jferrer@ing.puc.cl, Hugo Mora, Gabriel Bitran

This article examines the pricing decision of a provider that offers a bundle of products and services using a two-part tariff scheme. The pricing policy consists on a membership fee that is paid once by the customer at the beginning and a periodic fee paid on a monthly basis. We examine two cases, a monopoly and a duopoly. We conclude that firms will charge a higher membership fee in the duopoly case compared to the monopoly case in order to reduce the effect of supplier surfing.

3 - Applying Bayesian Estimation to Noisy Simulation Optimization

Geng Deng, Graduate Student, University of Wisconsin-Madison, 4723 Sheboygan Avenue, Apt. 118, Madison, WI, 53705, United States, geng@cs.wisc.edu, Michael Ferris

Simulations are typically governed by input parameters, choices of which lead to improved operation. The accuracy of a simulation run is often dependent on the number of replications. We describe an optimization algorithm that handles the tradeoff between simulation accuracy and quality of the optimized solution. Our methods apply Bayesian techniques to guide appropriate sampling strategies, while simultaneously enhancing algorithmic efficiency to obtain solutions of a desired accuracy.

4 - Multiobjective Simulation Optimization: SPGA

Hamidreza Eskandari, Research Associate, University of Central Florida, IEMS Department, 4000 Central Florida Boulevard, Orlando, FL, 32816, United States, eskandar@mail.ucf.edu, Christopher D. Geiger

We present a new approach, called stochastic Pareto genetic algorithm (SPGA), for multiobjective optimization of simulation models. New genetic operators are employed to enhance the algorithms performance in terms of convergence behavior, computational effort and its robustness against uncertain objective functions. Computational results for a few test problems indicate that SPGA is a promising approach and it outperforms the improved nondominated sorting genetic algorithm (NSGA-II).

5 - Redundancy Optimization of Reliability Models Subject to Imperfect Fault Coverage

Mohamed Ahmed, Professor, Kuwait University, Faculty of Science, Safat Box 5969, Kuwait, ku, 13060, Kuwait, wakeel@kuc01.kuniv.edu.kw

We develop a search procedure for redundancy optimization of reliability models. We consider those systems where the reliability cannot be evaluated exactly but must be estimated through Monte Carlo simulation. We show that the search process converges to the optimal set with probability one. The proposed procedure is illustrated through numerical examples of redundancy optimization for reliability systems subject to imperfect fault coverage.

■ WD32

Computer Assisted Analysis

Contributed Session

Chair: John Newman, Professor, Coppin State University, MNSC Department, 2500 W. North Avenue, Baltimore, MD, 21216, United States, jnewman@coppin.edu

1 - Endogenous Volatility for Hedging Options with Transactions Costs

Yonggan Zhao, Associate Professor, Dalhousie University, 6100 University Avenue, Suite 2010, Halifax, NS, B3H 3J5, Canada, Yonggan.Zhao@Dal.Ca, Leonard MacLean, William Ziemba

This paper studies a pricing and hedging model with an endogenous volatility for the calculation of delta over time. With transaction costs, the optimal hedging volatility is substantially different from the stock's volatility under the criterion of minimizing the total absolute replication error weighted by the probabilities that the option is in or out of the money. Data on S&P 500 index cash options are used to illustrate the model.

2 - Development of a User-Interface for MOLP Software ADBASE

M. D. Sarder, PhD Candidate, University of Texas at Arlington, 1505 E. Lamar Boulevard, Apt # 292, Arlington, TX, 76011, United States, bsarder@hotmail.com, Abu Masud, Bonnie Boardman

This paper describes the need for and process of developing user interface software that works together with ADBASE and removes the problems associated with using ADBASE. The principles behind the development of this software were the goal of providing versatility and flexibility to solve MOLP problems with an interactive user interface. Another principle was to maintain a database to store and retrieve problem data when necessary.

3 - Journal Influence and Quality Ranking for Operations Research and Management Science

Andrew Lim, Associate Professor, Department of Industrial Engineering and Engineering Management, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China, iealim@ust.hk, Vendy Wen, Zhou Xu, Brenda Cheang

This paper reports a quantitative and qualitative study on the ranking of journal influence in the area of Operations Research and Management Science. The methodology employed is an extension of the PageRank algorithm, which in fact, is a special random walk. The methodology employed is followed by extensive justifications through axiomatic analysis. As well, an exhaustive set of experiments were conducted, releasing very insightful details.

4 - A Methodology for Line-of-Sight Target Acquisition and Exposed Area Assessment

Dr. Steven Yuhaski, Operations Research Analyst, Natick Soldier Center, Supporting Science & Technology Directorate, 1 Kansas Street, Natick, MA, 01760, United States, steve.yuhaski@natick.army.mil, Robert Auer

A technique has been developed to determine whether a line-of-sight, emanating from a given point on a battlefield, intersects a target. The target may be either partially or totally obstructed by the terrain or features. Constraints, generated a priori, about the terrain, are used repeatedly to assess the exposed target area. To accommodate movement, a zoning of the planar surface of the terrain is implemented to efficiently select the subset of elements that might obstruct the target.

5 - Enhancing a Decision Support System with Creativity - An Empirical Study

John Newman, Professor, Coppin State University, MNSC Department, 2500 W. North Avenue, Baltimore, MD, 21216, United States, jnewman@coppin.edu

Recent research suggests that creativity can enhance the performance of people for a variety of tasks, including decision making. Creativity enhancements can be delivered through a decision making support system. In theory, such delivery should improve the decision performance of the system's user. This paper tests the theory empirically and discusses the implications for decision making.

■ WD33

Issues in National Airspace System (NAS) Modeling

Sponsor: Aviation Applications
Sponsored Session

Chair: Gerald Shapiro, CNA Corporation, Gerald.CTR.Shapiro@faa.gov

1 - A Microscopic Simulation Approach for Network-Based Airlines Competition Analysis

Ahmed Abdelghany, Assistant Professor, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Boulevard, Daytona Beach, FL, United States, abdel776@erau.edu, Khaled Abdelghany, Gregory Coldren

A network-based modeling framework for airlines competition analysis is presented. The framework adopts a microscopic simulation approach in which passengers are represented at the individual level. The model estimates the airlines market share and flights load factor as function of their supply-related decisions including flight schedule, seat inventory control, and ticket distribution. Simulation experiments that illustrate the model functionalities are presented.

2 - Strategic Analysis Using the FAA's NAS Strategy Simulator

Anne Suissa, Operations Research Analyst, FAA ATO-P Office of Strategy, 800 Independence Avenue SW, Washington, DC, 20591, United States, anne.suissa@faa.gov, Dan Goldner, Stephanie Chung

The Federal Aviation Administration's NAS Strategy Simulator (NSS) investigates impacts of system and policy changes to the National Airspace System (NAS). The NSS models three key sectors: passengers & cargo, airlines, and the NAS. The model simulates in one-year increments calculating metrics for each sector, and includes eight user group categories. The model's interfaces allow users to change input controls representing system or policy changes and to view future trends in real-time.

3 - Changing the Airline Industry

John Kettelle, kettelle@earthlink.net, Mark Tedone

This paper starts with justifying an estimate that, if it were a single airline, the whole domestic airline industry could deliver its current passenger traffic for $15B a year less that it does now. It then explores ways to build competition into this concept. This potential payoff is enhanced by the increased traffic and revenue that would be expected. It ends with a discussion of how there may be room for similar enhancements in other "industries".

■ WD34

Routing Applications II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Michel Gendreau, Director, CIRRELT / Univ. de Montréal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michelg@crt.umontreal.ca

1 - Elementary Shortest Paths Embedded in a Column Generation Framework for Location-Routing Problems

Suat Bog, sbog@ku.edu.tr, Selcuk Savas, Metin Turkay

Our work proposes a column generation algorithm for the solution of the capacitated location-routing problem (LRP). The master problem is a set-partition based formulation which proved to be useful for a variety of routing problems. For the subproblem we solve the elementary shortest path problem with resource constraints. The resulting algorithm is tested on various LRP benchmarks. The proposed column generation algorithm gave tight gaps for most of the benchmark problems.

2 - Modeling and Optimizing Transportation Decisions in a Manufacturing Supply Chain

Suleyman Karabuk, Assistant Professor, University of Oklahoma, School of Industrial Engineering, 200 West Boyd, Room 124, Norman, OK, 73019, United States, karabuk@ou.edu

We describe a transportation problem we observed at the trucking division of a manufacturer that owns and operates a large number of facilities in all stages of the supply chain. The problem involves scheduling of pick-up and delivery of daily inventory movement between plants. We develop integer programming models that are based on the current workflow of the schedulers and capture and optimize crucial aspects of the problem. We validate the models and demonstrate their use with actual data.

3 - Unified Heuristic for the Location-Routing Problem

Abdulrahman Alenezi, aalenezi@purdue.edu, Leyla Ozsen

We present a unified cluster first route second heuristic for the Location-Routing Problem. The special cases of this heuristic solves the VRP and MDVRP as well. We present preliminary results for all three problems.

4 - Arc Routing Problems with Time-Dependent Service Costs

Michel Gendreau, Director, CIRRELT / Univ. de Montréal, C.P. 6128, succ. Centre-ville, Montreal, QC, H3C 3J7, Canada, michelg@crt.umontreal.ca

We study a variant of the Capacitated Arc Routing Problem, motivated by winter gritting applications, in which service costs depend upon the time at which service is performed. Our problem-solving approach first transforms the arc routing problem into an equivalent node routing problem, which is then solved by column generation.

■ WD35

Network Behavior with Information

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC-4032, 110 8th Street, Troy, NY, 12180, United States, ukkuss@rpi.edu

1 - User Equilibrium with Recourse

Avinash Unnikrishnan, University of Texas Austin, 6.512 ECJ Hall, Austin, United States, avinash@mail.utexas.edu, S. Travis Waller

A traffic equilibrium formulation, accounting for online information and user recourse is provided. The User Equilibrium with Recourse (UER) is formulated as a mathematical program, which is proved to satisfy all the optimality conditions. The presented solution method solves an online shortest-path problem as a sub-routine to arrive at the optimal UER solution. The above model is highly beneficial in understanding network flow behavior under information provision.

2 - Robust Behavior-Consistent Traffic Routing Under Information Provision

Alexander Paz, apaz@purdue.edu, Srinivas Peeta

A fuzzy control framework is used to determine behavior-consistent traffic routing strategies based on the estimation of driver behavior. H-infinity filtering is used to optimize controller parameters and achieve greater computational efficiency. Significant differences in terms of total system travel time can be obtained when the behavior-consistent approach is compared to traditional assignment approaches.

3 - Dynamic Traffic Equilibrium Under Information: An Experimental Network Game Approach
Gitakrishnan Ramadurai, Renssalaer Polytechnic Institute, Department of Civil and Environmental Engineering, Troy, NY, 12180, United States, ramadg@rpi.edu, Satish Ukkusuri

User equilibrium behavior decisions are based on complete information of the network state. This is justified by two arguments: i) Users gain information traveling over the network repeatedly, and ii) ATIS can provide complete information about network state. In this paper, the above two arguments are examined. First, existence of equilibrium is investigated in a multi-player experimental game. Second, whether or not provision of real-time information aids in achieving equilibrium is tested.

4 - Exploring User Behavior in Online Network Equilibrium Problems
Satish Ukkusuri, Assistant Professor, Department of Civil and Environmental Engineering, Rensselaer Polytechnic Institute, JEC-4032, 110 8th Street, Troy, NY, 12180, United States, ukkuss@rpi.edu, Gopal Patil

We develop an online traffic assignment model which incorporates the en-route recourse actions. While accounting for recourse using an online shortest path algorithm, we incorporate travelers cost perception behavior using logit route choice model. Numerical results on a test network are demonstrated to show the benefit of the developed model over the traditional static traffic assignment.

■ WD36

Military Applications II

Contributed Session

Chair: LTC John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93943, United States, john-willis@us.army.mil

1 - Enhancing Joint Task Force Leadership Skills: Mental Modeling and Decision Analysis Approaches
Igor Linkov, Senior Scientist, Cambridge Environmental, 58 Charles Street, Cambridge, MA, 02141, United States, Linkov@cambridgeenvironmental.com, F. Kyle Satterstrom, George Fenton, Barclay Lewis, Rayland Gaskins

Today's war requires cognitive skills from a warfighter who must deal with social, cultural, and language barriers. We report use of mental modeling and decision analysis tools for overcoming cognitive and cultural barriers in Joint Task Force (JTF) operations. Components of shared mental models of JTF staff members' understanding of jointness, cultural differences among the Services, and operational capabilities and environments will be presented.

2 - Interfiring and Interkiling Times in Modeling a Combat
Yoon Hong, Professor, Department of ISE, Hansung University, 389, 3-Ga, Samsun-dong, Sungbuk-Gu, Seoul, 136-792, South Korea, yhong@hansung.ac.kr

The probability characteristic of the time between firings or killings performs a crucial role in the analysis of a combat. These terms are widely known in a stochastic combat modeling. The data from the field exercises are rearranged and utilized to obtain the appropriate probability distributions of the random times of interest. This study is limited to the particular entities, for instance, combatants or equipments. Comparisons and suggestions are presented.

3 - Loss-Tolerant Bottleneck Assignment Problem
Andrew Vakhutinsky, Akamai Technologies, Inc., 8 Cambridge Center, Cambridge, MA, 02142, United States, avakh2000@yahoo.com, Frederick Zeitz

We propose an approach to solving the following problem: Given a bi-partite graph with an integer number of deliveries available at each source node and delivery revenue coefficient between each pair of source-destination nodes, find an assignment between source and destination nodes to maximize the smallest revenue at the destination subject to the condition that one or more of the highest revenue deliveries to each destination is lost. The problem can be applied to the radar jamming.

4 - PHM Consequence Engine
Daniel Briand, Sandia National Labs, PO Box 5800 MS 1011, Albuquerque, NM, United States, dbriand@sandia.gov, Kelly Lowder

The consequence Engine (CE) is a forward looking simulation that predicts the effect operational strategies and repair/replace/inspect/wait strategies will have on the modeled system once PHM methods detect a change in a component's remaining useful life or time-to-failure. The CE optimizes alternative operations and maintenance schedules to provide a set of alternatives each with an expected cost/benefit, such as maximizing system availability while minimizing cost.

5 - Quick Turn-Around Analysis for the US Army's Rapid Equipping Force
LTC John Willis, TRADOC Analysis Center, ATTN: ATRC-RDM, Box 8695, Monterey, CA, 93943, United States, john-willis@us.army.mil

The US Army's Rapid Equipping Force (REF) is designed to increase mission capability while reducing risk to Soldiers. The REF equips operational units with off-the-shelf solutions that can be researched, developed and acquired quickly. The Army needs a means to assess emerging requirements and to recommend solutions for rapid fielding. This paper describes a quick-turnaround methodology to support the evaluation of REF solutions, the design of TTPs, and the distribution of capabilities.

■ WD37

Supply Chain Simulation

Contributed Session

Chair: Ananth Krishnamoorthy, PhD Candidate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, ananth.krishnamoorthy@okstate.edu

1 - Simulating an Oil Supply Chain
Eric Wainwright, CTO, Decisioneering, Inc., 1515 Arapahoe Street, Suite 1311, Denver, CO, 80202, United States, ewainwright@crystalball.com, Samik Raychaudhuri

In this presentation, we demonstrate a simulation of an oil supply chain consisting of multiple echelons: Refineries, Storage Points, Depots and Retail Outlets. The simulation model can be used to develop and test specific rules or strategies for decision making at particular levels of supply chain. Use of an interactive software (Crystal Ball) helps in analyzing multiple scenarios and optimize some of the decisions.

2 - Operational Performance Analysis of Introducing e-Procurement in a Public Sector Healthcare System
Sergio Maturana, Professor, Catholic University of Chile, Casilla 306, Correo 22, Depto. Ing. Industrial y de Sistemas, Santiago, RM, Chile, smaturan@ing.puc.cl, Ronny Gonzalez

Currently all Chilean government agencies, including government-run hospitals, have to purchase their supplies in an e-marketplace. This is profoundly changing the healthcare supply chain. It has also forced Cenabast, a government-run hospital supplier, to redefine its role. We present a simulation-based analysis of the operational performance of alternative designs for implementing e-procurement identifying those activities that Cenabast could perform that add more value to the hospitals.

3 - A Business Process Driven Supply Chain Simulation Framework
Wei Wang, R&D Engineer, IBM, Building 19, Zhongguancun Software Park, 8 Dongbeiwang West Road, Haidian District, Beijing, 100094, China, wangwcrl@cn.ibm.com, Hongwei Ding, Jin Dong, Changrui Ren

This article presents a supply chain simulation framework based on business process for a tactical-level decision making. It consists of a supply chain modeling library, a business process simulator, and a modeling and analysis environment. Industry knowledge is embedded in the library in term of representative supply chain entities, business rules and operation policies. Operations and dynamics are built in process elements. The simulation is thus driven by the process engine via token flows.

4 - Supply Chain Diagnostics with Probabilistic Boolean Networks
Chia-Hui Huang, Research Scholar, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109-2117, United States, leohuang@umich.edu, Han-Ying Kao

In supply chain systems, the key factors concerning customers and suppliers constitute intricate causal relationships with industrial performance. The aim of this paper is to propose probabilistic Boolean networks (PBN) as knowledge bases for supply chain diagnostics. PBN is a promising model that generalizes the rule-based interactions in complex temporal stochastic settings. This study also develops the simulation algorithm for diagnostic reasoning in a two-echelon supply chain.

5 - Value of Tactical Collaboration in Supply Chains
Ananth Krishnamoorthy, PhD Candidate, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, ananth.krishnamoorthy@okstate.edu, Manjunath Kamath, Ricki Ingalls

We examine the value in collaborative master planning in a two-echelon supply chain. We develop broad guidelines and managerial insights for collaboration by analyzing results from experiments conducted using an integrated supply chain model. We attempt to answer the following questions - When should a company collaborate? How does collaboration influence decisions about structure, investments and process improvement efforts in a supply chain?

■ WD38

Operations Management II

Contributed Session

Chair: Sungsu Kim, Department of Industrial and Manufacturing Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, sungsu@psu.edu

1 - Optimal Compensation of Procurement and Hedging Managers

Masha Shunko, Carnegie Mellon University, 6739 Wilkins Avenue, Pittsburgh, PA, 15217, United States, mshunko@cmu.edu, Laurens Debo, Nicola Secomandi, Lin Nan

As financial trading of commodities becomes an important risk management tool for organizations, there is an increasing need for understanding interaction between hedging and procurement. In the value-maximizing setting with a risk-averse principal and two risk-averse managers, we develop a model that examines interaction between the hedging and procurement managers, look at the optimal compensation strategies for both and analyze how these strategies change as a function of relevant parameters.

2 - Plants-within-Plant (PWPs) Using Multiple Focus

Ashwini Chaube, Student, Indian Institute of Technology Bombay, Hostel 7, Room 171, IIT Bombay, Powai, Mumbai, MS, 400076, India, ashwini.chaube@gmail.com, A. Subash Babu

In the present study, overall focus of PWPs or focused factories has been quantified in terms of product focus, process focus, market focus and strategy focus. Based on this, a multi-objective and non-linear model has been developed and solved using a heuristics, for the design of PWPs with product and resource allocation. The results obtained for various problems have been analyzed and interesting observations have been made, the details of which have been presented in the paper.

3 - Price-Driven Market Equilibria and VCG Auctions for a Linear Economic Model

Jose Prina, Cornell University, 206 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, jprina@orie.cornell.edu, Robin Roundy

We study pricing schemes that lead to equilibria in settings where a class of linear optimization models is suitable; specifically, markets where profit maximizing agents sell goods or services, and receive payments from a market intermediary that generally has complete information and pursues efficient solutions. We also study the application of VCG auctions in this setting and investigate the allocation of revenue under these alternate market mechanisms.

4 - Using Student-Managed Company Analysis Teams for Experiential Learning in an Operations Core Course

Raymond Jacobs, Professor of Business, Ashland University, Dauch College of Business and Economics, 401 College Avenue, Ashland, OH, 44805, United States, rjacobs@ashland.edu, Richard Symons, Daniel Fox

An Operations Management course was enhanced to promote experiential learning and support the College's competency-based learning framework. Each student team selects a manager to lead the analysis. Managers develop a "contract" for team members to sign, defining individual responsibilities and gaining student commitment. Students select a company, arrange plant visits, and develop questions addressing key operations issues. Student learning improved and ties to companies were built.

5 - Workforce Cross-Training Decision with Minimizing Number of Workers Under Various Factors in Parallel System

Sungsu Kim, Department of Industrial and Manufacturing Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, sungsu@psu.edu, David A. Nembhard

We study workforce cross-training decision with the objective of minimizing the number of workers for satisfying given production requirements under various factors in parallel system. We consider factors such as number of tasks, the length of time horizon/unit time period, upper-bound of cross-training level, worker selection rule, and production requirement level, and explore their effects on worker assignment schedule and cross-training decision in order to provide managerial insights.

■ WD39

Ballroom B

Applications of Integer Programming

Contributed Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta GA 30068, United States, sahmed@isye.gatech.edu

1 - The Impact of Distribution System Characteristics

Iqbal Agha, Professor, Isenberg School of Management, Finance & OM, University of Massachusetts, Amherst, MA, 01003, United States, aiali@som.umass.edu, Debra O'Connor

This paper examines the extent to which spatial and demand characteristics affect the ease of obtaining an optimal solution to a distribution model. Problem characteristics, reflected in a model's parameters, can render the model for one supply chain instance to be intractable and that for another to yield an optimal solution instantaneously. We introduce echelon-flow-based valid inequalities to explicate the extent to which problem characteristics impact model tractability.

2 - A Tabu Search Algorithm with Variable Clustering for the Unicost Set Covering Problem

Gary Kinney, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States, gary.kinney@afit.edu, Wes Barnes, Bruce Colletti

We develop a Tabu Search algorithm to solve the unicost Set Covering Problem (USCP-TS). We solve a LP relaxation of the problem and use the LP optimum to construct a quality solution profile. We cluster the variables based on the profile to partition the solution space. USCP-TS outperforms CPLEX (under varied settings) in solution quality for 53 of 65 benchmark problems.

3 - Reconstruction and Applications of Imperfect Phylogenies (Steiner Trees over Hypercubes)

Srinath Sridhar, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh PA 15213, United States, srinath@cs.cmu.edu, Russell Schwartz

We consider the problem of finding optimal Steiner minimum trees when the underlying graph is an m-cube. We develop and implement a new algorithm that runs in polynomial time if the size of the minimum Steiner tree is at most an additive constant q larger than the number of dimensions m of the graph. Our work is motivated by the problem of reconstructing phylogenetic trees for different human ethnic groups or for humans and closely related primates.

4 - Polyhedral Stochastic Integer Programming

Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30068, United States, sahmed@isye.gatech.edu, Yongpei Guan, George Nemhauser

We present polyhedral results for scenario based models of some stochastic integer programs. The key idea is to combine valid inequalities from scenario subproblems to derive new inequalities for the overall problem. We illustrate the procedure by developing inequalities for stochastic lot-sizing problems.

■ WD40

Using Optimization for Environment, Energy, and Natural Resources

Contributed Session

Chair: Adekola Oyenuga, Visiting PhD Student, Decision Sciences Department, London Business School, Regent's Park London NW1 4SA, UK., London, NW1 4SA, United Kingdom, aoyenuga.phd@london.edu

1 - A Mathematical Approach in Heat Conduction Problems

Nedim Sozbir, Sakarya University, Mechanical Engineering Deptarment, Sakarya, 15187, Turkey, sozbir@sakarya.edu.tr, Hasan Ríza Guven, Ismail Ekmekci

An algorithm is obtained to solve linear algebraical equations after applying the finite difference method in solution of conduction problems. This algorithm has three steps: Transformation of the original system to an auxiliary linear system; Solution of auxiliary linear system; and Determination of the roots of original system using the solution vector of the auxiliary linear system. The decrease in the number of iterations is significant reducing the computer operation time.

2 - Economic Optimisation of Hydrogen Infrastructure Investment
Jogeir Myklebust, PhD Student, NTNU, IOT, Gloeshaugen, 7491, Trondheim, Norway, jogeirm@iot.ntnu.no, Asgeir Tomasgard

The coming market for hydrogen requires equipment to produce it from primary energy sources as well as facilities for shipping it and the potential by-product CO2 to their markets. Most of these investments are irreversible and subject to economies of scale. The alternative supply chains are modelled using large scale MILP in order to determine the location, timing and types of investment that minimises the present value of the costs of meeting exogenous hydrogen demand.

3 - Optimal Endogenous Carbon Taxes for Electric Power Supply Chains with Power Plants
Trisha Woolley, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States, twoolley@som.umass.edu, Anna Nagurney, Zugang Liu

We develop a modeling and computational framework that allows for the determination of optimal carbon taxes applied to electric power plants in the context of electric power supply chain (generation/ distribution/ consumption) networks. This includes three distinct types of carbon taxation environmental policies, a decentralized scheme and two versions of a centralized scheme. We discuss the behavior of the various decision-makers and also provide numerical results for 12 examples.

4 - Second Best Prices for a Stochastically Available Service with Compensation for Interruptions
Adekola Oyenuga, Visiting PhD Student, Decision Sciences Department, London Business School, Regent's Park London NW1 4SA, UK., London, NW1 4SA, United Kingdom, aoyenuga.phd@london.edu

I propose an alternative approach to allocating a stochastic service using a price for deliveries and compensation for interruptions. The interruption applicable to any consumer is a fraction of his uninterrupted demand and is obtained by equalizing his marginal utility from the service with a spot price while the compensation is equal to a hypothesized loss when interrupted. A form of market organization is suggested, Second-Best service prices are derived and the utility's incentives examined.

■ WD42

Scheduling Applications III

Contributed Session

Chair: Natasa Vidic, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, natasa_vidic@yahoo.com

1 - Real-Time Oriented Lotsizing and Scheduling of Flexible Job-Shops
Thomas van Brackel, University of Paderborn, Warburger Strafle 100, Paderborn, 33102, Germany, tvb@upb.de

A new approach controlling job-shop systems in real-time is introduced. This approach is capable of handling occurring disturbances in order to ensure an efficient execution of the production plan. Known models are expanded by the integration of disturbances, installing a flexible production structure and lotsizing aspects. To solve this new problem, an efficient genetic algorithm is developed which is able to conduct a rescheduling simultaneous to the execution of the production processes.

2 - Satellite Mission Scheduling with Dynamic Tasking
Stephen Billups, Associate Professor, University of Colorado at Denver and Health Sciences Center, Department of Mathematical Sciences, Campus Box 170, PO Box 173364, Denver, CO, 80217-3364, United States, Stephen.Billups@cudenver.edu

"Satellite Mission Scheduling with Dynamic Tasking" involves scheduling tasks for a satellite where new requests can arrive at any time. Problem characteristics include differing processing times, priorities, and time window constraints for individual tasks as well as order-dependent setup times between tasks. We examine a hybrid evolutionary algorithm for creating a schedule in advance and a novel technique for reusing partial solutions to adjust for incoming requests in real-time.

3 - Understanding and Evaluating Scheduling Practices in Urban High Schools
Natasa Vidic, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, natasa_vidic@yahoo.com, Mary Besterfield-Sacre, Bryan A. Norman, Erica Halverson

The goal of this research is to create a more systemic approach to course scheduling in urban high schools that ensures equity and access for all high school students. We develop a comprehensive model to show the potential for improving the course master scheduling process in order to create a more equitable system with an emphasis on math and science courses.

4 - Single Machine Scheduling Under Uncertainty
Ihsan Sabuncuoglu, Professor, Bilkent University, Department of Industrial Engineering, Ankara, 06800, Turkey, sabun@bilkent.edu.tr, Selcuk Goren

In this study, we consider the single machine scheduling problem with random processing times and machine breakdowns. We take a proactive point of view and define several robustness and stability measures. We propose a branch-and-bound algorithm for minimizing expected total tardiness (one of the robustness measures) in the case where only source of uncertainty is processing time variability. We also develop simulation based beam search algorithms for the problems with machine breakdowns.

■ WD43

Multicriteria Decision Making II

Contributed Session

Chair: Kash Barker, Graduate Student, Systems and Information Engineering, University of Virginia, PO Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, kashbarker@virginia.edu

1 - Bicriteria Rescheduling with Controllable Processing Times
Ayten Turkcan, METU, Middle East Technical University, Department of Industrial Engineering, Ankara, 06531, Turkey, ayten@ie.metu.edu.tr

In this study, bicriteria rescheduling with controllable processing times problem is solved. We consider machine breakdown in a parallel machine environment. We propose an algorithm to find a set of nondominated solutions optimizing both efficiency and stability measures. The efficiency measure is the minimization of manufacturing cost and the stability measure is minimization of difference of starting and finishing times in the initial and final schedules.

2 - Optimal Warranty for Two-Attribute Policies
Jay Patankar, Professor, The University of Akron, 259 S. Broadway, College of Business Administration, Akron, 443254801, United States, jgp@uakron.edu, Amit Mitra

A warranty policy involving two attributes, for example time and usage, is considered. The paper analyzes a situation where a product is repaired on failure within the specified parameters, with the failure distribution of the repaired items being different from that of new items. A model is developed that incorporates expected warranty costs per unit sales and market share.

3 - Grouping Schemes for Data Envelopment Analysis to Solve Multiple Criteria Optimization Problems
Mauricio Cabrera-Ríos, Associate Professor, Universidad Autónoma de Nuevo León, Posgrado FIME, Av. Universidad S/N, San Nicolás de los Garza, NL, 66450, Mexico, mcabrera@mail.uanl.mx, María Guadalupe Villarreal-Marroquín

In the industry it is common to find optimization problems requiring the compromise between multiple measures in conflict. Finding solutions in an efficient manner to this kind of problems is critical if optimization is to be applied in these cases. In this work, data grouping schemes are proposed to make the solution process to multicriteria optimization problems efficient via Data Envelopment Analysis. The preliminary results of different schemes are reported.

4 - Scoring Rules, Generalized Entropy and Utility Maximization
Victor Richard Jose, Duke University, Durham, NC, 27708-0120, victorrichmond.jose@duke.edu, Robert Winkler, Robert F. Nau

This paper fleshes out the connections between measures of information coming from three seemingly distinct but surprisingly intertwined strands of literature: decision analysis, entropy and scoring rules. We discuss normalized forms of the pseudospherical and power scoring rules that arise from the solution of expected-utility-maximization problems and yield expected score functions that are generalized measures of divergence.

5 - Hierarchical Multiobjective Decisionmaking for Preparedness
Kash Barker, Graduate Student, Systems and Information Engineering, University of Virginia, PO Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, kashbarker@virginia.edu, Yacov Haimes

Preparedness plans for disruptions such as terrorist attacks, natural disasters, and accidents have recently been shifted toward "resilience and recovery," thus disregarding the previous narrow focus of only "prevention and protection." We present results on a hierarchical multiobjective decisionmaking framework to effectively invest for federal, state, and local preparedness objectives. Highlighted are those objectives that promote an acceptable cost and recovery time of critical infrastructures and key resources.

■ WD44

Simulation I and Heuristics

Contributed Session

Chair: Vinicius Armentano, Universidade Estadual de Campinas, Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br

1 - Holonic Supply Chain: A Simulation Study

Philip Huang, Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, phhuang@vt.edu, Sheneeta White

As market place gets competitive, a company needs to explore alternative strategy. In this paper, we examine a novel approach to structure a company's supply chain, which allows suppliers to form a consortium. When the company has material need, it will broadcast the information to the consortium. Its members will then negotiate to determine the distribution of this order. We are conducting a simulation experiment to test the strength of this new structure.

2 - Multiobjective Time-Dependent Optimal Experimental Design of Sampling Networks

Brent Thomas, Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90407, United States, bthomas@rand.org

Optimal experimental design (OED) is used to develop sampling networks in a contaminant transport scenario. The network could be used to improve the flow simulation, or to monitor contaminant flow, or both. A nondominated sorting genetic algorithm, NSGA-II, develops the Pareto surface of these objectives in concert with design cost. As time factors into both costs (through the discount rate) and kinetics, the approach addresses time dependency in the OED.

3 - Quasielastic Phenomenological Isotropic Optimization Medium Simulation for Phenomenal Liquid Crystal

Chang Chia-Fu, No. 949, Da Wan Road, Yung-Kang City, Tainan Hsien, 710 Taiwan, R.O.C., anderson880@yahoo.com.tw, Chen Wi-Ci, Win Zou-Ni

The problems of these two technologies have caused more and more product designers to turn to liquid crystal (LC) displays, which have consequently experienced phenomenal growth. The success of liquid crystal displays has fostered continued development, to the point where full-color video displays have been realized which can rival. Details of the lens structure and of the devices fabrication and performance are described. Simulation using the Jones matrix method. Director can change from point to point and is, in general, a function of space. The transition can be approached by changing the impurity concentration or, indirectly, by tuning the temperature since the pinning strengths of the random and crystal potential have in general a different temperature dependence. Light from conventional light source or laser is passed through a polarizer and then incident on the specimen. The resist profile simulation is carried out using the combined data thus obtained. The nematic liquid crystal is clear only when a long range order exists, in the whole medium. At the nematic-isotropic, transition temperature, the medium becomes isotropic and looks clear and transparent.

4 - Performance Analysis of Production Systems Operating with the PAC System

Corinne MacDonald, Assistant Professor, Dalhousie University, 5269 Morris Street, Halifax, NS, B3J 2X4, Canada, Corinne.macdonald@dal.ca, Eldon Gunn

We present some recent work on the performance analysis of manufacturing systems operating under a Production Authorization Card (PAC) system. Our analysis framework uses simulation to construct neural network metamodels. These metamodels provide a convenient framework to examine appropriate control strategies for a given production system.

5 - A Multistart Memory-Based Constructive Heuristic for the Container Loading Problem

Vinicius Armentano, Universidade Estadual de Campinas, Av. Albert Einstein, 400, Campinas, SP, 13083-970, Brazil, vinicius@densis.fee.unicamp.br, Olinto Araujo

We address the container loading problem which involves the selection of boxes in order to maximize the volume utilization subject to orientation and stability constraints. We propose a multi-start memory-based constructive heuristic with a load arrangement that is based on maximal cuboids that fit in given empty spaces. Computational tests on several instances from the literature show that the proposed method outperforms other approaches.

■ WD45

Tutorial: Peer-to-Peer Technologies: A Research-Oriented Introduction

Cluster: Tutorials

Invited Session

1 - Peer to Peer Technologies: A Research-Oriented Introduction

Ramayya Krishnan, H. John Heinz III School of Public Policy and Management, Carnegie Mellon University, 4800 Forbes Avenue, Pittsburgh, PA, United States, rk2x@andrew.cmu.edu, Michael Smith, Rahul Telang

P2P technologies — Napster, Kazaa, and Bit Torrent in file sharing and grid computing in shared services computing — offer network infrastructure that is widely used for large scale, high bandwidth information exchange or for high end computation. In this tutorial, we will discuss interesting research issues - predictive modeling and incentive engineering - that arise in the context of these peer to peer networks.

■ WD47

Supply Chains and Information

Contributed Session

Chair: Faisal Al-Khateeb, United Arab Emirates University, PO Box 23324, Al-ain, United Arab Emirates, faisal.alkhateeb@uaeu.ac.ae

1 - The Value of Information in Supply Chains

Larry J. LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, Larry.LeBlanc@owen.vanderbilt.edu, James Hill, Jerry Harder

We present a method for determining the value of information sharing (forecast accuracy) when planning production in a make-to-order supply chain environment. We examine the interaction of forecast errors, shortage vs. holding costs, and the cost of delaying production in a two-stage supply chain of a single product facing uncertain demand. We report computational results showing how to find the value of improved forecast accuracy

2 - Incentive-Compatible Allocation Policy: Individual versus Social Optimization

Kwan Wee, Singapore Mangement University, Singapore, Singapore, kewee@smu.edu.sg

We consider two customer allocation policies for a two-server queuing system: one induced by individuals' self-interest while the second based on social benefits. We show that in the equilibrium, when the servers incur penalty with respect to customers' waiting time, there is a threshold such that when the per unit time penalty exceeds the threshold, the social optimum induces higher service rates from the servers than the individual optimum; otherwise the result is reversed.

3 - Uncertainty Principles in Downstream Demand Inference (DDI)

Mohammad Ali, PhD Researcher, Buckinghamshire Business School, Goreland Lane, Chalfont St. Giles, Hp8 4AD, United Kingdom, m.ali@bcuc.ac.uk, John Boylan

In this paper, we present Uncertainty Principles to show that it is not possible for an upstream member in supply chains to accurately infer the consumer demand without any formal Information Sharing mechanism with the downstream member. Thus, we conclude that Demand Information Sharing has some value in reducing the Bullwhip Effect.

4 - Production Scheduling Under Demand Uncertainty With Time-Fence Driven Expediting/Cancellation Costs

Gregory DeYong, Doctoral Student, Indiana University, 1309 East Tenth Street, Bloomington, IN, 47405, United States, gdeyong@indiana.edu, Robert Jacobs, Kyle Cattani

The effects of a planning time fence complicate and transform rolling-horizon scheduling problems. This research develops rolling-horizon, fixed time fence scheduling for a discrete scheduling problem under uncertainty, with time-sensitive cancellation and expediting costs. We model a capital goods manufacturer to evaluate optimal and heuristic approaches to scheduling and study sensitivity of key variables. Use of a discrete-time Markov approach enhances understanding of the system states.

5 - Performance Analysis of Information Security in the Supply Chain Management

Faisal Al-Khateeb, United Arab Emirates University, PO Box 23324, Al-ain, United Arab Emirates, faisal.alkhateeb@uaeu.ac.ae

Information security has become an integral part of supply chain management. The importance of security is more evident as the value of system assets to protect increases. The main focus of this research is on the performance analysis of information security (PAIS) through supply chain management (SCM) drivers. To have a reliable security information system, each driver should have full control, feedback, and recovery for their own security.

■ WD49

Reverse Supply Chain Analysis

Contributed Session

Chair: Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States, Thomas_Sloan@uml.edu

1 - A Computational Analysis of Environmental Cost Impact on the Closed-Loop Network Design Problem

Dagoberto Garza, Assistant Professor, Tecnológico de Monterrey, Quality and Manufacturing Center, Eugenio Garza Sada 2501 Col. Tecnológico, Monterrey, NL, 64849, Mexico, dagarza@itesm.mx, Julio Mar

The extend interest in environmental aspects has originated several recovery models related to product recycling. Most models are focused in the design of a closed-loop supply chain (CLSC) considering infrastructure and transportations costs exclusively without environmental costs. In this work, a CLSC design model is presented with both economics and environmental costs. A series of experiments are used to study the effect of environmental costs under diverse scenarios and objectives.

2 - Computing Optimal Ordering Decisions to an Inventory Problem with Returns

Rahul Upreti, Doctoral Candidate, The University of Alabama, 300 Alston, Tuscaloosa, AL, 35487, United States, rupreti@cba.ua.edu, Charles Schmidt

A firm sells items in containers some of which may return from the field after a random number of time periods. Each period, some of the containers in the field are discarded and some are returned to the firm, which also buys new containers. We model the situation as a DTMC and using the Matrix-analytic technique to solve the associated QBD process, compute the operating characteristics over an infinite horizon under two cases - 1) No ordering policy, and 2) s,S ordering policy.

3 - Analysis of a Disassembly Machine with Kanban Control

Aybek Korugan, Assistant Professor, Bogazici Univeristy, Industrial Engineering Department Bebek, Istanbul, 34342, Turkey, aybek.korugan@boun.edu.tr, Gokce Nadir, Mehmet Can Aslantas, Burcu Sinsoysal

As a result of increasing environmental concerns remanufacturing activities are performed more frequently. The uncertainty in quality, quantity and timing of the return flow generates a unique control problem in the shopfloor. In this study we investigate the control of the disassembly process, a characteristic subprocess of remanufacturing activities, with kanbans. Here we use synchronization queues in order to keep track of faulty components disassembled from a returned product.

4 - Sustainable Supply Chains: The Impact of Supply Uncertainty on Green Manufacturing

Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States, Thomas_Sloan@uml.edu

Many firms have begun efforts to green their operations as a result of regulations, consumer preferences, and/or economic pressures. While environmentally responsible manufacturing may be desirable, it raises significant challenges in terms of product design, material procurement, and supply chain management. Motivated by an application in healthcare, we develop a model to evaluate different supply alternatives, each characterized by different levels of reliability and environmental impact.

■ WD50

Reverse Supply Chain Optimization

Contributed Session

Chair: Xiuli (Shelly) Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qu@ecn.purdue.edu

1 - Modeling Close-loop Supply Chain Systems with Stochastic Dynamic Programming

Guiping Hu, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15213, United States, guh5@pitt.edu, Bopaya Bidanda, Yan Wang, Lizhi Wang

Close-loop supply chain systems are attracting increasing attention because of cost competition, resource constraints and environmental issues. Electronic products are of particular concern due to short lifecycles and hazardous material. We formulate close-loop supply chain with Stochastic Dynamic Program methodology. By applying the reverse logistics concept and Markov Decision Process technique, we will be able to provide guidelines for product management throughout the close-loop lifecycle.

2 - Pricing and Positioning the Remanufactured Product in Terms of Cost and Quality

Gokce Esenduran, University of North Carolina, Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, United States, gokce_esenduran@unc.edu, Necati Aras, I. Kuban Altinel

We are concerned in the determination of the selling price of the manufactured product and the selling price and quality level of the remanufactured product from OEM's perspective. We propose a mathematical programming model using a linear relation between customer demand, and prices and quality. Assuming a functional relation between the cost and quality of the remanufactured product, the model is then used to generate insights by studying its behavior under various price and quality scenarios.

3 - Methodology for Reverse Supply Chain Design in Consumer Electronics Industry

Santhanam Rajagopalan, Graduate Teaching Associate, University of Texas, Arlington, 312 Uta Boulevard, 201, Arlington, TX, 76010, United States, sanmanisha@yahoo.com, Donald Liles, Srikanth Yellepeddi

In today's business, reverse supply chain (RSC) activities are becoming mandatory due to the legislations and associated economic benefits. The process of designing an efficient RSC system is one of the most strategic imperatives for an enterprise. This research proposes a methodology for designing the same within consumer electronics segment.

4 - Determining the Impact of Plastic Versus Metal Intensity on Reverse Automotive Production

Xiuli (Shelly) Qu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, qu@ecn.purdue.edu, Julie A. S. Williams

Automotive shredders need a reverse production planning strategy that includes determining the purchase price for vehicle hulks based on hulk composition. An important aspect of hulk composition is ferrous metal versus plastic content. We present a NLP model to make purchasing and processing decisions, develop an approximate hulk supply function, and compare two hulk pricing strategies. Our results indicate that the optimal purchasing and processing decisions can increase profit significantly.

■ WD52

Revenue and Inventory Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Opher.Baron@Rotman.Utoronto.Ca

Co-Chair: Joseph Milner, Professor, milner@rotman.utoronto.ca

1 - Models of Consumer Behavior in Waiting for Last Minute Discounts

Anton Ovchinnikov, Assistant Professor, Darden School of Business, University of Virginia, 100 Darden Boulevard, Charlottesville, VA, 22903, United States, anton@rotman.utoronto.ca, Joseph Milner

We consider the behavior of customers who strategically decide whether to wait for a last minute discount or to purchase early at full price. We suggest a game theoretic model and characterize the structure of equilibrium behavior. Then we suggest heuristic models of bounded rationality and analyze to what extent their predictions agree with or differ from the game theoretic model. We discuss the implications for firms that offer last-minute discounts.

2 - Value of Dynamic Pricing in a Decentralized Supply Chain
Tamer Boyaci, Associate Professor, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, tamer.boyaci@mcgill.ca, Saibal Ray, Yuyue Song

We study a decentralized manufacturer-retailer chain in a two-period non-stationary framework with price-sensitive, stochastic correlated retail demand. We allow one or more retail and wholesale pricing (i.e. contracting) opportunities. We show how optimal decisions behave temporally and are affected by system characteristics. Comparing profits with the centralized scenario, we show how the value of pricing flexibility and the division of supply chain profits are influenced by decentralization.

3 - Optimal Production and Admission Policies in Make-To-Stock/Make-To-Order Manufacturing Systems
Tieming Liu, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, tieming.liu@okstate.edu, Seyed Iravani, David Simchi-Levi

We study production and admission controls in manufacturing systems that produce two types of products. The first type consists of identical items that are produced to stock, while the second are products with varying features that are produced to order. We show a modified basestock policy is optimal with exponential production times and Poisson arrival demands for each product. We extend the results to problems with multiple make-to-order products and with cancelable make-to-stock backorders.

4 - Multiple Unit Dynamic Pricing with a Secondary Market
Joseph Milner, Professor, milner@rotman.utoronto.ca, Binbin Liu

We study the dynamic pricing policy of a firm in which a common price is used for multiple item types and a secondary market such as a discount or outlet store exists. We consider cases when the firm should discount the price in the primary market, when the firm should sell units to a secondary market, and cases where inventory should be moved to an outlet. The model provides insights into the effect of alternate distribution channels on pricing policy.

■ WD53

Data Issues in Supply Chain Management

Contributed Session

Chair: Zhong-Xian Wang, Professor, Department of Management & Information Systems, Montclair State University, Montclair, NJ, 07043, United States, wangj@mail.montclair.edu

1 - Costs, Benefits and Risks of RFID for Managing Supply Chains
Ertunga Ozelkan, Assistant Professor, University of North Carolina, Charlotte, 9201 University City Boulevard, Charlotte, NC, 28223, United States, ecozelka@uncc.edu, Agnes Galambosi

Although there is a strong push for Radio Frequency Identification (RFID) by some large corporations and government agencies, many supply chain players are still skeptical. This paper discusses the costs, benefits, and risks of RFID. A simulation and break-even analysis are conducted to understand when implementing RFID becomes more desirable than not implementing it. It is shown that although, RFID implementation is not risk-free, as margins and volumes go up, the risk decreases significantly.

2 - On Design of Data Quality Monitor for Supply Chain Optimizer
Guoquan Liu, Engineer, Intel Corporation, No. 999 YingLun Road, Waigaoqiao Free Trade Zone, Pudong, Shanghai, 200131, China, george.liu@intel.com, Zhenying Zhao

The data quality (DQ) monitor is an effective way to improve the DQ to guarantee accurate optimal solutions. The paper presents the requirements for a DQ monitor which take into account the requirements for a linear programming algorithm - a powerful and popular mathematical model for supply chain optimization.

3 - Using Real-Time Information for Improved Supply Chain Decision Making
Mahesh Srinivasan, The Pennsylvania State University, 463A Business Building, Department of SC&IS, University Park, PA, 16802, United States, maheshs@psu.edu, Doug Thomas

We develop decision making models to use real-time information for improved inventory decisions within the context of a supply chain. We consider 2 major problems - inventory systems with order crossover and inventory systems with two supply modes. We use dynamic programming based optimization to investigate optimal policies and use simulation to arrive at near-optimal inventory policies and mode choices.

4 - A Rational Agent Framework for Multi-Agent Supply Chain Modeling
Ramakrishna Govindu, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, ah0776@wayne.edu, Ratna Babu Chinnam

Multi-agent systems have emerged as an intrinsic paradigm for modeling complex systems such as supply chains. However, their development process remains involved and extremely time consuming. We develop a "software agent-component based framework" for SC modeling and validate it using "Tamagotchi" case. We share the details of extending it to make it a "Rational Agent Framework" by incorporating goal-directed rationality through Belief-Desire-Intention (BDI) model of human practical reasoning.

5 - Choosing Data Warehouse Methodology and Managing Data Warehouse Operational Cycle
Zhong-Xian Wang, Professor, Department of Management & Information Systems, Montclair State University, Montclair, NJ, 07043, United States, wangj@mail.montclair.edu, Qiyang Chen

With so many data warehousing methodologies to choose from, a major problem for many firms is which one the company should utilize for its situation. Several attributes have been used to evaluate the various methodologies. Given the need to respond to internal and external changes, the design of the data warehouse must be flexible enough to adapt to changes in the business cycle.

■ WD54

Telecommunications

Contributed Session

Chair: Cheng-Huang Hung, Assistant Professor, Department of Information Management, National Taiwan University of Science and Technology, 43 Sec. 4, Keelung Road, Taipei, 106, Taiwan, alexhung@cs.ntust.edu.tw

1 - Robust Analysis for Securing Localization in Wireless Sensor Networks
Wei Ye, University of Southern California, 2677 Ellendale Pl #205, Los Angeles, CA, 90007, United States, yewei@usc.edu, Fernando Ordonez

Wireless Sensor Networks (WSNs) are one of the active research problems in the world. Most problems in energy limited WSNs are based on the correct location position references, but the study for malicious attacks has been mostly ignored. In this paper, we present robust optimization methods to make the location estimate attack-tolerant in hostile environments. Our computation simulations show our robust methods outperform alternative methods to get the attack-tolerant location estimation.

2 - On the Performance of MANETS Routing Protocols in Various Fading Environments
Dr. Timothy I Matis, Assistant Professor, Department of Industrial Engineering, Texas Tech University, PO Box 43061, Lubbock, TX, 79409, United States, timothy.matis@ttu.edu, Ivan Guardiola

In this presentation, we examine the end-to-end performance of popular routing protocols for mobile ad-hoc networks (MANETS) under various multipath fading models. Our findings demonstrate the strong impact that fading has on the performance of a protocol, and we suggest possible remedial measures.

3 - Internet Service Provider Peering
Gireesh Shrimali, Stanford University, 444 San Antonio 9C, Palo Alto, CA, 94306, United States, gireesh@stanford.edu, Sunil Kumar

We look at paid Internet Service Provider (ISP) peering. Under reasonably general cost models, we show that one peer acts as a monopolist, and provide a characterization of the monopolist. Moreover, we show that it is still possible for both peers to be better off. We then look at the common ``Bill-and-Keep" peering, where no money exchanges hands, and establish sufficient conditions for neither ISP to be a monopolist and for both peers to be better off due to peering.

4 - Wireless Network Access Point Location Problem Under Level of Service Constraints
Cheng-Huang Hung, Assistant Professor, Department of Information Management, National Taiwan University of Science and Technology, 43 Sec. 4, Keelung Road, Taipei, 106, Taiwan, alexhung@cs.ntust.edu.tw, Chia-He Lin

We consider the problem that minimizes the number of wireless network access points to satisfy some desired level of service constraints. We develop a network-flow based algorithm. The performance of our algorithm and the comparisons of performance between the existed formulations and algorithms are presented.

■ WD55

Management of Technology in Information Systems

Contributed Session

Chair: Reuven Levary, Professor, Saint Louis University, 3674 Lindell Boulevard, Saint Louis, MO, 63108, United States, levarypr@slu.edu

1 - The Software Outsourcing Practices of Hong Kong SMEs

C.H. Cheng, Associate Professor, The Chinese University of Hong Kong, Department of Systems Engineering, & Engineering Management, Shatin, NT, Hong Kong, chcheng@se.cuhk.edu.hk, K.F. Wong

Due to the geographical proximity, and cultural and language affinity, many Hong Kong small and medium enterprises (SMEs) outsource their software development activities to China. We conduct a study to examine these activities in China through interviewing eight SME executives. Specifically through our study, we hope to increase our understanding of how the decisions are made, how the operations are managed, and how the concerns are addressed.

2 - Two-Tier Decision Model for IT Outsourcing

Edward Chen, Associate Professor, University of Massachusetts, Management Department, 1 University Avenue, Lowell, MA, 01854, United States, edward_chen@uml.edu

Information technology (IT) outsourcing becomes a major issue of large companies today. They are tapping the rich IT resources oversea to improve their bottom line. The task is critical and complex as it affects the company not only economically but also organizationally and strategically. This study proposes a two-tier decision model to facilitate the decision process. This model also provides a framework for managers to utilize decision aids in problem-solving.

3 - Winners-Take-Some: The Impact of Conversion Technologies on Network Effects in Digital Goods Markets

Zhechao Liu, University of Pittsburgh, Katz Graduate School of Business, 245 Mervis Hall, Pittsburgh, PA, 15213, United States, zhliu@katz.pitt.edu, Michael Smith, Chris Kemerer

The traditional "winner-take-all" assumption has been documented in many IT markets characterized with network effects. We derive an analytical model that endogenizes the provision of the conversion technology in the presence of network effects. The market equilibrium supports our hypothesis that the existence of the converter mediates the network effects of the pre-existing installed base and the conversion equilibrium is more sustainable the higher the degree of convertibility.

4 - Antecedents of Open Source Software Success

Jing Wang, Kent State University, A409, College of Business Administration, Kent State University, Kent, OH, 44242, United States, jwang2@kent.edu, Michael Hu, Marvin D. Troutt, Murali Shanker

Open source software (OSS) projects are emerging as a significant economic, social, and cultural phenomenon. Nonetheless, little is known on why certain projects like Apache and Linux succeed whereas many others fail. This research seeks to investigate factors relating to the success and evolution of OSS projects. Findings of this research provide guidelines on how to produce OSS products that have a greater chance of being deployed and how to promote open source software diffusion.

5 - Intrusion Detection Using an Adaptive Expert System

Reuven Levary, Professor, Saint Louis University, 3674 Lindell Boulevard, Saint Louis, MO, 63108, United States, levarypr@slu.edu

An adaptive expert system for intrusion detection that utilizes fuzzy sets is described. This system has the ability to adapt to the type and/or degree of threat. Examples of rule sets are provided. The adaptive ability of the system is demonstrated by experimenting with the system using simulation.