Monday, 8:00am - 9:30am

■ MA01

Optimization in Wireless Networks

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Mohammad Taghi Hajiaghayi, Post-Doctoral Fellow, Carnegie Mellon University, Department of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, hajiagha@mit.edu

1 - Improving Spatial Reuse Through Tuning Transmit Power and Data Rate in Multihop Wireless Networks
Jennifer Hou, Professor, University of Illinois Urbana-Champaign, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States, jhou@cs.uiuc.edu, Tae-Seok Kim

In wireless networks, one can increase spatial reuse by reducing transmit power or increasing carrier sense threshold. However, by doing so, the SINR decreases (and the data rate sustained) as a result of smaller received signal or increased interference level. In this study, we quantify the trade-off between the increase in spatial reuse and the decrease in the data rate sustained and study the relation between transmit power and carrier sense threshold.

2 - Modeling the Impact of Wireless Interference
Lili Qiu, Assistant Professor, University of Texasa at Austin, 1 University Station C0500, Austin, TX, 78712, United States, lili@cs.utexas.edu

A fundamental problem in wireless network research is how to model the impact of wireless interference on network performance. In this talk, I present methods for computing such performance bounds by modeling wireless interference using a conflict graph. The results have significant implications on designing and optimizing wireless networks.

3 - Wired Versus Wireless Connectivity Problems
Guy Kortsarz, Associate Professor, Rutgers - Camden, Camden, NJ, 08102, United States, guyk@camden.rutgers.edu

We survey some connectivity problems in wireless systems and compared them to their counterpart in wired systems. Two problems that are of particular interest. The first is: the b-cover problem. Given a graph G and a demand b(v) for every vertex, find a min-power (min-cost) subgraph G' such that degree_G'(v)\geq b(v) for every v. The second problem is that of finding a minimum power (cost) k-connected subgraph G' of G.

4 - OURS: Optimal Unicast Routing Systems in Non-Cooperative Wireless Networks
Xiang-Yang Li, Associate Professor, Illinois Insitute of Technology, 10 West 31st Street, Chicago, IL, 60616, United States, xli@cs.iit.edu, Yu Wang, WeiZhao Wang

We propose novel solutions for the problem of routing in a wireless network that consists of selfish terminals. We design a mechanism that results in Nash equilibria rather than the traditional strategyproofness. In addition, we systematically study the \emph{unicast routing system} in which both the relay 4terminals and the service requestor could be selfish.

■ MA02

Joint Session Open-Source/ICS: Mixed-Integer Nonlinear Programming with COIN-OR

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

Chair: Francois Margot, Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, fmargot@andrew.cmu.edu

1 - A New Open-Source Solver for MINLP
Pierre Bonami, Post-Doctorate, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, pbonami@us.ibm.com

We present our work related to developing an open-source solver for Mixed Integer NonLinear Programming. This solver has been developed in a joint effort by researchers both at IBM and Carnegie Mellon University. It implements three algorithms for solving convex MINLPs: a branch-and-bound, an Outer-Approximation decomposition and an hybrid method. We present computational result comparing this algorithm to classical algorithms (as implemented both in commercial solvers and in our code).

2 - IPOPT, An Interior-Point Solver for Exploiting Structure in Large-Scale Nonlinear Programs
Carl Laird, Graduate Student, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, claird@andrew.cmu.edu, Lorenz Biegler

We present the next-generation IPOPT, a large-scale interior-point solver for nonlinear programming problems available through the COIN-OR foundation (projects.coin-or.org/Ipopt). The algorithm performs all fundamental operations through a well-defined linear algebra interface. This allows development of specialized linear algebra for the efficient solution of structured problems without changes to the algorithm code. The approach will be demonstrated on a multi-scenario optimization problem.

3 - A Novel Library of Nonlinear Mixed-Integer and Disjunctive Programming Problems
Nicolas Sawaya, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, nws@andrew.cmu.edu

We present a new collection of mixed-integer and disjunctive nonlinear programming problems that arise in the fields of Operations Research, Chemical Engineering and Finance. These problems, which total over 250 and are organized into 15 classes of applications, span areas such as facility layout, synthesis of process networks, chemical batch process design, water networks and portfolio optimization. These problems are available at the following webpage: http://egon.cheme.cmu.edu/ibm/page.htm

■ MA03

Robust Optimization Theory and Applications

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

1 - Is Robust Optimization Too Conservative?
Reha Tutuncu, Vice President, Goldman Sachs Asset Management, 32 Old Slip, 23rd Floor, New York, NY, 10007, United States, reha.tutuncu@gs.com

A common objective in robust optimization is to optimize decisions under worst possible realizations of uncertain input parameters. These formulations typically lead to overly conservative choices. This conservatism is the result of allowing unlikely scenarios in the uncertainty sets. For the case where the uncertain parameters are estimates, we explore the use of restricted sets that respect their statistical properties. We illustrate the approach using portfolio selection examples.

2 - A New Conic Programming Approach for Robust Portfolio Selection Problems
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

We introduce the ``joint" uncertainty structures for portfolio selection problem parameters, which correspond to confidence regions of market parameters constructed by the statistical procedures. Based on the joint uncertainty structures, we provide a new conic programming approach to formulate and solve robust portfolio selection problems without destroying the confidence level of the joint uncertainty strutures. The resulting portfolio is more diversified than the other approaches.

3 - Safe Tractable Approximation of Chance Constrained Randomly Perturbed LMIs
Arkadi Nemirovski, Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, nemirovs@isye.gatech.edu

We present an approximation scheme which allows to build tight, in certain precise sense, computationally tractable sufficient conditions for the validity of chance constrained randomly perturbed Linear Matrix Inequalities.

4 - Goal Driven Optimization
Melvyn Sim, Assistant Professor, National University of Singapore, 1 Business Link, Singapore, Singapore, dscsimm@nus.edu.sg, Wenqing Chen

We develop a goal driven stochastic optimization model that takes into account an aspiration level or target. Our model maximizes the shortfall aspiration level criterion, which encompasses the probability of success in achieving the goal and an expected level of under-performance or shortfall. The key advantage of the proposed model is its tractability. We propose a decision rule based deterministic approximation in the form of second order cone optimization problems.

■ MA04

Lifting in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - Valid Inequalities for MIPs and Group Polyhedra from Approximate Liftings

Lisa Miller, Assistant Professor, University of Minnesota, 111 Church Street SE, 1100 Mechanical Engineering, Minneapolis, MN, 55113, United States, lmiller@me.umn.edu, Jean-Philippe Richard, Yanjun Li

We present an approximate lifting scheme to derive valid inequalities for general mixed integer programs and for the group problem. This scheme uses superadditive functions as the building block of integer and continuous lifting procedures. It yields an alternate simple derivation of new as well as known families of cuts that correspond to faces, and sometimes facets, of the group polyhedron.

2 - Cook, Kannan and Schrijver's Example Revisited

Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@purdue.edu, Jean-Philippe Richard

Cook, Kannan and Schrijver (1990) studied the split closure of polyhedron. They showed on a 3-dimensional example that the 1-term disjunctive rank of mixed-integer polytopes can be infinite. We generalize this example to a family of high-dimensional polytopes and present a close-form description of the split closures of all ranks for these polytopes. We conjecture that the k-term disjunctive rank of the (m+1)-dimensional polytope in this family is infinite for any k bbb m, where m ccc 1.

3 - MIP Lifting Techniques for Nonlinear Programs

Mohit Tawarmalani, Assistant Professor, Purdue University, School of Management, West Lafayette, IN, 47907, United States, mtawarma@purdue.edu, Jean-Philippe Richard

Lifting locally valid inequalities to make them globally valid is a successful methodology for obtaining cuts in MILPs. We extend this approach to generate cuts for nonlinear programming problems. We illustrate the approach in two different ways. First, we obtain cuts for mixed integer bilinear sets without adding variables. Partial sequence independence allows generation of exponentially many facet defining inequalities. Second, we obtain nonlinear convex hull of various disjunctive sets.

4 - Lifted Cover Inequalities for Bounded Nonlinear Purely Integer Programming

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu

Any bounded nonlinear purely (as opposed to mixed) integer programming problem (BNPIP) can, in theory, be formulated as a linear integer programming problem (LIP). We present a valid inequality generation procedure that can be used to obtain an initial approximate LIP for BNPIP and to improve the formulation automatically within a branch-and-cut algorithm. The procedure is based on lifting cover inequalities derived from the (possibly nonlinear) knapsack constraints of BNPIP.

■ MA05

Sampling Methods in Stochastic Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: David Morton, Associate Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station, C2200, Austin, TX, 78712-0292, United States, morton@mail.utexas.edu

1 - Sequential Sampling Procedures for Stochastic Integer Programs

Guzin Bayraksan, Assistant Professor, Department of Systems and Industrial Engineering, The University of Arizona, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

We present sampling-based procedures for stochastic integer programs with integer first stage. Input to our procedures is a sequence of solutions with at least one optimal limit point. We use increasing sample sizes to assess the quality of the solutions and provide stopping rules. Our first method increases the sample size one by one. An accelerated method increases it in jumps using the current information. We discuss asymptotic properties and present preliminary computational results.

2 - Efficient Sample Sizes in Stochastic Nonlinear Programming

Johannes Royset, Professor, Naval Postgraduate School, Operations Research Department, Monterey, CA, 93943, United States, joroyset@nps.edu, Elijah Polak

A solution approach to stochastic nonlinear programs is to solve a sequence of sample average approximations (SAA). Computational issues in this approach are determination of the sample size used in each SAA and the number of iterations to be carried out on each SAA. We show that efficient sample sizes and number of iterations can be determined by solving an auxiliary minimization problem whose objective function is the computing work required to obtain a specified cost-error reduction.

3 - Assessing Solution Quality in Stochastic Programming

Amit Partani, Graduate Research Assistant, University of Texas, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States, partani@mail.utexas.edu, David Morton

We discuss an adaptive jackknife estimator to reduce bias. It does not require a priori knowledge regarding the order of bias. We discuss convergence properties and apply it in the context of Monte Carlo-based simulation procedures in stochastic programming. We provide a bias reduction strategy for the optimality gap estimator of a candidate decision based on the adaptive estimator. Computational results are presented to evaluate the performance of the adaptive estimator.

■ MA06

Breaking Symmetries

Sponsor: INFORMS Computing Society/Constraint Programming
Sponsored Session

Chair: Meinolf Sellmann, Assistant Professor, Brown University, 115 Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu

1 - Recent Advances in Lexicographic Constraints

Jean-Francois Puget, Vice President, ILOG, 7 boulevard des Moulins, Carry-le-Rouet, 13620, France, puget@ilog.fr

Adding lexicographic constraints is a way to remove all variable symmetries of a problem. However this method has many drawbacks: One needs to state one constraint per symmetry, yielding an exponential number of constraints in the worst case; The method does not handle value symmetries; The order used in the lexicographic constraints may clash with the order used during a tree search. We show how to effectively address these shortcomings using improved lexicographic constraints.

2 - Static and Dynamic Structural Symmetry Breaking

Justin Pearson, Senior Lecturer, Uppsala University, Department of Information Technology, Box 337, SE-751 05, Uppsala, Sweden, justin.pearson@it.uu.se, Pascal Van Hentenryck, Meinolf Sellmann, Pierre Flener

We reconsider the idea of structural symmetry breaking. We show that dynamic dominance checks have a static counterpart: there exists a set of constraints that can be posted at the root node and that break all pairwise variable and value symmetries. Moreover, static and dynamic symmetry breaking coincide for static variable and value orderings. This is the first time that static symmetry breaking has been shown capable of breaking variable and value symmetries at the same time.

3 - Structural Symmetry Breaking Restarted

Meinolf Sellmann, Assistant Professor, Brown University, Waterman Street, PO Box 1910, Providence, RI, 02912, United States, sello@cs.brown.edu, Daniel Heller

We wish to assess how symmetry breaking and restarts interact with one another. We find that the improvements to be gained by restarting are far smaller for full symmetry breaking methods than those that can be obtained for methods that break only some symmetries or none at all. Surprisingly, the combination of restarts and breaking value symmetry only is often competitive with complete symmetry breaking.

■ MA07

High Throughput Optimization

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems & Computer Engineering, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Parallel and Distributed Optimization in Comet

Pascal Van Hentenryck, Professor of Computer Science, Brown University, Box 1910, 115 Waterman Street, 4th Floor, Providence, RI, 02912, United States, pvh@cs.brown.edu, Laurent Michel

Distributed computing is increasingly important at a time when Moore's law cannot be sustained much longer. Unfortunately, it also places significant conceptual and implementation burden on programmers. This talk aims at addressing this challenge and presents abstractions that allows distributed optimization programs to be close to their sequential and parallel counterparts. A preliminary implementation Comet exhibits significant speed-ups.

2 - The GAMS Grid Computing Facility

Alexander Meeraus, GAMS Development Corporation, 1217 Potomac Street, NW, Washington, DC, 20007, United States, AMeeraus@gams.com

As multiple CPUs and High Performance Computing Grids are becoming available more widely, the GAMS language has been extended to take advantage of these new environments. New language features facilitates the management of asynchronous submission and collection of model solution tasks in a platform independent fashion. A simple architecture, relying on existing operating systems functionality allows for rapid introduction of new environments and provides for an open research architecture.

3 - Decomposition and High Throughput Solution of Equilibrium Problems

Michael Ferris, Professor, University of Wisconsin-Madison, 1210 W. Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Thomas Rutherford

Decomposition approaches enable solution of otherwise intractable mathematical programming problems. We describe a decomposition approach for large scale complementarity problems arising from applied general equilibrium problems in economic analysis. We report on their solution using a variety of distributed algorithms in combination with the grid extensions of GAMS, the (high throughput) distributed computational resources of Condor and the PATH solver.

4 - Opportunities for Parallelism in Optimization Algorithms

David M. Gay, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 0370, PO Box 5800, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov

Algorithms for large-scale optimization problems can exploit parallelism in various ways. Expensive function evaluations can sometimes be done in parallel, as can linear algebra. Branch-and-bound (and cut) algorithms may seek incumbents independently of branching and could terminate some branches when a parallel branch finds a sufficiently improved incumbent. What is worthwhile depends on the parallel constructs available and their relative costs. Many constructs have been proposed.

■ MA08

Joint Panel Discussion TMS/NPD: Early Career Strategies in Interdisciplinary Areas - Perspectives from TMS and NPD

Sponsor: Technology Management, New Product Development
Sponsored Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

Co-Chair: Francisco Veloso, Assistant Professor, Carnegie Mellon University, Engineering & Public Policy, Pittsburgh, PA, 15213, United States, fveloso@cmu.edu

1 - Panel Discussion: TMS/NPD: Early Career Strategies in Interdisciplinary Areas - Perspectives from TMS and NPD

Moderator: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Panelists: Christoph Loch, Ashish Arora, Francisco Veloso

This Panel brings together several scholars to discuss strategies and approaches towards building a successful carreer working in the interdisciplinary areas that span the members of the TMS and NPD commununities. Issues to be discussed include managing the tension between interdisciplinary interests and disciplinary journals, building recognition and focus across disciplines and developing succesful tenure records.

■ MA09

Emerging Issues in Innovation

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, Professor, University of California - San Diego, Rady School of Management, 9500 Gilman Drive MC 0093, La Jolla, CA, 92093, United States, vkrishnan@ucsd.edu

1 - Social Preferences and Fair Process

Christoph Loch, Professor of Technology Management, INSEAD, Boulevard de Constance, Fontainebleau, France, christoph.loch@insead.edu, Yaozhong Wu

An emerging theme in operations is that people care not only about their payoffs in decisions, but also about the social interactions involved. For example, much empirical evidence suggests that "fair process", or transparency and employee engagement, enhances organizational performance. We build a model that links fair process to social preferences, explains why fair process may enhance performance, and predicts when it should not be used (which is absent from the empirical work so far).

2 - Appropriateness of Sequential and Simultaneous Innovation

Karthik Ramachandran, The University of Texas at Austin, 4580 Huggins Street, San Diego, CA, United States, karthikr@Mail.utexas.edu

While simultaneous creation of multiple variants allows leveraging complementarities in the product platform, sequential pursuit of improving variants enables focused execution of product development projects. We study the sequential vs simultaneous innovation problem faced by firms in developing products for multiple market segments. We show that the optimal simultaneity in development depends on resources available, technological characteristics, and most importantly, the maturity of the firm.

3 - Managing Co-Development Processes

Stylianos Kavadias, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30308, United States, Stylianos.Kavadias@mgt.gatech.edu, Sanjiv Erat

Recently, Delta Airlines collaborated with 3M to develop a flame-resistant paper that could potentially be licensed to airline carriers. The study considers settings where two companies collaborate to develop a new product/technology. Our results suggest that NPD variables such as performance and cost uncertainty have important implications to when the revenue sharing contracts should be signed (i.e., before, during, or after the project).

■ MA10

Software Demonstration

Cluster: Software Demonstration
Invited Session

1 - statistics.com - Teaching Data Mining Using Excel with XLMiner

Peter Bruce, statistics.com, 612 N. Jackson St., Arlington, VA, 22201, pbruce@statistics.com

With XLMiner, you can take advantage of Excel's familiar environment and short learning curve to teach data mining. For classification and precision XLMiner offers neural nets, k-nearest-neighbor, logistic and linear regression, Naive Bayes, decision trees and discriminant analysis. Plus association rules, clustering, and utilities for sampling and partitioning data.

2 - Palisade Corporation - From Software to Solutions in Statistics and Risk Analysis

Shawn Harahush, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, sharahush@palisade.com

Palisade, famous for its Monte Carlo simulation software, @RISK, offers a suite of powerful and sophisticated analytical data software tools that are useful both independently and in conjunction with one another. These tools fall into 4 main categories: Risk and decision analysis, data analysis, optimization, and developer kits.

■ MA11

Joint Session Minority/ Optimization: Discrete Optimization I

Sponsor: Minority Issues, Optimization/Interger Programming, Optimization/Network and Combinatorial Optimization
Sponsored Session

Chair: Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu

1 - Travel-Time Minimization in Transportation Networks by Near-Optimal Tollbooth Placement
Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States, mgcr@research.att.com, Luciana Buriol, Michael Hirsch, Tania Querido, Panos Pardalos

We present a memetic algorithm to place K tollbooths and set corresponding tolls on a capacitated transportation network such that when travelers take a least-cost route, their expected travel time is minimized. We illustrate the algorithm on five real networks: Sioux Falls, Anaheim, Stockholm, Barcelona, and Winnipeg.

2 - The Branchwidth of Graphs and their Cycle Matroids
Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Nolan McMurray

In this talk, we prove a conjecture stating that the branchwidth of a graph and the branchwidth of the graph's cycle matroid are equivalent if the graph has a cycle of length at least two.

3 - A Constructive Approach for Multidimensional Superadditive Lifting
Bo Zeng, PhD Candidate, Purdue University, 223 Arnold Drive, West Lafayette, IN, 47907, United States, bzeng@ecn.purdue.edu, Jean-Philippe Richard

Lifted cuts from single constraint of 0-1 MIPs have been proven to be very effective. We present a framework to efficiently and systematically build superadditive approximation of higher dimensional lifting function from the superadditive approximation of lower dimensional one. This framework can be used to generate cuts based on multiple constraints. Applications on several variations of classical knapsack and single node flow problems as well as 2-D knapsack problem will be presented.

4 - New Cuts for 0-1 Programming Problems
Osman Oguz, Assoc. Prof., Bilkent University, Ankara, 06800, Turkey, ooguz@bilkent.edu.tr

Cuts separating noninteger extreme point solutions from the solution set of the LP relaxation of a 0-1 programming problem are introduced. These cuts are similar to cover cuts in function, however the logic behind their derivation is different. Some experimental results on the use of the cuts will also be reported.

■ MA12

Mentoring: Perspectives of Winners of the Award for the Advancement of Women in OR/MS

Sponsor: Women in OR/MS
Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Mentoring
Cynthia Barnhart, Professor, MIT, 77 Massachusetts Avenue, Room 1-235, Cambridge, MA, 02139, United States, barnhart@mit.edu

As a Professor of Civil and Environmental Engineering, Industrial and Systems Engineering, Engineering Systems, and Co-Director of the MIT's Operations Research Center and the MIT Center for Transportation and Logistics, I have had several "mentoring" experiences, both on the giving and receiving end. I will try to describe some of lessons I have learned, and my assessment of what works and what doesn't work.

2 - 2006 WORMS Award Winner: Growing Up as an OR Professional - Role of Mentors, Role Models, Friends
Radhika Kulkarni, Director, Operations Research R&D, Analytical Solutions Division, SAS Institute Inc., Cary, NC, 27513, United States, Radhika.Kulkarni@sas.com

Building a successful Operations Research group, whether in Academia or in Industry, is a challenging experience. The journey is enriched by interactions with colleagues in several roles; some are close friends, others are advisors, and yet some others are role models. Not every interaction may appear to be a mentoring activity, but every one of them provides an opportunity to learn a valuable lesson. Some experiences and lessons learned will be described.

■ MA13

Teaching Decision Support System (DSS) Development

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Michelle M.H. Seref, Doctoral Student, Operations Management, Decision Information Sciences, University of Florida, Stuzin Hall 361-E, Gainesville, FL, 32611, United States, michelle.hanna@cba.ufl.edu

1 - Decision Support Services with Excel
Cliff Ragsdale, Bank of America Professor, Virginia Polytechnic Institute and State University, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, cragsdal@vt.edu

This presentation discusses Excelís evolution as an enterprise-wide DSS tool and associated implications for educators.

2- Using IT to Deliver Operations Research Solutions
Mark Eisner, Cornell University, me35@cornell.edu

Decision support systems are a frequent delivery vehicle for OR solutions. "Developing" such a DSS involves many issues beyond computer programming. This talk will describe a Cornell University course that introduces students to these issues with the objective of increasing the success of OR-based projects in their professional careers.

3- Key DSS Skills for Operations Management Majors at University of Dayton
Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton OH 45419-2130, United States, michael.gorman@udayton.edu

In this talk, I will discuss the key DSS skill sets required for the successful operations management major at the University of Dayton. We discuss important underlying tool skills, new DSS skill requirement for the major, and how these skills are used in some of our operations management capstone projects and beyond in the students' first jobs. We find these skills to be essential for students to conduct productive and efficiently analytical work of meaningful scale.

4 - A Course on Developing Spreadsheet-Based Decision Support Systems (DSS)
Michelle M.H. Seref, Doctoral Student, Operations Management, Decision Information Sciences, University of Florida, Stuzin Hall 361-E, Gainesville, FL, 32611, United States, michelle.hanna@cba.ufl.edu, Ravindra Ahuja

To develop a spreadsheet-based DSS, a student needs to learn the definition of a DSS, the functionalities of a spreadsheet software, the technology of a supporting coding language, and the process of constructing a complete DSS application. In our course, we teach these components using course lectures, in-class assignments, homework exercises, and a midterm exam followed by a full DSS project assignment. We find that students leave the course equipped to develop high-quality DSS applications.

■ MA14

Procurement and Combinatorial Auctions II

Cluster: Auctions and e-Commerce
Invited Session

Chair: David Parkes, Associate Professor, Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu

1 - Iterative Combinatorial Auctions with Linear Prices: Results of Numerical Experiments
Martin Bichler, Roland Berger & o2 Germany Professor of Internet-based Information Systems (IBIS), Department of Informatics, I18 Technische Universitaet Muenchen, Boltzmannstrasse 3, D-85748, Garching, Germany, martin.bichler@in.tum.de

Iterative combinatorial auctions exhibit a number of desirable economic properties. Some auction designs are based on linear prices. Although, exact linear prices are often impossible to calculate, these auction formats have performed very well in the laboratory. In this paper, we analyze the economic properties of these mechanisms in simulations.

2 - Core Payment Mechanisms for Combinatorial Auctions
Robert Day, Assistant Professor, Operations and Information Management, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06269, United States, Bob.Day@business.uconn.edu, S. Raghavan

In this talk I will summarize recent results on "Core" payment mechanisms for combinatorial auctions and their merits relative to the VCG and other mechanisms. Equilibrium bidding behavior, complexity, algorithmic techniques, and connections to shill bidding and collusion will be discussed.

3 - Shake it up Baby: Scheduling with Package Auctions
Kan Takeuchi, PhD Candidate, University of Michigan, Department of Economics, 611 Tappan Street, Ann Arbor, MI, 48109, United States, Yan Chen, John Lin, Thomas Finholt

We study the problem of scheduling the use of scientific equipments when there is synergy among contiguous time slots. The environment is based on the resource allocation problem faced by the Network for Earthquake Engineering Simulation (NEES). In this environment, we evaluate three mechanisms in the laboratory, RAD (Kwasnica et al, 2005), generalized Vickrey auction, and a knapsack ranking mechanism which is a best-case representation of current scientific equipment time allocation methods. We find that, while the RAD and Vickrey mechanism produces higher efficiency than knapsack, the Vickrey and knapsack mechanisms achieve higher equity level among participants than RAD.

4 - ICE: A Scalable and Expressive Iterative Combinatorial Exchange
David Parkes, Associate Professor, Harvard University, 33 Oxford Street, Cambridge, MA, 02138, United States, parkes@eecs.harvard.edu, Benjamin Lubin, Adam I. Juda, Jeffrey Shneidman

Combinatorial exchanges facilitate trade between multiple buyers and sellers that need to express complex preferences on bundles of items. Applications are to spectrum reallocation, airport slots, supply chain and logistics. ICE incorporates the following features: (a) a tree-based bidding language, (b) elicitation via refinement of cccbounds, (c) linear price feedback, (d) threshold-based payments.

■ MA15

Prediction Markets I

Cluster: Auctions and e-Commerce
Invited Session

Chair: Anthony Kwasnica, Assistant Professor, Penn State University, 332 Business Building, University Park, PA, 16802, United States, kwasnica@psu.edu

1 - Decision Markets and Moral Hazard
Shimon Kogan, Assistant Professor of Finance, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States, kogan@andrew.cmu.edu, Anthony Kwasnica, Roberto Weber

We study the use of markets as a forecasting tool for internal firm decision making. In this setting, it is likely that the participants in the market will also have the ability to affect the outcome of the market through some private, unobservable actions. We conduct laboratory experiments where subjects participate in both a coordination game and a market designed to predict the outcome of the coordination game.

2 - Prediction Markets in Theory and Practice
Justin Wolfers, Assistant Professor of Business and Public Policy, The Wharton School, Steinberg-Dietrich Hall, Suite 1400, 3620 Locust Walk, Philadelphia, PA, 19106, United States, jwolfers@wharton.upenn.edu, Eric Zitzewitz

Prediction Markets allow participants to trade contracts with payoffs tied to future events, thereby yielding prices that can be interpreted as market-aggregated forecasts. We highlight recent theoretical contributions that emphasize the possibility that these markets efficiently aggregate disperse information, and the lessons from empirical applications which show that market-generated forecasts typically outperform most moderately sophisticated benchmarks.

3 - Comparing Costs and Benefits of Prediction Markets
Robin Hanson, Associate Professor, George Mason University, MS 1D3, Carow Hall, 4400 University Drive, Fairfax, VA, 22030-4444, United States, rhanson@gmu.edu

Most attempts to create prediction markets have focused on keeping costs low and traders interested. Such topics can make good sandboxes, but they need not be where most of the untapped value lies. We qualitatively review the main costs and benefit drivers of prediction markets, in order to help identify the high value application areas.

4 - The Performance of Virtual Stock Markets in Institutional Forecasting
Gary Lilien, Distinguished Research Professor of Management Science, Penn State University, 484 Business Building, University Park, PA, 16802, United States, glilien@psu.edu, Gerrit Van Bruggen, Martin Spann, Bernd Skiera

We study the performance of Virtual Stock Markets (VSMs) in institutional forecasting. We find that VSMs can be effectively applied in an environment with a small number of knowledgeable informants. Our results show that where there is high knowledge-heterogeneity, the VSM outperforms the Combined Judgmental Forecasts approach. Our results provide insight into when each of the approaches might be most effectively applied.

■ MA16

Revenue Management with Demand Learning

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: 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

1 - Dynamic Pricing of New Experience Goods
Dirk Bergemann, Campbell Professor of Economics, Department of Economics, Yale University, 28 Hillhouse Avenue, New Haven, CT, 06511, United States, dirk.bergemann@yale.edu, Juuso Valimaki

We develop a dynamic model of experience goods pricing with independent private valuations. We show that the optimal paths of sales and prices can be described in terms of a simple dichotomy. In a mass market, prices are declining over time. In a niche market, the optimal prices are initially low followed by higher prices that extract surplus from the buyers with a high willingness to pay.

2 - Blind Nonparametric Revenue Management
Omar Besbes, PhD Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, ob2105@columbia.edu, Assaf Zeevi

We consider a general class of network revenue management problems where the decision maker is "blind" to the underlying demand function. We develop nonparametric pricing algorithms that learn this function "on the fly," and prove that, in a regime where the sales volume grows large, these algorithms achieve the optimal revenues generated by pricing policies that "know" the demand function a priori.

3 - Sequential Demand Learning and Dynamic Pricing
Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Victor Araman

A retailer is planning to introduce a new product into the market but does not know if there is enough demand and decides to test the market. He chooses a small set of representative locations (learning phase) where he offers the product for a short time. Based on this information he decides whether to launch the product in the entire market (revenue phase) or not. We assume that initial inventory is fixed and that dynamic pricing is used in both the learning and revenue phases.

4 - Revenue Management Heuristics Under Limited Market Information: A Maximum Entropy Approach
Serkan Eren, PhD Student, Columbia Business School, 435 West 119th Stree Apt. 3F, New York, NY, 10027, United States, se2027@columbia.edu, Costis Maglaras

We propose a tractable and intuitive approach based on maximum entropy (ME) distributions for revenue optimization problems in settings where firms have limited and/or censored market information. In this talk we illustrate the approach in the context of the single-resource capacity control problem, benchmarking it against other solutions based on some form of worse-case analysis, and showing how it can incorporate censored sales data in an intuitive manner and avoid the "spiral-down" phenomenon

■ MA17

Simulation-Based Shop Floor Control

Sponsor: Simulation
Sponsored Session

Chair: Jeffrey Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, jsmith@auburn.edu

1 - Dynamically-Integrated Planning and Control for the Distributed Enterprise
Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu

We present a multi-scale federation of simulation and decision models that support planning and control with dynamic updating through sensed and streamed data. Planning and control models are updated both from real-world sensed data and from simulations. While the real world may yield parameters such as current costs or inventory status, the simulation model, in synchronization with other federates in the supply network, will be used to compute lead times and effective resource availabilities.

2 - A Simulation Infrastructure for Procurement and Distribution
Rick Wysk, Professor, Penn State University, Department of Industrial Engineering, University Park, PA, 16802, United States, rwysk@psu.edu, Jianrui (Jerry) Wang

Today's warehouse and procurement centers face challenges in all aspects of service from procurement, to processing and logistics. This paper proposes a location based services infrastructure for forecasting, coordinating, and monitoring distributed simulation federations with real time location information. The infrastructure will significantly improve the performance of procurement and distribution, especially in case of critical needs such as nature disaster or terrorist attack.

3 - Simulation-Based Commissioning of Factory Control Systems
Jeffrey Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, jsmith@auburn.edu

Commissioning involves proving/demonstrating that a control system works as designed, intended and contracted. For complex factory control systems, commissioning is a time-consuming and expensive process. However, the commissioning process is critical from the contractual, performance, and safety points of view. This presentation discusses the opportunities for applying discrete-event simulation technology to the general factory control system commissioning process.

■ MA18

Operations Research and Homeland Security

Cluster: Counter Terrorism and OR
Invited Session

Chair: Lawrence Wein, Paul E. Holden Professor of Management Science, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, wein_lawrence@gsb.stanford.edu

1 - Deadly Games: Suicide Bombings and Targeted Killings in the Israeli-Palestinian Conflict
Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Daniel F. Jacobson

Suicide bombers murdered hundreds of Israeli civilians during the past six years. Israeli countertactics range from intelligence-driven arrests, to targeted killings of terror operatives (that have also led to civilian casualties), to last-minute interceptions. We develop a family of game theory models to examine suicide bombings and targeted killings in the Israeli-Palestinian conflict, and generate several results that aid in understanding the associated "cycle of violence."

2 - Large-Scale Dispensing for Emergency Response to Bioterrorisim and Infectious Disease Outbreak
Eva Lee, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, evakylee@isye.gatech.edu, Siddhartha Maheshwary

A simulation and decision support system, RealOpt, for planning large-scale emergency dispensing clinics to respond to biological threats and infectious disease outbreaks is described. RealOpt incorporates efficient optimization seamlessly interfaced with a simulation module. It allows public health administrators to investigate clinic design and staffing scenarios quickly for operational and strategic planning. Experience of using RealOpt for actual Anthrax drill planning will be analyzed.

3 - Trilevel Models for Protecting Critical Infrastructure
Kevin Wood, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, kwood@nps.edu, Gerald Brown, Matthew Carlyle, Javier Salmeron

We describe a tri-level Stackelberg game for planning the defense of critical infrastructure. (1) A "defender" chooses a budget-limited set of infrastructure components to harden. (2) An "attacker" sees the hardened system and attacks it using limited resources. (3) The defender operates the damaged system as best possible. The defender, at level 1, seeks to maximize system functionality after a worst-case attack. We illustrate with a realistic electric power-transmission problem.

4 - Designing Radiation Detection-Interdiction Systems to Protect Cities from a Nuclear Terrorist Attack
Michael Atkinson, Graduate Student, Institute for Computational and Mathematical Engineering, Stanford University, Durand 105A, Mail Code: 4042, 496 Lomita Mall, Stanford, CA, 94305, United States, mpa33@stanford.edu, Zheng Cao, Lawrence Wein

We consider a Stackelberg game in which a terrorist drives a nuclear weapon toward a city and chooses when to detonate, and the government chooses the number of neutron sensors and interdiction vehicles deployed. One layer of sensors and 10-20 vehicles can mitigate the damage from a plutonium weapon.

■ MA19

Forestry Applications V

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Marc McDill, Associate Professor of Forest Management, Penn State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States, mem14@psu.edu

1 - Effects of Improved Search Space Representation on Optimal Road Network
Hans R. Heinimann, Professor of Forest Engineering, ETH Zurich, Universitaetsstrasse 16, CHN K 72.2, Zurich, 8805, Switzerland, hans.heinimann@env.ethz.ch, Juerg Stueckelberger

The problem of optimal road network layout is challenging. Most of the previous models use a grid representation that considers only the eight closest neighbor cells to define feasible road links. We present an improved search space and alignment constraints representation mapped on a mathematical graph for better forest road network design. Our model provides enhanced vertical and horizontal road alignments - especially in steep terrain - and reduces the construction cost by 20% to 70%.

2 - Land Acquisition and Restoration Strategies for Prairie-Obligate Butterfly Species
Stephanie Snyder, USDA Forest Service, North Central Research Station, St. Paul, MN, United States, stephaniesnyder@fs.fed.us, James Miller, Adam Skibbe, Robert Haight

We develop a multi-objective land acquisition model to identify habitat protection and restoration strategies for prairie-obligate butterflies in suburban Chicago. Species' persistence depends upon the provision of grasslands and open wetlands in close proximity. Both protection and restoration of wetlands are considered. Buffering requirements for wetlands are explored using clique constraints. Trade-offs between total area of protected habitat and distance to existing reserves are explored.

3 - Dynamic Reserve Site Selection Under Contagion Risk of Deforestation
Daniel Spring, Research Fellow, Monash University, School of Biological Sciences, PO Box 18, Clayton, Victoria 3800, Australia, Daniel.Spring@sci.monash.edu.au, Regis Sabbadin

Land development often takes the form of a contagion process in which sites most likely to be developed are near sites already developed. To consider nature reserve site selections in such cases, we propose an algorithm that uses a graph representation of the sites network and parameterised reinforcement learning to consider dynamic selection problems involving many sites. The method outperforms previously proposed heuristics in terms of the average number of species conserved.

■ MA20

Joint Session DAS/ENRE: R&D. Electricity, and Climate Change

Sponsor: Decision Analysis Society, Energy, Natural Resources & The Environment
Sponsored Session

Chair: Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu

1 - Assessing Potential Electricity R&D Projects in the Context of Climate Change

Erin Baker, Assistant Professor, University of Massachusetts, Mechanical and Industrial Engineering, 220 Elab, Amherst, MA, 01003, United States, edbaker@ecs.umass.edu, Jeffrey Keisler

We will present the results of expert assessments on specific climate change technologies that probabilistically relate focused R&D expenditures to specific technological advances. We analyze a limited number of electricity sector technologies which are candidates for investment, including technologies in the categories of advanced solar, carbon capture and sequestration, nuclear fission and fusion, bio-energy, wind, transmission and the grid, and combustion.

2 - Innovation, Uncertainty and Instrument Choice for Climate Policy

Thomas Rutherford, 4829 Northgate Drive, Ann Arbor, MI, 48103, United States, tom@mpsge.org, Christoph Böhringer

Climate change is a long-term problem. Efficient policy responses involve the choice of policy instruments and their timing. We present an intertemporal framework where we can study the trade-off between emission taxes and innovation (R&D) subsidies as a means to cope with long-term emission constraints. A stochastic programming setting allows us to investigate how policy choices are affected by uncertainties on the future availability of clean energy technologies.

3 - How to Stimulate Technology Breakthroughs in an World with Endogenous Uncertainty

Valentina Bosetti, FEEM, C.so Magenta 63, Milano, It, Italy, valentina.bosetti@feem.it, Massimo Tavoni

In this paper we analyze optimal energy R&D investments meant to foster technological breakthroughs -modelled as endogenous random phenomena- in a setting characterized by climate change mitigation goals. We employ solution methods enabling to incorporate endogenous uncertainty. Such a setting allows to analyze climate policy actions -especially those affecting R&D investments- as directly influencing the success rate. We are thus able to derive optimal short term R&D profiles.

■ MA21

Eliciting, Evaluating, and Combining Expert Judgments

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States, lichtendahlc@darden.virginia.edu

1 - Scoring Rules, Competition Among Forecasters, and Probability Reconciliation

Robert Winkler, Professor, Duke University, 317 Fuqua School of Business, Durham, NC, 27708, United States, rwinkler@duke.edu

We study how competition among forecasters can cause reported probabilities to be more extreme even if proper scoring rules are used and investigate how a decision maker should revise her probabilities after seeing these reported probabilities. The results have prescriptive implications for forecasters who care about relative performance and for decision makers using reported forecasts as well as descriptive implications related to overconfidence.

2 - Averaging Opinions: When Does it Work Well, and When Do People Do it?

Jack Soll, Assistant Professor of Management, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, jsoll@duke.edu, Richard Larrick, Al Mannes

People tend to "chase the expert," preferring a chosen expert's forecast to an average of several. Averaging can be highly effective, depending on variation in expertise, correlated errors, and the validity of cues to expertise. To some extent, people adapt their aggregation strategies to the environment. Still, they would do well to average more often. Chasing the expert is appealing psychologically, and the feedback environment often makes it difficult to learn the benefits of averaging.

3 - Elicitation of Likelihoods, Priors and Utilities

Jay Kadane, Professor, Carnegie Mellon University, Department of Statistics, Pittsburgh, PA, 15213, United States, kadane@stat.cmu.edu

This talk reviews the current state of frameworks and methods for elicitation. As our ability to compute advances, our ability to elicit is likely to become a most urgent issue for the advancement of Bayesian methods.

4 - Bayesian Opinion Pools

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States, lichtendahlc@darden.virginia.edu, Robert Winkler

Opinion pools are popular ways used in practice to combine expert forecasts of a continuous random quantity into a single forecast. We propose several Bayesian opinion pools as directly assigned posteriors of the random quantity given an expert's forecast and compare the implied likelihoods to likelihoods in other Bayesian combination models.

■ MA22

Joint Session MAS/DAS: Military Decision Analysis

Sponsor: Military Applications, Decision Analysis Society
Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Department of Systems Engineering, West Point, NY, 12520, United States, gregory.parnell@usma.edu

1 - Dynamic Risk Management for Real-Time Decision Support of Network Centric Systems

Paul West, Assistant Professor, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, paul.west@usma.edu

The emergence of network-centric systems of knowledgeable, autonomous, yet interdependent nodes has created unique problems for decision makers, especially in a military environment that is complex, dynamic, and characterized by uncertainty, ambiguity, and friction. This paper explores multi-attribute decision analysis methods for managing NCS in an asymmetric competitive environment and presents a real-time, values-oriented decision support system for NCS based on risk management techniques.

2 - Using Decision Analysis to Determine Objective Function Weights for Capital Budgeting Problems

Paul Ewing, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States, paul.ewing@us.army.mil

There are often competing multiple objectives when planning military resource allocation. Many times, the measures of effectiveness (MOE) and tradeoffs used in the optimization objective function are ill-defined or non-existent. We discuss applications where decision analysis has been used to help prioritize the MOE's and define weights for the objective function.

3 - Multiple Objective Decision Analysis for Systems Engineering

Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Department of Systems Engineering, West Point, NY, 12520, United States, gregory.parnell@usma.edu

We present and illustrate a system decision process using multiple objective decision analysis for evaluation and improvement of system design alternatives. This methodology is developed in our new textbook used for our introductory course for all majors and three course sequencers in our Systems Engineering Department at West Point.

4 - Analytical Support to 3ACR in Iraq

Michael Kwinn, Associate Professor, DSE, USMA, West Point, NY, 10996, United States, michael.kwinn@usma.edu, Jason Wolter

Authors will present analytical work conducted in Iraq in support of the 3rd Armor Cavalry Regiment whose operations in Tal Afar were noted by many senior leaders, including President Bush. Analysis dconducted on operations center layout and design and operational level assessments.

■ MA23

Emergent Models and Factors that Drive Efficiency Gains

Cluster: Global Services Sourcing
Invited Session

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

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

1 - Effectiveness of Instruments Of Governance in Off-Shore Outsourcing of Services

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 investigate the comparative effectiveness of different governance instruments used by firms to improve the output quality of services outsourced offshore. Based on primary data collected using survey instruments, we find that real-time monitoring such as the manager's monitoring effort are in general more effective than contracting such as the incentive or penalty clauses. Other findings include buyer firm's monitoring advantage and its relationship with service process codifiability.

2 - Monitoring in Offshored Processes

Subhajyoti Bandyopadhyay, shubho.bandyopadhyay@gmail.com, Praveen Pathak, Ravi Aron

The emergence of a new class of technology-enabled monitoring - thanks to recent advances in Information Technology and telecommunications - has enabled organizations to effectively track the quality of outsourced processes. We present a game-theoretic model to analyze this new development, especially in the context of offshore processes. A multi-year survey across several countries back our analytical results.

3 - Offshore Sourcing of Services - Impact of Distributed Monitoring Systems

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

Internet enabled distributed monitoring systems allows firms to source services globally. Buyers of such services can monitor the execution of processes in real time. They can thus exert managerial control over information workers located in distant region. We present the results of survey conducted over 3 years across 3 continents. Our analysis shows that internet enabled monitoring has allowed forms to move to what we term as Efficient Monitoring Frontier.

■ MA24

Product Development I

Contributed Session

Chair: Wenge Zhu, Assistant Professor, Troy University, Bib Graves 207, Troy, AL, 36082, United States, wzhu@troy.edu

1 - Outsourcing is the Vehicle of Global Productivity Improvements

Mohammed Quasem, Associate Professor, Howard University, 2600 6th Street, NW, Washington, DC, 20059, United States, quasem2@hotmail.com, Daniel Owunwanne, Karmal Argarwal

Outsourcing is a practice used by companies to reduce costs by transferring portions of their works to outside suppliers rather than completing them internally. The goals of outsourcing are to reduce costs while achieving higher profits. In this article, outsourcing will be examined to determine whether or not it is really the vehicle of global productivity improvement based on some empirical data. Through the use of appropriate statistical test, a conclusion will be drawn.

2 - Framework of Investing in Downstream Research Effort for Overlappng Activities in Product Development

Che-Ping (Jack) Su, Assistant Professor, The Anderson School of Management, MSC05 3090, 1 University of New Mexico, Albuquerque, NM, 87131, United States, su@mgt.unm.edu

Develop dynamic model using optimal control theory to capture the trade-offs of overlapping product devlopment activites and provide managerial insights about how to invest in downstream activites to maximize the profit.

3 - Compression of Project Activities

Abdelghani Elimam, Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, aelimam@sfsu.edu, Bajis Dodin

Normally, only critical project activities are crashed. In this paper, we identify and model project management situations that can benefit from crashing non-critical activities. We also treat crashing of activities with stochastic durations. Model Characterization and computational results on activities crashing are presented.

4 - Brand Reputation, Warranty, and Product Quality

Kunpeng Li, PhD Candidate, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States, kli@uiuc.edu, Dilip Chhajed, Suman Mallik

We examine the interaction between warranty, brand reputation, and product quality in both one period and two-period models. We model a monopolist who tries to convery unobservable product quality through signals such as warranty and brand reputation. Heterogeneous consumers perceive the signals and form quality beliefs. Under this framework, we study the manufacturer's optimal decisions of price, warranty, and quality in various decision-making situations.

5 - A Tabu Search Approach to Product Line Design

Wenge Zhu, Assistant Professor, Troy University, Bib Graves 207, Troy, AL, 36082, United States, wzhu@troy.edu, Haitao Li

The traditional problem of product line design has been proved to be NP-hard. Many approaches have been attempted to solve the problem more efficiently and incorporate more realistic factors. Our paper contributes to the literature by attacking the problem with a novice approach and with a more realistic model.

■ MA25

Integer Programming

Contributed Session

Chair: Amandeep Parmar, Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, aparmar@isye.gatech.edu

1 - A Knapsack Cryptosystem Secure Against Attacks Using Basis Reduction and Integer Programming

William Webb, Professor, Washington State University, PO Box 643113 WSU, Pullman, WA, 99164-3113, United States, webb@math.wsu.edu, Bala Krishnamoorthy, Nathan Moyer

We propose a knapsack cryptosystem which does not have an underlying superincreasing sequence (each coefficient greater than the sum of all the previous ones). This property was used for mounting attacks on the traditional knapsack cryptosystem. We also add restrictions on 0-1 variables. Application of shortest vector calculations using basis reduction will not break this cryptosystem. Standard integer programming methods fail to solve these problems as well, as shown by computational results.

2 - Cut Generation Techniques within the Branch & Price Scheme

Deepak Warrier, Doctoral Student, Texas A&M University, 501 Sycamore Lane Apt #1121, Euless, TX, 77840, United States, deepakwarrier@hotmail.com, Wilbert Wilhelm

We present an approach for generating cutting planes within the Branch & Price scheme by exploiting the Facet Generation Procedure.

3 - A Math Programming Approach to a Class Timetabling Problem: A Case Study with Gender Policies

Salem Al-Yakoob, Assistant Professor, Department of Mathematics and Computer Science, College of Science, Khaldyah, Kuwait University, PO Box 5969, Safat 13060, Kuwait, salem@al-yakoob.com, Hanif D. Sherali

This paper considers the class scheduling and timetabling problem faced at Kuwait University (KU). The principal focus is to design efficient class offering patterns while taking into consideration newly imposed gender policies. We formulate a mathematical programming model that assigns offered classes to time-slots and addresses gender issues by defining appropriate surrogate constraints along with objective penalty terms.

4 - Maintenance Scheduling Optimization Model for a Vehicle Fleet

Fabian Giraldo, DecisionWare, Calle 114 56 75 Of. 606, Bogota, Colombia, fabian.giraldo@gmail.com, Carlos Osorio Ramirez, Jesus Velásquez

In this paper, an integer programming model is presented for solving the scheduling problem of the maintenance operations for a vehicle fleet.

5 - An Integer Programming Approach for the OSPF Weight Setting Problem

Amandeep Parmar, Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States, aparmar@isye.gatech.edu, Joel Sokol, Shabbir Ahmed

Open Shortest Path First (OSPF) protocol routes flow in an IP network on the shortest paths between source and destination. Shortest path is based on pre-assigned weights on the links. The OSPF weight setting problem is to determine a set of weights such that, if flow is routed as per OSPF protocol, network congestion is minimized. We present an integer programming based solution strategy for this problem. We develop a family of valid inequalities for the IP and also present numerical results

■ MA26

Joint Session DM Invited/DM Sponsored: New Approaches and Problems for Data Mining

Cluster: Data Mining and Automated Learning, Data Mining
Invited Session

Chair: Alan Montgomery, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, 255A Posner Hall, Pittsburgh, PA, 15213, United States, alanmontgomery@cmu.edu

1 - Searching in Graphs Containing Both Data and Text

William Cohen, Associate Research Professor, Carnegie Mellon University, School of Computer Science, Pittsburgh, PA, 15213, United States, wcohen@cs.cmu.edu, Einat Minkov

Similarity measures for text are vital tool in information retrieval. Here I describe similarity metrics for graphs that contain a heterogeneous mixture of textual and non-textual objects. These similarity queries can be easily formulated by a naive user, and subclasses of these queries can be used to solve several interesting problems, such finding the referents for entity names in context. Tuning similarity search with learning leads to excellent performance on many problems.

2 - The Support Vector Decomposition Machine

Geoff Gordon, Carnegie Mellon University, School of Computer Science, Department of Machine Learning, Pittsburgh, PA, 15213, United States, ggordon@cs.cmu.edu

In learning problems with many more features than training examples, dimensionality reduction can be essential. Some previous work has treated such problems in two phases: first reduce dimensionality using, e.g., an SVD, then classify using, e.g., an SVM. Instead, we combine the two phases into a single learning objective, and present an algorithm which optimizes this objective directly. We demonstrate our algorithm classifying fMR brain images according to what subjects are thinking about.

3 - Emerging Business Applications of Data Mining

Rayid Ghani, Researcher, Accenture Technology Labs, 161 North Clark Street, Chicago, IL, 60601, United States, rayid.ghani@accenture.com

New and growing sources of data, improved learning algorithms, and the increasing ability of businesses to act on the results of these algorithms has enabled new business applications. I will talk about some recent projects at Accenture Technology Labs including extracting product attributes from descriptions, predicting end-price of auctions to offer price insurance, and learning individual consumer models for personalized promotions.

■ MA27

Prognostics and Adaptive Decision Making

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

1 - Sensory-Driven Prognostic Models for Adaptive Spare Parts Logistics

Alaa Elwany, University of Iowa, Iowa City, IA, 52242, United States, alaa-elwany@uiowa.edu, Nagi Gebraeel

Logistical decisions in maintenance management are among the most important decisions in the scope of Supply Chain Management. This research focuses on the development of adaptive decision models related to equipment replacement and spare part inventory using real-time prognostic information. The proposed framework is used to determine optimal replacement and component ordering times in a sense and respond environment.

2 - Preventive Maintenance Based on Residual-Life Distribution Updates

Lisa Maillart, Assistant Professor, University of Pittsburgh, lisa.maillart@case.edu, Nagi Gebraeel

Recent developments in condition-monitoring, the process of collecting sensor data to gauge the health of a system more accurately than what results from a priori knowledge alone, include Bayesian procedures for updating the residual life distribution of a system in real time. We present a cost-rate minimizing optimal-stopping decision model to determine, after each residual life distribution update, whether to perform preventive maintenance or to continue to the next observation time.

3 - Simultaneous Optimization of SPC and PM Policies Under an Economic Objective

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

We formulate a partially observable, discrete-time Markov decision process in order to obtain the near-optimal combined preventive maintenance/statistical process control policy that minimizes the costs associated with maintenance, sampling, and poor quality. We develop transition probabilities for the various states of the infinite horizon problem and a solution algorithm for finding the best policy. It is shown that in almost every case a combined PM and SPC policy is the most cost efficient.

4 - Simulation-Based Analysis of Maintenance Policies for Lean Manufacturing

Kevin Kaiser, Research Assistant, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, kevin-kaiser@uiowa.edu, Nagi Gebraeel

The success and effectiveness of modern lean manufacturing concepts requires robust and reliable machinery. We develop a simulation study to compare the performance of a manufacturing system under three different maintenance polices: a reliability-based preventive maintenance policy, a degradation-based predictive maintenance policy and a sensory-driven prognostic maintenance policy. System performance and maintenance costs are analyzed under several system reliability levels.

5 - Degradation-Based Prognostics via Phase-Type Approximations

Jeffrey Kharoufeh, Associate Professor, Air Force Institute of Technology, 2950 Hobson Way (AFIT/ENS), Wright Patterson AFB, OH, 45433-7765, United States, Jeffrey.Kharoufeh@afit.edu

We present a degradation-based procedure for estimating the full and residual lifetime distribution of a system experiencing degradation induced by a semi-Markov environment. The hybrid approach uses degradation measures and phase-type approximations to numerically estimate the distributions. Numerical examples are provided to illustrate the procedure.

■ MA28

Robust Parameter Design: New Ideas and Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 755 Ferst Drive, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

1 - A Dual-Response Approach to Robust Parameter Design for a Generalized Linear Model

William Brenneman, Senior Statistician, The Procter & Gamble Company, 8700 Mason-Montgomery Road, Mason, OH, 45040, United States, brenneman.wa@pg.com, William Myers, Raymond Myers

Robust Parameter Design has been studied and applied, in most cases, assuming a linear model under standard assumptions. More recently, RPD has been considered in a generalized linear model (GLM) setting. In this paper we apply a general dual response approach when using RPD in the case of a GLM. We motivate the need for exploring both the process mean and process variance, by discussing situations when a compromise between the two is necessary.

2 - A Bayesian Adaptive Control Approach to Robust Parameter Design

Arda Vanli, PhD Student, The Pennsylvania State University, 350 Leonhard Building, University Park, PA, 16802, United States, oav100@psu.edu, Enrique Del Castillo

In the dual response approach to RPD, the optimal operating settings are determined based on (static) regression models. These settings, however, may be ineffective in minimizing the process variability if the noise factors have strong autocorrelation or if they are nonstationary. We propose a Bayesian predictive approach to RPD in which the optimal settings of the controllable factors are adjusted during the operation of the process according to the levels of the response and noise factors.

3 - Robust Synthesis of Nanostructures
Tirthankar Dasgupta, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, tdasgupt@isye.gatech.edu, Christopher Ma, Roshan Vengazhiyil, Zhong Lin Wang, Jeff C. F. Wu

An effort is made to systematically investigate the best process conditions that ensure large-scale synthesis of different types of nanostructures. Models linking the probabilities of obtaining specific morphologies to the process variables are developed. A new iterative algorithm for fitting a Multinomial GLM is proposed and used. The optimum process conditions that are robust with respect to inner noise are derived from the fitted models using Monte-Carlo simulations.

■ MA29

Health Care Systems Optimization

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

Chair: Leyuan Shi, Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, leyuan@engr.wisc.edu

1 - A Model and Algorithm for Robust Optimization in Cancer Treatment Planning
Stephen Wright, Professor, University of Wisconsin-Madison, 1210 West Dayton Street, Madison, WI, 53706, United States, swright@cs.wisc.edu, Arinbjorn Olafsson

We describe a formulation of IMRT cancer treatment planning that takes account of uncertainties in organ location and dose calculation, and present an algorithm for solving the resulting optimization problem efficiently.

2 - Using Nested Partitions for Beam Angle Selection in Intensity-Modulated Radiation Therapy
Hao Zhang, PhD Student, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, haoz@cae.wisc.edu, Leyuan Shi, Warren D'Souza, Robert Meyer

Modern treatment technologies allow clinicians to develop complex treatment plans for a wide array of illnesses, including many forms of cancer. In this research we describe results obtained by applying the Nested Partitions (NP) metaheuristic to the problem of selecting beam angles for radiation delivery in Intensity-Modulated Radiation Therapy (IMRT). Our metaheuristic has led to significant reductions in treatment complexity and delivery time.

3 - Optimizing the Allocation of Surgeries to ORs in an Open-Booking Scheduling System
Brian Denton, Assistant Professor, Mayo Clinic College of Medicine, 200 First Street SW, Rochester, MN, 55906, United States, Denton.Brian@mayo.edu, Andrew Miller, Huschka Todd

Hospitals that operate according to open-booking policies allocate large numbers of procedures across many operating rooms each day. The allocation problem is analogous to a stochastic bin-packing problem, where the objective includes expected costs of overtime and fixed costs of opening ORs. We describe our model, solution methods, and numerical results based on real data.

■ MA30

OR in Nurse Planning

Sponsor: Health Applications Section
Sponsored Session

Chair: Jay Rosenberger, Assistant Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, jrosenbe@uta.edu

1 - Short-Term Adjustment of Nurse Schedules Using Branch and Price
Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712, United States, jbard@mail.utexas.edu, Hadi Purnomo

In most hospitals, the nursing staff is given a midterm schedule that specifies their daily work assignments. Emergencies, call-outs, and normal fluctuations in personnel requirements, though, can play havoc with the schedule. As a result, it is necessary to make short-term adjustments, either by reallocating resources when shortages exist or by canceling assignments when demand drops. This problem is formulated as an integer program and solved with a branch-and-price algorithm.

2 - A Stochastic Programming Model for Nurse Assignment
Prattana Punnakitikashem, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, prattana.punnakitikashem@uta.edu, Jay Rosenberger

Our research focuses on the last stage of nurse planning, which makes daily decisions on assigning nurses to patients. We develop a stochastic integer programming model for nurse assignment with an objective to minimize excess workload on nurses. The problem is solved using a Benders' decomposition approach, in which a greedy algorithm is implemented to solve the recourse subproblem. We propose sets of valid inequalities to strengthen the relaxed master problem. Computational results are presented.

3 - A Data-Integrated Simulation Model for Nurse Activity (Submitted for the 2006 Pierskalla Award)
Durai Sundaramoorthi, Graduate Research Associate, The University of Texas at Arlington, 400 Yates Street, #217, Arlington, TX, 76010, United States, dsundaramoorthi@uta.edu, Victoria Chen, Jay Rosenberger, Seoung Bum Kim

This research develops a novel approach for constructing simulation models based on a real data set provided by Baylor Regional Medical Center (Baylor) in Grapevine, Texas. Kernel density estimates and trees were utilized to extract important knowledge about the workload of nurses from an encrypted data set provided by Baylor for four care units. Results from this data-integrated simulation of nurse-patient assignments are discussed.

4 - Nurse-To-Patient Ratios: A Queuing Perspective
Francis de Véricourt, Associate Professor, Duke University, 1 Towerview Road, Durham, NC, 27708, United States, fdv1@duke.edu, Otis Jennings

The motivation of this presentation is California Bill AB 394, a piece of legislation which mandates fixed nurse-to-patient staffing ratios as a means to address the current crisis in the quality of health care delivery. With a predictive queuing analytic approach we seek to determine whether or not ratio policies are effective and, if not, to provide an alternative staffing paradigm.

■ MA31

Finance and Stochastics

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Erhan Bayraktar, Assistant Professor of Mathematics, University of Michigan, Mathematics Department, 530 Church Street, 1043, Ann Arbor, MI, 48109, United States, erhan@umich.edu

1 - Affine Point Processes for Multi-Name Credit
Kay Giesecke, Assistant Professor, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States, giesecke@stanford.edu

The value of any credit derivative is a function of market wide risk factors generated by the complex web of relationships in the economy. To incorporate these factors, we value credit derivatives from the top down by modeling the dynamics of aggregate losses directly. We make this approach computationally tractable within the affine point process framework. Affine point processes account for both cyclical dependence and contagion. They support Fourier transform based pricing and implementation.

2 - A Moving Boundary Approach to American Option Pricing
Kumar Muthuraman, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States, kumar@purdue.edu

This talk presents a computational method to find the optimal exercise boundary (policy) and the price of an American option. The method uses a boundary guess and the associated value of using the guessed boundary, to construct an improved boundary. It can be shown that the sequence of boundaries obtained is monotone and converges to the optimal exercise boundary. I will also demonstrate the generality of this approach to other problems in finance.

3 - How Much Does it Help if You Are Aware of the Default?
Xin Guo, Assistant Professor, UC Berkeley/Cornell, xinguo@ieor.berkeley.edu, Arijit Ckakrabarty

It is well recognized that filtration expansion/shrinkage plays a critical role in information-based credit risk modelling, especially for default intensity estimate. In this talk, we show for the first time in explicit forms the impact and difference of filtration expansion on optimization problems involving default risk.

4 - Optimal Portfolio with Regime Switching and Transaction Costs
Jussi Keppo, Assistant Professor, University of Michigan, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu, Erhan Bayraktar

We consider the portfolio and consumption optimization problem when the risky asset price follows a regime switching process and when the agent faces transaction costs. The optimal solution is compared with the cases without the transaction costs and/or regime switching.

■ MA32

Portfolio Optimization and Firm Valuation

Sponsor: Financial Services
Sponsored Session

Chair: Dessislava Pachamanova, Assistant Professor, Babson College, 319 Babson Hall, Babson Park, MA, 02457, United States, dpachamanova@babson.edu

1 - Mean-Risk Models Using Two Risk Measures: A Multi-Objective Approach
Gautam Mitra, Professor, CARISMA, Brunel University, School of Mathematical Sciences, John Crank Building, Uxbridge, Middlesex, UB8 3PH, United Kingdom, gautam.mitra@brunel.ac.uk, Ken Darby-Dowman, Diana Roman

We propose a model for portfolio optimization in which distributions are described and compared using three statistics: mean, variance and CVaR at a specified confidence level. The purpose is to improve on mean-variance and mean-CVaR efficient solutions. The problem is multi-objective and transformed into a single objective problem. In the case of scenario models, the problem is a quadratic program. The model is tested on real data drawn from the FTSE 100 index.

2 - Tractable Portfolio VaR Optimization
Dessislava Pachamanova, Assistant Professor, Babson College, 319 Babson Hall, Babson Park, MA, 02457, United States, dpachamanova@babson.edu, Melvyn Sim, Karthik Natarajan

We discuss a computationally tractable parametric method for portfolio Value-at-Risk (VaR) optimization based on robust optimization techniques. The method uses optimization of a modified risk measure that is coherent, and is thus desirable from a financial theory perspective as well. Numerical experiments suggest that the approach outperforms other parametric and sample-based approaches for VaR optimization used in practice, especially when return distributions are skewed.

3 - Robust Portfolio Selection with Uncertain Exit Time
Dashan Huang, PhD Student, Department of Applied Mathematics and Physics, Graduate School of Informatics, Kyoto University, Kyoto 606-8501, Japan, dhuang@amp.i.kyoto-u.ac.jp, Masao Fukushima, Frank Fabozzi

To deal with the two types of uncertainties in the distribution of exit time and in the distribution of portfolio return conditional on exit time, we propose a tractable approach for the robust portfolio section problem by applying worst-case VaR strategy to the case where partial information on the exit time distribution and on the conditional distribution of portfolio return is available, and formulate the corresponding problems as semidefinite programs which can be efficiently solved.

4 - Volatility and Valuation of Early Stage Firms with Jump Risk
Nalin Kulatilaka, Wing Tat Lee Family Professor of Management, Professor of Finance, Boston University, School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, nalink@bu.edu, Feng Shu

We model early-stage firms as sequences of call options leading to mature firms, thus, volatility is critical to proper valuation. Ignoring jumps due to innovations or failure results in over-estimates of volatility. The impact on firm value also depends on whether the option is away-from or at-the money (investment requirement). Our results explain why volatility of firms undergoes discrete reductions when clearing investment stages and provide new insights regarding over- and under-valuation.

■ MA33

Joint Session Aviation App./TSL: Models for Managing Air Traffic Delays

Sponsor: Aviation Applications, Transportation Science & Logistics
Sponsored Session

Chair: Michael Ball. Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

1 - A Probabilistic Framework for Weather-Based Rerouting and Delay Estimations
Michael McCrea, Lieutenant Colonel, U.S. Army/Virginia Tech, #5 Staff Village, Radford, VA, 24141, United States, mvmccrea@vt.edu, Hanif D. Sherali, Antonio Trani

We present a severe weather-modeling paradigm within the context of a large-scale Airspace Planning and Collaborative Decision-Making Model in order to reroute flights with respect to a specified probability threshold of encountering severe weather, subject to collision safety, airline equity, and sector workload considerations. Our modeling constructs include the development of discretized representations of weather phenomena along with a probabilistic delay assessment methodology.

2 - Real-Time Inter-Modal Substitution as an Airport Congestion Management Strategy
Mark Hansen, Professor, University of California at Berkeley, Civil and Environmental Engineering, 114 McLaughlin Hall, Berkeley, CA, 94720, United States, mhansen@ce.berkeley.edu, Yu Zhang

We explore the potential for inter-modal substitution to reduce flight traffic and delays when there is a temporary shortfall in airport capacity. In our scheme, airlines cancel short-haul flights and rebook passengers on surface transport modes when delay savings from reduced flight traffic justify this. We demonstrate an optimization model that chooses which flights to cancel, as well as a more complex model that considers missed connections, surface vehicle routing, and other issues.

3 - Algorithms for Planning Ground Delay Programs Under Uncertainty in Capacity Forecasts
Avijit Mukherjee, University of Maryland, 3117 A.V. Williams Building, Institute for Systems Research, College Park, MD, 20740, United States, avijit@isr.umd.edu, Michael Ball, Robert Hoffman

Ground delay programs (GDPs) are implemented to mitigate arrival demand - capacity imbalance, mostly due to adverse weather, at an airport. Here we present algorithms that address both equity and efficiency while planning GDPs under uncertainty in capacity. We propose an algorithm that essentially favors long-haul flights over short-hauls while assigning slots to individual flights, and show that this minimizes expected delay when there is a possibility of earlier termination time of a GDP.

4 - Matchings in Connection with Ground Delay and Airspace Flow Programs
Thomas Vossen, Assistant Professor, University of Colorado, Leeds School of Business, UCB419, Boulder, CO, 80309, United States, Thomas.Vossen@Colorado.edu, Michael Ball, Geir Dahl

This presentation discusses matchings that arise within the allocation of airport arrival slots during Ground Delay Programs and airspace entry time slots during so-called Airspace Flow Programs, which have recently been proposed for managing en-route congestion. We introduce procedures for allocating flights to slots, discuss fundamental properties of the resulting matchings, and describe how the resulting methods can be used to determine which flights should be canceled or rerouted.

■ MA34

Joint Session TSL/Counter Terrorism: Urban Transportation Planning Models I: Transportation System Risk, Security, and Emergency Response

Sponsor: Transportation Science & Logistics, Counter Terrorism and OR
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 - Modeling Spatial Concentration of Transportation Systems to Assess Vulnerability to Natural Hazard and Terrorist Threats
Carlos E. Restrepo, Research Scientist, New York University, Wagner/295 Lafayette St. 2nd Fl, New York, NY, United States, cer202@nyu.edu, Zvia S. Naphtali, Jeffrey S. Simonoff, Rae Zimmerman

Spatial concentration of transportation facilities, capacity, usage and value are important indicators of transportation vulnerability to consequences of catastrophic events. Regional economic measurements and models to discern patterns in concentration are applied to U.S. air, sea, and land transport of people and goods, as well as the transport of energy products. Policy implications and transferability of decision tools are described.

2 - Virtual Simulation Technology Applied to Transportation Safety and Security
Carl Berkowitz, FASCE, PhD, PE, AICP, Professor and Director of the Center for Intermodal Transportation Safety and Security at Florida Atlantic University, John D. McArthur Campus, 5353 Parkside Drive - SR 236, Jupiter, FL, 33458, cmberkowitz@hotmail.com, Clifford Bragdon

A key analysis tool for transportation safety and security is advanced simulation technology that depicts the air-land-sea access and potential vulnerabilities in a virtual real-time format. This simulation process makes it possible to identify vulnerabilities, create realistic scenes for examination, view elevations at various multi eye-points, and evaluate advanced technologies.

3 - Application of GIS and Optimization to the Distribution of Emergency Medical Supplies in an Urban Area

Harry Bowman, Center for Risk and Economic Analysis of Terrorism Events, 3710 McClintock Avenue, Room 314, University of Southern California, Los Angeles, CA, 90089, United States, hbowman@usc.edu

In the event of a major disease outbreak or bioterror event, local officials must plan for emergency distributions of medicine to the population. Dispensing locations must be selected, and supplies delivered to those locations before dispensing. Geographic analysis and optimization techniques can be applied to several parts of this problem.

■ MA35

Hazard Management and Evacuation I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@CLEMSON.EDU

1 - Optimal Signal Control for Corridor-Based Emergency Evacuation

Ying Liu, Research Assistant, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States, lyng@wam.umd.edu, Xiaorong Lai, Gang-Len Chang

This study presents two mixed-integer models for design of signal control strategies for corridor-based evacuation. The models take into account various operational complexities, such as selection of critical intersections for control of turning movements, design of signal settings, and rerouting of traffic from origins to critical intersections or between corridors. The numerical results for two networks in Washington D.C. have revealed the models' potential for use in real-world applications.

2 - A Cell-Based Dynamic System Optimal Model and Its Heuristic Solution Method for Emergency Evacuation

Henry Liu, Assistant Professor, University of Minnesota, Department of Civil Engineering, 500 Pillsbury Drive SE, Minneapolis, MN, 55123, United States, henryliu@umn.edu, Xiao-Zheng He, Jeff Ban

In this talk, we present a dynamic system optimal (DSO) model to identify routes and schedules to evacuate affected populations to safety zones in the event of natural disasters or terrorist attacks. The DSO model embeds the cell transmission model for traffic flow representation and considers departure time as one of the decisison variables. To reduce the computational cost for solving the DSO, a heuristic solution approach is proposed to provide a close approximation of system optimum.

3 - Planning for Evacuation of Low-Mobility Groups: Model Framework and the Pickup Location Problem

Mark Hickman, Associate Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr.arizona.edu, Chi Pak Chan

We consider the challenges of using public vehicles to evacuate low-mobility persons in an emergency, including the problems of determining the location of evacuation sites and the subsequent vehicle routing. For the selection of evacuation sites, we provide a mathematical formulation and identify heuristic techniques to solve the problem. We also illustrate the solution technique on several test problems.

4 - Allocating and Scheduling Resources During Hospital Evacuations

Kevin Taaffe, Assistant Professor, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, taaffe@CLEMSON.EDU, Esengul Tayfur

We study the allocation of hospital resources during evacuations in which a staged response is possible, most notably for hurricanes. The evacuating hospital must determine the best use of its medical staff and transport vehicles to move patients to any number of sheltering facilities. Each of these facilities has a limited capacity for accepting various levels of patient acuity. We propose an optimization model and solution algorithm that can minimize either evacuation time or cost.

■ MA36

Urban Transportation Planning Models II: Land Use and Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Heng Wei, Assistant Professor, Department of Civil & Environmental Engineering, University of Cincinnati, 792 Rhodes Hall ML-0071, Cincinnati, OH, 45221, United States, heng.wei@uc.edu

1 - Dynamic Games in Complex Transportation Networks

Jürgen Scheffran, ACDIS, Adjunct Associate Professor, Political Science and Atmospheric Sciences, University of Illinois, 359 Armory Building, MC 533, 505 East Armory Avenue, Champaign, IL, 61820, scheffra@uiuc.edu, Kieran Donaghy

A framework of complex dynamic transportation networks is presented to examine the evolution of goods movement and network externalities, including the increased fragmentation of production processes. Based on data, we analyze the solutions to non-cooperative dynamic games between producers (shippers), carriers, and environmental policy makers.

2 - Unit-Performance-Reliability Based Optimization Model for Prioritizing Improvement Alternatives of a Mixed Traffic Network under Cost Constraint using Genetic-Algorithm

Yanyan Chen, Professor, Beijing Transportation Engineering Key Laboratory, Beijing University of Technology, No.100 Pingleyuan, Chaoyang District, Beijing, China, cdyan@bjut.edu.cn, Heng Wei, Ying Liang

We present a method to prioritize the improvement alternatives for a mixed traffic roadway network given cost constraints. Unit performance reliability, which describes the performance of a network link or intersection, is used to establish the objective of an optimization model that systematically maximizes the performance of the entire network.

■ MA37

ISR Special Issue Session

Sponsor: Information Systems Society
Sponsored Session

Chair: Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu

1 - Capabilities of the IS Applications Portfolio and Relational Value in Inter-Firm Partnerships

Nilesh Saraf, Assistant Professor, Simon Fraser University, 8888 University Drive WMC 3323, Burnaby, BC, Canada, nsaraf@sfu.ca, Sanjay Gosain, Christoph Schlueter Langdon

We examine how the Information Systems applications portfolio contributes to the performance of business units, specifically focusing on process coupling and knowledge sharing in the extended enterprise as mediating mechanisms. Cross-sectional survey-based data shows that IS integration contributes to both mediators, which in turn contribute partially to performance. IS flexibility is a foundational capability contributing indirectly by enabling greater inter-firm IS integration.

2 - Understanding the Sourcing Choices for Business Processes

Prabhudev Konana, Associate Professor, University of Texas at Austin, 2100 Speedway #B6500, CBA 5.202, Austin, TX, 78712, United States, Prabhudev.Konana@mccombs.utexas.edu, Huseyin Tanriverdi, Ling Ge

Business process characteristics impact production and transaction costs and, hence, sourcing choices. This research develops two new constructs - unbundling readiness and IT-business coupling - and adapts transaction cost economics-based human and intellectual capital specificity to show impact on firm choices. The hypotheses are supported using multinomial logit and 93 data samples.

3 - Impact of Internet Referral Services on the Supply Chain

Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Tridas Mukhopadhyay, Uday Rajan

In many industries, internet referral services, hosted either by independent third-party infomediaries or by manufacturers, serve as digitally enabled lead-generators in electronic markets, directing consumer traffic to downstream retailers in a distribution network. We model competition between retailers in a supply chain with such digitally enabled institutions, and consider their impact on the optimal contracts between the manufacturer, referral intermediary and the retailers.

■ MA38

Experiences and Opportunities in Rail Fleet and Crew Management

Sponsor: Railroad Applications
Sponsored Session

Chair: Sami Gabteni, Senior Consultant, Jeppesen, Middlex Business Centre, Imm. Lumiere, 40 av. des Terroirs de France, Paris, 75012, France, sami.gabteni@jeppesen.com

1 - Decision Support System for Crew Planning at CSX Transportation

Kamalesh Somani, Manager - Operations Research, CSX Transportation, 3019 Warrington Street J500, Jacksonville, FL, 32254, United States, Kamalesh_Somani@csx.com, Dharma Acharya, Vidya Verma

Crew planning is done at strategic and tactical levels. On strategic level the interest is in finding number of crews required to operate scheduled and unscheduled train network. On tactical level the task is to determine crew rotation and deadhead (taxi) moves for a given time period. We present a web-based information system and network flow optimization model to assist in crew planning.

2 - New Opportunities Based on Recent Experiences in Rail Crew Management

Michael Forbes, CTO, Carmen Systems, Level 4, 54 Jephson Street, Toowong, QL, 4066, Australia, mforbes@carmensystems.com

We analyse recent experiences in deploying crew management systems for strategic planning and day of operations at Amtrak and SNCF. The system deployed makes extensive use of optimisation and decision support and has facilitated significant process change. We will highlight the benefits achieved at these railways. Finally, we will discuss how the same processes, with different time scales, can be used to achieve similar benefits at any other railway. An opportunity not to be missed!

3 - Next Generation Approach for Rolling Stock Scheduling Optimization

Sami Gabteni, Senior Consultant, Jeppesen, Middlex Business Centre, Imm. Lumiere, 40 av. des Terroirs de France, Paris, 75012, France, sami.gabteni@jeppesen.com

Traditional rolling stock scheduling optimizers reason at an elementary level: fleet units are assigned to scheduled tasks. We present the approach developed for the Danish State Railways (DSB), which handles compositions of units (consists) and sequences of tasks to capture the network dimension of the problem. Based on the evaluations performed by DSB, we will discuss the benefits of this approach, and the opportunities for other railways.

■ MA39

Ethics in OR

Contributed Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - The Ethical Implications of Designing Computational Models to be Transparent

William Wallace, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, wallaw@rpi.edu, Kenneth Fleischmann

Computational models are not pure abstractions, but rather are only as good as their inputs and assumptions. The role of ethics and values in computational modeling can have far-reaching consequences, yet this is still a significantly understudied topic in need of further research. This presentation focuses on one particular value, transparency, documenting both how models can be transparent and why models should be transparent.

2 - Implementing Transparency in Computational Models

Andrew Crapo, Information Engineer, GE Global Research, K-1 5C10A, One Research Circle, Niskayuna, NY, 12309, United States, crapo@crd.ge.com, Kenneth Fleischmann, William Wallace

Semantic technology is utilized to capture the context of a model, providing a networked representation of information that allows users to explore the meaning of content and examine the values embedded within the model. An example is given that uses an ontologically structured and visually perceivable and navigable representation of contextual information.

3 - A Computational Model of a Group of Individuals Resolving an Ethical Dilemma: Virtual Experiments

Russell Robbins, Assistant Professor, Marist College, 3399 North Road, Poughkeepsie, NY, 12601, United States, robbins.russ@gmail.com, William Wallace

We will describe the development, verification and validation of a computational model of a group of individuals resolving an ethical dilemma. We ran virtual experiments based upon varying individual values and personality and group size, composition, and decision rules. We studied the number of suggestions within the "discussion" and the group "decision" and will report results. We also submit this as an Interactive Presentation.

4 - Exploration of Values and Group Formation Using the Enron Email Corpus

Yingjie Zhou, Research Assistant, Rensselaer Polytechnic Institute, 110 8th Street, CII 5015, Troy, 12180, United States, zhouy5@rpi.edu, William Wallace, Kenneth Fleischmann, Jeffery Baumes, Malik Magdon-Ismail, Mark Goldberg

This study uses the Enron email corpus to examine the role of values in group formation. Content analysis is used to code the values according to ten value types. The hypothesis for this study is that individuals having similar values tend to communicate. Overlapping clusters are identified, followed by value counts for each type within clusters. This method makes it possible to statistically test the hypothesis. As a result, more can be learned about how values influence social interaction.

■ MA40

Joint Session SOLA/Minority Issues/ Public Programs: Public-Sector Facility Location and Urban Planning

Sponsor: Location Analysis, Minority Issues, Public Programs and Processes
Sponsored Session

Chair: Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

1 - Identifying Decision Opportunities in Building Design through Value-Focused Thinking

Yun-Shang Chiou, Doctoral Student, School of Architecture, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, ychiou@andrew.cmu.edu, Michael Johnson, Khee Poh Lam, Cliff Davidson

Building design decisions often focus on alternatives. These decisions are intended to provide design solutions to meet defined criteria, and do not examine whether these criteria fully address design objectives. We apply "value-focused thinking" to the "green building" rating system and a high-profile construction project at a major university. We demonstrate how VFT can help designers regain a focus on values and objectives as well as identify decision opportunities that would have otherwise gone unnoticed.

2 - Mathematical Models for Reconstruction Planning in Urban Areas

Changmi Jung, Doctoral Student, Heinz School of Public Policy & Management, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, changmi@andrew.cmu.edu, Michael Johnson

After a natural disaster, urban planners must design a restoration strategy. We develop math programming models for this purpose to maximize social welfare. First, we construct a measure of neighborhood-level viability, calibrated with real-world data for the city of New Orleans. Second, we construct and evaluate a neighborhood development model to maximize the total viability of neighborhoods by optimally assigning land uses subject to budget, contiguity and spatial orientation constraints.

3 - Covering Models for Sensor Placement in Water Distribution Systems under Uncertainty

Jianhua Xu, Doctoral Candidate, Department of Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, mumu@cmu.edu, Jeanne VanBriesen, Michael Johnson, Paul Fischbeck, Mitchell Small

We present math programming models for location of sensors across a water distribution network. Multiple objectives include minimizing placement cost, maximizing system coverage and minimizing the population at risk, all subject to probability thresholds on detection time. The model is applied to distribution systems of varying sizes. Computational results and policy implications are reported.

4 - How Much Does it Pay to Use Models for Affordable Housing Development?

Michael Johnson, Extern, Carnegie Mellon University, Center for Economic Development, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3890, United States, johnson2@andrew.cmu.edu

Math programming models for affordable housing development choose the size and location of housing to optimize social welfare and equity objectives. In this paper data from an affordable housing provider is used to create more accurate estimates of social benefits and costs and validate current planning models. The current configuration of the provider's affordable housing stock is shown to be suboptimal. Substantial social returns may be associated with the use of prescriptive planning models.

■ MA41

Joint Session AP/Minority: Queues and Call Centers

Sponsor: Applied Probability, Minority Issues

Sponsored Session

Chair: Mark Lewis, Associate Professor, School of Operations Research and Industrial Engineering, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States, mel47@cornell.edu

1 - Staffing of Time-Varying Queues to Achieve Time-Stable Performance

William Massey, Professor, Dept. of Operations Research and Financial Engineering, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, wmassey@Princeton.EDU, Zohar Feldman, Avi Mandelbaum, Ward Whitt

We introduce a simulation-based iterative-staffing algorithm (ISA) for multiserver queues with time varying arrival rates and customer abandonment. For Markovian queues, we prove that ISA always converges. Moreover, our simulation experiments show that the ISA yields time-stable delay probabilities across a wide range of target probabilities. Other call center performance measures, such as agent utilizations, abandonment probabilities and mean waiting times, are stable as well.

2 - IT Application Portfolio Management Using a Finite State Markov Decision Process

Robert Hampshire, PhD Candidate, Princeton University, Princeton, NJ, 08544, United States, rhampshi@Princeton.EDU

Managing IT application portfolios is an important and ongoing process that impacts the efficiency of business enterprises. A sequential decision model for application portfolio management is presented. The output of the model is an optimal asset management plan. A state space approximation is used and evaluated for the efficient computation of the optimal asset management plan.

3 - Diffusion Limit of Overloaded Multiclass FIFO Queues with General Abandonments

Otis Jennings, Assistant Professor, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, otisj@duke.edu, Josh Reed

Consider a sequence of overloaded multiclass FIFO queues with abandonment, indexed by n. The sequence of arrival and service rates are linear in n, whereas the abandonment distribution is constant. All r.v.'s have general distributions. In the limit, the diffusion-scaled, abandonment-filtered virtual waiting time process is an OU process whose drift is proportional to the traffic intensity-weighted sum of the abandonment densities, each evaluated at the limiting deterministic waiting time value.

4 - Control of a Two-Class Call Center with Upgrades

Mark Lewis, Associate Professor, School of Operations Research and Industrial Engineering, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States, mel47@cornell.edu, Doug Down

Consider a call center with two classes, modeled as parallel queues, and (random) customer upgrades from the second class to the first class. We study the problem of resource allocation in this system under several decision-making scenarios. In the first, a single decision-maker must allocate finite capacity between each class. We then extend to multiple servers at each station. Structural results are obtained via sample path and MDP arguments.

■ MA42

Advances in Multi-Machine Scheduling

Cluster: Scheduling

Invited Session

Chair: Phil Kaminsky, Associate Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu

1 - Job Shop Scheduling with Earliness, Tardiness and Intermediate Inventory Holding Costs

Kerem Bulbul, Assistant Professor, Manufacturing Systems & Industrial Engineering, Sabanci University, Engineering & Natural Sciences, Orhanli, Tuzla, Istanbul, 34956, Turkey, bulbul@sabanciuniv.edu

We consider a job shop scheduling problem with the objective of minimizing the sum of tardiness, earliness (finished goods inventory holding) and intermediate (work-in-process) inventory holding costs. We develop a shifting bottleneck heuristic to minimize the total cost and demonstrate its effectiveness computationally.

2 - Coordinated Scheduling of Customer Orders with Decentralized Machine Locations

Jinwen Ou, PhD Candidate, The Hong Kong Polytechnic University, Department of Logistics, Kowloon, Hong Kong, 03900425r@polyu.edu.hk, Chung-Lun Li

We consider a scheduling model with two machines at different locations. Each job is composed of two tasks where each task must be processed by a specific machine. The finished tasks are shipped to a distribution center in batches before they are bundled together and delivered to customers. The objective is to minimize the sum of the delivery cost and customers' waiting costs. We develop polynomial-time heuristic algorithms for this problem and analyze their worst-case performance.

3 - MTS-MTO Production Systems in Supply Chains

Phil Kaminsky, Associate Professor, Department of Industrial Engineering and Operations Research, University of California, Berkeley, CA, 94720, United States, kaminsky@ieor.berkeley.edu, Onur Kaya

We consider a two facility supply chain featuring a manufacturer served by a single supplier, both of which need to decide which items to produce to order, and which items to produce to stock. MTS Inventory levels must be set, MTO due dates must be quoted, and sequencing decisions must be made. We design algorithms for various versions of these models, and use these algorithms to assess the value of joint MTS-MTO systems, and the value of centralized control.

4 - Solving a Class of Parallel Machine Scheduling Problems with Nonlinear Cost Functions

Thomas Sharkey, PhD Student, University of Florida, ISE Department, PO Box 116595, Gainesville, FL, 32608, United States, sharkeyt@ufl.edu, H. Edwin Romeijn

We consider a capacitated parallel machine scheduling problem which minimizes the sum of assignment costs of jobs to machines and the sum of convex functions of the makespans of the machines. We propose a greedy heuristic based on the dual multipliers associated with the optimal solution of a relaxation of the problem that allows each job to be split between machines, as well as an algorithm to solve that relaxation. We also perform a computational study of the performance of these algorithms.

■ MA43

AHP/ANP Applications

Cluster: Analytic Hierarchy Process

Invited Session

Chair: Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

1 - Comparing AHP and ANP Shiftwork Models: Hierarchy Simplicity V/S Network Connectivity

Isabel Spencer, Fulcrum Ingenieria, L.T. Ojeda 0180 Of.1004, Santiago, Chile, isabelspencer@fulcrum.cl, Claudio Garuti

The method called Analytic Network Process (ANP), is a mathematical extension of the AHP method, where the feedback process is allowed, moreover, you can connect any criteria with any other one (even with himself) in different ways. These new groups, called clusters, may have a set of criteria or alternatives (now called nodes) inside. Once the model is built, we continue by entering the judgments or pairwise comparisons of elements with respect to each of the influenced element.

2 - The Difficulty of Applying Fuzzy Set Number Crunching to Decision Making

Thomas Saaty, University Professor, University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA, 15260, United States, saaty@katz.pitt.edu

Fuzzy logic has difficulty producing valid answers in decision-making. Absent are theorems to prove its workability by crunching numerical representations of judgments to produce results already known and estimated with judgments. The numerical representation of judgments in the AHP is already fuzzy. Fuzzifying judgments does not lead to a better outcome and often a worse one.

3 - Interval Judgments and Euclidean Centers
Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu, Ami Arbel

We formulated the problem of finding a priority vector from an interval reciprocal matrix as an Euclidean center problem. This formulation always has a solution and provides knowledge about the feasible region. We show that, if the Euclidean center objective function is positive, there are multiple plausible solutions, if it is negative, there no feasible solutions, and if it is equal zero, the feasible region consists of a single point.

4 - Real Life AHP. Issues and Trouble Shooting
Claudio Garuti, Fulcrum Ingenieria, L.T. Ojeda 0180 Of.1004, Santiago, Chile, cgaruti@fulcrum.cl, Isabel Spencer

This presentation try to put light in the way that we are using AHP in real life problems. What are his benefits and what his claim. His application area and its limitations. Also put some light in few of the criticisms made. The most of them, due to a bad understanding of the method and its axioms, resulting in a lack of modelling knowledgement for real life problems representation.

■ MA44

The Resilient Enterprise - Challenges in Supply Chain Security and Resilience

Sponsor: Junior Faculty Interest Group (JFIG)
Sponsored Session

Chair: Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

1 - The Resilient Enterprise - Challenges in Supply Chain Security and Resilience
Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

The Book "The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage" (MIT Press, Oct. 2005) describes how flexible supply chain designs can help companies plan for and recover from high impact/low probability disruption. The book got rave reviews in the New York Times, The Wall Street Journal, The Economist and numerous trade publications. It was mentioned as one of the best business books of 2005 by the Financial Times. The book was the culmination of a four year research project at MIT. It is based on dozens of examples and case studies, many of which will be covered in the talk by the author, Yossi Sheffi. The talk will also lessons for general supply chain management, covering lessons from recent disruptions as well as research challenges in the areas of security and resilience.

■ MA45

Tutorial: Semidefinite and Second Order Cone Programming and Their Application to Shape Constrained Regression and Density Estimation

Cluster: Tutorials
Invited Session

1 - Semidefinite and Second Order Cone Programming and their Application to Shape Constrained Regression and Density Estimation
Farid Alizadeh, Associate Professor, Management Science and Information Systems and RUTCOR Rutgers, State University of New Jersey, 640 Bartholomew, Piscataway, NJ, 08854, United States, alizadeh@rutcor.rutgers.edu

Many statistical analyses require the approximation of a functional relationship between explanatory and response variables, subject to certain "shape constraints". This implies a connection between shape-constrained regression and semidefinite programming. In this tutorial, we introduce semidefinite programming and second order cone programming, review specific statistical problems amenable to solution via semidefinite programming, and discuss extensions and limitations to this method.

■ MA46

Panel Discussion: Marketing your OR/MS Skills

Contributed Session

Chair: Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

1 - Panel Discussion: Marketing your OR/MS Skills
Moderator: Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu, Panelists: Seth Bonder, Ann Bixby, Warren B. Powell

Panelists will share their experience and offer advice on how to market your OR/MS skills based on their experiences in a variety of different industries and in several different roles, including staff consultant, business owner and university researcher. There will be ample time for questions from the audience.

■ MA47

Integrated and Robust Planning for Freight Transportation

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Using Composite Variable Modeling to Solve Integrated Freight Transportation Planning Problems
Sarah Root, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, seroot@umich.edu, Amy Cohn

Developing plans for a small package carrier is a complex process, with many interdependent and constrained resources. As a result, the process is often decomposed into sequential steps, which can greatly impact solution quality. We present a modeling approach, solution techniques, and computational results to integrate three of these sequential sub-problems: the assignment of packages to trailer types, the routing and matching of trailers, and the balancing of empties.

2 - Robust Optimization Methods for Large-Scale, Network-Based Resource Allocation Problems
Lavanya Marla, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-235, Cambridge, MA, 02139, United States, lavanya@mit.edu, Cynthia Barnhart

We consider large-scale, network-based resource allocation problems under uncertainty. By modeling data uncertainties in service time, resource availability, supplies and demands, we generate more robust solutions, that is, solutions that are more likely to be executed or easier to repair when disrupted. We solve our model using a new decomposition scheme, geared specifically for large-scale problems and evaluate our approach using data provided by a large-scale carrier.

3 - Designing Membership and Allocation Mechanisms for Air Cargo Alliances
Lori Houghtalen, PhD Student, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, lhoughta@isye.gatech.edu, Özlem Ergun, Joel Sokol

We address causes of suboptimal behavior among carriers in air cargo alliances, and design mechanisms that may be used to promote compliance with the system optimal solution. In particular, we develop algorithms for fair revenue allocation from among alliance members and investigate implications for member carriers operating different types of networks.

4 - Incorporating Implementation Complexity in Periodic Vehicle Routing Problems
Karen Smilowitz, Assistant Professor, Northwestern University, 2145 Sheridan Road, M233, EV3119, Evanston, IL, 60208, ksmilowitz@northwestern.edu, Peter Francis, Michal Tzur

In this talk, we discuss methods to quantify implemenation complexity for periodic vehicle routing problems and show how these metrics can be used in routing decisions.

■ MA48

Service Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Martin Lariviere, Associate Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, m-lariviere@kellogg.northwestern.edu

1 - New Product Introduction and Services

Gad Allon, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Achal Bassamboo

We consider a monopoly that sells a durable product and a complementary perishable product or service. We first study the pricing problem under the assumptions that customers form rational expectation regarding future prices and quality levels of the service. We then study the "new product introduction" problem faced by the monopolist in the presence of aftermarket products or services.

2 - Advance Selling with Asymmetric Information on Quality

Hyun-Soo Ahn, University of Michigan, 701 Tappan Street, Ann Arbor, 48104, United States, hsahn@umich.edu, Roman Kapuscinski, Man Yu

We consider a monopolistic seller whose product can be sold both in advance and at the time of consumption. The quality of the product is a private knowledge of the seller. The seller needs to decide whether to sell in advance, how much to offer, and at what price. We show how the buyers' beliefs on product quality, as well as, limited capacity influence the seller's optimal pricing and rationing policy.

3 - Outsourcing Contracts for a Call Center

Sameer Hasija, Simon School of Business, University of Rochester, Rochester, NY, 14627, United States, hasijas1@simon.rochester.edu, Robert Shumsky, Edieal Pinker

We study contracts to co-ordinate the capacity decision of a vendor who has been hired by a client to provide call center support. We consider different types of contracts based on our observations of contracts used by one large vendor. We show when these contracts are coordinating and how coordination can be achieved under information asymmetry about the vendor's productivity. Under each contract type we also consider how profits are allocated between the client and the vendor.

4 - Incentives for Quality through Endogenous Routing

Lauren Xiaoyuan Lu, PhD Student, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208, United States, lauren-lu@kellogg.northwestern.edu, Jan Van Mieghem, Canan Savaskan

This paper investigates how incentives and endogenous rework routing can induce effort and improve a firm's quality and profits. We consider quality control and rework routing policies of a firm implementing piece rate compensation. In general, cross routing generates the highest profit rate when appraisal, internal failure, or external failure costs are high, while self routing performs the best when gross margins or disutilities of effort are high.

■ MA49

Integration in Closed-Loop Supply Chains

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

Chair: Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca

1 - Design and Analysis of Robust Service Networks

Rajesh Piplani, Associate Professor, Nanyang Technological University, School of MAE, Centre for SCM, 50 Nanyang Avenue, N3-2C-84, Singapore, 639798, Singapore, mrpiplani@ntu.edu.sg, Rommert Dekker

Design and operation of service networks should take into account service and demand dynamics, and uncertainty inherent in the parameters. We present the development of a network design methodology where first MIP models are used to generate solutions considering multi-level product and component sharing. Then scenarios of uncertainty are defined which will be used in the robust optimizaiton models.

2 - Designing Customer Return Policies to Optimize Overall Channel Profitability

Prashant Yadav, Professor of Supply Chain Management, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, AR, 50009, Spain, pyadav@MIT.EDU, Sweta Thota

A large fraction of the return flows in the supply chain consist of non-defective returned products. Using different consumer choice models, we investigate the impact of credit returned and duration of return time allowed on the profits of retailers and manufacturers. The insights are useful for retail managers involved in setting terms of their return policy and for logistics managers in building their case for restricted returns.

3 - Customers' Role in Enhancing Environmental Performance of Suppliers

Olga Kaminer, PhD Student, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, okaminer@schulich.yorku.ca, Ashwin Joshi, Murat Kristal, Markus Biehl

In order to stay environmentally friendly, manufacturing companies have to ensure that inputs to their products and/or processes that come from outside suppliers, are environmentally friendly. In the current study we present results of a large scale quantitative survey that investigates different mechanisms that can be employed by customers (manufacturers) in order to enhance their suppliers' environmental performance.

4 - Sharing Product Responsibility Across the Supply Chain

Brian Jacobs, Doctoral Student, College of Management, Georgia Tech, 800 West Peachtree Street NW, Atlanta, GA, 30332, United States, brian.jacobs@mgt.gatech.edu, Ravi Subramanian

Product take-back - a policy tool within Extended Producer Responsibility, typically holds producers responsible for take-back of post-consumer products, despite emphasis on the need to involve all supply chain actors. We investigate the impact of shared responsibility for product take-back across the supply chain by developing and analyzing a two-stage supply chain model with key policy specifications of recycling, collection, and shared responsibility.

5 - Framework of Decision Support System for Intelligent Maintenance Systems

Haixia Wang, University of Cincinnati, 598 Rhodes Hall, Center for IMS, Cincinnati, OH, 45221, United States, haixiaw2001@hotmail.com, Jay Lee

Decision support system in Intelligent Maintenance Systems is to use predicted machine health information as well as historical data to optimize maintenance plans in a systematic way. It can be defined in three levels: equipment intelligence, synchronization intelligence, and operations intelligence. This presentation will present methodology, tools, and examples on how to realize the operations intelligence with least maintenance cost while maintaining service quality and productivity.

■ MA50

Network Resilience and Reliability

Sponsor: Telecommunications
Sponsored Session

Chair: Halit Uster-, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu

1 - Studies on the Reliability of Ad-Hoc Networks

Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu, Jason Cook

Ad-hoc networks are employed for the flexibility provided to network users and ease of deployment. The lack of infrastructure allows for the rapid configuration changes because only wireless communication devices are necessary. This attribute violates basic assumptions on which existing reliability methods are founded. This study describes the unique characteristics of ad-hoc networks and current research developed to account for their effects in the determination of reliability.

2 - Design of Resilient Network Topologies with Balanced Rings

Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Sarath Sasi Kumar

We consider the design of telecommunications network topologies with ring components balanced with respect to various criteria. We provide efficient heuristic solution approaches and present promising computational results.

3 - Assignment of Network Services Considering Risk

Abdullah Konak, Assistant Professor, Penn State - Berks, Tulpehocken Road, Reading, PA, 19610, United States, konak@psu.edu

Most networks today use the client-service paradigm to provide services to users in distributed manner. In this model, an entity that uses a service called client and an entity that provides service(s) is called server. This work introduces the problem of assigning network services to network nodes to minimize a risk measure in the case of catastrophic events.

■ MA51

Environmental Issues, Innovation and Supply Chain Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu

1 - The Diffusion of No-Regrets Environmental Technologies

Karl Ulrich, Professor, The Wharton School, 500 Huntsman Hall, Philadelphia, PA, 19104, United States, ulrich@wharton.upenn.edu

The International Panel on Climate Change reports that global greenhouse gas emissions could be reduced by more than 2 gigatonnes of carbon per year at no net cost. This analysis is met with skepticism by most economists. This talk reports on empirical research to understand the extent to which "no regrets" environmental innovations actually exist in practice and to explain the way these innovations diffuse.

2 - Optimal Return Policies and Information Provision

Jeff Shulman, Assistant Professor, University of Washington Business School, 252 MacKenzie Hall Box 353200, Seattle, WA, 98195, United States, jshulman@u.washington.edu, Canan Savaskan, Anne Coughlan

In this paper, we merge research streams from marketing and operations by developing an analytical model that describes how consumer purchase and return decisions are affected by a firm's pricing and restocking fee decisions. We identify the value to the firm of investing in marketing efforts to inform consumers of the best purchase decision in order to eliminate returns. Surprisingly, we find that informing consumers of product fit is not always optimal, even if it were free to do so.

3 - OEM Strategies on the Secondary Market

Beril Toktay, Associate Professor, College of Management, Georgia Institute of Technology, 800 West Peachtree Street, NW, Atlanta, GA, 30308, United States, Beril.Toktay@mgt.gatech.edu, Mark Ferguson, Nektarios Oraiopoulos

We study a monopolist's incentives to manipulate the secondary market through modifying the cost of remanufacturing. A high remanufacturing cost discourages remanufactures and thus eliminates future competition. A low remanufacturing cost, however, will result in high salvage values since remanufacturers will have an interest in acquiring the used products. This, in turn, creates additional value for the consumers of new products and therefore allows the monopolist to extract additional profits.

4 - Competitive Equilibrium under Restrictions on Hazardous Substances

Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu, Terry Taylor

New laws restrict sale of electronics containing hazardous substances. Manufacturers may test competitors' products and thus prevent sale of noncompliant products. We characterize the equilibrium in the manufacturers' investments to eliminate toxics, testing of competitors' products, and sales quantities. The new laws may cause entry by noncompliant, nonbranded manufacturers.

■ MA52

Risk and Uncertainty in Revenue Management

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

1 - Risk in Revenue Management and Dynamic Pricing

Yuri Levin, Assistant Professor, School of Business, Queen's University, 143 Union Street, Kingston, ON, K7L 3N6, Canada, ylevin@business.queensu.ca, Jeffrey McGill, Mikhail Nediak

We present a model for optimal dynamic pricing of perishable products that incorporates a simple loss-probability risk measure that permits control of the probability that total revenues fall below a minimum acceptable level. This model is particularly appropriate for inventory clearance of high-value items, sales of single-class transportation services or hotel accommodations.

2 - Robust Revenue Management with Dynamic Budgets of Uncertainty

Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We present an approach to dynamic pricing with imperfect demand information based on robust optimization techniques and the sequential update of a budget of uncertainty, whose initial value quantifies the decision-maker's risk aversion. At each time period the manager decides whether to use some of his budget to protect against present uncertainty or to keep it for later use. We connect our results with traditional dynamic programming and the optimal pricing strategy in that framework.

3 - Risk-Averse Newsvendor Networks: Resource Flexibility, Sharing, and Hedging

Jan Van Mieghem, Harold L. Stuart Distinguished Professor of Managerial Economics, Professor of Operations Management, Kellogg School of Management, Northwestern University, MEDS Department, 2001 Sheridan Road, Evanston, IL, 60208-2009, United States, VanMieghem@kellogg.northwestern.edu

We discuss how differences in risk exposure and risk attitude affect optimal resource levels in a multi-product network. While the focus is on theory, results may apply to capacity controls on recent flexible revenue management products. Ideas are illustrated by two networks that serve two markets through two dedicated or one flexible resource but differ in the position of the flexible resource. Revenue maximization suggests to increase (decrease) parallel (serial) flexibility.

4 - Pricing Dynamics of Competitors Whose Models Ignore Competition

Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu, William L. Cooper, Tito Homem-de-Mello

We study a duopoly in which sellers do not have the correct model specification. The demand model that each seller estimates with the seller's data, models the quantity demanded as a function of the price of the seller, and these models do not include the price of the other seller. We compare the resulting dynamical behavior with the outcomes in other settings, such as equilibria of well informed competitors, the outcomes of collaborators, and the outcomes when there is asymmetric information.

■ MA53

Inventory Management: Lead Time and Yield Uncertainty

Contributed Session

Chair: Keli Feng, Assistant Professor, St. Cloud State University, 720 Fourth Avenue South, St. Cloud, MN, 56301, United States, kfeng@stcloudstate.edu

1 - Continuous Review Inventory Policies with Supplier Risk: Partial Yield and Supply Stoppage

Xinmin Wu, PhD Candidate, North Carolina State University, Operations Research Programs, Raleigh, NC, 27695, United States, xwu@ncsu.edu, Arun Gupta, Robert Handfield

We examine the impact of (Q,r) policies by a supplier with two stages of partial yield and one stage of supply off. In additional to Poisson demand, we assume that each supply stage duration is exponentially distributed. An efficient heuristics based on pattern search is put forward to search for the optimal policy with fill rate constraint. Numerical examples and Monte Carol simulation results are presented to evaluate our approaches.

2 - An Inventory System with Two Randomly Available Suppliers and Stochastic Lead Times

Esmail Mohebbi, Assistant Professor, Department of Industrial & Management Systems Engineering, University of Nebraska - Lincoln, Lincoln, NE, 68588-0518, United States, emohebbi@unlnotes.unl.edu, Nicolas Robayo

We consider the problem of sole versus dual sourcing in a continuous-review inventory system with stochastic demand and non-zero lead time where each supplier alternates randomly between an available and an unavailable state. We examine the merit of dual sourcing as a means of alleviating the impact of such uncertainty in the supply process and present some results based on an analytical model.

3 - Modeling Inventory Systems with Random Demand and Random Lead Times in Regional Supply Chains

Elena Valentina Gutierrez, Assistant Teacher, Universidad de Antioquia, Calle 67 No. 53-108 Udea - B.21-OF405, Medellin, Colombia, evlaila@udea.edu.co, Carlos Julio Vidal Holguìn, Hector Hernan Toro Diaz

Randomness of demand and lead times is not yet considered in the design of inventory systems in most Colombian companies. We developed a model that incorporates these factors and that allows defining coordinated inventory policies for final products and raw materials. Considering a periodic review system and using the Sample Average Approximation method (SAA), we developed a computational tool for the model, and applied it in a food company located in Valle del Cauca, Colombia.

4 - Goal-Driven Inventory Management

Geoffrey Bryan Chua, PhD student, National University of Singapore, Department of Decision Sciences, NUS, BIZ2 Building, #01-02, 1 Business Link, Singapore, 117592, Singapore, geoffreychua@nus.edu.sg, Melvyn Sim

Current inventory theory encompasses a rich collection of deterministic and stochastic models, multi-period models, and models with alternative decision objectives. Our paper adds to the literature on alternative objectives by using a goal-driven optimization framework, which combines an aspiration level criterion with a penalty for intensity of goal violation. Interestingly, our results show that the optimal policies from the expected profit case are preserved under our proposed framework.

5 - Safety Stocks In MRP: A Two Moment Approximation

Keli Feng, Assistant Professor, St. Cloud State University, 720 Fourth Avenue South, St. Cloud, MN, 56301, United States, kfeng@stcloudstate.edu, Uday Rao

We examine a single end product, discrete time inventory replenishment problem in a material requirements planning (MRP) environment with demand uncertainty and supply capacity limits on replenishment orders. We develop a stochastic programming model to determine replenishment orders over the planning horizon. We propose a novel two-moment approximation approach and evaluate order-up-to inventory policy as well. We also provide computational results and managerial insights on this problem.

■ MA54

Pricing: The Interface of Operations and Marketing

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Burak Kazaz Assistant Professor, University of Miami, School of Business, 414 Jenkins Building, Coral Gables, FL, 33124, United States, bkazaz@miami.edu

1 - Dynamic Joint Pricing and Inventory Control with Multiplicative Demand and Fixed Order Cost

Yuyue Song, Faculty of Business Administration, Memorial University, St. John's, NL, A1B 3X5, Canada, ysong@mun.ca, Saibal Ray, Tamer Boyaci

We consider the dynamic joint pricing and inventory control problem with multiplicative price-sensitive stochastic demand and fixed order cost. For both the lost sale model and the backlogging model with non-stationary parameters, we show that an (s, S, A, p) policy is optimal. For some special cases, we show that either (s, S, P) policy or base-stock policy is optimal.

2 - Vertical Integration with Price-Setting Competitive Newsvendors

Chongqi Wu, Assistant Professor, Alabama A&M University, PO Box 429, Normal, AL, 35762, United States, cqwu72@yahoo.com, Dilip Chhajed, Nicholas Petruzzi

Consider two manufacturers, each producing a substitutable product and selling it through either a decentralized or an integrated retailer, modeled as a price-setting newsvendor. A multiplicative demand function incorporating a uniform random factor is assumed. Under a uniform distribution on [0, x], the equilibrium design does not depend on x; under a uniform distribution on [1-r, 1+r], an increase in r favors the integrated structure and hurts the decentralized one.

3 - Structural Properties of Buyback Contracts for Price-Setting Newsvendors

Saibal Ray, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, H3A1G5, Canada, Saibal.Ray@McGill.ca, Shanling Li, Yuyue Song

This paper studies a buyback contract in the Stackelberg framework of a manufacturer selling to a price-setting, newsvendor retailer. Using an analytical model which focuses on a multiplicative demand form, we generalize previous results and produce new structural insights. We identify the necessary and sufficient conditions for the optimal contract to be distribution-free, and for a no-buyback contract to be optimal from the manufacturer's perspective.

4 - Pricing and Production Planning under Yield Uncertainty with Multiple Customer Segments

Burak Kazaz, Assistant Professor, University of Miami, School of Business, 414 Jenkins Building, Coral Gables, FL, 33124, United States, bkazaz@miami.edu, Brian Tomlin, Nenad Jukic

This paper investigates the combined pricing and production planning decisions for a producer of medical supplies that serves two customer segments and faces yield uncertainty. The model considers the new regulation that requires producers to make available the price information of lower-level customer segments to its higher-level customers. The sharing of price information is done by using an information system that features a database with polyinstantiated data.

5 - Efficient Contract Design in Multi-Principal Multi-Agent Supply Chains

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Hongxia Xiong

We consider a general multi-principal multi-agent contracting game in a complete-information supply-chain setting and determine coordinating equilibrium transfer schedules in closed form. We allow for multidimensional actions and arbitrary payoff externalities between all members of the supply chain. For the coordinating contracts to exist it suffices that all payoff functions are continuous on the compact action sets in a general sense that accommodates discrete action sets.

■ MA55

Technical Issues in DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Hiroshi Morita, Professor, Department of Information and Physical Sciences Graduate School of Information Science and Technology, Osaka University, 2-1 Yamadaoka, Suita, 565-0871m, Japan, morita@ist.osaka-u.ac.jp

1 - DEA Model for Supply Chain Network Redesign

Seungkee Baek, GRIPS, 7-22-1, Roppongi, Minatoku, Tokyo, Japan, seungkee@grips.ac.jp, Kaoru Tone

Well designed supply chain network will guarantee successful performance of supply chain members. We evauate relative efficiency of supply chain network using DEA and propose strategic approach for performance improvement.

2 - Which Strategy to Adopt in Boom and Bust? A DEA Analysis on Software Companies: 1995-2004

Shanling Li, Associate Professor, McGill University, 1001 Sherbrooke Street West, Montreal, PQ, H3G 1A5, Canada, shanling.li@mcgill.ca, Sandra Slaughter, Jennifer Shang

For software companies, the correct choice, implementation and evolution of a business strategy can provide considerable competitive advantages. This research sets out to discover exactly how different business strategies influenced the three capabilities: marketing, operations and R&D, in economic boom and bust. Both DEA window analysis and stochastic efficiency frontier approaches are used and compared. We derive managerial insights and discuss strategic implications.

3 - Variable Selection by SN Ratio for Data Envelopment Analysis

Hiroshi Morita, Professor, Department of Information and Physical Sciences Graduate School of Information Science and Technology, Osaka University, 2-1 Yamadaoka, Suita, 565-0871m, Japan, morita@ist.osaka-u.ac.jp

We introdude the concept of SN ratio into variable selection for data envelopment analysis, where the suitable variables should be selected according to the external information of efficiency. SN ratio is used at Mahalanobis Taguchi system to discrimination problem of two populations. As a case study, we adopt the Nikkei financial data to establish the evaluation model of the firm's performance by selecting appropriated variables.

Monday, 10:00am - 11:30am

■ MB01

Online Network Design

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Seffi Naor, Professor, Technion - Israel Institute of Technology, Computer Science Department, Haifa, 32000, Israel, naor@cs.technion.ac.il

1 - Oblivious Network Design
Anupam Gupta, Professor, Carnegie-Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, anupamg@cs.cmu.edu

We consider a network design problem in which the cost of the flow routed between sources and sinks is a concave cost function; the goal is to minimize the total cost incurred. The routing has to be oblivious: when a terminal pair makes its routing decisions, it does not know the current flow on the network nor the identity of the other pairs in the system. We develop a framework to model oblivious network design problems and give algorithms with poly-logarithmic competitive ratio.

2 - Online Network Design with Economies of Scale
Adam Meyerson, Professor, University of California, Los Angeles, 4732 Boelter Hall, Los Angeles, CA, 90095, United States, awm@cs.ucla.edu

The steiner tree problem where edge costs are concave increasing functions in the demand is considered. Finding a minimum-cost flow in this model has received a great deal of attention and poly-logarithmic approximation results are known. The online variant of these problems, where demand arrives gradually and must be routed upon arrival, is somewhat less studied. In this talk a poly-logarithmic competitive algorithm for the single commodity variant is presented.

3 - How to Distribute Antidote to Control Epidemics in a Network
Amin Saberi, Professor, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, amin.saberi@gmail.com

Thresholds for an infection to become an epidemic are know to exist in mathematical epidemiology. Recent work on heterogeneous networks showed that they can be prone to infection spread at arbitrarily low infection rates. As many real-world networks exhibit this behavior, we consider strategies for distributing curing resources in such networks. We show that distributing vaccine or antidote in proportion to the connectedness of an individual ensures a non-zero threshold.

■ MB02

Joint Session Open-Source/ICS: Open-Source Branch-and-Bound Solvers from Sandia National Laboratories

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

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, caphill@sandia.gov

1 - ACRO: A Common Repository for Optimizers
William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, wehart@sandia.gov

We give an overview of Acro, an open-source software project integrating many optimization software packages including libraries and frameworks developed at Sandia National Laboratories and publicly available third-party libraries. Acro software packages are grouped into projects providing support for global and local optimization and mixed-integer programming. Parallel optimizers support DOE applications. Acro supports portability tests, nightly build tests, and software quality assessment.

2 - PICO: Parallel Integer and Combinatorial Optimizer
Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, caphill@sandia.gov, Jonathan Eckstein, William Hart

We will summarize the capabilities of the PICO mixed-integer programming solver and PEBBL, the general branch-and-bound framework upon which PICO is built. PICO and PEBBL were built to exploit the thousands of processors available on DOE's massively-parallel machines, but they can run in serial. We will emphasize recent new capabilities such as checkpointing, enumeration of near-optimal solutions, cut support, performance enhancement, and software quality activities.

3 - Customizing PICO Searches Using Multidimensional Symbols
Jonathan Berry, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 1110, PO Box 5800, Albuquerque, NM, 87185-1110, United States, jberry@sandia.gov, Cynthia Phillips, William Hart

Mathematical programming languages like AMPL allow developers to express a mixed-integer program (MIP) using natural multidimensional variables rather than the linear representation of general MIP solvers. The PICO solver provides scripts to automatically generate derived PICO C++ classes aware of names from an AMPL model. We show examples of custom heuristics and cut generation algorithms using these names. PICO can use free glpk software to interpret AMPL models.

4 - GNLP, an Open-Source Package for Rigorous Global Nonlinear Programming on Parallel Machines
David M. Gay, Principal Member of Technical Staff, Sandia National Laboratories, Mail Stop 0370, PO Box 5800, Albuquerque, NM, 87185-0370, United States, dmgay@sandia.gov, Pradeep Polisetty, Edward Gatzke, William Hart

This talk gives an overview of GNLP, a branch-and-bound code for rigorous global optimization of algebraically specified nonlinear functions subject to nonlinear constraints involving bounded continuous or discrete variables. GNLP builds on PICO's facilities for parallel computing, rewrites expression graphs to obtain convex or linear bounding functions, and uses some facilities from COCONUT (another open-source global-optimization project). We give preliminary results from work in progress.

■ MB03

Advances in Large-Scale Nonlinear Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Richard Waltz, President, Ziena Optimization, Inc., Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu

1 - General-Purpose Optimization Techniques for Partial-Differential-Equation-Constrained Problems
Frank Curtis, Graduate Student, Northwestern University, 2145 Sheridan Road, C230, Evanston, IL, 60208, United States, fecurt@gmail.com, Jorge Nocedal

We investigate optimization-specific issues that arise when attempting to apply a SQP method to equality-constrained problems defined by systems of differential equations. A major obstacle for employing such an approach is often the inability to explicitly form the constraint Jacobian and, consequently, to factor the KKT matrix. We study alternatives to direct factorization and remark on related issues such as inertia control, inexactness in step computation, and appropriate merit functions.

2 - QPPAL: A Friendly Solver for Large-Scale QPs
Sven Leyffer, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, leyffer@mcs.anl.gov, Michael Friedlander

Our new approach for solving quadratic programs (QPs) is based on gradient projection, augmented Lagrangian, and filter methods. Using gradient projection, we approximately minimize the augmented Lagrangian to estimates the optimal active set. This active set estimate is explored further by approximately solving an equality constrained QP. Global convergence is promoted through a filter. Our implementation is based on the large-scale toolboxes TAO and PETSc.

3 - Preconditioning Interior-Point Methods for Nonlinear Optimization
Richard Waltz, President, Ziena Optimization, Inc., Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States, rwaltz@ece.northwestern.edu, Long Hei, Jorge Nocedal

Interior-point methods that use an iterative approach (such as the conjugate gradient method) may be needed when solving constrained problems with large, dense Hessian matrices. If in addition the Hessian is ill-conditioned, preconditioners may be needed to improve the efficiency. This talk will look at some general purpose preconditioners for interior-point methods. Numerical results will be presented using the KNITRO software package.

4 - Duality and Exact Penalization via A Generalized Augmented Lagrangian Function

Xiaoqi Yang, Professor, Hong Kong Polytechnic University, Department of Applied Mathematics, Hung Hom, Kowloon, Hong Kong, mayangxq@polyu.edu.hk

In this talk, we will discuss the existence of an optimal path and its convergence to the optimal set of a primal problem of minimizing an extended real-valued function via a generalized augmented Lagrangian and corresponding generalized augmented Lagrangian problems, in which no convexity is imposed on the augmenting function. We will show that these results further imply a zero duality gap property between the primal problem and the generalized augmented Lagrangian dual problem. A necessary and sufficient condition for the exact penalty representation in the framework of a generalized augmented Lagrangian is obtained. In the context of constrained programs, we will show that generalized augmented Lagrangians present a unified approach to several classes of exact penalization results.

■ MB04

Advances in Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ahmet B. Keha, Assistant Professor, Department of Industrial Engineering, Arizona State University, PO Box 875906, Tempe, AZ, 85287-5906, United States, ahmet.keha@asu.edu

1 - Uncapacitated Lot-Sizing with Backlogging: The Convex Hull

Simge Kucukyavuz, Assistant Professor, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, simge@sie.arizona.edu, Yves Pochet

In this talk, we give facets of the uncapacitated lot-sizing polyhedron with backlogging that subsume all known inequalities for this polyhedron. We show that these inequalities are enough to give the convex hull of solutions. We give an efficient combinatorial separation algorithm for an important special case. Finally, we summarize our computational results.

2 - Branch-and-Cut for Piecewise Linear Optimization

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Hongxia Zhao, Justin Yates, Ming Zhao

Any nonlinear optimization problem can be formulated approximately as a piecewise linear optimization problem (PLOP). We will discuss representability, modeling, and cutting planes for continuous and discontinuous PLOP and a branch-and-cut algorithm for them.

3 - Polyhedral Aspects of Nonconvex, Lower Semicontinuous Piecewise Linear Optimization

Juan Pablo Vielma, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, jvielma@isye.gatech.edu, George L. Nemhauser, Ahmet B. Keha

We present a SOS2 based branch-and-cut algorithm for solving linear problems with nonconvex lower semi-continuous separable piecewise linear cost functions. We show how valid inequalities (cuts) previously introduced by Keha et. al. for the continuous case can be extended to the lower semi-continuous case. We then introduce a simple generalization of one of these cuts and two new cuts for fixed charge jumps. Finally, we present computational results showing the effectiveness of these cuts.

4 - Monitoring Progress of Branch-and-Bound Algorithms

Osman Ozaltin, Graduate Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, ozaltn@yahoo.com, Brady Hunsaker

The most common methods to monitor the progress of branch-and-bound algorithms have drawbacks, particularly the fact that they do not improve monotonically. We consider new methods for monitoring the progress of branch-and-bound algorithms using the data extracted from the branch-and-bound tree. Our goal is to provide users with more useful information about the progress of the algorithm as well as the likelihood of it finding better solutions.

■ MB05

Sampling-Based Methods for Stochastic Integer Programs

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Guzin Bayraksan, Assistant Professor, Department of Systems and Industrial Engineering, The University of Arizona, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

1 - Bounds on the Value of Stochastic Mixed-Integer Programs

Nan Kong, Assistant Professor, Industrial and Management Systems Engineering, University of South Florida, ENC 2505, Tampa, FL, 33620, United States, kong@eng.usf.edu, Andrew Schaefer, Burhaneddin Sandikci

We consider a general two-stage stochastic mixed-integer program with discrete distribution and finite support. We derive a class of bounds for the optimal objective value of this problem by solving a number of truncated deterministic equivalent problems, each of which corresponds to a subset of scenarios. For the cases where the number of scenarios is large, we apply sampling techniques. Computational results for several stochastic linear and integer programs are presented.

2 - Stochastic Approximation Algorithms and Max-Norm Projections

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu, Sumit Kunnumkal

If the iterates of a stochastic approximation algorithm are constrained to lie in a closed and convex set W, then the standard approach is to project the iterates onto this set. In this talk, we consider the case where the projection of the vector z onto W is chosen as a vector v in W that minimizes the max norm of z-v. We show how our results can be used to improve the performance of Q-learning algorithm.

3 - Accelerating Cut Generation in D2 and D2-BAC Algorithms for Stochastic Mixed-Integer Programs

Suvrajeet Sen, Professor, Department of Systems and Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States, sen@sie.arizona.edu, Yang Yuan

The D2 and D2-BAC algorithms use strong disjunctive cuts in each iteration of the respective algorithms. However, these cuts can be somewhat time-consuming when the number of outcomes are very large. We show to speed-up the cut generation process. This capability is particularly critical for sampled decomposition algorithms for stochastic mixed-integer programs.

■ MB06

Project Management

Contributed Session

Chair: Roel Leus, Assistant Professor, Katholieke Universiteit Leuven, Research Center for OR & Business, Naamsestraat 69, Leuven, 3000, Belgium, roel.leus@econ.kuleuven.be

1 - Adaptive Scheduling of Projects with Stochastic Activity Durations

Vera Tilson, PhD Candidate, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, VeraT@alum.mit.edu, Joseph Szmerekovsky, Matthew Sobel

We investigate adaptive scheduling that seeks to maximize EPV. It is assumed that the tasks are exponentially distributed, and there is an outlay of funds at the start of each task, and a payoff at the end of the project. We report on the computational performance of our algorithm, and compare our results with the performance of the late start time heuristic.

2 - The Evaluation and Implementation of DSpace at the Intercontinental Hotels Group: Project Management

Michael King, Research Assistant, University of Virginia, 6108 Laura Lane, Crozet, VA, 22932, United States, michael.king@comm.virginia.edu

The Intercontinental Hotels Group NYSE:IHG is the world's largest hospitality and accommodation provider by room count. In 2004, IHG had $4.23 B in revenue. IHG's primary business model is franchising. The company's flagship franchise is the Holiday Inn brand. 2002 was a banner growth year for IHG and the volume of CRM projects posed a digital retention problem. The DSS department initiated a digital repository project and managed the project with a departmental project portfolio process.

3 - A Mathematical Programming Approach for Critical Path Analysis with Fuzzy Activity Times

Matthew Liberatore, Professor, Department of Decision and Information Technology, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States, matthew.liberatore@villanova.edu

Fuzzy logic has been proposed as an alternate approach for quantifying uncertainty relating to project activity duration. The extension principle of fuzzy logic leads to the development of a mathematical programming approach that constructs the fuzzy set of critical path lengths and fuzzy activity and path criticality indices. Computational studies based on a subset of the Patterson problems demonstrate the applicability of the suggested solution approach.

4 - Using Critical Chain Methodology to Improve Management of Plant Maintenance Operations

Samir Shah, Graduate Student, Rutgers School of Business, 227 Penn Street, Camden, NJ, 08102, United States, sshahmd@camden.rutgers.edu, Rajiv Misra, Alok Baveja, Ajai Kapoor

This work discusses the implementation of robust critical chain project management (CCPM) principles in a plant maintenance environment involving one of the larger steel manufacturers in the world. Traditional project management techniques did not yield target reduction in machine downtimes which in turn had a significant impact on the profitability of this organization. Implementation of CCPM dramatically improved throughput, reduced lead times and increased profits by as much as 25%.

5 - R&D-Project Scheduling with Technology Risks

Roel Leus, Assistant Professor, Katholieke Universiteit Leuven, Research Center for OR & Business, Naamsestraat 69, Leuven, 3000, Belgium, roel.leus@econ.kuleuven.be, Bert De Reyck, Pascale Crama

Due to technological risks a typical R&D project may have to be terminated before completion, each of its stages having a specific likelihood of success. In the project-scheduling literature this technological uncertainty has typically been ignored. In this paper we examine how to schedule projects in order to maximize their expected net present value when the project activities have a probability of failure and when an activity's failure leads to overall project termination.

■ MB07

The Science of (Optimizing) Better

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: Hans D. Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, MITTELMANN@asu.edu

1 - Benchmarking of Continuous Optimization Software

Hans D. Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, MITTELMANN@asu.edu

In this talk we will present results from evaluating continuous optimization software, in particular in areas of recent interest such as semidefinite programming.

2 - MIPLIB 20XX: On the Difficulties to Find a Good Set of MIP Instances for Benchmarking

Thorsten Koch, Senior Scientist, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Takustrafle 7, 14195 Berlin-Dahlem, Germany, koch@zib.de, Alexander Martin, Tobias Achterberg

Benchmarking MIP solvers is difficult at best. How could we compare the performance of two solvers in a fair and meaningful way? What are suitable criteria for selecting problem instances in a benchmark? Only difficult to solve instances? Constructing unsolvable instances is always possible. Only real-world examples? People who want results tend to use models that work well with existing solver technology. We will try to propose some answers to these questions. Discussion welcome.

3 - Performance Analysis of Grid-Enabled GAMS

Steven Dirkse, GAMS Development, 1217 Potomac Street NW, Washington, DC, 20007, United States, sdirkse@gams.com

GAMS is grid-enabled, i.e. independent solver jobs run in parallel with the results collected as they become available, allowing the user to take advantage of cheap and powerful computational grids with no programming effort. We demonstrate this by partitioning a MIP model for solution on a grid. Using the GAMS performance analysis tools (www.gamsworld.org/performance) we measure the importance of the parameters involved (e.g. partitioning algorithm, MIP solver, grid nodes used).

4 - State-of-the-Optimization Using Xpress-MP v2006

Alkis Vazacopoulos, Director, Dash Optimization Inc., 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, av@dashoptimization.com, Gabriel Tavares, Richard Laundy

The state of the Xpress-MP v2006 Linear Programming (LP) and Mixed Integer Programming (MIP) solvers is analyzed in this study. Some new features of v2006 will be described including: the addition of in-tree cuts for parallel MIP, a feasibility pump heuristic, a 64 bit version, and improved solutions and preprocessing interfaces.

■ MB08

KLIC III

Sponsor: Technology Management

Sponsored Session

Chair: Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu

1 - Knowledge Management for Product and Process Design Teams

Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, Atlanta, GA, 30308-0520, United States, Cheryl.Gaimon@mgt.gatech.edu, Gulru Ozkan

We consider strategies for managing product and process design team knowledge. Net revenue is a function of knowledge. Each team's knowledge increases from learning-by-doing, knowledge transfer, and induced learning. We determine the optimal rate and direction for knowledge transfer and the optimal rate that induced learning should be pursued over time. Key results include conditions that drive different managerial strategies including the delay in knowledge creation.

2 - Myopia of Selection: Does Organizational Adaptation Limit the Efficacy of Population Selection?

Hart Posen, Assistant Professor of Strategy, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, hposen@umich.edu, Daniel Levinthal

A central tenet of the evolutionary analogue in organization theory is that selection disproportionately removes less fit firms. However, the analogue is imperfect because variation is not blind - firms engage in adaptive learning. Is the efficacy of selection invariant to the nature of the adaptation process? We find that learning intended to enhance the performance of individual firms may have the unintended consequence of reducing the efficacy of selection in identifying superior firms.

3 - Riffing: The Multivocality of Innovative Action

David Obstfeld, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, DObstfel@uci.edu

Riffing refers to verbal representations by one individual of the voice or lived-in experience of another individual or category of individuals. Riffing is a variant of knowledge articulation whereby knowledge is made more explicit, usable, or relevant to the situation at hand. Field observations in an automotive manufacturer suggest innovation advocates exhibit a propensity to riff and draw from a repertoire of voices to make compelling depictions of existing and envisioned business processes.

4 - Learning While Sourcing: Productivity Gains While Coordinating Software Development

Paulo Gomes, Assistant Professor, Universidade Nova de Lisboa, Campus de campolide, Lisbon, 1099-032, Portugal, pgomes@fe.unl.pt, Steve Rosenthal, Nitin Joglekar

Organization theory makes a distinction between work conducted within an organization's technical core and coordination processes that buffer this core from the environment. We build on this distinction to look for evidence of learning while sourcing. Learning is not observed in terms of total effort. Segregation yields significant effects: learning associated with the management of distributed software development is significant for coordination tasks and less pronounced for technical tasks.

■ MB09

Innovation and the Management of the Development Process

Cluster: New Product Development

Invited Session

Chair: Gary Pisano, Professor of Business Administration, Harvard Business School, Morgan Hall 417, Boston, MA, 02163, United States, gpisano@hbs.edu

1 - R&D Portfolio Strategy, Diversification and Performance: An Information Perspective

Gary Pisano, Professor of Business Administration, Harvard Business School, Morgan Hall 417, Boston, MA, 02163, United States, gpisano@hbs.edu, Francesca Gino

In this paper, we take an information-based approach to R&D diversification. Projects with similar information processing problems belong to the same "information regime." Using project-level data from the pharmaceutical industry, we find evidence that firms diversify their portfolios across different information regimes. We also find that there are performance costs of such diversification.

2 - Team Experience and Returns to Management in Software Services
Brad Staats, Doctoral Candidate, Harvard Business School, Morgan Hall 428A, Boston, MA, 02163, United States, bstaats@hbs.edu, David Upton, Robert Huckman

Using data from an Indian software services firm we examine the returns to project-level management and team experience.

3 - Resource Allocation in the Pharmaceutical Development Process
Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Karl Ulrich, Karan Girotra

We present a dynamic capacity allocation model that supports the portfolio planning process in the pharmaceutical industry.

■ MB10

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Imagine That, Inc. - ExtendSim
Dave Krahl, Imagine That Inc., 6830 Via Del Oro, Suite 230, San Jose, CA, 95119, davek@imaginethatinc.com

See the future of the Extend simulation application. Introducing ExtendSim 7Ö with its revolutionary new simulation technology and 3D animation. Core ExtendSim features including hierarchical model building, user interface creation, and interactive modeling will also be showcased.

2 - Decisioneering, Inc. - Crystal Ball Software
Tracy Manchego, Decisioneering, Inc., 1515 Arapahoe Street, Suite 1300, Denver, CO, 80202, tmanchego@crystalball.com

Crystal Ball® is a suite of Microsoft® Excel-based applications for Monte Carlo simulation, forecasting, optimization and real options analysis. Crystal Ball transforms your spreadsheets into dynamic models that solve almost any problem involving uncertainty, variability and risk. We provide software, training and consulting services to understand, communicate and manage risk.

■ MB11

Joint Session Minortiy/Optimization: Discrete Optimization II

Sponsor: Minority Issues, Optimization/Integer Programming, Optimization/Network and Combinatorial Optimization

Sponsored Session

Chair: Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu

1 - MIR Inequalities, Mixed Integer Knapsack Problems and the Closure of Single-row Systems : Part I
Ricardo Fukasawa, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, rfukasaw@isye.gatech.edu, Marcos Goycoolea, William Cook

The purpose of this work is to develop a fast algorithm for optimizing over single row systems and use it as a subroutine to perform exact separation over such systems, extending the work of Andrew Boyd to this more general case. With such a tool in hand we will be able to analyze the practical potential of valid inequalities derived from single-row Mixed Integer Programs (in particular Mixed Integer Rounding inequalities) and potentially use it to generate cuts for general MIP's.

2 - Generalization of Cliques, Independent Sets and Coloring
Balabhaskar Balasundaram, PhD Candidate, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, baski@tamu.edu, Sergiy Butenko, Illya Hicks

In this talk we will present a graph theoretic generalization of a clique, known as a k-plex, originally introduced in social network analysis. Based on this model, systematic generalizations for independent sets and coloring are also introduced. Computational complexity results, integer programming formulation and facets and valid inequalities for the associated polytope are presented. Branch-and-cut approaches are discussed and computational test results are provided.

3 - Generalized Mixed Integer Rounding Inequalities for Integer Programming Problems
Kiavash Kianfar, PhD Candidate, Department of Industrial Engineering, North Carolina State University, 458 Daniels Hall, Campus Box 7906, North Carolina State University, Raleigh, NC, 27695, United States, k_kianfar@ncsu.edu, Yahya Fathi

We present a new class of valid inequalities for the mixed integer programming problem. These valid inequalities are based on a generalization of the concept of mixed integer rounding that has been extensively discussed in the open literature. We present theoretical properties of these valid inequalities, compare them with existing valid inequalities, and discuss their relationship with facets of the master cyclic group polyhedra.

4 - MIR Inequalities, Mixed Integer Knapsack Problems and the Closure of Single-row Systems: Part II
Marcos Goycoolea, Universidad Adolfo IbaÒez, Santiago, Chile, marcos.goycoolea@uai.cl, Ricardo Fukasawa, William Cook

In this talk we focus on a key component of the exact separation algorithm for single row systems: an LP based branch-and-bound algorithm for solving mixed integer knapsack problems. The main feature of this algorithm is that it exploits cost and lexicographic dominance in order to significantly improve solution times. We compare the algorithm performance with CPLEX and discuss possible extensions of the approach.

■ MB12

Leadership in Service Activities

Sponsor: Women in OR/MS

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - You Want to be a Journal Editor?
Candi Yano, Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, yano@ieor.berkeley.edu

This presentation will describe successful strategies for becoming involved in journal review processes and for moving up the levels of responsibility, from associate editor to department editor to journal editor. Responsibilities, obligations and expectations of the various editorial ranks will be described, along with professional development that is necessary or helpful in each of these roles.

2 - Lessons from the Founding of JFIG and Other Service Activities
Julie Swann, Assistant Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, jswann@isye.gatech.edu

As a junior faculty, many of us want to give back to our community, but this may conflict with our need to ensure time is spent on tenure-promoting activities. I will discuss my experiences in co-founding JFIG and participating in other service activities, offering any lessons learned on how to balance the competing tensions.

3 - Getting Involved in OR Education Initiatives and Activities
James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

I will discuss my involvement with various INFORM-ED (the Education Forum of INFORMS) initiatives and activities and other OR education initiatives and activities. I will explain how I initially became involved, where my involvement has led me, how you can get involved, and the potential benfits of involvement.

4 - Volunteering, Social Capital and Professional Leadership
Michael Trick, General Chair, INFORMS Anuual Meeting, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States, trick@cmu.edu

Service in organizations can come about through unexpected directions. I'll talk about how an inability to remember web addresses led to a year of being president of INFORMS, and the key social capital aspects involved.

■ MB13

Tutorial: Teaching a Traditional Optimization Course in a Non-traditional Manner

Sponsor: Education (INFORM-ED)

Sponsored Session

Chair: James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU

1 - Teaching a Traditional Optimization Course in a Non-Traditional Manner
James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU, Michael Metzger

This tutorial will share what we have learned in teaching an undergraduate optimization course at MIT over the past decade. While the syllabus is traditional, the presentation of class material is not. We will share how to use PowerPoint

animation for teaching algorithms and other subject material. We will also discuss a variety of approaches for keeping students engaged and interested while they learn both traditional modeling and algorithms.

■ MB14

Online Auctions I

Cluster: Auctions and e-Commerce
Invited Session

Chair: John Morgan, Professor, University of California at Berkeley, Haas School of Business, Berkeley, CA, 94720, United States, morgan@haas.berkeley.edu

1 - How Can You Price a Phrase? Search Engine Auctions as Evolving Practices
Charles W. Smith, charles.smith@qc.cuny.edu

Sponsored word/phrase Internet search engine auctions, like many emerging Internet markets, deal with what might be called virtual commodities that defy normal spatial-temporal parameters. These markets are also highly dependent upon modern computer and digital technologies. Perhaps most importantly, many of these markets are engaged in definitional transformations that involve not only changes in the ranking and values of parameters, but the introduction of new parameters. While a number of word/phrase auctions, each with its own peculiarities, are presently operative, the discussion that follows will deal exclusively with the two largest auctions: one sponsored by Overture and the other by Google.

2 - The Geography of Trade on eBay and MercadoLibre.com
Asis Martinez-Jerez, Assistant Professor, Morgan Hall 397, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States, amartinezjerez@hbs.edu, Ali Hortacsu, Jason Douglas

This paper analyzes the geographic patterns of trade in two large online auction sites, eBay and MercadoLibre. The online auction environment can be considered "frictionless" in certain important dimensions, so trade should not be distance-dependent. However, we find that distance has a very negative and non-linear effect on trade as commerce is abnormally high within the city limits and abnormally low across borders.

3 - How Much is a Dollar Worth? Tipping versus Equilibrium Coexistence on Competing Online Auction Sites
John Morgan, Professor, University of California at Berkeley, Haas School of Business, Berkeley, CA, 94720, United States, morgan@haas.berkeley.edu

The equilibrium model of Ellison, Fudenberg, and Möbius (2004) predicts that, if two competing auction sites are coexisting, then: Seller revenues and buyer-seller ratios on each site should be approximately equal. We examine these hypotheses using field experiments selling identical items on the eBay and Yahoo auction sites. We find evidence that is inconsistent with the equilibrium hypotheses, and suggest that the eBay-Yahoo market is in the process of tipping. Robust statistical tests indicate that revenues on eBay are consistently 20 to 70 percent higher than those on Yahoo. In addition, eBay auctions attract approximately two additional buyers per seller than equivalent Yahoo auctions. We also vary the Yahoo ending rule from a hard close to soft close but find no statistically- or economically-significant changes in revenue or numbers of bidders. Moreover, the magnitude of the revenue and buyer-seller ratio disparity remains inconsistent with the notion of equilibrium coexistence even after accounting for various "frictions"associated with switching between the sites.

■ MB15

Prediction Markets II

Cluster: Auctions and e-Commerce
Invited Session

Chair: Anthony Kwasnica, Assistant Professor, Penn State University, 332 Business Building, University Park, PA, 16802, United States, kwasnica@psu.edu

1 - Predicting Influenza
George Neumann, Professor of Economics, University of Iowa, Department of Economics, W388 Pappajohn Business Building, Iowa City, IA, 52242, United States, george-neumann@uiowa.edu, Forrest Nelson, Philip Polgreen

The official position of the CDC is that influenza outbreaks are not predictable. Using emergency room doctors and nurses as well as epidemiologists and clinical microbiologists we demonstrate that influenza is predictable. Using the state of Iowa and employing prediction markets to aggregate the information possessed by these health practitioners we show that useful predictions of influenza prevalence can be obtained 4 weeks in advance of an outbreak.

2 - Information Mechanisms
Paul J. Healy, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, phealy@cmu.edu, Richard Lowery, John Ledyard

Markets are just one way to elicit predictions and to aggregate information from groups. Other mechanisms include pari-mutuel processes, voting, scoring rules, polls, etc. We examine the performance of many mechanisms in both simple and moderately complex environments. We find that markets and pari-mutuel mechanisms perform less well than usually advertised. Suitably designed polls and market scoring rules perform better - yielding more accurate and faster information aggregation.

3 - Security Design and Information Aggregation
Yiling Chen, Yahoo! Research, 45 W. 18th Street, 6th Floor, New York, NY, 10011, United States, cheny@yahoo-inc.com, Anthony Kwasnica

With two differently designed securities, we examine the impact of security design on the information aggregation ability of markets in laboratory experiments. Results show that markets with one security aggregate information signicantly better than markets with the other security, implying that information aggregation ability of markets is affected by the security design. Behavior of individual participants is then investigated to understand the observed market behavior.

■ MB16

Dynamic Pricing: Issues and Challenges

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Soulaymane Kachani, Professor, Columbia University (IEOR Department), S.W. Mudd Building Room 334, New York, NY, United States, kachani@ieor.columbia.edu

1 - An MPEC Approach to Dynamic Pricing with Learning Under Competition
Carine Simon, PhD Student, MIT Operations Research Center, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States, casimon@mit.edu, Georgia Perakis, Soulaymane Kachani

We consider an oligopoly for multiple perishable products where each firm dynamically updates its optimal prices (resp. allocations), while learning the demand (resp. price) function, using observed data. We formulate the problem as a Mathematical Problem with Equilibrium Constraints (MPEC) and design a solutions algorithm. We prove that as the horizon increases, learning is achieved and discuss computational results.

2 - Approximation Algorithms for Stochastic Revenue Management
Ana Radovanovic, Research Staff Member, Stochastic Analysis Group, IBM, Mathematical Sciences Department, IBM TJ Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, aradovan@us.ibm.com, Retsef Levi

We consider a system with a single resource pool of capacity C that is facing demands from M different classes of customers. Each customer requests one unit of the resource for a certain period of time which is a-priori random; if served, he/she is willing to pay for the resource. Our goal is to find admission policies that (i) Can be computed efficiently; (ii) Are intuitive conceptually; (iii) Admit worst-case performance guarantees for any value of capacity C.

3 - Optimal Pricing and Production Planning for Subscription-Based Products
Ali Sadighian, PhD Student, Columbia IEOR, 325 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, as2446@columbia.edu, W. Tim Huh, Soulaymane Kachani

In this talk, we address the problem of jointly setting production quantities, single-copy and subscription prices for subscription-based products such as magazines. We consider both the finite and infinite horizon cases, and provide a dynamic programming formulation for which we propose a single stage reduction. We extend the analysis to the competitive case and report on computational results.

4 - Network Capacity Management Competition
Houyuan Jiang, Professor, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk

We consider airline capacity management games where passengers can purchase same class tickets from competing airlines if they do not get tickets from their preferred airline. Four models are developed. We provide conditions for existence of a Nash or generalized Nash equilibrium for all four games and uniqueness of a Nash equilibrium for two games. For generalized Nash games, we propose a numerical algorithm that combines penalty and smoothing techniques and establish a convergence result.

■ MB17

Simulation

Sponsor: Simulation
Sponsored Session

Chair: Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

1 - Multivariate Input Models for Asymmetric Dependence Structures

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

Despite its flexibility in capturing a wide variety of distributional shapes, we show that the Vector-Autoregressive-To-Anything input model falls short in representing asymmetric dependence structures and extend it to work for such dependence structures via the use of copula theory, which has been used primarily for random vectors, for multivariate time-series input modeling. The resulting input models lead to fast and efficient sampling algorithms for driving stochastic simulations.

2 - Adaptive Control Variates Techniques for Steady-State Simulation

Sujin Kim, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States, sk329@cornell.edu, Shane Henderson

We introduce an adaptive control variate scheme for estimating steady-state performance measures for stochastic systems using simulation. We use a procedure based on sample average approximation for tuning the control variate estimators. The underlying processes are assumed to be regenerative which allows establishing consistency of these estimators in an efficient way under mild conditions.

3 - Bootstrap Methods for Capturing Simulation Input Distribution Uncertainty

Russell Barton, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States, rbarton@psu.edu, Lee Schruben

In simulation, input distributions are usually constructed using finite samples of real data. This introduces an error component in the simulated performance that is not usually captured in the analysis of simulation output data, which affects the coverage probability of confidence intervals. Often this error dominates the error caused by the finite length of the simulation run. Under certain conditions bootstrap methods can provide intervals with approximately correct coverage.

4 - Simulation Optimization with Industrial Strength COMPASS

Barry Nelson, Professor, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, nelsonb@northwestern.edu, Jie Xu

We present an algorithm for optimizing the expected performance of stochastic simulations with respect to integer-ordered decision variables. The algorithm combines the convergence theory of COMPASS (Convergent Optimization via Most Promising Area Stochastic Search), heuristic search techniques to enhance practical performance,and statistical procedures to provide inference on the estimated optimal solution.

■ MB18

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security I

Cluster: Counter Terrorism and OR, Decision Analysis Society
Invited Session

Chair: Henry Willis, Policy Researcher, RAND Corporation, 201 N. Craig Street, Suite 102, Pittsburgh, PA, 15217, United States, hwillis@rand.org

1 - Evidence-Theory Based Parameter Assessment for Homeland Security Risk Analysis

William McGill, Center for Technology and Systems Management, University of Maryland, College Park, MD, 20742, United States, wmcgill@umd.edu, Bilal Ayyub

This paper applies the Transferable Belief Model to estimate parameter distributions for probabilistic risk assessments based information from previous analyses, expert opinion, and qualitative assessments (i.e., evidence). The proposed methodology is demonstrated with an example that estimates the physical vulnerability of a critical infrastructure asset.

2 - Rationale and Development of a Security Assurance Index and its Application to Cyber Attacks on Control Systems

Martin Michael Plum, Advisory Engineer/Economist, Idaho National Engineering and Environmental Laboratory, PO Box 1625, Idaho Falls, ID, 83415-3878, United States, Martin.Plum@inl.gov, George A. Beitel

Assurance categories were developed to support the Department of Homeland Security's efforts in the mitigation of Cyber Attacks on Control System. Defined according to the risk of life and economic loss, the minimum range is designated by policy; whereas, the maximum limit seems to be constrained only by limits and interdependencies of the controlled systems. This paper will present an overview of some existing scales of disaster and security assurance and the rationale behind the development of the Security Assurance Index (SAI). Use of the SAI and its associated security assurance levels (SAL) has proven helpful in managing risk due to the index's ease in use, communication, and understanding. As a test of reasonableness, SAL-1 meets the minimum threshold limits of DHS interest and responsibility as defined by HSPD-7; whereas, SAL-5 is consistent with the 9-11 attack on the World Trade Center. The addition of higher risk categories will be discussed for its applicability to other WMD events such as bio-terror events or the detonation of nuclear weapons in densely populated areas.

3 - Critical Infrastructure Protection Decision Support System

Michael Samsa, Decision and Risk Analysis Group Leader, Argonne National Laboratory, Building 900, 9700 South Cass Avenue, Argonne, IL, 60439-4832, United States, msamsa@anl.gov

The Critical Infrastructure Protection Decision Support System is a set of system dynamics models that estimate interdependent consequences from infrastructure disruptions, coupled with a multi-attribute decision model that can reflect the value trade-offs and risk attitudes of the decision making organization. A hypothetical infectious disease case is used to illustrate how the model is used to inform decision makers.

4 - Guiding Resource Allocations Based on Terrorism Risk

Henry Willis, Policy Researcher, RAND Corporation, 201 N. Craig Street, Suite 102, Pittsburgh, PA, 15217, United States, hwillis@rand.org

With every regulatory or funding decision for a risk management program, society decides whether or not risk is tolerable. We compare estimates of terrorism risk in urban areas that received homeland security grants to other federal risk management decisions. Allocations are generally consistent with other federal risk management decisions. However, terrorism risk in several cities that received funding is below levels that are often tolerated in other risk management contexts.

■ MB19

Mining Applications

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

1 - Long- and Short-Term Production Scheduling at LKAB's Kiruna Mine

Alexandra Newman, Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

We describe an optimization model that plans production both at the strategic and at the operational level for a large underground sublevel caving mine. We present optimization-based heuristics to expedite solution time for this large mixed-integer programming model, and supporting numerical results.

2 - Modeling the Mining Production Chain

Rafael Epstein, Associate Professor, University of Chile, Department of Industrial Engineering, PO Box 2777, Santiago, Chile, repstein@dii.uchile.cl, Andres Weintraub, Rodrigo Caro

Based on our experience in modeling Chilean open pit and underground copper mines, we discuss the importance of modeling in an integrated way the production chain from the initial extraction to delivery of final product. Such a model incorporates different intermediate processes, often nonlinear.

3 - The Design of a Decline Using a Decline Optimisation Tool

Doreen Thomas, Associate Professor, The University of Melbourne, Department of Electrical Engineering, Victoria, 3010, Australia, d.thomas@ee.unimelb.edu.au

This paper describes applying a Decline Optimisation Tool to find the best decline design to connect from three possible breakouts on an existing mine infrastructure to nominated points on the perimeter drives of a nominated stope. In addition the decline had to avoid a number of mineralized zones.

4 - Production Scheduling with Uncertain Supply: Example from Mining Orebodies
Roussos Dimitrakopoulos, Professor, McGill University, Department of Mining Engineering, Montreal, Quebec, Canada, roussos.dimitrakopoulos@mcgill.ca

The presentation considers production scheduling under uncertain supply for metal mines. Orebodies mined are uncertain in metal contained; a production schedule must be defined to ensure supply of ore in all production periods so that net present value is maximised. A new framework for mine production scheduling based on stochastic integer programming is outlined along with the concept of supply risk discounting, leading to substantial improvements of net present value of production schedules.

■ MB20

Carnegie Mellon University: Decision Models

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Kara Morgan, Senior Advisor for Risk Analysis, US FDA, 5600 Fishers Lane, HFP-20, 15-62, Rockville, MD, 20857, United States, kara.morgan@fda.hhs.gov

1 - Evidence Synthesis for the Risk of Adverse Reproductive Outcomes Due to DBPs in Drinking Water
Royce Francis, Graduate Research Assistant, Department of Engineering and Public Policy, Carnegie Mellon University, Baker Hall 129, 5000 Forbes Avenue, Pittsburgh, PA, 15232, United States, rafranci@andrew.cmu.edu, Mitchell Small

We demonstrate a method allowing regulatory research planners to combine judgment about methodological differences across epidemiological studies to synthesize epidemiological evidence. The impact of a decision maker's prior perception of the body of evidence is demonstrated using an example scenario facing a decision maker by using simple Bayesian Belief Networks.

2 - An Options Theory Method to Value Emissions Control Devices
Dalia Echeverri, PhD Student, Engineering and Public Policy, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, dpe@andrew.cmu.edu

In responding to uncertain future air-emissions regulations, decision makers in the electricity industry face tremendous uncertainty and incur significant financial risk. We show how decision makers may value certain options as hedges against these risks. More generally, we demonstrate how a method of options-valuation can inform the choices of the electricity industry and policy makers.

3 - An Interactive Tool to Compare Traffic Risks
David Gerard, Executive Director, Center for the Study & Improvement of Regulation, Engineering & Public Policy, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, dgerard@andrew.cmu.edu, Paul Fischbeck

This talk presents a general framework in which motor vehicle travel risks can be systematically estimated, flexibly displayed, and interactively compared. Drawing upon existing data (FARS and NHTS), this tool determines risk estimates using per mile, per trip, or per minute measures for millions of attribute combinations (age, gender, time of day, day of week, month, vehicle type, geographic region, etc.).

4 - Model to Select More Valuable Weatherization Investments Before an On-Site Audit
Amelia MacSleyne, Carnegie Mellon University, 5032 Forbes Avenue #1073, Pittsburgh, PA, 15289, United States, amacsleyne@cmu.edu, Paul Fischbeck

In this talk, we present an evaluation of utility-sponsored energy conservation programs, specifically low-income household weatherization. Decision analysis tools are developed that improve the cost-effectiveness of this program. Through our investigation of the engineering and behavioral components of energy conservation, we formulate a set of policy guidelines that could be implemented by the state in an effort to make the program more efficient.

■ MB21

Bringing Decision Skills to Youth

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, cspetzler@sdg.com

1 - Reaching Out to Juvenile Detention Centers
Ali Abbas, Assistant Professor, College of Engineering, University of Illinois-Urbana Champaign, 104 S. Mathews Avenue, Urbana, IL, 61822, United States, aliabbas@uiuc.edu

We will discuss our experience reaching out with decision skills to teens in Juvenile Detention Centers in central Illinois and the lessons learnt. Topics of (i) Owning my decision, (ii) Decision fitness, and (iii) Framing my decisions were among the most important messages to convey.

2 - Extending Good Decision-Making Skills Education Beyond Classrooms
Chris Spetzler, Program Director, Decision Education Foundation, 745 Emerson Street, Palo Alto, CA, United States, chris@decisioneducation.org

Decision Education Foundation (DEF) is working with Riekes Center for Human Enhancement to integrate decision-making skills into Riekes' innovative programs in Athletic Fitness, Creative Arts and Nature Studies. Riekes helps students define and accomplish their goals and improve character, self-confidence, and peer relationships. Collaborating with Riekes extends decision skills training into an alternative (out of school) environment where youth utilize decision skills to attain their goals.

3 - Declaring a Decision - An Important Life Skill
Steven Tani, Partner, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, stani@sdg.com

A common source of poor decision-making among young people is the failure to think consciously about making a choice before taking action. An important decision-making skill that we teach to young people is called Declaring a Decision. This skill includes taking personal responsibility for the choices that affect one's life and being alert to decision triggers that signal the need to stop and think about the choices rather than simply "go with the flow".

4 - Decision Fitness — The Skill of Making Better In-the-Moment Decisions.
Carl Spetzler, Chairman, Strategic Decisions Group, 735 Emerson Street, Palo Alto, CA, 94301, United States, cspetzler@sdg.com

We use our current decision habits and decision fitness for making the myriad of in-the-moment decisions that we face. In this session we will cover how we are helping youth to understand their current decision fitness and to become more decision fit.

5 - Decision Skills within the English Classroom
Daniel Slack, 591 Brookwood Road, Wayne, PA, 19087, United States, dgslack@gmail.com

To help students learn the importance of good decision making, the Decision Education Foundation is developing a grade 5 through 12 curriculum that integrates English and decision skills. Through character studies in literature, personal writing, and public speaking exercises, students will learn how to identify significant decisions, how to be creative in the way that they explore choices, and how to use a full array of critical thinking skills in their approach to a decision.

■ MB22

Maintenance Modeling and Analysis

Sponsor: Military Applications

Sponsored Session

Chair: Edward Pohl, Associate Professor, University of Arkansas, Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, epohl@engr.uark.edu

1 - Rapidly Deployable Sensory-Based Prognostic Models
Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

Successful deployment of prognostic models requires prior knowledge of degradation processes. This information is available in databases consisting of degradation-based signals. Unfortunately, these databases may not be available for legacy systems, and their development can be very expensive. This research proposes a mathematical framework that enables the development of adaptive prognostic models for predicting residual life distributions in the absence of prior degradation information.

2 - Operational Readiness as a Function of Maintenance Personnel Skill Level
Justin Chimka, Assistant Professor, University of Arkansas, Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States, jchimka@uark.edu, Heather Nachtmann

Independent variables measuring maintenance personnel skill level including the numbers and percentages of 3, 5, 7 and 9 level maintainers, and dependent variables including mission capable rate, utilization variables, and reliability and maintainability variables are identified. Correlation and regression analyses result in a set of candidate regression models, and final models are selected by examining linear fit, efficiency, and adherence to model assumptions.

3 - Simulation-Optimization of Control Chart and Preventive Maintenance Policies

Rajesh Swaminathan, Graduate Student, University of Arkansas, Bell Engineering, Fayetteville, AR, 72701, United States, rswamin@engr.uark.edu, Edward Pohl

The problem combines the economic design of a control chart with the optimization of preventive maintenance policies. The research areas of control chart design and preventive maintenance have received a great deal of attention separately in the quality and reliability research communities. Our problem investigates the use of GA's and ant colony optimization in simultaneously selecting parameters for a control chart (X-bar, EWMA) as well as the best replacement period for equipments.

4 - Valuing Flexibility in Maintenance Policies

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

Real options analysis is used to value the flexibility provided by the option to perform preventive, condition-based maintenance in a manufacturing process outside of a strict age-based policy. Contingent claims analysis and option pricing theory are used to value these maintenance options in terms of expected cost savings. This research develops a methodology for properly valuing these options and incorporates the values into a model to determine the optimal maintenance policy.

■ MB23

Service Quality and Customer Satisfaction in Global Services Sourcing

Cluster: Global Services Sourcing
Invited Session

Chair: Aliza Heching, IBM TJ Watson Research Center, PO Box 218, Yorktown Heights, NY, 10598, United States, ahechi@us.ibm.com

1 - The Managers Problem Under Uncertainty

Anshul Sheopuri, PhD Student, Stern Business School, 44th West 4th Street, New York, NY, 10012, United States, asheopur@stern.nyu.edu, Eitan Zemel

We study a single decision maker, single period problem which has wide applications in the study of crime, service level and inventory decisions. We study important properties of this problem and identify conditions for uniqueness of the solution. Finally, we extend the analysis to a non-linear case and study the finite horizon version of problem.

2 - Business Process Outsourcing and "Off-Shoring": The Globalization of Information-Intensive Services

Uday Karmarkar, Professor, UCLA Anderson, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90077, United States, uday.karmarkar@anderson.ucla.edu, Uday Apte

Information-intensive services are being globalized as corporations take advantage of the opportunities made available by the progress of information technology and respond to the challenge of increasing global competition. After analyzing the role that information technology plays in globalizing information-intensive services, the paper reviews a wide range of illustrative examples where information-intensive services have been globalized. Based on this analysis, the paper proposes a theoretical framework that identifies the criteria and guidelines for successfully selecting service activities to be globalized and for choosing the appropriate country location.

3 - Call Center Outsourcing: Coordinating Staffing Levels and Service Quality

Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Yong-Pin Zhou

In this paper we study the contracting issues in an outsourcing supply chain consisting of a user company and a call center that does outsourcing work for the user company. We model the call center as a G/G/s queue with customer abandonment. Our results suggest that managers pay close attention to service quality and its contractibility in seeking call center outsourcing.

■ MB24

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Optimal Control of an Inventory with Simultaneous Obsolescence

Markus Emsermann, Operations Research Analyst, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, markus.emsermann@jeppesen.com, Burton Simon

We consider the problem of determining the optimal ordering and reordering policy for an inventory where the entire stock will simultaneously become obsolete at some time, T. Many businesses face the challenge of maintaining inventories that suddenly become obsolete. These circumstances render traditional inventory analysis unsuitable for balancing reordering costs with the costs of overstocking. We construct a mathematical model of an inventory with simultaneous obsolescence, and a new method for determining its optimal control policy.

3 - A Periodic Review Modeling Approach for Guaranteed Service Supply Chains

John M. Bossert, Senior Research Scientist, Optiant, 4 van de Graaff Drive, Burlington, MA, 01803, United States, john.bossert@optiant.com, Sean Willems

We extend the guaranteed service supply chain modeling framework to allow for an arbitrary integer review period or ordering frequency at each stage. We accommodate three different periodic review operating policies - constant base stock, constant safety stock, and adaptive base stock. We apply the model to real-world data and show that inventory metrics of the new model differ by more than 30% from those derived through the simpler modeling approach of aggregating a review period into leadtime.

■ MB25

OR Practice in Semiconductor Manufacturing

Cluster: OR Practice
Invited Session

Chair: James Wuerfel, Optimization Program Coordinator, Intel, CH3-113, 5000 W. Chandler Boulevard, Chandler, AZ, 85225, United States, james.r.wuerfel@intel.com

1 - Production Scheduling in a Fully Automated Semiconductor Fab

Nirmal Govind, Intel Corporation, 5000 W. Chandler Boulevard., Chandler, AZ, 85226, United States, nirmal.govind@intel.com

The talk will describe the implementation of a near real-time production scheduler at one of Intel's fully automated fabrication facilities, including the modeling challenges encountered and business process changes that were required.

2 - Scheduling Engineering and Production Lots in Wafer Fabrication

Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Kristy Crist, Brian Kelly

We present a simulation study examining the performance of different scheduling policies for allocating machine capacity between production and engineering lots in a semiconductor wafer fab. Our results indicate the basic tradeoffs involved in this problem, and suggest a broader view of the problem is required for effective solutions.

3 - Optimization to Fully Synchronized 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 full automated 300mm wafer fabs,scheduling system is incapable to be the only decision making point of material flow. It needs comprehend contradictive information from other manufacturing systems(e.g. AMHS,process control,yield management,etc.) to create a fully synchronized manufacturing environment to ensure the fab running with high availability, low inventory, high process stability and yield performance. This presentation discusses the potential role of optimization in such environment.

4 - Extending Performance Metric from Factory View to Global Manufacturing Networks
Hans Ehm, Principal Logistics Systems, Infineon, Am Campeon 1-12, Neubiberg, Ge, 85579, Germany, hans.ehm@infineon.com, Ralf Lelickens

Managing the Characteristic Curve enabled: short cycle time and a high capacity utilization. Can this approach be transferred to a multifab multi supply chain production network? Yes, but it requires the extension of the Characteristic Curve from a factory approach to global production network. This is demonstrated on the example of factory capacity planning (the IFX HTCP - Harmonized Test Capacity Planning - project).

5 - Matching Supply from Multiple Components to Competing Demands with Changing Attributes
Alfred Degbotse, IBM, 1000 River Street, Essex Junction, VT, 05452, United States, adegbo@us.ibm.com, Robert Orzell, Brent Elmer, Chi-Tai Wang, R. John Milne

Demand attributes such as quantity and priority can vary as a function of delivery date. We describe an element of our Supply Chain software which assigns supply to demand in the situation where demand attributes vary and multiple components are present. The software is used to plan IBM's semiconductor operations and those of an external client.

■ MB26

Education Panel: Data Mining from Statistical and OR Perspectives

Sponsor: Data Mining
Sponsored Session

Chair: Janet Twomey, Associate Professor, Industrial & Manufacturing Engineering, Wichita State University, Wichita, 67206, United States, janet.twomey@wichita.edu

1 - Education Panel: Data Mining from Statistical and OR Perspectives
Moderator: Janet Twomey, Associate Professor, Industrial & Manufacturing Engineering, Wichita State University, Wichita, 67206, United States, janet.twomey@wichita.edu, Panelists: Jayant Rajgopal, Jye-Chyi (JC) Lu, George Runger, Marietta Tretter

In this session a panel of faculty who teach undergraduate and graduate level courses in data mining come together to present and exchange information about their data mining courses, in terms of the course design, topics covered, data supplied, software and text books used. Faculty share their experiences and offer some lessons learned in the development of their courses. This session is intended for anyone who is currently teaching or hoping to create a course on the subject of data mining.

■ MB27

Predicative Modeling and Control of Manufacturing Quality

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu

1 - Predicting the Sum of All Evils: Aggregate Level Modeling of Non-Conformances
Vittal Prabhu, Associate Professor, Penn State University, 348 Leonhard Building, University Park, PA, 16802, United States, prabhu@engr.psu.edu, Nazrul Shaikh

Estimating the potential number of non-conformances in a product is critical for compliance and quality management. It is also a measure of the efficacy of the monitoring and control strategies associated with the process. In this work, a growth model for describing the observed non-conformances is developed and tested empirically. The model captures the interplay between maintenance strategies and reliability, and can be used as an early warning system for non-conformances and warranty costs.

2 - Error Equivalence Methodology in Quality Prediction and Control
Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

Error equivalence, an engineering phenomenon concerning the mechanism that different error sources result in identical dimensional variation patterns, impacts almost every stage of quality control, from tolerance synthesis in engineering design to root cause identification in manufacturing. This proposed research seeks to establish the science basis for quantitatively analyzing the error equivalence phenomenon to achieve better control of product dimensional quality.

3 - Predictive Modeling and Control Using Approximate Dynamic Programming
Rajesh Ganesan, Assistant Professor, George Mason University, 4400 University Drive, ST2, MS4A6, Fairfax, VA, 22030, United States, rganesan@gmu.edu, Tapas K. Das

Many process controllers rely on good process models that are seldom available for many complex large-scale nonlinear engineering systems fraught with uncertainties. Even with good models, the issue becomes the speed of execution during online applications, which ultimately forces model simplification and resultant suboptimal control. Hence, there is a need for model free approaches, which can dynamically and efficiently predict the uncertainties, and provide a path for optimal control.

4 - Discrete Event Sequence Data Monitoring Using Rank Test
Zhiguo Li, Research Assistant, University of Wisconsin, Madison, College of Engineering, 1513 University Avenue, Madison, WI, 53706, United States, zhiguoli@wisc.edu, Shiyu Zhou

Discrete event sequence data has become an important type of data in the service and maintenance. This paper, without any distributional assumption for the event history data, develops a monitoring procedure for the hazard rate of failures using the rank test. Based on the asymptotic properties of the rank statistic, a generic formula for the operating-characteristic of the control chart is derived to show the relationship of the type-I error, type-II error, sample size and hazard rate change.

■ MB28

IIE Transactions/Quality and Reliability Engineering

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Susan Albin, Professor, Department of Industrial & Systems Engineering, Rutgers University, Piscataway, NJ, 08904, United States, salbin@rci.rutgers.edu

1 - Online Automatic Process Control Using Observable Noise Factors for Discrete-part Manufacturing
Judy Jin, Associate Professor, Department of Industrial and Operations Engineering, University of Michigan, IOE 2855, Ann Arbor, MI, 48109, United States, jhjin@umich.edu, Yu Ding

Different from offline robust parameter design (RPD) method, this research is to develop automatic process control methodology (APC) based on DOE response models for process variation reduction. A cautious control strategy, which explicitly considers the observation uncertainty in adjusting the settings of controllable factors, makes the system performance consistently more favorable when compared with the certainty equivalence control strategy and RPD.

2 - Automatic Feature Selection for Unsupervised Clustering of Cycle-Based Signals
Shiyu Zhou, Assistant Professor, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, szhou@engr.wisc.edu, Judy Jin

A cycle-based signal refers to an analog or digital signal that is obtained during each repetition of operation cycles in a manufacturing process. Different from the available supervised classification approaches that depend heavily on the training dataset or the engineering field knowledge, this paper aims to developing an automatic feature selection method for unsupervised clustering of cycle-based signals. The technique is a data pre-processing technique for process monitoring and diagnosis.

3 - Effects of Estimation Errors on Cause-Selection Charts
Fugee Tsung, Professor, Hong Kong University of Science and Technology, IELM Department, Kowloon, Hong Kong, season@ust.hk, Lianjie Shu, K-L Tsui

The cause-selecting chart (CSC) is a statistical process control (SPC) tool for analyzing multistage processes. It distinguishes between incoming and outgoing quality problems by establishing a relationship between input and output measurements. In practice, the model relating the input and output must first be estimated before the CSC is implemented. This paper investigates the effect of parameter estimation errors on the performance of CSCs and presents some useful results.

4 - Process-Oriented Tolerancing for Multistation Assembly Systems
Yu Ding, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, yuding@iemail.tamu.edu, Darek Ceglarek, Judy Jin, Jianjun Shi

In multi-station manufacturing systems, the quality of final products is significantly affected by both product design as well as process variables. Historically, however, tolerance research primarily focused on allocating tolerances based on product design characteristics of each component. The concept of process-oriented tolerancing expands the current tolerancing practices, which bound errors related to product variables, to explicitly include process variables.

■ MB29

Optimization in Medicine and Biology

Cluster: Joint Cluster Healthcare/ HAS: Healthcare Engineering
Invited 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- Computational Approaches for Beam Angle and Fluence Map Optimization in IMRT
Gino Lim, Assistant Professor, University of Houston, 4800 Calhoun Road, E211, Engineering Building 2, Houston TX 77204, United States, ginolim@uh.edu

We present computational approaches for optimizing beam angles and fluence maps in IMRT planning for cancer patients. A mixed integer programming (MIP) model and a linear programming (LP) model are used to find an optimal set of beam angles and their corresponding fluence maps. The LP model is solved using the interior point method while the MIP model is solved using branch-and-bound. In order to reduce the computational burden for solving the optimization models, we introduce iterative beam angle elimination algorithms in which an insignificant beam angle is eliminated in each iteration.

2 - Edge Weighting Ethics in Maximum Matchings on Graphs for Kidney Paired Donation
Sommer Gentry, Assistant Professor, Mathematics, U.S. Naval Academy, 572-C Holloway Road, Mailstop 9E, Annapolis, MD, 21402, United States, gentry@usna.edu, T. S. Michael, Dorry Segev

Arranging kidney exchanges requires matching on a graph. Maximum cardinality matchings are desirable, but the relative utility of kidney exchanges must be represented by edge weights. Setting edge weights within a narrow range that we have characterized precisely guarantees that a maximum edge weight matching will also have maximum cardinality.

3 - Graph-Theoretical Approach to the Study of Abnormal Brain Network
W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Wichai Suharitdamrong, Panos Pardalos

The investigation of brain synchronization with application in epilepsy has raised many research challenges in optimization, due to a large number of combinations among electrodes which exponentially increases with the number of electrodes. It is difficult to visualize specific coupling patterns from each individual group of electrodes. We will present a brain similarity network (BSN), derived from a graph-theoretical approach, to investigate natural clusters of the brain network.

4 - Robust Radiotherapy Optimization via Parameterized Edge-Enhancements
Timothy Chan, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, tcychan@mit.edu, Thomas Bortfeld, John Tsitsiklis

We consider the problem of radiotherapy treatment planning under uncertainty and use a parameterized approach to deliver a robust solution. We analyze the relationship between uncertainty and solution structure, deriving simple bounds on the uncertainty that identify the resulting complexity of the robust solution. These results can be used to guide medical physicists in producing treatments plans that will be robust to the variety of uncertainties realized in practice.

■ MB30

Decision Support Models

Sponsor: Health Applications Section
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - A Case Study of a Simulation-Based Decision Support Tool for Surgical Scheduling
Michael Carter, Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Hai Ein (Jean) Yong

A simulation tool was developed to determine the surgical booking policy for allocating caediac operating room time. In practice, it was rather difficult to get the surgeons and the managers to quantitatively describe the current processes. Much of the effort on the project was focused on translating practice into a set of rules that could then be used to predict future behaviour.

2 - Simulating Resource Allocation at The Ottawa General Hospital: A System Dynamics Approach
Sonia Vanderby, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, sonia@mie.utoronto.ca, Michael Carter

In this study, a simulation was constructed using system dynamics to determine what could be done to alleviate the pressure within the Ottawa General Hospital's ED. The goal of this model is to enable scenario testing through altering demand patterns as well as resource levels and distribution. It provides a high-level image of the potential outcomes of various resource allocation decisions, enabling hospital administrators to make informed decisions and forecast for future demand.

3 - Turnover Times Between Surgeries Vary with Time of the Day
David Strum, Associate Professor Anesthesiology, Queen's University, Department of Anesthesiology, KGH, 76 Stuart Street, Kingston, ON, K7L 2V7, Canada, dstrum1@cogeco.ca, Luis Vargas

Surgical scheduling is complicated by variability inherent in the turnover times (TT) between surgeries. We investigated TT with the goal to describe variability in TT and the associated factors that might be predicted, controlled, or altered to improve surgical scheduling. Our results suggest TT are specific to time of the day and knowledge of the sources of variability in TT are important to improve surgical scheduling and reduce sub-optimal utilization of costly operating rooms.

4 - Modeling and Analysis of Surgical Demand in the Operating Room
Ian Moore, Queens University, Dept. Math and Stats., Kingston, ON, Canada, icmoore@mast.queensu.ca, David Thomson, David Strum

We investigated daily surgical demand at a large trauma hospital using Thomson's multitaper spectral estimator method and a harmonic F-test to extract the periodic components from the time series. We employed an ARIMA model to investigate model residuals and showed the residuals were close to Gaussian post extraction. Finally we will present an analytical description of our model in state space format and discuss issues with detecting variance patterns in the remaining residuals.

■ MB31

Risk Management and Operations

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Jussi Keppo, Assistant Professor, University of Michigan, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, keppo@umich.edu

1 - What Is a Good Measure of Risk: The Controversies and a Different Set of Axioms
Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu, Xianhua Peng, Chris Heyde

Axioms-based coherent risk measures have been widely used in mathematical finance. In this paper we point out some controversies of the axioms. We then suggest a different set of axioms and derive risk measures based on the axioms.

2 - Optimal Dividend Payments under Fixed Cost and Implementation Delays for Various Models
Erhan Bayraktar, Assistant Professor of Mathematics, University of Michigan, Mathematics Department, 530 Church Street, 1043,

Ann Arbor, MI, 48109, United States, erhan@umich.edu, Masahiko Egami

We solve the dividend optimization problem for a corporation when the managers are facing (regulatory) implementation delays. We consider several cash reservoir models for the firm including two mean-reverting processes: Ornstein-Uhlenbeck and square-root processes. We provide our solution via a new characterization of the value function for one-dimensional diffusions and provide easily implementable algorithms to find the optimal control and the value function.

3 - Hiring, Firing and Employment Protection

Tim Maull, PhD Candidate, Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, timmaull@umich.edu, Jussi Keppo

We analyze how hiring and firing costs as well as firing delays affect a firm's labor market demand. We solve the firm's optimal hiring and firing policies by using stochastic control. Then we study the properties of the optimal solution as well as comparative statics. Finally we perform a cross-sectional analysis over selected OECD countries.

4 - Financial Hedging of Operational Risk

Mike Ludkovski, Assistant Professor of Mathematics, University of Michigan, East Hall, 530 Church Street, Ann Arbor, MI, 48109, United States, mludkov@umich.edu

We study the optimal behavior of a manager that has control over a physical asset/plant, as well as opportunity for imperfect hedging on futures markets. We solve the combined problem by separating the continuous and impulse controls and passing to a sequence of stochastic control with discretionary stopping sub-problems. A complete numerical implementation is then given for CARA risk-preferences where we obtain a recursive formula in terms of conditional expectations.

■ MB32

Project Scheduling

Cluster: Project Management
Invited Session

Chair: Willy Herroelen, Professor, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, Willy.Herroelen@econ.kuleuven.be

1 - Acceptance and Planning of Dynamically Arriving Offers in an Over-Demanded Organization.

Jade Herbots, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, jade.herbots@econ.kuleuven.be, Willy Herroelen, Roel Leus

When a project is offered to an over-demanded organization, a quick acceptance decision is often required, while the company has only little knowledge of the project under discussion. We develop an approach that integrates order acceptance and resource capacity loading. Therefore we use a dynamic programming method that optimizes the company's expected profits. Here from we derive insights about the optimal allocation of capacity when accepting projects.

2 - Proactive Resource Allocation Heuristics for Robust Project Scheduling

Filip Deblaere, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, Filip.Deblaere@econ.kuleuven.be, Erik Demeulemeester, Willy Herroelen

The resource-constrained project scheduling problem involves the determination of a predictive schedule of the project activities satisfying the precedence relations and resource constraints while minimizing the project duration. During execution of the project, activity duration disruptions may disturb this schedule. We propose procedures for allocating resources to activities in order to maximize schedule stability. We report on computational results obtained on a set of benchmark problems.

3 - Building Robust Project Schedules in an Environment Subject to Resource Uncertainties

Olivier Lambrechts, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, olivier.lambrechts@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

In practice, project execution is subject to disruptions. Our aim is to generate baseline project schedules that are as well as possible protected against the impact of disruptions caused by resource breakdowns. Optimally building robust schedules is hard due to the stochasticity of the problem and interactions between disruptions. Therefore, we impose additional constraints allowing us to develop good solution procedures for subproblems of the RCPSP with stochastic resource availabilities.

4 - Heuristic Procedures for Reactive Project Scheduling

Stijn Van de Vonder, K.U.Leuven, Research Center for OM, Naamsestraat 69, Leuven, B-3000, Belgium, stijn.vandevonder@econ.kuleuven.be, Erik Demeulemeester, Francisco Ballestin, Willy Herroelen

This paper describes new reactive procedures that may be used to repair resource-constrained project baseline schedules when activity duration disruptions occur during project execution. We aim to minimize the deviations between the baseline schedule and the actually realized schedule. We discuss computational results obtained with priority-rule based schedule generation schemes, a sampling approach and a weighted earliness tardiness heuristic on a set of randomly generated project instances.

■ MB33

Applications in Airline Operations Recovery

Sponsor: Aviation Applications
Sponsored Session

Chair: Tina Shaw, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, tina.shaw@sabre.com

1 - Airlines Schedule Recovery During Irregular Operations: An Integrated Framework

Khaled Abdelghany, Assistant Professor, Southern Methodist University, PO Box 750335, Dallas, TX, 75205, United States, khaled@engr.smu.edu, Ahmed Abdelghany

A framework for proactive airlines schedule recovery during irregular operations is presented. The framework integrates a schedule simulation methodology and a resource assignment optimization model. Implementations issue and application examples are also presented.

2 - Tactical Crew Recovery During Irregular Airline Operations

Chunhua Gao, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, cgao@isye.gatech.edu, Alex Kalyta

During irregular operations it is often possible to revise schedules, reroute aircraft, and reaccommodate passengers to get back to normal operations by the next morning. However, this is not the case for crew. It typically takes several days to get crew back onto their planned rosters. We discuss tactical crew recovery.

3 - Integrated Crew Pairing and Roster Recovery: Case Studies

Tina Shaw, Sabre Holdings, 3150 Sabre Drive, Southlake, TX, 76092, United States, tina.shaw@sabre.com

Several case studies from our earlier work are presented to illustrate that fully legal and deployable crew recovery solutions can be obtained by simultaneously recreating duties, pairings, and crew rosters. Implementations issues and specific techniques designed to improve runtimes while maintaining good solution quality are discussed.

■ MB34

Hazard Management and Evacuation II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu

1 - Pre-Positioning of Emergency Supplies for Disaster Response

Carmen Rawls, Graduate Research Assistant, Cornell University, 310 Hollister Hall, Ithaca, NY, 14853, United States, cgr7@cornell.edu, Mark Turnquist

We describe a two-stage stochastic optimization model for determining locations and amounts of emergency supplies for disaster preparation. The model includes uncertainty in demands, locations, transportation network capacity, and the possibility that some of the pre-positioned supplies might be destroyed by the event. An illustrative case study is included.

2 - A Methodology for Consolidating Multiple Fire Stations with Traffic Signal Preemption

Bryan A. Norman, PhD, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States, banorman@pitt.edu, Lin Wang, Ming-En Wang

Many cities in the U.S. are now facing the difficult decision of closing some of their firehouses due to budget cuts. We investigate methods to decide which firehouses to close in a given fire district in order to minimize the increase in the average response time. We also consider which traffic locations should receive Traffic Signal Preemption equipment to help mitigate the effect of firehouse closures. Numerical examples based on a map of the City of Pittsburgh show results for each scenario.

3 - A Case Study of Ambulance Location and Relocation
Rahul Nair, Graduate Assistant, Department of Civil & Environmental Engineering, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States, rahul@umd.edu, Elise Miller-Hooks

We solve a multi-objective, integer program to assess whether or not there is significant benefit in relocating ambulances. A relocation strategy involves repositioning ambulances in response to an emergency call or in anticipation of future demand. We present methodology to overcome practical issues in solving a real-world optimization problem and results from simulation runs to test output strategies.

4 - A Staircase Formulation and Solution Procedure for Cell-Based Dynamic System Optimal Evacuation
Yi-Chang Chiu, Assistant Professor, University of Arizona, PO Box 210072, Tucson, AZ, 85721, United States, chiu@utep.edu, Hong Zheng

We propose a staircase formulation for the cell-based simultaneous evacuation destination, flow assignment and departure schedule problem. The staircase formulation exhibits an internal structure that can be exploited to decompose the original large-scale problem into smaller sub-problems. A solution algorithm is presented to compare the solution quality and computational efficiency.

■ MB35

Urban Transportation Planning Models III: Goods Movement

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu

1 - Algorithmic Solutions for the Common Carrier Case of the Integrative
Jose Holguin-Veras, Professor, Rensselaer Polytechnic Institute, 110 8th Street, Room JEC 4030, Troy, NY, 12180, United States, jhv@rpi.edu, Ellen Thorsn

This talk will focus on the description of the solutions developed for the common carrier case of the Integrative Freight Market Simulation. The IFMS is a comprehensive modeling framework for urban goods modeling that represents the only applucation of Spatial Price Equilirium to urban goods and discrete mathematics.

2 - The Vehicle Routing Problem with Variable Pickup Locations
Stephen Hill, PhD Candidate, The University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, shill@cba.ua.edu, John Mittenthal

In this research we introduce the vehicle routing problem with variable pickup locations (VRPVPL), an extension of the vehicle routing problem with pickups and deliveries. We propose a formulation for the VRPVPL and consider a practical instance of the problem.

3 - Modeling Truck Lane Restriction on Major Urban Freeways
Renatus Mussa, P.E., Associate Professor & Director of Traffic Engineering Laboratory, Department of Civil and Environmental Engineering, FAMU-Florida State University College of Engineering, 2525 Pottsdamer Street, Room 129, Tallahassee, FL, 32310, United States, mussa@eng.fsu.edu

To improve safety and efficiency of traffic flow on urban freeways, some agencies have imposed restriction of trucks from certain lanes. This research determines the safety and operational benefits of truck lane restrictions in peak and off-peak periods considering whether the freeway corridor has a high occupancy vehicle (HOV) lane.

■ MB36

Traffic Network Design Modeling Advances

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 - Incorporating Environmental Justice Measures into Equilibrium-Based Transportation Network Design
Jen Duthie, PhD Student, University of Texas, Austin, 1 University Station C1761, Austin, TX, 78705, United States, jduthie@mail.utexas.edu, S. Travis Waller

The environmental justice (EJ) order passed a decade ago has far-reaching impacts for the transportation industry by requiring all projects that receive federal funding to show no disproportionately adverse impact to all protected populations. This presentation focuses on incorporating EJ analysis into transportation project selection. A heuristic method is presented to select network improvement projects that maximize accessibility for each protected population.

2 - Effect of Load Transfers on Carrier Collaboration: A Network Design Formulation
Salvador Hernandez, Research Assistant, Purdue University, School of Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States, shhernan@purdue.edu, Srinivas Peeta

A single carrier (small to medium) seeks to collaborate with other carriers to ship demand it cannot fully serve. The goal of the carrier is to identify the routes that minimize the sum of the collaborative path costs which include transfer costs. A mixed integer formulation is presented, issues are identified, and solution directions are discussed.

3 - Robust Traffic Signal Setting Design
Ampol Karoonsoontawong, PhD Candidate, Department of Civil Engineering, The University of Texas at Austin, ECJ 6.202, Austin, TX, 78712, United States, ampolk@mail.utexas.edu, S. Travis Waller

We formulate the robust traffic signal setting design based on dynamic user equilibrium when accounting for long-term O-D demand uncertainty. This approach enhances the traditional pre-timed signal setting design in the operational planning by providing an optimal solution that is the least sensitive to the demand variation. We develop diverse metaheuristic algorithms for this problem, and also compare the deterministic, stochastic and robust solutions using limited test networks.

4 - Accounting for Flexibility in Transportation Network Design Under Uncertainty
Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, 4002 JEC, Department of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

We study a multiperiod flexible network design problem (F-NDP) accounting for demand uncertainty. Here the planner gets the flexibility of increasing/reducing the investment on any link at later stages based on the available recourse. We introduce the concept of transportation network flexibility and present two MPEC formulations for F-NDP. The implications of the model and results on test network are discussed.

5 - Stochastic System Optimal Network Design Problem
Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, 4002 JEC, Department of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

We address the issue of demand uncertainty in the transportation NDP by formulating the System Optimal Network Design Problem (SONDP) as a two-stage stochastic program with recourse. Our focus in this paper is on accounting for stochasticity and hence we adopt the relatively simple SO approach instead of more realistic UE approach. We formulate the SONDP as a two stage stochastic programming formulation. In the first stage of the stochastic SONDP, improvement and path flows are decided. The second stage penalizes the deviation in the demand realization. One key contribution of this work is in arriving at appropriate penalty functions for this problem. Computational results on multiple transportation networks show the benefit of accounting for stochasticity in the proposed formulation.

■ MB37

IT Value

Sponsor: Information Systems Society
Sponsored Session

Chair: Sanjeev Dewan, Associate Professor, Information Systems, University of California at Irvine, Paul Merage School of Business, Irvine, CA, 92697, United States, sdewan@uci.edu

1 - A Model of Search Intermediaries and Paid Referrals
Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Zhiqiang (Eric) Zheng

We develop a simple two-stage model of a search intermediary in a vertically differentiated product market. After the intermediary chooses a ranking function, competing firms place their bids for each referral by the search engine. The revenue-maximizing search-engine design bases rankings on a weighted average

of product performance and bid amount; the intermediary has an interest to obfuscate search results and thus reduce consumer surplus compared to a socially optimal design.

2 - Antecedents and Consequences of Internet Use in Procurement: An Empirical Investigation

Abhay Mishra, Assistant Professor, University of Maryland, 4325 Van Munching Hall, Robert H. Smith School of Business, College Park, MD, 20742, United States, amishra@rhsmith.umd.edu, Prabhudev Konana, Anitesh Barua

This paper examines the antecedents and consequences of Internet use in the procurement process. Drawing upon the resource-based view of the firm and the technology, organization and environment framework, we develop an integrative model that examines the antecedents and consequences of Internet use in two stages of the procurement process. The model enables us to deconstruct both the usage and the performance aspects of IT use and to provide insights into the enablers of use and business value.

3 - Risk and Return of Information Technology Initiatives: Evidence from Electronic Commerce Announcements

Fei Ren, PhD Candidate, University of California, Irvine, The Paul Merage School of Business, University of California, Irvine, CA, 92697, United States, fren01@merage.uci.edu, Sanjeev Dewan

This paper jointly examines wealth and risk effects of eCommerce announcements using event study. We estimate a generalized model allowing both systematic and unsystematic risk changes on 1996-2002 data. A striking result is wealth effects are not significant, inside or outside the Internet bubble, after controlling contemporaneous risk changes, which are quite significant. With a variety of robustness tests, it contributes to our nascent understanding of how IT affects firm risk-return profile.

■ MB38

Issues in Real Time Train Dispatching Systems

Sponsor: Railroad Applications
Sponsored Session

Chair: Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States, Roger.Baugher@BNSF.com

1 - Brief Summary of Real Time Meet-Pass Planning Implementations

Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States, Roger.Baugher@BNSF.com

To put the other presentations in perspective, the author will summarize past experience in implementing meet-pass planning algorithms in real time dispatching systems in the U. S.

2 - Optimized Tactical Traffic Planning: What is Required for Success?

Frank Boyle, Union Switch & Signal Inc., 1000 Technology Drive, Pittsburgh, PA, 15219, United States, cfboyle@switch.com

US&S' Optimizing Traffic Planner (OTP) is a tactical traffic planning system that optimizes the movements of trains in real time. Successful development of such a system and its deployment across a class 1 railroad's network present significant challenges ranging from technical to practical to organizational, and even philosophical. This presentation is a recounting of the major hurdles one can expect when undertaking a project of this kind and how to clear them.

3 - Movement Planner: A System for Improving Network Capacity

Melih Arpaci, Director of Engineering, Siemens Transportation Systems, Ackerstrasse 22, Braunschweig, 38122, Germany, melih.arpaci@siemens.com, Iris Jungherr

Increased network velocity and an optimized traffic flow can be realized through an online Movement Planning system. As soon as disruptions occur in operations (e.g. routes are not available), rescheduling measures are to minimize the extent of the effects involved and reduce their timescale (e.g. search for alternative routes). This paper introduces Siemensí approach for a movement planner system. It was designed specifically for automatic train dispatching without manual intervention.

■ MB39

Ballroom B

Great Unsolved Problems in OR - I

Cluster: Great Unsolved Problems in OR
Invited Session

Chair: Arjang Assad, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, aassad@rhsmith.umd.edu

1 - Representing Uncertainty in Decision Support

Harvey Greenberg, Professor, University of Colorado at Denver, Mathematics Department, Denver, CO, 173364, United States, Harvey.Greenberg@cudenver.edu

There are more than 20 measures of uncertainty — probability, possibility, plausibility, rough sets, and more. How do we know which is the right choice in an OR/MS situation? Once we decide measurement, how do we represent it in a model — recourse, chance-constrained, robust, [C]VaR, or some other risk metric? The problem I shall address is how to make that decision. I do not know how to do this, so my talk will merely organize what needs to be done.

2 - Large-Scale Dynamic Stochastic Programming

John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu

While practical decision making requires the integration of many complex inputs, uncertain responses, and dynamic revisions, most OR/MS results pertain only to systems with simple relationships, certain or predictable responses, and limited opportunities for revision. Optimization of fully dynamic and stochastic systems remains an ongoing challenge. We address reasons for this persistent gap in practical optimization, potential developments to aid in its closure, and future needs.

3 - Computational Global Optimization

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

Global optimization - the task of finding the best possible solution in multi-modal problems - is one of the toughest numerical challenges. The theoretical foundations of GO have been followed by algorithmic advances and recent software implementations for compilers, spreadsheets, modeling languages and integrated computing systems. In this talk we review these developments, and illustrate both the current state-of-the-art and some significant areas in need of GO technology.

■ MB40

Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Locating Multiple Facilities in a Competitive Environment

Zvi Drezner, Professor, California State University, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu, Atsuo Suzuki, Tammy Drezner

We investigate the location of one or more facilities anywhere in an area in which several competing facilities already exist. The attractiveness of each facility is modeled by a utility function. Each customer selects the facility with the greatest utility function value. As a case study we find the best locations of new convenience stores in the city of Seto, Japan.

2 - Competitive Pricing and Location with Differentiated Products

Binbin Liu, PhD Candidate, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, binbin.liu02@rotman.utoronto.ca, Dmitry Krass, Oded Berman

We study the duopoly's simultaneous pricing and location game with differentiated products. Customers' valuation of a product increases in quality, and decreases in price and distance. We derive Nash Equilibrium pricing, location and product differentiation strategies. Different kinds of equilibriums results are shown, with insights from these Equilibrium results discussed.

3 - Inventory-Location Problems in the Presence of Time-Sensitive Consumer Demand

Mozart Menezes, Assistant Professor, Department of Operations Management & Information Technology, HEC School of Management, Paris, 1 Rue de la Liberation, Jouy-en-Josas, 78351, France, Menezes@hec.fr, Dmitry Krass, Oded Berman

We consider a problem of serving customer demand from a set of facilities where demand may be lost if the delivery cannot be made in time. Thus, both inventory and location decisions must be made simultaneously, taking into account fixed location costs, inventory-related costs and opportunity costs for lost demand. Such problems are often faced by internet-based retailers, such as Amazon.com. Both theoretical and computational results will be presented.

4 - An Alternative Modeling and Solution Approach for Planar Multi-Facility Location-Allocation Problem
Alper Murat, Assistant Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, alper@eng.wayne.edu, Vedat Verter

We consider a single-echelon, fixed-charge, planar facility location-allocation problem with large number of customers. We represent the customer demand with a continuous demand density function. After projecting location decisions into the allocation decision space and we demonstrate how this approach accommodates a wide-range of modeling features such as capacity constraint and non-linear cost functions. Lastly, we illustrate exact and heuristic solution methods for these extensions.

■ MB41

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability
Sponsored Session

Chair: Mor Armony, Assistant Professor of Operations Management, Leonard N. Stern School of Business, New York University, 44 West 4th Street #8-62, New York, NY, 10012, United States, marmony@stern.nyu.edu

Co-Chair: David Gamarnik, Assistant Professor, MIT Sloan School of Management, E53-353, 77 Massachusetts Avenue, Cambridge, MA, 02139, gamarnik@mit.edu

1 - On Connections Between Network Coding and Stochastic Network Theory - An Introduction
Bruce Hajek, b-hajek@uiuc.edu

Randomly generated coded information blocks form the basis of novel coding techniques used in communication networks. The most studied case involves linear coding, in which coded blocks are generated as linear combinations of data blocks, with randomly chosen coefficients. Digital fountain codes, including Luby's LT codes, and Shokrollahi's Raptor codes, involve coding at the source, while network coding involves coding within the network. Recently Maneva and Shokrollahi found a connection between the analysis of digital fountain codes, and fluid and diffusion limit methods, such as in the work of Darling and Norris. A simplified description of the connection is presented, including fluid and diffusion approximations, with implications for code design.

2 - Fluid Limit Approximations to Combinatorial Algorithms
R. W. R. Darling, Applied Research Mathematician, National Security Agency, P. O. Box 535, Annapolis Junction, MD, 20701, United States, rwdarli@nsa.gov

The coding theory examples presented in Bruce Hajek's Markov Lecture will be used to illuminate the possibilities for building a parsimonious and accurate differential equations model, in cases where a simple combinatorial algorithm is applied to a large (usually sparse) data set. Suitable references and study materials will be suggested for those wishing to try fluid limits.

3 - On Applications of Digital Fountain Codes
Michael Mitzenmacher, Harvard, 33 Oxford Street, Cambridge, MA, 02138, United States, michaelm@eecs.harvard.edu

Fountain codes were originally designed for multicast applications, but have since been proposed for several other related applications. We review major potential applications of fountain codes, focusing on the potential benefits coding gives over solutions without coding. We also discuss the impediments to fountain code adoption, and consider the tradeoffs between fountain codes and network coding.

■ MB42

Supply Chain Scheduling & Related Problems

Cluster: Scheduling
Invited Session

Chair: Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu

1 - Production and Transportation Integration for a Make-to-Order Manufacturing Company
Xuying Zhao, PhD Student, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, xuying.zhao@student.utdallas.edu, Kathryn Stecke

To reduce shipping costs paid to a third party logistics company, a make-to-order manufacturer can take advantage of slow shipping modes through proper scheduling. We analyze such an integration problem for different distribution scenarios. When partial delivery is allowed, a non-preemptive EDD schedule is proved to be optimal. When partial delivery is not allowed, efficient and effective heuristic algorithms with numerical experiments are given following an NP-hard complexity analysis.

2 - Responding to Excess Demand in a Two Stage Supply Chain
Zhixin Liu, Ohio State University, Department of Management Sciences, 2100 Neil Avenue, Columbus, OH, 43210, United States, liu.573@osu.edu, Nicholas G. Hall

Consider a multiple product supply chain with one manufacturer and several distributors, where capacity constraints prevent the manufacturer from meeting all its orders. We model the manufacturer's problem as a combined scheduling and negotiation problem. We model the distributors' problem as a cooperative game, where the distributors make revised decisions about order quantities. We discuss the value of information sharing and cooperation in the supply chain, and provide managerial insights.

3 - Discrete-Time Economic Lot Scheduling Problem on Multiple, Non-Identical Machines
Ramesh Bollapragada, Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, rameshb@sfsu.edu, Federico DellaCroce, Marco Ghirardi

We develop a general discrete time dynamic demand model to solve the real time resource allocation, lot-sizing, and scheduling in a multimachine environment. We consider the problem of apportioning item production to distinct manufacturing lines with different costs and capabilities. We will model the problem quantitatively, develop and test several alternative solution methods, and build managerial insights on problem parameters from computational experimentation.

4 - Integrated Production-Distribution Scheduling: Some Open Problems
Zhi-Long Chen, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, ZChen@rhsmith.umd.edu

In the last couple of years, we have seen a growing interest in integrated production-distribution scheduling models. The computational complexity of many models have been clarified in the recent literature. In this talk, we will present a number of problems with unknown complexity.

■ MB43

AHP/ANP Group Consensus and Multi-Decisions Decision Making

Cluster: Analytic Hierarchy Process
Invited Session

Chair: Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu

1 - Priorities for Multiple Decisions Multi-Decisions Decision Making
Thomas Saaty, University Professor, University of Pittsburgh, 322 Mervis Hall, Pittsburgh, PA, 15260, United States, saaty@katz.pitt.edu

High level governmental and corporate decisions require choosing, ordering and allocating resources to many decisions in a multi-decisions decision making process. Actions are improvised to deal with crises. Much politics and committee work determine the outcome. Measurement of intangible basic criteria provides a scientific basis for prioritization and resource allocation of multiple decisions.

2 - The AHP, a Multicriteria Decision Making Methodology for Shiftwork Prioritization
Claudio Garuti, General Manager, FULCRUM Ingenieria, Luis Thayer Ojeda 0180 Of.1004, Santiago, RM, Chile, claudiogaruti@fulcrum.cl

The objective of this paper is to show a very powerful methodology for decision-making, specifically in the Shiftwork area, where the huge numbers of variables and knowledge to be structured, integrated and synthesized, forces the need for a system analysis process, capable of dealing with such complexity.

3 - Dispersion of Group Judgments
Luis Vargas, Professor, University of Pittsburgh, 314 Mervis Hall, Pittsburgh, PA, 15260, United States, lgvargas@pitt.edu, Thomas Saaty

To achieve a decision with which the group is satisfied, the group members must accept the judgments, and ultimately the priorities. This requires that (a) The judgments be homogeneous, and (b) The priorities of the individual group members be compatible with the group priorities. In this paper we study the homogeneity of group preference for a single paired comparison (monogeneity) and the impact it has on group priorities.

■ MB44

Supply Chain Security and Vulnerability

Sponsor: Junior Faculty Interest Group (JFIG)
Sponsored Session

Chair: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au

1 - Supply and Demand Uncertainty in Multi-Echelon Supply Chains
Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu, Zuo-Jun Max Shen

We discuss the effects of both demand and supply uncertainty in multi-echelon supply chains. We demonstrate that, in many cases, the optimal strategy for coping with supply uncertainty is exactly opposite to the conventional wisdom from the OM literature on coping with demand uncertainty. Using a combination of analytical and simulation studies, we illustrate this contrast in various settings, including risk pooling, inventory placement, supplier diversification, and others.

2 - Strategies for Managing Supply Uncertainty
Brian Tomlin, Assistant Professor, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

This talk will focus on the management of supply uncertainty, with a particular emphasis on supply disruptions. We will discuss such tactics as inventory, sourcing, pricing, and insurance. Findings from a number of papers will be presented along with potential directions for future research.

3 - Perspectives on Research in Supply Chain Security and Resiliency
Alan Erera, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, alan.erera@isye.gatech.edu

This talk will provide some perspectives on the role of operations research and management science in the area of supply chain security and resiliency. Using examples, the presentation will attempt to identify interesting problem domains for study, and where enhancements are needed in exisiting methodological solution approaches. Some ideas generated from an NSF workshop on this topic will also be discussed.

■ MB45

Tutorial: Robust and Data-Driven Optimization: Modern Decision-Making Under Uncertainty

Cluster: Tutorials
Invited Session

1 - Robust and Data-Driven Optimization: Modern Decision-Making Under Uncertainty
Dimitris Bertsimas, Boeing Professor of Operations Research, Massachusetts Institute of Technology, Sloan School of Management Room E53-363, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, dbertsim@mit.edu, Aurelie Thiele

We present a mathematical approach to decision-making under uncertainty incorporating limited information on the sources of randomness and decision-makers' risk attitudes. We review recent developments in robust and data-driven optimization, where random variables represent uncertain parameters in a convex uncertainty set and the decision-maker protects the system against their worst-case values. We also address construction of sets using historical data and connections with coherent risk measures.

■ MB46

Incentive Issues in Supplier Management

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Serguei Netessine, Assistant Professor, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, netessine@wharton.upenn.edu

1 - Long Term Contracts Under the Threat of Supplier Failure
Robert Swinney, Doctoral Student, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, rswinney@wharton.upenn.edu, Serguei Netessine

We address the issue of how to contract with suppliers facing the threat of failure when the probability of failure is directly influenced by contract terms (e.g., price and length of contract). We model this dynamic through a two period contracting game with two suppliers, a single buyer, and uncertain production costs. We determine when it is optimal to commit to a long-term relationship, and how this decision is affected by suppliers under the threat of failure.

2 - Contracting for Supply Flexibility Under Asymmetric Information
Tianjun Feng, University of California-Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States, fengt@uci.edu, Fuqiang Zhang

This paper studies a buyer's procurement problem when there are either one or multiple potential suppliers with private cost information. The market demand is uncertain and the supplier needs to make capacity decisions before demand is realized. We derive the optimal procurement mechanism for the buyer and also identify simple mechanisms that perform well.

3 - Resilient Supply Chains: Diversification vs. Dedicated Supplier Procurement Strategies
Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Avenue, IOE 2783, Ann Arbor, MI, 48105, United States, babich@umich.edu, Luz Caudillo

Using a dynamic, stochastic model which combines procurement and financial subsidies decisions, this paper examines the tradeoffs of a manufacturing firm between two strategies for managing supply default risks: diversification of the supplier base vs. financial subsidies to a few dedicated suppliers. We describe properties of the optimal policies and derive conditions under which the firm prefers capital concentration to diversification.

4 - Inventory or Reliability? Contracting Strategies in After-Sales Service Supply Chains
Sang-Hyun Kim, Doctoral Student, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, shkim@wharton.upenn.edu, Morris Cohen, Serguei Netessine

In a performance based contracting environment of after-sales service supply chains, the service provider who is rewarded for performance enhancement (e.g. increase in spare parts availability) faces two choices: invest in parts inventory or invest in reliability improvement. We identify a tradeoff between these two choices, and analyze commonly used contracts and their impacts on supply chain efficiency.

■ MB47

Supply Chain Optimization I

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: H. Edwin Romeijn, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, romeijn@ise.ufl.edu

1 - Logistics Contracts in Manufacturing
Osman Engin Alper, University of California, IEOR, Berkeley, CA, 94530, United States, engin@ieor.berkeley.edu, Hyun-Soo Ahn, Phil Kaminsky

The value of integrating production and logistics operations is increasingly appreciated by managers, while at the same time logistics outsourcing is becoming a more prevalent across many industries. Motivated by this observation, we develop models of logistics contracts in manufacturing systems, characterize optimal policies, provide computational results, and summarize practical implications.

2 - Inventory Pooling to Satisfy Multiple Service Levels
Aydin Alptekinoglu, Assistant Professor, Department of Decision & Information Sciences, Warrington College of Business, University of Florida, Gainesville, FL, 32611, United States, aalp@ufl.edu, Anand Paul

What are the optimal ordering and allocation policies that minimize the inventory level when a pool of inventory is used to satisfy individual type-one service levels for multiple customers? In seeking an answer to this research question, we find that pooling helps even when the demands are perfectly positively correlated, and that the aggregate service level (the probability that the pooled inventory exceeds the total demand) is generally less than the minimum of the individual service levels.

3 - The Economic Lot-Sizing Problem with a Remanufacturing Option

Wilco van den Heuvel, PhD Student, Econometric Institute, Erasmus School of Economics, Erasmus University, PO Box 1738, 3000 DR, Rotterdam, Netherlands, wvandenheuvel@few.eur.nl

We present an extension of the classical economic lot-sizing (ELS) model. In the ELS model there is a known demand for a fixed number of periods which has to be satisfied by manufacturing items at minimal cost. In our extended model, besides manufacturing new items, demand can be satisfied by remanufacturing returned items. Costs include setup cost, unit (re)manufacturing cost and holding cost. We derive polynomial time algorithms and complexity results for different model assumptions.

4 - Lot-Sizing Problems Integrating Production, Transportation, Inventory, and Pricing Decisions

Mehmet Onal, PhD Student, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States, monal@ufl.edu, H. Edwin Romeijn

Through pricing decisions the demand levels a firm should satisfy can be controlled and higher profits can be obtained. We consider a lot-sizing problem where production, inventory, transportation, and pricing decisions are integrated to maximize profits. We assume general concave revenue functions and fixed charge production cost functions. We develop polynomial-time solution approaches to solve these problems under a number of different inventory holding and transportation cost structures.

■ MB48

Managing Operations in Health Care Industry

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, 404 Uris Hall, New York, NY, 10027, United States, svs30@columbia.edu

1 - Optimization of Surgical Suite Scheduling Decisions Under Uncertainty

Hari Balasubramanian, Research Associate, Mayo Clinic, 200 First St. SW, Rochester, MN, United States, Hari.Balasubramanian@asu.edu, Ahmed Rahman, Brian Denton

Appointment scheduling systems are used by many health care providers to balance the utilization of resources with patient waiting time. In this talk we describe a stochastic optimization model for a commonly encountered outpatient surgery scheduling problem in specialty care clinics. We present insights about the model structure, special cases, and numerical results based on real data that illustrates the potential impact of our model in a clinical environment.

2 - Multiplexing Patients in Chronic Illness Facilities: Optimal Capacity Overbooking

Donald Lee, PhD Student, Management Sci & Eng, Stanford University, Stanford, CA, 94305, United States, dkklee@stanford.edu, Stefanos Zenios

Individuals suffering from chronic illnesses require periodic treatment. For example, those afflicted with kidney disease require dialysis thrice weekly. Complications from treatment also cause frequent patient hospitalizations, a significant source of revenue loss. Modeling the system with a migration network, we propose that clinics should overbook capacity to maintain optimal utilization while pooling spare resources with those of nearby facilities to hedge the risk of overflow.

3 - Appointment Management in Presence of Patient & Provider Preferences

Diwakar Gupta, Professor, Department of Mechanical Engineering, University of Minnesotta, Twin Cities, MN, United States, guptad@me.umn.edu

Patients (providers) make different choices when booking (controlling access to) appointment slots. Some patients visit only their designated doctor, whereas others visit any doctor who is available at a convenient time. Some providers routinely double book and work overtime to accommodate urgent demand, whereas others work fixed hours. This talk will summarize author's efforts to model the resulting booking control problems in several different health care settings.

4 - How Advanced Should Advanced Access Be?

Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, 404 Uris Hall, New York, NY, 10027, United States, svs30@columbia.edu, Linda Green

Advanced access has been advocated to decrease appointment delays and increase utilization in healthcare facilities. The goal is to be able to offer a same-day appointment to the vast majority of patients. In this talk, we consider the general appointment management problem for a facility that permits patients to get an appointment within a fixed number of days, T, with a high probability and establish the optimal values of T under various conditions.

■ MB49

Optimization in Closed-Loop Supply Chains

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

Chair: Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

Co-Chair: Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu

1 - To Repair or to Replace? Optimal Repair Durations for Short Lifecycle Products

Kristin Sahyouni, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208, United States, kristin@iems.northwestern.edu, Canan Savaskan, Mark Daskin

We consider a repair operation in which defective warranty items arrive to an OEM over a known period and must be repaired using spare parts procured from a third party supplier or replaced with a comparable next generation alternative. We show how facility costs, inventory holding costs, replacement costs, and variable repair costs affect a firm's optimal decision. Extensions consider arrival rate uncertainty, supplier contracting options, and the value of information over the lifecycle.

2 - Closed Loop Supply Chain Network Design Problem with Multi-Product Remanufacturing

Gopalakrishnan Easwaran, PhD Student, Department of Industrial and Systems Engineering, Texas A&M University, College Station, TX, 77843, United States, egopalakrishnan@tamu.edu, Halit Uster, Elif Akcali, Sila Cetinkaya

We consider a remanufacturing network design problem under the closed loop supply chain setting. We provide mathematical formulation for optimization of strategic decisions involving facility locations and coordinated product flows in the forward and reverse channels of this network. We develop efficient solution procedures based on decomposition approaches. We also present computational results on the performance of the solution methods for test problem instances.

3 - Reverse Production Systems: Centralized vs. Decentralized Models

Jane Ammons, Associate Dean of Engineering for Faculty Affairs and Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, jane.ammons@isye.gatech.edu, Jane Ammons, Matthew Realff

A reverse production system is a network of transportation logistics and processing functions to collect, consolidate, refurbish, and demanufacture end-of-life products. We examine centralized and decentralized models of decision-making for material flows and associated transaction prices for these networks. The centralized approach may overestimate of system material flows and profit if the system planner utilizes a centralized view to predict behaviors of independent entities in the system.

■ MB50

Wireless Networks

Sponsor: Telecommunications
Sponsored Session

Chair: Eli Olinick, Associate Professor, Southern Methodist University, PO Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu

1 - Reliable W-CDMA Network Design with Sectorization

Eli Olinick, Associate Professor, Southern Methodist University, PO Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu, Jeffery Kennington, Qibin Cai, Joakim Kalvenes

We present a comprehensive planning model for W-CDMA networks. Our model involves the simultaneous selection of base station location and antenna type combinations, MTSO and PSTN gateway locations, construction of the backbone network, and assignment of service of subscriber locations to antenna sectors while satisfying reliability,capacity, and QoS requirements. An extensive empirical analysis is performed with multiple strategies to obtain good feasible solutions and tight upper bounds.

2 - Tower Location for CDMA Networks Under Demand Uncertainty

Jay Rosenberger, Assistant Professor, The University of Texas at Arlington, PO Box 19017, Arlington, TX, 76019, United States, jrosenbe@uta.edu, Eli Olinick

Designing Code division multiple access networks includes determining an optimal location of radio tower. We describe a deterministic model for tower location and a stochastic model to optimize revenue given a set of constructed towers. We integrate these models in a stochastic integer programming problem

that optimizes the location of towers under demand uncertainty. We develop algorithms and heuristics using Benders' reformulation, and we provide computational results.

3 - A Multiple-Network Choice System for Mobile Telephones
David Shallcross, Senior Research Scientist, Telcordia Technologies, 1 Telcordia Drive, RRC-1C305, Piscataway, NJ, 08854, United States, davids@research.telcordia.com

Mobile wireless devices such as cell phones may now have the ability to communicate to a central network via several different access networks, such as WiFi hot spots and GSM cells. We investigate a system whereby the network can balance the load among different access methods, for example to reduce overall blocking.

4 - Distributed Control of Multihop Wireless Networks for Full Utilization
Atilla Eryilmaz, Post-Doctoral Associate, LIDS, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D566, Cambridge, MA, 02139, United States, eryilmaz@mit.edu, Eytan Modiano, Asuman Ozdaglar

We develop a generic randomized Routing-Scheduling-Flow Control Algorithm that can be implemented for a large class of interference models. We prove that the algorithm achieves 100% throughput efficiency and fairness across flows. For a two-hop interference model, we develop specific distributed algorithms with polynomial complexity that fits into the proposed generic framework. This is the first distributed algorithm in this context that guarantees full utilization of the resources.

■ MB51

Designing and Managing Product and Service Variety

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Jay Swaminathan, Professor, University of North Carolina, Chapel Hill, Kenan Flagler Business School, Chapel Hill, NC, 27599, United States, msj@unc.edu

1 - Seeking Closure: Competition in Complementary Markets
H. Sebastian Heese, Assistant Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, hheese@indiana.edu, Kyle Cattani

Firms that compete in markets for complementary products must consider the interdependence across markets as well as the competition within markets. When does a strategy based on preclusion make sense, and when would firms be better off by accepting a common standard? We address these questions employing standard game theoretic analysis to a simple spatial model that captures aspects of both inter-market externalities and intra-market competition.

2 - Inventory Substitution Model with Competition
Raj Rajagopalan, Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, srajagop@marshall.usc.edu, Mahesh Nagarajan

We look at a duopoly model where two newsvendors selling substitutable products with negatively correlated demand compete by setting inventory levels. We consider both static and dynamic versions of this game and show some interesting properties of the equilibrium inventory policy. In particular, we specify conditions when players may ignore their competitor's inventory levels and potential substitution demand.

3 - Capacity Allocation Under Vertical Differentiation
H. Muge Yayla, PhD Student, University of North Carolina at Chapel Hill, CB#3490 McColl Building, UNC-CH, Chapel Hill, NC, 27599-3490, United States, yaylah@kenan-flagler.unc.edu, Jay Swaminathan, Ali Parlakturk

In this paper, we study a firm that has to allocate its fixed capacity between two offerings that are vertically differentiated. The customer base is sensitive to both quality and prices. We find the optimal capacity allocation to the two classes under alternative cost, quality and capacity usage assumptions under monopoly and duopoly.

4 - Empirical Evidence on the Impact of Component Standardization on Product Quality
Kamalini Ramdas, Associate Professor, Darden School, 189 FOB, 100 Darden Boulevard, Charlottesville, VA, 22902, United States, Ramdask@Darden.virginia.edu, Taylor Randall

We report on an empirical study that examines the impact of component standardization on product reliability, in the context of automotive braking systems. We find that depending on how it is done, standardization can either help or hurt reliability. We also discuss how standardization can impact quality in other industries.

■ MB52

Revenue Management Theory

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Garrett van Ryzin, Columbia University, Uris Hall, New York NY 10027, United States, giv1@columbia.edu

1 - Choice Based Demand Forecasting in Airline Revenue Management Environment
B. Venkateshwar Rao, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, beju.rao@sabre.com

Bookings data observed in a revenue management environment is not the true underlying demand. Passengers often end up booking on flights that are not their first preference, due to capacity and/or fare class availability restrictions. Spilled demand from a closed fare classes is either sold up to a higher fare class, or recaptured on other flights. We present a customer choice model based framework for obtaining the first choice, untruncated demands for various services at different fare values. The forecasting methodology is applicable in restriction free pricing as well as in traditional environments. We provide measures to evaluate forecast accuracy. We discuss benefits associated with a choice based forecasting as well as challenges associated with the implementation.

2 - On Bid Price Controls for Network Revenue Management
Baris Ata, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Evanston, IL, 60208, United States, b-ata@kellogg.northwestern.edu, Mustafa Akan

We consider a network model of revenue management and propose a novel class of bid-price control mechanisms. Under mild assumptions, we show that the proposed bid-price control mechanism is optimal, and that the optimal bid prices form a martingale. Optimality and martingale property of bid-prices are robust to information distortions. In particular, we show that under semi-continuous information structures, there exist near-optimal predictable bid-price policies having the martingale property.

3 - Stock-Outs and Consumer Search Behavior for Products with Quality Uncertainty
Laurens Debo, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Garrett van Ryzin

A stock-out contains information for a consumer who is uncertain about the quality of the product. It is an indication that the product is likely of high quality as many other consumers have bought the product. This may motivate the consumer to search for the product in other stores. We discuss how the equilibrium consumer search and purchasing behavior depends on the costs of information gathering for the consumer and the store replenishment rates.

4 - Stochastic Programming and the Option of Doing it Differently
Stein W. Wallace, Professor, Molde University College, PO Box 2110, NO-6402, Molde, Norway, Stein.W.Wallace@hiMolde.no

Option theory and stochastic programming are tightly linked. Most options can be analyzed in both frameworks, and the two approaches support each other in many slightly more complex situations. But this similarity hides some central differences in perspective: Option theory can be applied only to options already identified, while stochastic programming is able to help us find options in contexts where it is not at all clear what they are, and where finding might be more important than valuing.

5 - Product Positioning without Market Information
Serkan Eren, PhD Student, Columbia Business School, 435 West 119th Stree Apt. 3F, New York, NY, 10027, United States, se2027@columbia.edu, Garrett van Ryzin, Costis Maglaras

Traditional pricing and product positioning models assume that firms have full information about the market demand and consumer preferences. In practice, however, one rarely has such accurate information, which raises the important question of how to make decisions under limited market information. We study five classical settings where the firm has limited information. Several results correspond to common policies observed in practice. This talk will concentrate on product positioning models.

■ MB53

Inventory Management: Role of Information

Contributed Session

Chair: Ron Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

1 - Optimal Production and Rationing Decisions in a Supply Chain with Information Sharing

Boray Huang, Assistant Professor, University of Mississippi, Holman 349, PO Box 1848, University, MS, 38677, United States, bhuang@olemiss.edu, Seyed Iravani

We consider a two-level capacitated supply chain with a upstream supplier and two non-identical downstream retailers. The retailers are of different importance and share their inventory information with the supplier. The supplier has to decide: How much inventory to keep and how to allocate the on-hand inventory to arriving orders. We characterize the optimal production and stock rationing policies. We also study how retailers' order sizes affect the benefit of stock rationing.

2 - Optimal Ordering and Learning Policies for a Fashion Good Retailer

Tong Wang, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, tong.wang@insead.edu, Nils Rudi

A retailer sells a single fashion good to end consumers. The selling season is one single period, and she acts as a newsboy. Before the season there are T periods that she can replenish inventory, acquire signals, and learn the demand. She need tradeoff between low ordering cost in early periods and low demand uncertainty in late periods. We show the optimal ordering policy is base-stock policy, and the base-stock level is a linear function of signal realizations.

3 - Optimal Ordering Policies for Stochastic Inventory Problems with Observed Information Delays

Qi Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B5000, Austin, TX, 78705, United States, annabelle.feng@mccombs.utexas.edu, Alain Bensoussan, Metin Cakanyildirim, Suresh Sethi

We consider a newsvendor who plans his ordering strategy based on cost-efficiency and long-term customer satisfaction. A two-stage newsvendor model is formulated to study this problem. The vendor commits his long-term standing order at the first stage, and makes short-term adjustment (either upward or downward) at the second stage. We characterize the cost-optimal ordering strategy that meets a long-term service target. We also discuss various managerial insights and policy behaviors.

4 - Optimal Inventory Policies of a Censored Newsvendor

Arnab Bisi, Assistant Professor of Management, Purdue University, Krannert School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, abisi@mgmt.purdue.edu

We address the problem of computing the optimal policies in a periodic-review inventory model with unobservable lost sales. Demand distribution is unknown and needs to be updated based on sales data. We develop a method for computing the optimal ordering policies for this censored newsvendor problem.

5 - The Bayesian Newsboy Problem with Seasonal Demand

Ron Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 028, Reno, NV, 89557, United States, rtl@unr.edu

We consider a finite-horizon newsboy problem where the mean and standard deviation are unknown, using Bayesian updating to generate better estimates of the demand distribution. We consider the case where expected demands each period are not constant. This allows us to consider the finite-length, seasonal demand pattern experienced by many retail products. We extend the solution to the case where the seasonal indexes are not known with certainty, a priori.

■ MB54

Design and Operation of Distribution Channels

Cluster: Operations and Marketing for Emerging Markets

Invited Session

Chair: Stephen Gilbert, Associate Professor, The University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Steve.Gilbert@mccombs.utexas.edu

1 - The Value of Losing Control: Competition in Markets for Complements

Hubert Pun, PhD Candidate, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States, hpun@indiana.edu, H. Sebastian Heese

Manufacturers that sell complementary products can benefit from considering the resulting interdependencies. While using independent retailers makes it difficult to internalize this positive externality, it leads to double marginalization which mitigates within-market competition. We use standard game theoretic analysis to determine the optimal distribution channel structure (through independent retailers or integrated) for competing manufacturers that participate in markets for complements.

2 - Comparative Analysis of Distribution Channels for Innovative Durable Goods

Genaro Gutierrez, Associate Professor, The University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Genaro.Gutierrez@McCombs.utexas.edu, Xiuli(Sophia) He

We compare the desirability of direct, indirect, and hybrid channel structures for the distribution of a durable good for which consumer demand follows a price sensitive Bass-type diffusion process. We examine the desirability each of these distribution channel structures as a function of the relative brand/retailer influence on the consumer, distribution costs, inventory costs, and after sale profit opportunities such as sale of service contracts and sale of complementary products.

3 - Incentives for Information Flows in a Vertical Contract

Manu Goyal, Assistant Professor, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States, mgoyal@rhsmith.umd.edu, Krishnan Anand

In practical settings, material and information flows are intertwined, calling for their joint optimization to maximize channel efficiency. We analyze one such setting where material and information flows intersect through the mechanism of information leakage (non-consensual sharing of information), and study its effect on the joint determination of material flows (the order quantities) and information flows (acquisition and dissemination of demand information) in a vertical contract.

4 - Implications of Product Lifecycle and Channel Structure Upon Optimal Investment in Durability

Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, Cox School of Business, Dallas, TX, 75275, United States, sbhaskar@cox.smu.edu, Stephen Gilbert

We investigate how the use of intermediaries in the channel of distribution affects a manufacturer's investment in the durability of a product. Depending upon the product and technology lifecycles, we show that a manufacturer can have an incentive to invest more in durability when he sells through intermediaries than when he sells directly. We also explore how this incentive to invest in durability is affected by the intensity of competition among the dealers.

■ MB55

Modeling Issues in DEA

Cluster: Data Envelopment Analysis

Invited Session

Chair: John Ruggiero, J. Robert Berry Endowed Faculty Fellow, University of Dayton, 517 Miriam Hall, Department of Economics and Finance, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

1 - Orientation Issues in Data Envelopment Analysis

Andy Johnson, Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States, ajohnson@isye.gatech.edu

There have been at least four different orientations for measuring efficiency suggested in the data envelopment analysis literature. This talk will address the issue of selecting an orientation in the short-run analysis and suggest methods for estimating the parameters of the directional distance function.

2 - Evaluating U.S. State Police Performance Using Data Envelopment Analysis

Michael Gorman, Associate Professor, University of Dayton, Department of MIS, OM and DSC, 300 College Park, Dayton, OH, 45419-2130, United States, michael.gorman@udayton.edu, John Ruggiero

We evaluate the efficiency of state police services in the US using a multiple-stage data envelopment analysis model. Technical and scale efficiency are calculated for the 49 continental states. We allow for environmental factors of production and control for these nondiscretionary inputs. Our results indicate that most states are technically efficient, but nearly half are operating at less than optimal scale size.

3 - Technical Efficiency Estimation with Multiple Inputs and Multiple Outputs Using Regression Analysis
John Ruggiero, J. Robert Berry Endowed Faculty Fellow, University of Dayton, 517 Miriam Hall, Department of Economics and Finance, Dayton, OH, 45469, United States, John.Ruggiero@notes.udayton.edu

Regression and linear programming are two popular techniques for estimating efficiency. A purported disadvantage of the regression based models is the inability to allow multiple outputs without additional data on input prices. In this paper, a multiple output regression model is developed. Notably, technical efficiency can be estimated using Corrected OLS in multiple-input, multiple-output environments without input price data.

Interactive Session
Monday, 12:30pm-1:30pm

Ballroom Foyer

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

1 - Computer Implementation of EMS Deployment Models
Rashid Al-Jalahema, Department of Systems and Industrial Engineering, 111 Engineering, Tucson, AZ, 85721, United States, rashid@email.arizona.edu, Jeff Goldberg

We will demonstrate computer models for evaluating system and grid coverage under static and dynamic deployment for EMS systems. The model interface allows the user to design systems, solve a model to estimate performance, and then graphically display results using a geographic information system. Performance calculators that can be deployed on a dispatcher's desktop to evaluate re-deploy decisions will also be presented.

2 - A Multi-Agent Complex Systems Modelling Framework for Improving Supply Chain Resilience
Partha Datta, Doctoral Scholar, Cranfield University, Wharley End, Cranfield, MK43 0AL, United Kingdom, partha.datta.phd.03@cranfield.ac.uk, Peter Allen, Martin Christopher

Effective supply chain management in dynamic environment calls for building resilient supply chains which can maintain good control over performance variability in the face of disturbances. This paper conceptualizes supply chains as complex systems with multiple autonomous agents and suggests methods of improving resilience, in the context of a real life paper tissue manufacturing company.

3 - Bayesian Sequential Change Diagnosis: Detection and Identification of a Change in a Random Sequence
Christian Goulding, Princeton University, ORFE, E-Quad, Princeton, NJ, 08544, United States, cgouldin@Princeton.EDU, Savas Dayanik, H. Vincent Poor

Sequential change diagnosis is the joint problem of detection and identification of a sudden and unobservable change in the pdf of a sequence of i.i.d. random variables to one of finitely many alternative pdf's. The objective is quick detection of the change and accurate inference of the ensuing pdf. Following a Bayesian approach, a new sequential decision strategy for this problem is revealed and is proven optimal. Geometrical properties of this strategy are demonstrated via numerical examples.

4 - Production Planning With Start-Time Dependent Variable Costs
James Luedtke, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, jluedtke@isye.gatech.edu, George Nemhauser

We present a multi-period planning model in which the variable costs are determined by the technology available when activities are begun. This leads to a natural mixed integer bilinear programming formulation, which we reformulate in different ways to obtain linear models. We study the associated polyhedra and present computational results.

5 - Process to Expedite Admission Decisions
Luciano Fleischfresser, OSSM - ATC, 1201 West Willow Road, Enid, United States, l_fle@alumni.ou.edu

A scoring system to rank prospective applicants is being developed. Coined PEAD (Process to Expedite Admission Decisions), the procedure evaluates three aspects for each candidate: (I) application forms; (II) personal interviews; and (III) multiple-choice test results. PEAD is used with a group sample and the results discussed.

6 - Optimal Job Releasing for a Benchmark Reentrant Line
Jose Ramirez-Hernandez, Ph.D Student, University of Cincinnati, 707 MLK Dr. W, Apt. 506E, Cincinnati, Oh, 45220, United States, ramirejs@ececs.uc.edu, Dr. Emmanuel Fernandez

We study the problem of optimal job releasing for a benchmark reentrant line with exponential arrival and processing times. System and optimization models are presented under the framework of an infinite horizon discounted cost criterion, and optimality conditions and optimal policies are derived. The application of approximate dynamic programming methods is also discussed.

7 - Optimal Planning Quantities for Product Transition
Hongmin Li, Ph.D. student, MIT Sloan School of Management, E53-384, 30 Wadsworth Street, Cambridge, MA, 02142, United States, hmli@mit.edu

We study the inventory planning decisions for product upgrades when there is no replenishment opportunity during the transition period and we allow product substitutions. The optimal substitution decision is a time-varying threshold policy. We can then find the optimal planning quantities for a stochastic transition date and non-stationary demand. Further, we determine the optimal transition delay given the inventory of old product.

8 - Design and Analysis of Large-Scale Networks
Hari Prasad Thadakamalla, Student, The Pennsylvania State University, 310 Leonhard Bldg., University Park, PA, 16802, United States, hpt102@psu.edu, Soundar R. T. Kumara, Reka Albert

During the last few years we have witnessed the emergence of many networks with large number of nodes. Few examples include the Internet, the World Wide Web and Military logistics network. The sheer size of these networks poses unique challenges in their design and analysis. We discuss an approach based on statistical physics (complex networks theory) for design and optimization in such large networks. In specific, we study the problem of robustness and routing on these networks.

9 - Screening with Externalities
Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu

We consider a general screening model with payoff externalities and type-dependent constraints. The principal can design contract instruments of arbitrary dimension to influence each agent's valuation of the proposed transaction, which also depends on the anticipated choice of other agents. We characterize the class of all implementable menus and provide necessary optimality conditions for the general multiattribute fulfilled-expectations screening problem.

10 - Vessel Traffic Modeling and Risk Analysis for the Istanbul Strait
Ozgecan Uluscu, Ph.D. Student, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States, ozgecanu@yahoo.com, Tayfur Altiok

We have developed a detailed simulation model of the vessel traffic including various classes of dangerous cargo in the Istanbul Strait. The purpose is to analyze various scheduling policies to allow vessels to enter the Strait with the purpose of minimizing various risk measures and vessel waiting times.

11 - An Investigation of the Performance Effects of Internal Capabilities and Supplier Linkage
Xiaosong Peng, Ph.D student, University of Minnesota, 321 19th Ave S, Room 3-150, Minneapolis, MN, 55455, United States, dpeng@csom.umn.edu, Rachna Shah, Roger Schroeder

This research investigates the individual and joint effects of two intra-firm capabilities namely improvement and innovation and two types of supplier linkage namely supplier quality linkage and supplier design linkage. It draws on the relational view (Dyer and Singh, 1998) to explain the joint effects of internal capabilities and supplier linkage on performance. Regression was used to test the proposed model.

12 - An Integrated Procedure for Supply Chain Network Designs with Scale Economies
Michael Bucci, PhD student, Industrial Eng., North Carolina State University, 3300 Drexel Hill Court, Apex, NC, 27539, United States, mbucci@nc.rr.com, Michael Kay, Donald Warsing

We present a meta-heuristic approach for supply chain network design that builds off of the alternate location-allocation (ALA) procedure. Unlike more traditional mixed-integer programming-based formulations, our method permits nonlinear costs - allowing a full solution of network design problems that can incorporate production, transportation, and inventory pooling economies of scale. We compare the speed and quality of our near-optimal solutions with other methods.

13 - The Impact of Process Flexibility on First-Mover Advantages
Bin Shao, University of Illinois at Urbana Champaign, 1206 S Six St, Champaign, 61820, United States, binshao@uiuc.edu, Dilip Chhajed

We explores the impact of several operational issues such as, change-over flexibility, experience curve, and production cost on first-mover advantages and product-design decisions in duopoly setting with customers making repeat purchases. We decide each firm's design policies and provide the criteria under which the first entrant enjoys the first-mover advantages. We also find that when the first entrant has more flexibility, the competitor may benefit more.

14 - Observation, Theory, and Simulation of Integrated Concurrent Engineering
John Chachere, Ph.D. Student, Stanford University, 1311 Ulloa St., San Francisco, CA, 94116, United States, chachere@stanford.edu

We observed a team that designs space missions at a greatly accelerated pace using methods that resemble mission operations. Existing organizational theory and models do support their performance claims, but do not explain how and when their method is effective. We assert that aligning ten factors shortens information response latency and dramatically compresses project schedule. We propose response latency as a unifying theoretical principle to describe, evaluate and manage accelerated engineering collaboration.

15 - A Visual Tour of Music
Arpi Mardirossian, University of Southern California, Dept. Industrial & Systems Engineering, Los Angeles, CA, 90089, United States, mardiros@usc.edu, Elaine Chew

We present computational ways to accurately assess, quantify, and visualize the degree of similarity between two samples of music. The music properties we examine to determine similarity are key frequencies and average time in key. Users may select two pieces from a database for similarity assessment.

16 - When Can Manipulations Be Avoided in Two-Sided Matching Markets? Maximal Domain Results
Fuhito Kojima, PhD Candidate, Department of Economics, Harvard University, 1875 Cambridge Street, Cambridge, MA, 02138, United States, kojima@fas.harvard.edu

We study conditions for the student-optimal stable mechanism (SOSM) and the college-optimal stable mechanism (COSM) to be immune to manipulations via capacities and pre-arranged matches. For SOSM, the classes of strongly monotone preferences in populations and weakly maximin preferences are the maximal domains of college preferences guaranteeing immunity to these manipulations, respectively. In contrast, COSM is susceptible to both manipulations whenever colleges have multiple positions.

17 - An OR Approach to Business Calculus
Audrey Borchardt, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, afborchardt@comcast.net, Bruce Pollack-Johnson

We describe a federally-funded re-engineering of a business calculus course organized around the process of solving real-world problems using math models, calculus, and technology. Students learn OR-style post-optimality analysis, including verification, validation, and sensitivity analysis, in doing student-generated projects on topics from their own lives. Excel templates have been developed for 3-D graphing, finding logistic models, and testing solutions for local and global optimality.

18 - RAMP for the Linear Ordering Problem
Dorabela Gamboa, Assistant Professor, Polytechnic of Porto, ESTGF, Apt. 205, Felgueiras, 4610-156, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego, Fred Glover

A RAMP algorithm for the Linear Ordering Problem is proposed. The algorithm combines cross-parametric relaxation with scatter search to create a primal-dual RAMP approach. Computational tests disclose 58 new best solutions found by the RAMP algorithm for the 175 instances in the testbed for which the optimal solution is unknown.

19 - System Contents and Delay in Discrete-time Queues — Performance Assessment of Communication System
Peixia Gao, Dr., Ghent University, St-Pietersnieuwstraat 41, Gent, 9000, Belgium, pg@telin.ugent.be, Sabine Wittevrongel, Herwig Bruneel, Koenraad Laevens

The analysis of system contents and packet delay of discrete-time queueing systems is very important for the performance evaluation of communication systems. We present some methodologies for the analysis of those two quantities. It has been shown that our methodologies are extremely suitable and efficient.

20 - Impact of Using Designated Secure Rest Facilities on Single Lane Truck Dispatching Productivity
Steven Morris, Georgia Institute of Technology, 1536 Walton Lane, Smyrna, GA, 30082, United States, smorris@gatech.edu, Alan Erera

A mixed integer program for determining optimal rest area locations and a set of heuristics for determining feasible load-to-driver assignments are analyzed on sample data sets. Results indicate that for lanes of realistic length the productivity impact of restricting rest to a small number of discrete locations is likely to be small.

21 - Closed Form Harmonic Prior Bayes Estimators for the Multivariate Normal Mean
Juntian Xu, The Wharton School, University of Pennsylvania, 3730 Walnut Street, 400 Huntsman Hall, Philadelphia, PA, 19104, United States, juntianx@wharton.upenn.edu, Lawrence Brown

This paper derives explicit closed form expressions for harmonic prior Bayes estimators of the mean of a multivariate normal distribution. They facilitate practical application of the minimax competitor to the James-Stein estimator and associated confidence sets obtained as Gaussian approximations.In particular, we show by a numerical study that such confidence sets are good competitors to the usual confidence spheres in terms of smaller size for nearly equal frequentist coverage.

22 - Revenue Management in Mobile Communication Networks
Joakim Kalvenes, Cox School of Business, SMU, PO Box 750333, Dallas, TX, 75275, United States, kalvenes@smu.edu, Neil Keon

We propose a revenue management approach to improve the performance of real-time service systems where there is no possibility of advance reservations. We study the user equilibrium for our proposed revenue management pricing mechanism and its effects on a queuing model of the service system. With mobile communication services as an example, we show that the revenue management scheme can increase traffic carrying capacity by as much as 25% over the original system capacity.

23- Agent-Based Simulation of Mass Egress
Doug Samuelson, Homeland Security Institute, 871 1 Chippendale Court, Annandale VA 22003, United States, samuelsondoug@yahoo.com, Ric Blacksten, Owen Densmore, Stephen Guerin, Loren Miller, Matthew Parker, Stacey Pommerenck, Brett Steele, Josh Thorp, Austin Zimmerman

For the Science and Technology Directorate, U S Department of Homeland Security, we constructed agent-based simulation models of mass egress from a stadium (PNC Park, in Pittsburgh) and a subway station following detonation of one or more improvised explosive devices. We offer hands-on demonstrations of these models and discuss their application and planned expansion to identify promising counter-IEDs technologies, to support preparedness and planning, and to help manage incidents.

Monday, 1:30pm - 3:00pm

■ MC01

Optimization in Network Coding

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Muriel Medard, Associate Professor, Massachusetts Institute of Technology, Room 32-D626, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, medard@mit.edu

1 - Coding and Queueing Asymptotics in Large Networks
Sanjay Shakkottai, Assistant Professor, The University of Texas of Austin, ECE Department, Austin, TX, 78712, United States, shakkott@ece.utexas.edu

Traditionally, network buffer resources have been used at routers to queue transient packets. In contrast, we propose a scheme where intermediate routers have no buffers for queueing transient packets. Instead, network storage (memory) is used only at source and destination nodes to encode/decode packets using random linear coding over time. In this paper, we show that coding at end hosts yields better performance (packet delay tail probability) in a large multi-hop network.

2 - Distributed Optimization Algorithms for Network Coding
Edmund Yeh, Associate Professor, Yale University, PO Box 208267, New Haven, CT, United States, edmund.yeh@yale.edu, Yufang Xi

We consider the problem of finding the minimum-cost multicast scheme based on network coding. We present a set of node-based distributed algorithms which iteratively adjust local control variables so as to converge to the optimal coding subgraph and congestion control configuration. We then discuss the application of our algorithms to wireless networks where minimum-cost multicast must be achieved by jointly optimizing network coding subgraphs with power control and congestion control schemes.

3 - Back Pressure Methods for Network Coding Optimization
Tracey Ho, Assistant Professor, California Institute of Technology, 1200 East California Boulevard, Pasadena, CA, 91125, United States, tho@caltech.edu

We show how back pressure methods, originally used to find asymptotically optimal solutions to multicommodity routing problems, can be generalized to network coding. We overview our range of techniques covering multicast (intra-session) and non-multicast (inter-session) network coding, wired and wireless network models, and independent and correlated sources, and discuss in detail the non-multicast case.

4 - On Serving Multiple Unicast Sessions with Inter-Session Network Coding

Atilla Eryilmaz, Post-Doctoral Associate, LIDS, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D566, Cambridge, MA, 02139, United States, eryilmaz@mit.edu, Desmond Lun

We propose a dynamic Routing-Scheduling-Coding Strategy for serving multiple unicast sessions in networks when linear network coding is allowed across sessions. Noting that the set of stabilizable throughput levels in this context is an open problem, we prove that our strategy supports any point in a recently characterized achievable rate region. This work also provides a theoretical framework in which performance of intersession network coding and pure routing can be compared.

■ MC02

Joint Session Open-Source/ICS: Cuts & Constraints

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

Invited Session

Chair: Lou Hafer, Simon Fraser University, School of Computing Science, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

1 - Piecewise Linear Optimization with COIN-OR

Ismael de Farias, Assistant Professor, SUNY Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Ming Zhao, Justin Yates, Hongxia Zhao

Any nonlinear optimization problem can be approximated to an arbitrary degree of accuracy as a piecewise linear optimization problem (PLOP). We discuss modeling and a branch-and-cut approach to continuous and discontinuous PLOP. We discuss the implementation of our theory in COIN-OR and we present computational results.

2 - Computational Study of Aggregation Procedure for Two-Step MIR Inequalities

Joao Goncalves, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, jpgoncal@us.ibm.com, Oktay Gunluk

We study the application of the aggregation procedure for mixed-integer rounding (MIR) inequalities proposed by Marchand and Wolsey (2001) to the two-step MIR inequalities proposed by Dash and Gunluk (2003). We describe our implementation and present computational results.

3 - Cutting Planes in SCIP

Tobias Achterberg, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, achterberg@zib.de, Kati Wolter

We give an overview of the cutting plane techniques included in the constraint integer programming framework SCIP. Implementational and numerical issues of several cutting plane separation algorithms are discussed. Additionally, we show how cut selection is performed in SCIP. Computational results show the impact of the different types of cutting planes and the cut selection strategy.

■ MC03

Advances in Large-Scale Numerical Optimization

Sponsor: Optimization/ Nonlinear Programming

Sponsored Session

Chair: Dominique Orban, Ecole Polytechnique de Montreal, CP 6079 Succ. Centre-Ville, Montreal, QC, H3C-3A7, Canada, Dominique.Orban@polymtl.ca

1 - New Filter Methods for Large-Scale Optimization

Sven Leyffer, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, leyffer@mcs.anl.gov

We present a new active set method for large-scale nonlinear optimization. The method employs an unconstrained minimization to identify the optimal active set followed by an equality QP solve to promote fast local convergence. We enforce global convergence through the use of a trust-region and a filter.

2 - Quasi-Newton Techniques for Nonlinear Optimization

Long Hei, Northwestern University, Evanston, IL, United States, lhei@ece.northwestern.edu, Jorge Nocedal

For large scale problems users cannot afford to operate the Hessian matrix, or sometimes are unwilling to invest effort to define it. Limited memory quasi-Newton methods are considered. It can be shown the quasi-Newton matrix overestimates the curvature along the eigenvectors corresponding to the small eigenvalues of the Hessian. We propose ideas on improving the convergence of quasi-Newton methods by incorporating spectral information into the algorithm.

3 - Use of Approximate Derivatives in the Filter-Trust-Region Method for Unconstrained Optimization

Caroline Sainvitu, Facultés Universitaires Notre-Dame de la Paix, Rempart de la Vierge, 8, Namur, 5000, Belgium, caroline.sainvitu@math.fundp.ac.be, Philippe Toint

This talk will focus on defining a filter-trust-region method designed for solving unconstrained nonlinear optimization problems. The main idea is to let the filter play the major role when convexity is present and to fall back on the classical trust-region method only if things do not go well or if non-convexity is encountered. We will mainly analyze the use of approximate derivatives in the algorithm. Numerical experiments carried out on small-scaled unconstrained problems will be presented.

4 - First-Order Primal-Dual Algorithms for Cone Programming

Renato Monteiro, Professor, ISyE, Georgia Institute of Technology, Atlanta, GA, United States, monteiro@isye.gatech.edu, Guanghui Lan, Zhaosong Lu

In this talk, we discuss first-order algorithms for solving cone programming problems. The algorithm consists of applying well-known first-order methods by Nesterov and Nemirovski to suitable reformulations of the cone programming problem. We compare the different variants obtained in this manner among themselves and compare the performance of the most efficient variant against the low-rank method of Burer and et al.'s on a set of randomly generated semidefinite programming problems.

■ MC04

Advances in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Santanu Dey, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, sdey@purdue.edu

1 - Branchwidth via Integer Programming

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Elif Kolotoglu

Branch decomposition based algorithms have been used in a practical setting to solve NP-hard problems modelled on graphs. The essential element of a branch decomposition based algorithm is an input branch decomposition whose width is close to the branchwidth for the input graph. We present an integer programming formulation for solving the optimal branch decomposition and branchwidth problem. Some preliminary computational results are also presented.

2 - Conflict Hypergraphs in Integer Programming

Siddhartha Maheshwary, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332, United States, sid@isye.gatech.edu

We study the facial structure of the independent set polytope using conflict hypergraphs. Various structures such as cliques, odd holes, odd antiholes, webs and antiwebs are identified on the conflict hypergraph, and valid inequalities are derived.

3 - A General Framework for Intersection Cuts

Anureet Saxena, PhD Student, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States, anureets@andrew.cmu.edu, Gabor Pataki

Given an extreme point x of the LP-relaxation of a mixed integer program (MIP), the basis cone centered at x has been at the focus of integer programming in the past two decades. Several classes of well-known cutting planes such as intersection cuts, MIG cuts, split cuts etc can be obtained by careful examination of the conic relaxation. This paper presents a detailed investigation of the class of cutting planes which can be obtained from the conic relaxation using arbitrary disjunctions.

4 - Two Families of Facets for Two Dimensional Infinite Group Problems

Santanu Dey, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States, sdey@purdue.edu, Jean-Philippe Richard

We present the first two proven families of facet-defining inequalities for two-dimensional infinite group problems (2DIGP). The first family uses inequalities of the one dimensional infinite group problem as building blocks. This construction provides a complete characterization of piecewise linear facets of the 2DIGP that have two gradients. The second family has three gradients. The coefficients of its continuous variables are not dominated by those of one-dimensional group cuts.

■ MC05

Risk Analysis in Military Applications

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, mzabaran@stevens.edu

1 - Multi-Sensor Target Tracking: A Probabilistic Combinatorial Analysis

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

We consider a random Multidimensional Assignment Problem in application to multi-sensor tracking of multiple mobile targets. A probabilistic analysis of the problem, including convergence of optimal value, estimation of the number of local minima, properties of the solution landscape, etc. is presented.

2 - Optimal Security Inspection with a Single-Server Queue

Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, mzabaran@stevens.edu

An optimization problem for security inspection with a single-server queue subject to a constraint on the average time spent in a system has been formulated and solved for the M/G/1 queue for two specific performance functionals for exponential, shifted-exponential and triangular inspection-time distributions. A version of the Pollaczek-Khinchin formula for the steady-state waiting-time distribution for the M/G/1 queue has been derived in the framework of Riemann boundary-value problems.

3 - Quantile-Based Deviation Measures

Bogdan Grechuk, Ph.D. student, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, bgrechuk@stevens.edu, Michael Zabarankin, Anton Molyboha

Quantile-based deviation measures as a class of general deviation measures, defined by Rockafellar et al., have been introduced, and the main properties of this class have been studied. Under the condition of equal means for random variables to be ordered, quantile-based deviation measures have been shown to be SSD consistent. For this class of deviation measures, the classical Chebyshev's and Rao-Blackwell theorems have been generalized, and Chebyshev's inequalities have been obtained.

4 - Optimal Sensor Placement for Underwater Threat Detection

Anton Molyboha, Ph.D. student, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States, amolyboh@stevens.edu, Michael Zabarankin

Mathematical models for underwater acoustic sensors have been proposed. Single-period and multi-period statistical models for threat detection by a network of sensors have been suggested. Optimization approaches for optimal sensor placement within an urban harbor have been developed. The limit theorem about optimality of quasi regular sensor placement under certain conditions has been proved, and numerical experiments illustrating this result have been conducted.

■ MC06

Finance-Risk Management I

Contributed Session

Chair: Dominic Nocera, Senior Manager, Supply Chain, Lucent Technologies, 6200 East Broad Street, Columbus, OH, 43213, United States, dnocera@lucent.com

1 - Dynamics of International Financial Networks with Variable Weights Multicriteria Decision-making

Jose Cruz, Assistant Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, jcruz@business.uconn.edu, Dmytro Matsypura

In this paper, we consider the dynamics of international financial networks with intermediaries in which both the sources of financial funds as well as the intermediaries are multicriteria decision-makers. In particular, we assume that these decision-makers seek not only to maximize their net revenues but also to minimize risk with the risk being penalized by a variable weight. The framework also allows for the modeling and theoretical analysis of the dynamics of prices and product transactions.

2 - Learning from Price Optimization: Applications to Other Problems

Frank Bria, Vice President, Response Analytics, 4615 E Buckboard Ct, Gilbert, AZ, 85297, United States, frank.bria@responseanalytics.com

There has been a significant amount of work done building demand models and solving the resulting price optimization problem. However, price isn't the only strategic lever available to product managers to generate more volume and ensure better margins. The lessons of price optimization can be leveraged to other strategic problems such as improved customer retention, increased line utilization, and negotiated pricing.

3 - Multi-Objective and Dynamic Optimization of Stocks Portfolios

Bartosz Sawik, M.Sc., AGH University of Science and Technology, Faculty of Management, Department of Systems Analysis & Computer Modeling, al. Mickiewicza 30, Kraków, 30-059, Poland, b_sawik@yahoo.com

This paper presents multi-objective and dynamic optimization models based on the classical Markowitz and Sharpe problems with modifications in the objective functions and with additional constraints. Computational experiments have been made for selected stocks in portfolio structures. The theory of selection the optimal portfolio structure from classical models and data from Warsaw Stock Exchange and Zurich SMI were used as a tool for the analysis. Selected investment periods were considered.

4 - Playing Bankrolls for Poker Players

Gary Carson, MathandPoker.com, 315 N. Violet, Cushing, 74023, United States, garycarson@alumni.northwestern.edu

People have used a variety of models, with a variety of assumptions, to determine bankroll requirements for poker players. Models based on classical ruin problems, interval estimation, optimal bet size with fractional betting, and insurance/dam problems have all been applied. I review some of those models and some of the player behavioral assumptions used in those models.

5 - Shareholder Value Based Decision Model as Applied to Supply Chain Re-Design Alternatives

Dominic Nocera, Senior Manager, Supply Chain, Lucent Technologies, 6200 East Broad Street, Columbus, OH, 43213, United States, dnocera@lucent.com

A real world example of investment decision-making as applied to the global re-design of returns and repair processes of a Fortune 500 telecommunications company. The model incorporates variable discounted cash flows, risks, stochastic modeling, and sensitivity analysis to determine the optimal course of action among alternatives. Benefits to attendees include a review of financial concepts, format to apply a similar analysis, and instruction on how to create a "no-cost" excel simulation.

■ MC07

Applications of Semidefinite Programming

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

Chair: Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - An SDP-Based Approach for Anchor-Free 3D Graph Realization

Kim-Chuan Toh, Associate Professor, National University of Singapore, Department of Mathematics, 2 Science Drive 2, Singapore, 117543, Singapore, mattohkc@nus.edu.sg, Yinyu Ye, Pratik Biswas

A distributed algorithm for solving anchor-free Euclidean metric realization problems arising from 3D graphs is proposed. We first subdivided the graph into smaller subgraphs, then use a regularized SDP relaxation method to localize each subgraph. Finally, the clusters are assembled together. We test our method on finding the 3D molecular configurations of proteins based on limited number of given pairwise distances between atoms. The results show that our method is robust and efficient.

2 - Globally Optimal Solutions for Large Single-Row Facility Layout Problems

Miguel Anjos, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, anjos@stanfordalumni.org, Anthony Vannelli

We consider the single-row facility layout problem which asks for a placement of facilities with varying lengths on a straight line so as to minimize the total weighted pairwise distances. We consider semidefinite programming relaxations and prove that for a specific relaxation, a significant number of facet-defining inequalities of the underlying integer polytope implictly hold. Using this relaxation, we obtain the first globally optimal layouts for large instances with up to 30 departments.

3 - Semidefinite Relaxations in Constraint Programming
Willem-Jan van Hoeve, Cornell University, 4130 Upson Hall, Ithaca, NY, 14853, United States, vanhoeve@cs.cornell.edu, Carla Gomes, Lucian Leahu

We first show how semidefinite relaxations can be integrated effectively as search heuristics in constraint programming. Then we investigate the predictive power of semidefinite relaxations when they are used as such. Both issues are illustrated with experimental results.

4 - An SDP-Based Branch and Bound Code for the Maximum Independent Set Problem
Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

We present a branch and bound code for maximum independent set problems that uses semidefinite programming bounds. The SDP bound is much tighter than linear programming bounds and computational results show that this approach can outperform conventional integer linear programming approaches. Results are presented for several large instances arising from coding theory.

■ MC08

KLIC IV

Sponsor: Technology Management
Sponsored Session

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

1 - Exploring Unique Learning in Bio-Pharmaceutical Innovation
Deborah Dougherty, Professor, Rutgers University, 1169 Lincoln Ct, Long Branch, NJ, 07740, United States, doughert@rbsmail.rutgers.edu, Danielle Dunne

Discovering and developing a new medicine requires ongoing alignment of disparate systems of knowing and doing - sciences, technologies, strategy, and operations - over 16 years and across multiple firm boundaries. This process cannot be simplified in the usual way (no paths, feedback, or modularity). We tease out unique learning for compounds and pipeline management, and suggest ways to enhance learning in this science-based industry that can also inform innovation management in general.

2 - The Effect of Information Technology on Knowledge Retention in Organizations
Linda Argote, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, argote@andrew.cmu.edu, Michael Ashworth, Tridas Mukhopadhyay

Our research examines whether new information technology (IT) contributes to an organization's ability to retain knowledge. We conducted a cross-sectional time series analysis monthly data spanning five years at six financial institution payment processing facilities. Results indicate that the IT enhances the retention of knowledge about productivity.

3 - Choices and Outcomes: The Effects of Improvement Project Portfolio Choices
Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu, Richard Bohmer, Ingrid Nembhard

Healthcare organizations strive to improve the quality of care they deliver. For many, the first step is to develop a portfolio of improvement projects. We present data from 44 intensive care units that created such portfolios by selecting among 93 practices they had collaboratively developed. We examine the effects of three portfolio choices - number of practices, type of practices and project team - and interactions among choices, on patient length of stay, infection rates and mortality.

■ MC09

Simulation I

Contributed Session

Chair: Michael Kuhl, Associate Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Industrial & Systems Engineering Dept., Rochester, NY, 14623, United States, mekeie@rit.edu

1 - Variance Estimation in Steady-Sate Simulations Using Linear Regression
Vivek Gupta, Student, Georgia Institute of Technology, 6640 Akers Mill Rd, Apt #3526, Atlanta, GA, 30339, United States, vkg378@gmail.com, Sigrún Andradóttir, Dave Goldsman

We propose a new variance estimator for steady-state simulations that is computed using linear regression. We show that the estimator thus obtained has good statistical properties. The regression approach can also be used for estimation of bias in time-series based estimators. We use this idea to develop a new sequential stopping rule for steady-state simulations. Numerical results indicate that the new sequential stopping rule is quite effective in practice.

2 - Designing a Database to Support Electrical Circuit Validation
Genetha Gray, Senior Member of the Technical Staff, Sandia National Laboratories, PO Box 969, MS 9159, Livermore, CA, 94550, United States, gagray@sandia.gov, Monica Martinez-Canales

Experiments are a critical component of simulation code validation activites. However, rising costs dictate that experiments should specifically address the available resources, code capability, and required predictive confidence for the intended application. Moreover, experiments should produce statistically meaningful data. In this talk, we will discuss the generation of a database supporting the validation of an electrical circuit model.

3 - Discrete Optimization via Simulation in the Presence of Regularity
Eunji Lim, Stanford University, 321 Terman Engineering, Stanford University, Stanford, CA, 94305, United States, eunji96@stanford.edu, Peter W. Glynn

We propose a stochastic approximation-type algorithm, originally proposed for continuous optimization, that can be shown to be convergent for discrete problems for which the objective is submodular and integrally convex. This assumption is known to hold in a number of important problem contexts. We shall also discuss generalizations of this idea to other settings in which regularity of the objective is known to hold.

4 - Performance Evaluation of Comparison-with-a-Standard Procedures
E. Jack Chen, Senior Staff Specialist, BASF Corporation, 333 Mount Hope Avenue, Rockaway, NJ, 07866, United States, e.jack.chen@basf.com

We investigate the performance of several comparison-with-a-standard procedures. The goal is to identify the best design, and if the chosen best design is not the standard, to determine whether the chosen best design is better than the standard. We give preferential status to the standard because there are costs and time involved in replacing the standard. We accomplish this goal by extending indifference-zone selection procedures.

5 - Simulation Analysis of Dispatching Rule Behavior in Reentrant Production Systems
Michael Kuhl, Associate Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Industrial & Systems Engineering Dept., Rochester, NY, 14623, United States, mekeie@rit.edu, Katie McConky

Reentrant production systems occur in many industries, and are typical of systems in semiconductor manufacturing. One variable that affects system performance is the dispatching rule chosen to control the selection of the next item for processing from a machine's queue. This study utilizes simulation methods to characterize and analyze the performance of dispatching rules under various conditions. The results are compared with non-reentrant systems to test hypotheses about rule behavior.

■ MC10

Software Demonstration

Cluster: Software Demonstration
Invited Session

1 - LINDO Systems, Inc. - Efficient Tools for Optimization Modeling
Mark Wiley, LINDO Systems, Inc., 1415 North Dayton, Chicago, IL, 60622, mwiley@lindo.com

LINDO Systems will demonstrate the latest enhancements to LINDO API, LINGO and What'sBest - their popular linear, integer, quadratic, general nonlinear and global optimization tools. Find out how easy it is to: —Quickly build complex optimization models —Effortlessly access data in Excel and databases — Seamlessly embed optimization into your own applications.

2 - Maximal Software, Inc. - Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
Bjarni Kristjansson, Maximal Software, 2111 Wilson Boulevard #700, Bjarni@maximalsoftware.com

We will demonstrate the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library has been augmented to include several new objects and methods. The speed and scalability of the model generation has been greatly enhanced, and with the new 64-bit Itanium version capable of solving much larger models than ever before. Several new solvers have been added and existing solvers updated.

■ MC11

Energy

Contributed Session

Chair: Fernando Oliveira, CEMPRE - FEP.UP and University of Warwick, Rua Dr. Roberto Frias, Porto, NA, 4200-464, Portugal, Fernando.Oliveira@wbs.ac.uk

1 - Unit Commitment and Market Strategies for Distributed Generation

Ralph Badinelli, Professor, Virginia Tech, Dept. of BIT 0235, Virginia Tech, Blacksburg, VA, 24061, United States, ralphb@vt.edu

Distributed generation within electricty grids offers the potential of a cheaper and more reliable electricity supply system. However, the market structure for the sale and purchase of distributed generation power is still being debated. This paper defines the decision models that would apply to various market structures for the trading of distributed generation power and the implications of these models for the behavior of market participants and the performance of the electric power market.

2 - Validation of Simulation Models for Policy Analysis Illustrated

Hassan Qudrat-Ullah, York University, 282 Atkinson, 4700 Keele St., Toronto, ON, M3J 1P3, Canada, hassanq@yorku.ca

This paper argues that structural validity of the simulation model -right behavior for the right reasons- is a stringent measure to build confidence in a simulation model regardless of how well the model passes behavior validity tests. That leads to an outline of formal structural validity procedures available but less explored in system dynamics modeling "repertoire". Finally, some conclusions on the increased appeal for simulation models for policy analysis are presented.

3 - Development of Finite Automata Models of Energy Firms

Fernando Oliveira, CEMPRE - FEP.UP and University of Warwick, Rua Dr. Roberto Frias, Porto, NA, 4200-464, Portugal, Fernando.Oliveira@wbs.ac.uk

In this paper we look at the problem of modelling the strategic behaviour of an energy firm by formalising it as a bundle of finite automata. (Finite automata represent conditional decision rules.) We show that these finite automata can be used to develop complex models of interacting policies, such as product pricing, long-term contracting, investment, and vertical integration, enabling a better understanding of the interactions and interdependencies between these policies within a firm.

■ MC12

Joint Session WORMS/INFORMS-ED: Academia and Industry Collaboration: Research and Development

Sponsor: Women in OR/MS, Education (INFORM-ED)
Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

Co-Chair: Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

1 - The Role of "Men of Power" and "Men of Insights"

Elif Akcali, Assistant Professor, University of Florida, 303 Weil Hall, PO Box 116595, Gainesville, FL, 32611-6595, United States, akcali@ise.ufl.edu

For successful industry-academia collaboration, it is important to establish contact with both "men of power" and "men of insights" in industry. While the men of power, i.e., the executives of corporate management, can ensure institutional support, the men of insights, i.e., the members of the middle management or engineers, can facilitate the transfer of institutional knowledge. In this talk, we will talk about some strategies on how to establish contact with both "men."

2 - How to Collaborate Effectively with Industry

Sridhar Tayur, Ford Distinguished Research Professor, Carnegie Mellon University, Forbes Avenue, Pittsburgh, PA, 15213, United States, stayur@andrew.cmu.edu

This talk will discuss some examples of collaboration where the industrial project created value, and the resulting work was published enthusiastically both in academic journals as well as business magazines.

3 - Transforming Academic Research into Software Products

Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, ahuja@ufl.edu

Over a period of 8 years, the speaker has evolved from a theoretician to an applied researcher to an entrepreneur aiming to build a major software product development company (www.InnovativeScheduling.com) in transportation using cutting-edge OR. In this talk, the author will describe this evolution and share his bitter/sweet experiences in working with companies, hurdles faced in winning their business, obtaining federal funds to start a company, and monitoring its growth.

4 - Industry-University Relationships: Some Lessons Learned

Leon McGinnis, Georgia Institute ofTechnology, 765 Ferst Drive, Atlanta, GA, 30332, United States, leon.mcginnis@isye.gatech.edu

After thirty years of experience in starting and managing industry-university partnerships, I've learned a few key lessons. This talk will summarize those lessons in an easy to use format.

■ MC13

Education

Contributed Session

Chair: Robert Kilmer, Faculty, Walden University, 13 Donegal Drive, Carlisle, PA, 17013, United States, rkilmer@walden.edu

1 - Introducing Liberal Arts Students to OR/MS

Dawn Strickland, Assistant Professor, Mathematics, Winthrop University, 156 Bancroft Hall, Rock Hill, SC, 29733, United States, stricklandd@winthrop.edu

Are you interested in spreading the word about OR to talented students at institutions near your own? We have created a presentation aimed to inform students of the methods, applications, and need for OR/MS in the world today. In this talk, we will demonstrate the presentation itself, how you can individualize it, and where you can use it. Please join us in marketing the "Science of Better."

2 - SCM Process Map for Effective Teaching of Supply Chains

Divakar Rajamani, Professor & Managing Director of C4ISN, University of Texas at Dallas, PO Box 830688, Mail Stop: SM 26, Richardson, TX, 75083, United States, divakar@utdallas.edu, Ertunga Ozelkan

A new framework named "Supply Chain Management (SCM) Process Map" is presented and shown that it can be helpful for teaching and managing supply chains effectively. SCM Process Map establishes a unifying relation between the end-to-end supply chain processes (such as create, source, make, move, store, market, sell, return and service) and the strategic, tactical and operational decision phases of SCM. An example from the soft goods supply chain is presented to illustrate the proposed framework.

3 - A Statistics and Geography Clustered Pair Experiment at Carthage College

Thomas Groleau, Associate Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States, tgroleau@carthage.edu

To meet students' interdisciplinary studies general education requirement, Carthage offers block enrollment in two separate but related courses called "clustered pairs". With a single group of students, both instructors attend both classes and work together to create explicit links between the subjects. This paper reports on a pairing of business statistics and geographic information systems in Spring 2006.

4 - What Needs to be Taken into Account When Validating a Business Simulation Game?

Juuso Töyli, Professor, Helsinki School of Economics, PO Box 1210, Helsinki, FIN-00101, Finland, juuso.toyli@hse.fi

Presents the validation framework and process used when developing a business simulation game, SIMBU, used to train about 1,700 students and managers. The framework consists of primary (learning, realism, balance, experienced realism, experienced balance, developer dependency, and facilitator dependency) and supportive dimensions (briefing, motivation, de-briefing, complexity, challenge, and usability). Observations, interviews, questionnaires, and feedback reports were used to gather the data.

5 - Grade Inflation and Operations Research

Robert Kilmer, Faculty, Walden University, 13 Donegal Drive, Carlisle, PA, 17013, United States, rkilmer@waldenu.edu

Grade inflation is a complicated issue that most institutions of higher education pretend does not exist. For non-quantitatively oriented administrators this appears to be the easiest and safest approach. To those open to quantitative approaches there are systematic procedures that could be used to facilitate analysis and discussion of grades among administrators, faculty and students. This session examines a Grade Inflation Measurement Analysis and Discussion model.

■ MC14

Sponsored Search

Sponsor: e-Business
Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton Business and Economics, Lexington, KY, 40502, United States, de.liu@uky.edu

1 - Efficient Allocation of Online Advertising Resources

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Abhishek Bapna

We provide a general mechanism for the allocation of a finite number of divisible online advertising resources to a finite number of heterogeneous firms. The mechanism is ex-post efficient and dominant-strategy incentive compatible. The mechanism is robust in the sense that equilibrium bid functions do not depend on any assumptions about other players except for smoothness and monotonicity of their otherwise arbitrary payoff functions.

2 - Competing Keyword Auctions

Jianqing Chen, The University of Texas at Austin, CBA 5.202, IROM, Austin, TX, 78712, United States, chenjq@mail.utexas.edu, De Liu, Andrew B. Whinston

Most research done on keyword auctions is under monopoly settings. This paper models an unaddressed but critical issue: the competition between search engines in the keyword advertising market. We analyze the advertisers' equilibrium participation and bidding strategies and the auctioneers' strategies on the ranking rules, and eventually predict the market segmentation under the competition.

3 - Quality Uncertainty And Adverse Selection In Online Sponsored Search Markets

Siva Viswanathan, Assistant Professor, University of Maryland, 4313 Van Munching Hall, RH Smith School of Business, College Park, MD, 20742, United States, sviswana@rhsmith.umd.edu, Vandana Ramachandran, Animesh Animesh

Yahoo! and Google employ different mechanisms to rank bidders' advertisements in their sponsored search listings. This provides an unprecedented opportunity to test earlier predictions relating quality and advertising. Using data from sponsored search auctions we examine the relationship between advertisers' quality and their advertising intensity. We find significant differences in the quality-advertising relationships across product categories as well as across the two market mechanisms.

4 - Inferring Competitive Measures on the Web from Aggregate Usage Data

Zhiqiang (Eric) Zheng, Assistant Professor, University of Texas at Dallas, School of Management, SM33, Richardson, TX, 75083-0688, United States, ericz@utdallas.edu, Balaji Padmanabhan, Peter Fader

In this paper we present methods for learning various competitive measures such as market share for electronic commerce. Rather than estimating these numbers from detailed customer level Web browsing data, the methods presented here derive the measures from simple aggregate data that is assumed to be available freely. Based on data from ComScore we show empirically that our methods perform well in inferring key diagnostic measures such as market share and share of requirement.

5 - Shopbots and Online Consumer Search

Jie Zhang, Jennifer.zhang@utoledo.edu

Online price comparison agents (shopbots) allow consumers to instantaneously receive price and other information from many online retailers. Intuitively consumers are expected to search less because shopbots have displayed prices and other relative information from retailers on the search result page(s). Surprisingly, this study demonstrates consumers are actually visiting more online retailer web sites after using shopbots. The empirical finding is explained by an analytical model.

■ MC15

Online Auctions II

Cluster: Auctions and e-Commerce
Invited Session

Chair: Peter Popkowski Leszczyc, Associate Professor of Marketing, School of Business, University of Alberta, Edmonton AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - An Empirical Comparison of Three Auction Strategies for Multiple Products

Michael Shen, yshen@ualberta.ca, Peter Popkowski Leszczyc, Gerald Häubl, Paul Messinger

This study investigates bidders' bidding strategies and the relative profitability of three auction strategies: one bundled auction, two simultaneous separate auctions, and two sequential separate auctions. We study how bidders' bids and seller's revenue are affected by: product complementarity, heterogeneity in valuations across bidders, and the number of bidders.

2 - Is Overbidding in Online Auctions the Result of a Pseudo-Endowment Effect?

James R. Wolf, Fisher College of Business, Ohio State University, 400 Fisher Hall, 2100 Neil Avenue, Columbus, OH, 43210, wolf.206@osu.edu, Hal R. Arkes, Waleed A. Muhanna

Possession of an item increases an owner's valuation of it; a phenomenon termed the endowment effect. We hypothesize that temporarily being the high bidder during an auction may induce a related pseudo-endowment effect. To test this, we examine eBay bid data and conduct a variation of the classic mug experiment.

3 - Bidder Regret, Sniping, and the Sequential Auction Problem on eBay

Adam I. Juda, PhD Candidate, Harvard University, Wyss Hall, Harvard Business School, Boston, MA, 02163, United States, ajuda@hbs.edu

Bidders on eBay have no dominant bidding strategy when faced with multiple auctions each offering the same item. An analysis of 10,151 bidders in 1,956 auctions for a Dell E193FP LCD monitor demonstrates a large number of bidding "mistakes" which are likely hampering the efficiency of the market system.

■ MC16

Pricing and Demand Models in Revenue Management

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Rene Caldentey, Assistant Professor in Operations Management, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-77, New York, NY, 10012, United States, rcaldent@stern.nyu.edu

Co-Chair: Gabriel Bitran, Professor, Massachusetts Institute of Technology, Memorial Drive 50, Cambridge, MA, 02142, United States, gbitran@MIT.EDU

1 - Optimal Dynamic Pricing of Account-Based Services with Customer Switching Costs

Garrett van Ryzin, Columbia University, Uris Hall, New York NY 10027, United States, giv1@columbia.edu, Qian Liu

We look at a model of pricing account-based services, such as telecome service and financial services, in which switching costs play a critical role. We show the optimal pricing strategy can be characterized simply in terms of a critical account level. We then analyze a duopoloy version of the model.

2 - Pricing and Capacity Rationing with Stragetic Customers

Matulya Bansal, Graduate Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, mb2431@columbia.edu, Costis Maglaras

We consider a retailer that faces a market of heterogeneous customers that strategize over their time of purchase in response to the retailer's dynamic pricing and capacity rationing strategies. We formulate the retailer's revenue maximization problem as one of mechanism design, which allow us to unify old results, and derive several new insights about the structure of the optimal policies.

3 - Dynamic Pricing and Inventory Control Through Robust Optimization

Georgia Perakis, J. Spencer Standish Associate Professor of Operations Research, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02139, United States, georgiap@mit.edu, Elodie Adida

We study a make-to-stock manufacturing system where demand is a linear function of the price, with uncertain parameters. We consider a dynamic setting where multiple products share production capacity. A key part of the model is that no backorders are allowed. We consider and compare various approaches that deal with demand uncertainty and give rise to closed loop policies such as adjustable robust optimization and dynamic programming. We discuss our insights.

■ MC17

Statistical Methods, Quality Control, and Simulation

Sponsor: Simulation

Sponsored Session

Chair: Hong Wan, Assistant Professor, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, hwan@purdue.edu

1 - Factors Here, Factors There, Interactions Everywhere!

Susan Sanchez, Professor, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Road, Monterey, CA, 93943, United States, ssanchez@nps.edu, Paul Sanchez

We describe a simple method for generating highly efficient, resolution-V fractional factorial and central composite designs. This is part of an ongoing effort to study simulations involving hundreds of input factors. Our portfolio of designs has yielded insights for a variety of defense and homeland security issues.

2 - A Distribution-Free Tabular CUSUM Chart for Correlated Data with Automated Variance Estimation

James Wilson, Professor, North Carolina State University, Edward P Fitts Industrial & Systems Engineering Department, Campus Box 7906, Raleigh, NC, 27695-7906, United States, jwilson@ncsu.edu, Joongsup (Jay) Lee, Christos Alexopoulos, Dave Goldsman, K-L Tsui, Seong-Hee Kim

A distribution-free tabular CUSUM chart, DFTC-VE, is designed to include automated variance estimation so as to detect shifts in the mean of a correlated process. Extensive experimentation shows that the performance of DFTC-VE compared favorably with that of other competing process-monitoring schemes for correlated processes.

3 - A Polytope Method for Efficiently Identifying Mean and Dispersion Effects

Russell Cheng, Professor of Operational Research, University of Southampton, School of Mathematics, Highfield, Southampton, NA, SO17 1BJ, United Kingdom, rchc@maths.soton.ac.uk, Bruce Ankenman, Susan Lewis

We consider how to identify important factors influencing a response in a simulation experiment, where the number of factors is large and factors can affect both dispersions and means; the directions of the effects being known. We present a method using a polytope construction that efficiently makes use of all available information to estimate both dispersion and mean effects. Numerical examples are given showing its improved performance compared with sequential bifurcation.

4 - Multi-Product Cycle Time and Throughput Evaluation via Simulation on Demand

Feng Yang, Assistant Professor, Industrial and Management Systems Department, West Virginia University, Morgantown, WV, 26506, United States, feng.yang@mail.wvu.edu, Bruce Ankenman, Barry Nelson

Cycle time and throughput are important performance measures for manufacturing. We seek to estimate the cycle-time measure as a function of throughput and product mix via simulation for semiconductor manufacturing. The proposed methodology exploits our early success in the generation of cycle time-throughput (CT-TH) curves for a fixed product mix. Experiment design strategies are derived for covering the product-mix space, and techniques for interpolating among CT-TH curves are developed.

■ MC18

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security II

Cluster: Counter Terrorism and OR, Decision analysis Society

Invited Session

Chair: Doug Samuelson, Homeland Security Institute, 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

1 - Risk Management and Decision Analysis Tools for Military and Homeland Security Applications

Igor Linkov, Senior Scientist, Cambridge Environmental, 58 Charles Street, Cambridge, MA, 02141, United States, Linkov@cambridgeenvironmental.com, F. Kyle Satterstrom

Available frameworks for homeland security risk management are often applied without adjustment for unique environmental, social, political, and economic conditions. This presentation will illustrate several case studies which apply MCDA tools to homeland security and related areas. It will also report the results of the NATO workshop on current practices and options to address the complex challenges of protecting infrastructure at industrial ports.

2 - Estimated Consequences and Mitigation Effectiveness For Release of a Toxic Industrial Chemical

Tony Barrett, Graduate Research Assistant, Doctoral Student, Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, tonybarrett@cmu.edu

Parametric analysis is performed on potential acute fatalities and injuries from terrorist-caused release of a toxic industrial chemical in an urban location, using atmospheric dispersion and human effects models and a focus on high-consequence scenarios. These models are used to assess the effectiveness of fatality and injury mitigation measures. Adding information on costs and other tradeoffs of mitigation allows multi-criteria decision analysis of strategies.

3 - Physical and Data-Driven Screening Systems for Security: Systems Analysis and Risks

David Ortiz, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States, David_Ortiz@rand.org

This presentation examines the limitations of networked systems to screen persons when presenting themselves at a controlled checkpoint. We present a framework for evaluating the risk in networked screening systems using as examples the Transportation Security Administration's Secure Flight system and the Department of Homeland Security's US-VISIT program. We show that all components of the systems can function as described, but that as a whole each system can fail to satisfy its goals.

■ MC19

Joint Session ENRE/Optimization: Optimization/Equilibrium Models and Algorithms in Energy

Sponsor: Energy, Natural Resources & The Environment, Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Steve Gabriel, Assistant Professor, Department of Civil & Environmental Engineering, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu

1 - Forward Markets in Electricity, Do They Increase Total Supply?

Fred Murphy, Professor, Temple University, The Fox School of Business, 108 Speakman Hall, 1810 N. 13th Street, Philadlephia, PA, 19122, United States, fmurphy@temple.edu, Yves Smeers

Allaz and Vila proved that adding a futures market leads to an increase in production. They model a two-stage game with futures positions taken before spot decisions. This work has led to belief that a futures market can reduce market power in electricity markets. With a third stage added to the game, prior to futures positions, production can either increase or decrease and a futures market can lead to multiple equilibria. Thus, a futures market is no panacea for a lack of competition.

2 - Methods for Stochastic Complementarity Models of Natural Gas Market Equilibria

Steve Gabriel, Assistant Professor, Department of Civil & Environmental Engineering, University of Maryland, 1143 Martin Hall, College Park, MD, 20742, United States, sgabriel@umd.edu, Jifang Zhuang, Ruud Egging

We present a detailed model of the natural gas market where certain components are stochastic (e.g., inverse demand function coefficients). Combined within a Nash-Cournot framework for the market players, the resulting model is an instance of a stochastic complementarity problem. As such both game theoretic and risk elements are addressed. We describe recent numerical efforts to solve these and related stochastic games using scenario reduction techniques.

3 - Custom Power Contract Portfolio Optimization with CVAR Constraints

Roy Kwon, Prof, University of Toronto, 5 Kings College Rd., Toronto ON, Canada, kwon@mie.utoronto.ca, Scott Rogers, Sheena Yau

This paper considers a stochastic IP model that jointly considers the problem of selecting custom contracts and finding the optimal procurement strategy of meeting contract obligations under spot price uncertainty. We use a two stage stochastic programming model with CVAR constraints. It will be shown that the CVAR model will allow acceptance of contracts at lower prices compared to the risk-neutral model as a hedge against mis-specified arbitrage.

4 - The Cost of Anarchy in Self-Commitment Based Electricity Markets

Ramteen Sioshansi, Graduate Student, IEOR Department, University of California at Berkeley, Berkeley, CA, 94720-1777, United States, ramteen@queue.IEOR.Berkeley.EDU, Richard O'Neill, Shmuel Oren

We compare the efficiency and distributional implications of centralized unit commitment based on multipart offers in competitive day-ahead electricity markets to a self-commitment approach with one part energy offers. In the centralized approach generators are paid hourly marginal energy clearing prices plus a daily "make-whole" payment to cover revenue shortfalls. Under self-commitment, all costs are covered by energy payments based on hourly marginal clearing prices.

■ MC20

Joint Session DAS/Health Applications: Decision Modeling in Health Care Applications

Sponsor: Decision Analysis Society, Health Applications Section
Sponsored Session

Chair: Elissa Ozanne, Instructor, Harvard Medical School, Institute for Technology Assessment, 101 Merrimac Street, 10th Floor, Boston, MA, 02114, United States, elissa@mgh-ita.org

1 - Can the Human Inclination Toward Fairness Help Employers Manage the Cost of Prescription Drugs?

Robert Nease, Vice President of Knowledge Management, Express Scripts, 13900 Riverport Drive, Maryland Heights, MO, 63043, United States, RNease@express-scripts.com

Employers often consider changes to the pharmacy benefit to manage costs. However, concern about employee reaction stops many plans from making such changes. This concern is based largely on the assumption that people are self interested. We briefly review evidence to the contrary, focusing on the anomalous human desire towards fairness. We speculate as to a possible evolutionary explanation for this anomaly, and present example communications that take advantage of this human attribute.

2 - Estimating HIV Incidence in the United States from HIV/AIDS Surveillance Data and Less-Sensitive HIV

Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Ruiguang Song, John Karon, Ron Brookmeyer

Development of a less-sensitive HIV test that detects recent infection has enabled the US Centers for Disease Control and Prevention to develop new estimators for annual HIV incidence in the United States based on HIV reporting data. We develop statistical models noting that: individuals choose how frequently to get tested; test frequency varies among individuals; only HIV+ test results are reported; and prior HIV-negative testing dates can be obtained from supplementary data sources.

3 - Productivity of Tuberculosis Control

Stephen Resch, PhD Candidate, Harvard University, 718 Huntington, Boston, MA, 02115, United States, resch@fas.harvard.edu, Milton Weinstein, Megan Murray, Joshua Salomon

Endemic TB is a major public health problem in dozens of nations, killing an estimated 2 million people per year. Policymakers face a decision regarding how to distribute available resources across sequentially connected components of TB control programs: population coverage, case recruitment, diagnosis, and treatment. With an objective of minimizing deaths, we explore tradeoffs in allocating resources across these program activities using a state-transition model and deterministic simulation.

4 - Decision Analysis in Support of Clinical Trial Protocol Decisions

Joseph Kahn, Novartis Pharmaceuticals, 1 Health Plaza, East Hanover, NJ, 07936, United States, joseph.kahn@novartis.com

Presentation will illustrate via a case study for a phase IIa/b adaptive program design how modelers can use decision analysis to more productively assist clinical teams with protocol decisions. Topics include: Framing and developing a manageable set of compelling alternatives; Assuring information is relevant and has credence; Salient value measures; Analytic methods and software useful for implementation; Achieving buy-in from both clinical teams and colleagues in statistics.

■ MC21

MARA 2006 - An International Initiative in Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Martin Schilling, PhD Candidate, London School of Economics, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, m.schilling@lse.ac.uk

Co-Chair: Cornelius Schaub, PhD Candidate, London School of Economics & Political Science, Department of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, c.schaub@lse.ac.uk

1 - MARA 2006: Core Idea

Cornelius Schaub, PhD Candidate, London School of Economics & Political Science, Department of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, c.schaub@lse.ac.uk, Martin Schilling

MARA 2006 is a project organised by international (PhD) students to contribute to the internationalization of decision analysis. With the support of experienced academics, such as Bob Clemen, Ralph Keeney, Gregory Parnell, Larry Phillips and Detlof von Winterfeldt, the MARA group members trained 30 international participants from ten different countries to subsequently conduct decision analyses in five projects in Germany. In addition to the core idea of MARA, we introduce in this presentation, two MARA cases at the interface between decision analysis and HR strategy.

2 - Public Management: Appraising Infrastructure Funding Requests for the Berlin Government Senate Department for Economics (SenWAF)

Dinah Vernik, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States, dinah.vernik@duke.edu, Felix Ruebcke

In the face of increasingly tight financial constraints, the Berlin Government Senate engaged a team from MARA 2006 to develop an MCDA-based approach to evaluate and prioritise its business-related infrastructure funding requests. In this presentation, we summarize the results of the SenWAF case in the context of MARA 2006.

3 - R&D: Analyzing Research Directions in the Area of Optoelectronics for the Ferdinand-Braun-Institute in Berlin

Dolchai La-Ornual, PhD Student, Decision Sciences, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Dolchai.LA-ORNUAL@insead.edu

A socio-technical approach incorporating MCDA, assisted leaders at a prominent research institute to evaluate prospective research directions. The decision makers gained understanding and insights into conflicting criteria that determine each option's potential benefits and costs. In this presentation, we highlight the insights gained for the institute's strategic research plans.

4 - MARA Effectiveness Research: Decision Analyses in the Context of Strategy Development

Martin Schilling, PhD Candidate, London School of Economics, Department of Operational Research, Houghton Street, London, NW3 1AH, United Kingdom, m.schilling@lse.ac.uk, Nadine Oeser

The evaluation of the effectiveness of socio-technical decision analyses in strategy development contexts is the research focus of MARA 2006. The across-project research results of MARA 2006 are the topic of this presentation.

■ MC22

Agent Based Modeling and Simulation for National Security Analy sis

Sponsor: Military Applications
Sponsored Session

Chair: Isaac Porche, Senior Analyst, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States, porche@rand.org

Co-Chair: Matthew Koehler, MITRE, 7515 Colshire Drive, MS: H305, McLean, VA, 22102, United States, mkoehler@mitre.org

1 - Leveraging Agent-Based Models for Military Analysis and Decision-Support: Techniques and Application

Matthew Koehler, MITRE, 7515 Colshire Drive, MS: H305, McLean, VA, 22102, United States, mkoehler@mitre.org

We have investigated the use of agent-based models for military decision-support and applied these models in a number of domains. This paper will address some techniques used in our investigations and two applications of agent-based models. The techniques include methods for examining large parameter spaces inherent within agent-based models and use of data within an agent-based model. The specific applications include Course of Action Analysis, and Acquisition and Capabilities Analysis.

2 - Applying Effects-Based Thinking to Complex Problems Using SEAS

Alok Chaturvedi, Professor of Management & Director of PHSI, Purdue University, 403 W. State Street, West Lafayette, IN, 47906, United States, alok@purdue.edu

Effect Based Thinking (EBT) provides a complete understanding of the strategic, operational, and tactical issues of an environment viewed as a complex adaptive system. This paper describes the process of creating a synthetic environment for analysis and simulation (SEAS) that mirror "real world" counterparts in all their key aspects. By combining millions of artificial agents with a small number of human agents, SEAS captures both detail and strategic interactions.

3 - Impact of Networking on Warfighter Effectiveness: A Study Using the MANA Agent-Based Simulation Tool

Isaac Porche, Senior Analyst, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States, porche@rand.org

The objective of the research effort described in this presentation is to quantify the marginal impact of networking as part of an effort to evaluate the concept of network-centric operations. Specifically, this presentation analyzes networking concepts and uses simulation results from agent-based combat models to quantify and assess the marginal benefit of networking concepts with respect to warfighter effectiveness at the tactical level.

4 - Reviewing a Hardware, Human In The Loop Experiment Using an Agent Based Model

Bradley Wilson, Research Programmer, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15212, United States, bradleyw@rand.org, Isaac Porche

This paper reports on the findings and lessons learned from a hardware and human-in-the-loop experiment conducted in May 2006 for the Joint Staff. The experiment linked a network simulation called QualNet with a human-in-the-loop version of the agent based tool Map Aware Non-Uniform Automata. Several areas will be investigated, such as the choice of models, design of experiments, analysis of similar efforts, as well as the technical challenges encountered in modifying the model for HITL use.

■ MC23

Sourcing Models in a Global Economy: Comparing R&D, BPO, and IT Services

Cluster: Global Services Sourcing
Invited Session

Chair: Natalia Levina, Assistant Professor, New York University, 2 Washington Square Village, #13R, New York, NY, 10012, United States, nlevina@stern.nyu.edu

1 - Global Product Development Processes

Steven Eppinger, Professor and Deputy Dean, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, MA, 02142, United States, eppinger@mit.edu, Anshuman Tripathy

This research explores various modes of implementing global product development, including the outsourcing and offshoring of engineering services. We have observed two distinct ways to distribute work: process decomposition and component decomposition. Through several case studies, we have identified particular challenges for coordinating the product development process deriving from each type of work decomposition.

2 - Offshore Business Process Outsourcing

Amiya Chakravarty, Philip McDonald Chair and Professor, Northeastern University, 214 Hayden Hall, Northeastern University, Boston, MA, 02115, United States, akc@neu.edu

Options for ownership and operations of an offshore facility include the captive center, offshore-development center (ODC), and build-operate-transfer (BOT). We compare capacity strategies of ODC and BOT. Further, we study improvements in productivity, employing the principal/agent model. We are interested in managerial insights addressing the desirability of BOT over ODC, behavior of optimal prices and investments, and incentive compatibility.

3 - Collaborating Effectively on Globally Sourced IT Projects

Natalia Levina, Assistant Professor, New York University, 2 Washington Square Village, #13R, New York, NY, 10012, United States, nlevina@stern.nyu.edu

It has been argued that offshoring complex and poorly defined IT projects is best accomplished through captive centers. I will discuss the case of a large global bank which used both captive centers and 3rd party vendors. Surprisingly, the data indicated that project effectiveness did not depend on whether the project was kept within firm boundaries. Instead, it depended on an effective engagement of mid-level managers in specific boundary-spanning practices.

■ MC24

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Warranty Inventory Optimization for Hitachi Global Storage Technologies, Inc.

John Khawam, Graduate Student, Management Science & Engineering Department, Stanford University, Stanford, CA, 94305, United States, jkhawam@stanford.edu, Warren Hausman

Warranty inventory must cope with random replacement demands and three sources of resupply with differing lead times: no defect found (NDF), remanufacturing of returned units, and purchase of new product. By modeling NDF and Remanufacturing as negative demand, we create a heuristic order-up-to inventory model for this setting and use the model to show the payoffs from reducing lead times and reducing batching in remanufacturing. We also describe who the customer is, how and why the work was initiated, who the "users" are, and how the results are applied in practice.

3 - Solving Real-Life Railroad Blocking Problems

Jian Liu, Innovative Scheduling, Inc., Gainesville, FL, liujian@InnovativeScheduling.com, Krishna Jha, Ravindra Ahuja

The railroad blocking problem, an important railroad planning problem, is a very large-scale multi-commodity flow network design and routing problem containing billions of decision variables. This paper describes a novel Very Large-Scale Neighborhood (VLSN) Search Algorithm to solve it to near-optimality within one to two hours of computer time. Use of this algorithm has resulted in significant cost savings for several large US freight railroads.

■ MC25

Portfolio Optimization

Cluster: OR Practice
Invited Session

Chair: Rajesh Tyagi, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States, rajesh.tyagi@research.ge.com

1 - An Examination of Correlation Assumptions Under CreditMetrics

Sung-Ho Ahn, Wachovia Bank, 201 South College Street, Charlotte, NC, 28244, United States, sung-ho.ahn@wachovia.com

Models of portfolio credit risk based on CreditMetrics utilize obligor asset correlations in loss distribution calculations. Given the computational burden of directly estimating the complete correlation matrix for all obligors, a factor model is typically employed to reduce the dimensionality of the problem. This article

examines several issues that arise in counterparty risk attribution as a result of the assumptions behind the factor modeling and their impact on portfolio optimization.

2 - Decision Support Tools for Commercial Real Estate Portfolio Management

Rajesh Tyagi, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States, rajesh.tyagi@research.ge.com

Commercial real estate companies must meet financial target by selling invested properties to realize gains. To maintain a healthy portfolio, this target must be achieved without giving away too much recurring income and future potential gains. We developed a suite of decision support tools that help decision-makers. The tools were integrated into a web-based enterprise platform and is used by financial, risk and asset managers.

3 - The Academics of OR Practice

Karen Holness, PhD Student, University at Buffalo, 435 Bell Hall, Department of Industrial Engineering, Buffalo, NY, 14260, United States, holness@eng.buffalo.edu

The interdisciplinary nature of OR warrants an investigation into the core skills required for successful OR project work. This research examines the key practitioner skills identified in the OR, MS and Industrial Engineering literature and correlates them with those obtained from our empirical questionnaire and interview studies.

■ MC26

Joint Session DM Invited/DM Sponsored: Applications of Machine Learning

Cluster: Data Mining and Automated Learning, Data Mining
Invited Session

Chair: Artur Dubrawski, Systems Scientist/Adjunct Professor, Robotics Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu

1 - Learning Bayesian Networks: Methodology and Applications

Marek J. Druzdzel, Professor, University of Pittsburgh, Decision Systems Laboratory, 135 North Bellefield Avenue, Pittsburgh, PA, 15260, United States, marek@sis.pitt.edu

I will summarize the existing techniques for learning directed probabilistic models, such as Bayesian networks, from data. I will give examples of applications and point out possible pitfalls related to learning models from data. Finally, I will demonstrate GeNIe, a computer program developed in the Decision Systems Laboratory, University of Pittsburgh and available at http://genie.sis.pitt.edu/, that allows for learning models from data and using them to support decisions under uncertainty.

2 - Machine Learning in in vivo CNS Drug Discovery

Jeff Schneider, Associate Research Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, schneide@cs.cmu.edu

Machine learning has had success in modeling and optimizing commercial processes. A recent trend is to observe that the scientific method is a process that can be approached similarly. We consider discovery of CNS drugs using in vivo behavioral testing. We discuss: kernel density estimators for improved probabilities in multi-class problems; semi-supervised learning for training data with uncertain class labels; and active learning to control experimentation for drug discovery.

3 - Evolving Fuzzy Models to Identifying the Best and Worst Units in a Fleet

Piero Bonissone, Computer Scientist, Coolidge Fellow, General Electric Global Research, One Research Circle K1-5C32A, Niskayuna, NY, 12309, United States, bonissone@crd.ge.com

We use local fuzzy models to determine remaining life for each vehicle in a fleet. We identify clusters of peers, similar units with comparable use and performance, and create a local fuzzy model per cluster. We combine this approach for model generation with evolutionary search for model maintenance. We generate competing models, evaluate them with actual data, refine them with evolutionary search, and select the best one. We repeat this process periodically to produce updated models.

4 - Early Detection of Emerging Patterns of Adverse Events

Artur Dubrawski, Systems Scientist/Adjunct Professor, Robotics Institute, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu

We review the use of selected machine learning techniques in early detection of emerging patterns of adverse events in spatio-temporal and event-based data. These techniques have been successfully applied in support of monitoring food safety and bio-surveillance, where reliable and rapid detection is the key to effective protection of public health. We discuss performance, implementation issues and we hint on possible applications of the presented methods beyond their original deployment areas.

■ MC27

Joint Session QSR/ Health Applications: Quality and Statistical Decision-Making in Healthcare Applications II

Sponsor: Quality, Statistics and Reliability, Health Aplications Section
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 - Improving Patient Flow and Resource Allocation Through Healthcare Decision-Making

José Zayas-Castro, Professor & Chairperson, Industrial & Management Systems Engineering, 4202 E Fowler Avenue ENB 118, Tampa, FL, 33620, United States, josezaya@eng.usf.edu, Michael Weng, Alcides Mercado, Jana Iezzi, Abhik Bhattacharya

Various operational decisions are made by the medical staff in a hospital. Statistical analysis and process mapping are used to improve and standardize decisions. Studies are being conducted at two major hospitals to investigate both inpatient and outpatient processes. The objective is to improve patient flow and resource allocation through enhanced decision-making processes.

2 - Measurement Error Models in Survival Data

Ciprian Crainiceanu, Assistant Professor, Johns Hopkins University, 615 N. Wolfe Street, E3636, Baltimore, MD, 21208, United States, ccrainic@jhsph.edu

Cox regression is a major statistical tool for analysis of survival data. An essential problem in many studies is that some of the risk factors are measured with error, which typically leads to biased effect estimates of relative risk and invalid tests of statistical significance. We propose a new, computationally usable, methodology for the analysis of survival data with risk factors subject to measurement error and nonlinear log hazard function.

3 - Difference Between Reported and Expected Nursing Hours in Wisconsin Nursing Facilities

Jenya Antonova, University of Wisconsin-Madison, 1175 WARF Building, 610 Walnut Street, Madison, WI, 53726, United States, Jenya_Antonova@chsra.wisc.edu, David Zimmerman, Karen Reilly, Jim Robinson

The nursing home industry experiences severe staff shortages. There is no optimal standard staffing requirement in nursing homes. We analyzed staffing standards associated with the Resource utilization groups — the instrument used by the Medicare for nursing home reimbursement — and compared them to staffing levels reported by nursing homes.

4 - Detection of Physiologic Condition Changes Based on Synchronization Patterns

Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

The synchronization is a fundamental phenomenon in physiologic systems. It has long been recognized as an important mechanism by which the brain codes and processes information. Defining "synchronization patterns" of neuronal groups under different physiologic conditions may provide great implications to health condition monitoring and treatment of neurological diseases. This study presents a method to detect synchronization changes using a new nonlinear dynamics model.

■ MC28

Wavelets, Data Mining, and Statistical Modeling

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 - Bayesian Mean and Variance Wavelet Thresholding for Multiple Complicated Functional Data

Jye-Chyi (JC) Lu, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30022, United States, jclu@isye.gatech.edu, Myong K. Jeong, Cuizhen Shen

This talk uses a Bayesian hierarchical model to describe data trend and variation for several complicated functional curves. In particular, a wavelet based random-effect model enables us to characterizes local variations between curves. Our work develops a wavelet thresholding procedure for both mean and variance parameters. Bayes factors makes the hypothesis testing for parameter thresholding simple. A real-life example from antenna manufacturing illustrates the developed methods.

2 - A Spatial Autocorrelation Analysis in Semiconductor Wafer Maps

Seong-Jun Kim, Visiting Scholar, University of Tennessee, Knoxville, TN, 37996, United States, skim47@utk.edu, Young S. Jeong, Myong K. Jeong

Wafer map is a graphical illustration to represent the locations of defective chips on the wafer. Defective chips are likely to exhibit a spatial dependence across the wafer map, in which useful information about integrated chip (IC) fabrication processes is contained. By incorporating a join-count statistic with spatial lags, this paper presents a novel approach to detecting the presence of spatial dependences on the wafer map.

3 - Restricted Error Regression - Some Preliminary Results

James Cochran, Louisiana Tech University, College of Administration & Business, PO Box 10318, Ruston, LA, 71055, United States, jcochran@cab.latech.edu

We consider the benefits and ramifications of restricting regression analyses so the error terms satisfy the conditions necessary for valid inference (homoskedasticity, normality, independence, and linearity/fit). Specifically, we assess the difficulty and time required to solve the resulting constrained nonlinear optimization problem. We appraise the validity of standard summary statistics and hypothesis tests for the restricted error regression.

■ MC29

Optimization

Contributed Session

Chair: Dan Stratila, Operations Research Center, MIT, 77 Massachusetts Avenue, E40-129, Cambridge, MA, United States, dstrat@mit.edu

1 - On the Application of Network Optimization: The Case of a National Food Supply System

Nguyen Huu Trung, PhD Candidate, National Graduate Institute for Policy Studies - GRIPS, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan, d0412@stu.grips.ac.jp, Tatsuo Oyama, Kunihisa Yoshii

The paper proposed a new networked structure of a National Food Supply System (NFSS) to investigate the situation of food availability in a given country. In this NFSS, "food export" was not considered from the supply side, but as a demand sector. A food security optimal model, then, was built up to solve different food problems. The case of Vietnam was studied with objectives focusing on increasing exports while maintaining the people's diet in the context of future demands.

2 - Strongly Polynomial Primal-Dual Algorithms for Concave Cost Combinatorial Optimization Problems

Dan Stratila, Operations Research Center, MIT, 77 Massachusetts Avenue, E40-129, Cambridge, MA, United States, dstrat@mit.edu, Thomas Magnanti

Primal-dual algorithms (PDA) for uncapacitated fixed charge combinatorial optimization problems often possess attractive properties, yet do not generalize to problems with concave costs and arbitrary demands. Our result yields a PDA for a concave cost problem whenever one exists for its fixed charge special case. As a result, we obtain new approximation algorithms for concave cost facility location and inventory problems, and new heuristics for concave cost multicommodity flows.

■ MC30

HIV Models

Sponsor: Health Applications Section
Sponsored Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca

1 - S4HARA: System for HIV/AIDS Resource Allocation

Arielle Lasry, Prevention Effectiveness Fellow, Center for Disease Control, Division of HIV/AIDS Prevention, 1600 Clifton Road, Atlanta, GA, 30333, United States, alasry@cdc.gov, Michael Carter, Greg Zaric

HIV/AIDS resource allocation decisions are influenced by political, social, ethical and other non-quantifiable factors. Therefore, rational models of HIV/AIDS resource allocation have had limited impact on actual spending decisions. We propose S4HARA, decision-support system that takes into account both principles of efficient resource allocation and the role of non-quantifiable influences on the decision-making process for HIV/AIDS resource allocation. We demonstrate S4HARA by an example.

2 - Incorporating Toxicity Information in HAART Therapy Initiation

Robert Koppenhaver, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, rzk9@pitt.edu, Andrew Schaefer, Steven Shechter, Mark Roberts, R. Scott Braithwaite

HAART is very effective in improving key health metrics for HIV patients. However it introduces an increased death rate from non-HIV related causes. We consider the question of when to start therapy by explicitly incorporating toxicity information into the patient's health transitions. Using a discrete event simulation we examine how toxicity can lead to delayed initiation of therapy for various starting conditions. We also will discuss possible improvements to the model and future work.

3 - An MDP Model of the Optimal Time to Initiate HIV Therapy as a Function of Two Variables

Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca, Mark Roberts, Andrew Schaefer, Matthew Bailey, Scott Braithwaite

National guidelines policies for the best time to initiate HIV therapy consider two primary measures of HIV infection: the CD4 blood cell count and the level of HIV virus in the blood. We present a MDP model that considers both factors in a two-dimensional state space and develop structural properties in this context. For example, we present conditions that lead to a two-dimensional version of a control-limit policy. We also discuss the use of real clinical data to solve the MDP model.

4 - Clinical Benefits and Cost-Effectiveness of Antiretroviral Therapy in Resource-Poor Settings

Heather Hsu, Research Assistant, Section of Decision Science and Clinical Systems Modeling, University of Pittsburgh, 200 Meyran Avenue, 2nd Floor, Pittsburgh, PA, 15213, United States, hsuhe@upmc.edu, Rochelle Walensky, Jon Kaplan, Kenneth Freedberg, Sue Goldie, Yazdan Yazdanpanah, Elena Losina, Milton Weinstein, Xavier Anglaret, April Kimmel, Charles Holmes

As antiretroviral therapy (ART) is increasingly utilized in resource-limited settings, questions remain regarding treatment timing and use of diagnostic tests to guide clinical decisions. Our aim was to assess the cost-effectiveness of ART for HIV-infected adults in Côte dÍvoire and similar settings. We present a state-transition simulation model of HIV, incorporating CD4 and HIV RNA as predictors of disease progression, to project long-term clinical, cost, and cost-effectiveness outcomes.

■ MC31

New Directions in Risk Management and Hedging

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

1 - Default Risk Premia and Asset Returns

Antje Berndt, Assistant Professor of Finance, Tepper School of Business, GSIA 335, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, aberndt@andrew.cmu.edu, Iulian Obreja, Aziz Lookmann

We investigate the source for common variation in the portion of returns on corporate debt that is not explained by changes in risk-free rates or expected default losses. We extract a latent common component from firm-specific changes in default risk premia that is orthogonal to known systematic risk factors. Asset pricing tests suggest that our DRP factor is priced in the corporate bond market, and helps explaining returns on short-term, OTM put options. For equity markets, results are mixed.

2 - Efficient Monte Carlo Methods for Convex Risk Measures in Portfolio Credit Risk Models

Stefan Weber, Assistant Professor, School of OR&IE, Cornell University, 279 Rhodes Hall, Ithaca, NY, 14853, United States, sweber@orie.cornell.edu

We discuss efficient Monte Carlo methods for the estimation of convex risk measures in portfolio credit risk models. These risk measures do not share the deficiencies of the current industry standard Value at Risk (VaR). In the present paper we demonstrate that importance sampling with an exponential twist can be used to construct numerically efficient estimators within the framework of the credit risk models CreditRisk+ and CreditMetrics.

3 - Option Pricing: A Matroid Theory Perspective

Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

In this talk I show how matroid theory provides a unifying framework for diverse approaches to option pricing theory in incomplete markets. Algorithmic implications are also discussed.

4 - Optimal Hedging Under Convex Risk Measures and Application to Shortfall Risk

Antoine Toussaint, Princeton University, ORFE, Princeton, NJ, United States, atoussai@Princeton.EDU, Ronnie Sircar

We study the hedging of contracts in an incomplete financial model. The criteria for optimal hedging is determined by a suitable convex risk measure. Under some assumptions on the set of trading strategies, we prove the existence of optimal hedging strategies and we give an expression for the minimum capital requirement. Applied to the framework of shortfall risk, it provides a bridge to minimal variance pricing.

■ MC32

Real Options in Project Governance

Cluster: Project Management

Invited Session

Chair: Scott Mathews, Lead, Computational Finance and Stochastic Modeling, The Boeing Company, PO Box 3707 MC 45-93, Seattle, WA, 98124-2207, United States, scott.h.mathews@boeing.com

1 - Real Metrics: Using Real Program Value for Development Program Management

Murray Cantor, Distinguished Engineering, IBM Software Group, 340 W. 72nd Street, Apt. 6A, New York, NY, 10023, United States, mcantor@us.ibm.com

Classical program management measures such as “earned value” do not account for the statistical nature of the program variables and so do not drive behavior that drives program success. In this talk, I discuss the use of the Datar and Mathews Real Program Value measures to derive a set of program development measures, Real Metrics that drive effective development management, enable staged program investment, and provide a means for evaluating development organization value creation.

2 - Government Decisions and Real Options: Cases and Potential

Scott Farrow, Professor & Chair, Department of Economics, University of Maryland, 1000 Hilltop Circle, Baltimore, MD, 21250, United States, Farrow@umbc.edu

Many Government program and project decisions involve uncertainty, irreversibility, and flexibility in timing. Examples include oil and gas leasing, regulations, and major procurements. In contrast to many private sector applications, market data are frequently lacking. Existing and potential applications are discussed.

3 - Finding and Valuing “What’s Next” Technology

Chris Johnson, Manager, Risk & Value Technologies Lab, GE Global Research, 1 Research Circle, Niskayuna, NY, 12301, United States, johnsonch@crd.ge.com

What’s next and why? If our objectives include creating economic value for our projects, there exists a need to describe the context and risk/return of the requisite investment. Both the systemic approach to finding what should be next and our communication are critical to build commitment for action. A simulation and optimization based approach that incorporates the path dependencies and stochastic nature of potential scenarios into a financial objective function is presented.

4 - Integrating Real Options Business Engineering into Manufacturing Investment Decisions

Scott Mathews, Lead, Computational Finance and Stochastic Modeling, The Boeing Company, PO Box 3707 MC 45-93, Seattle, WA, 98124-2207, United States, scott.h.mathews@boeing.com

Boeing has developed and patented a set of strategic investment decision-modeling methods and tools based on real option techniques. These methods and tools appropriately value investment and risk of opportunities while assessing the likelihood of future events, and thereby aid decision makers in designing strategies that select high-benefit outcomes while minimizing risks. At Boeing real options help make real investment decisions for product design, risk management and allocation of resources.

■ MC33

Next Generation Air Transportation System (NGATS)

Sponsor: Aviation Applications

Sponsored Session

Chair: Dipasis Bhadra, Principal Economist, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org

1 - Portfolio Analysis of NGATS

Shahab Hasan, Program Manager, LMI Government Consulting, 2000 Corporate Ridge, McLean, VA, 22102, United States, shasan@lmi.org, Dan Goldner

This presentation would demonstrate an analysis of planned JPDO operational improvements, time-phased, to show how benefits accrue as we proceed to full implementation of NGATS (end state or Segment 7).

2 - Constraints Analysis

Kevin James, Senior Scientist, NASA, Ames Research Center, Moffett Field, CA, 94035, United States, kjames@mail.arc.nasa.gov

This is related to the investment portfolio under NGATS, but would look at how various facets of the NAS constrain performance, starting with the current system and then applying NGATS improvements. The idea being to make sure JPDO is addressing the critical issues and in the right order.

3 - Real Time Probabilistic Weather

George Hunter, Senior Scientist, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States, george.hunter@sensis.com, Kris Ramamoorthy, Benjamin Boisvert

This presentation summarizes JPDO research efforts in improving probabilistic weather modeling, evaluation and use in traffic flow management decision support tools. We present an equity-based traffic flow management solution and ProbTFM, a realtime traffic flow management evaluation platform.

4 - Cost-Benefit and Business Case Development for NGATS

Richard Golaszewski, Executive Vice President, GRA Inc., 115 West Avenue, Suite 201, Jenkintown, PA, 19046, United States, richg@gra-inc.com, David Ballard

The presentation would cover broad areas of business case development under NGATS. Developing advanced air traffic control system requires complemantaary investments by industry and government. These parties differ in what they consider to be benefits and costs, as well as in time horizon for investments. This session will review business case development for both industry and government.

■ MC34

Routing Applications I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Ann Campbell, Associate Professor, Department of Management Sciences, University of Iowa, Iowa City, IA, 52242, United States, ann-campbell@uiowa.edu

1 - A VRP Application to a Large Convenience-Store Distribution Application

Arianne Trudeau, ari_chic@yahoo.com, Teodor Gabriel Crainic

We examine the centralized distribution problem of a convenience-store chain that covers a large territory with significant diversity among regions in population and store density. We focus on the modelling aspects of the problem and their relations to the transformation processes taking place in the firm. Computational experiments will also be reported.

2 - An Analysis of Network Structures for the Robust Vehicle Routing Problem

Ilgaz Sungur, PhD Candidate, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States, sungur@usc.edu, Fernando Ordonez, Maged Dessouky

We apply robust optimization methodology on the Vehicle Routing Problem to address the uncertainty in demand and cost. We develop robust counterparts and use performance measures to compare the robust and deterministic solutions. We experimentally analyze demand uncertainty using an open source solver. Our results on both literature and random instances show that for certain network structures, robust solution benefits from strategic allocation of the slack in vehicles with little extra cost.

3 - Applying the Attribute-Based Hill Climber Heuristic to the Vehicle Routing Problem

Ulrich Derigs, Professor, WINFORS - University of Cologne, Pohligstrasse 1, Köln, 50969, Germany, derigs@informatik.uni-koeln.de, Raimund Kaiser

The attribute based hill climber method (ABHC) proposed by Whittley and Smith [2004] is a variant of the general tabu-search principle. We will show that a straightforward implementation of the ABHC-concept to the Vehicle Routing Problem leads to results which are competitive with the best-known / state-of-the-art algorithms from literature. At the same time this new approach shows a striking simplicity: easy to understand, easy to code, and independent on any obscure parameter settings.

■ MC35

Integrated Logistics Network Design and Inventory Management

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Erhan Kutanoglu, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, erhank@mail.utexas.edu

1 - A Dynamic Spatial Hydrogen Facility Penetration Model

Tony Wu, Lawrence Livermore National Lab, 7000 East Avenue, L-644, Livermore, CA, 94550, United States, wu26@llnl.gov, Jeffrey Stewart, Alan Lamont, Gene Berry

Hydrogen is considered as a possible fuel carrier for transportation vehicles nationally and in the State of California. To evaluate infrastructure transition to serve the potential hydrogen demand, we need to dynamically and spatially model the hydrogen facility penetration. We develop a network flow model with fixed charges on the arcs. The objective function is to minimize total cost under scenarios set by sponsors the State of California and the Department of Energy.

2 - Multicommodity Logistics Network Design Models with Inventory Stocking and Part Commonality

Vishv Jeet, PhD candidate, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States, vjeet_a@mail.utexas.edu, Erhan Kutanoglu

We address problems with strong interactions between network design and inventory decisions in service parts logistics. Expanding our analysis with variable substitution and outer approximation for single part models, we analyze the multi-product multi-part settings. The challenge is to satisfy time-based product-level service constraints for geographically dispersed customers when locating/stocking facilities with parts common across products. We present bounding and exact solution techniques.

3 - Integrated Logistics Network Design and Inventory Management in SPL for Customer-Centric Service

Mehmet Ferhat Candas, PhD Candidate, University of Texas at Austin, 3370 Lake Austin Boulevard Apt. D, Austin, TX, 78703, United States, mfcandas@mail.utexas.edu, Erhan Kutanoglu

We study the integrated logistics network design and inventory stocking problem in SPL with customer centered service levels, where each customer requires a certain time-based service level. Our analysis show that the model with customer centered service constraints has polynomially solvable subcases, but even the general setting in this case is still a challenging problem, for which we provide a Lagrangian-relaxation based approach that provides extremely tight lower and upper bounds.

4 - Integrated Logistics Network Design and Inventory Stocking with Customer-Dedicated Facilities

Ilyas Iyoob, PhD Candidate, University of Texas at Austin, ETC 5.124, C2200, Austin, TX, 78705, United States, iiyoob@mail.utexas.edu, Erhan Kutanoglu

Most of the work on logistics network design considers locating only one type of facilities. However, companies may prefer to have a variety of facilities. This paper expands earlier integrated network design and inventory models by explicitly considering two types of stocking facilities, one type serving multiple customers, and the other dedicated to a single customer. Computational results show that considering dedicated facilities may improve service, solution quality and time.

■ MC36

Dynamic Programming Applications in Transportation Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

1 - Dynamic Analysis of Multi-Item Freight Consolidation

Ali Ulku, PhD Student, Department of Management Sciences, University of Waterloo, 200 University Avenue West, N2L 3G1, Waterloo, ON, Canada, maulku@uwaterloo.ca, James Bookbinder

Consolidation is a common practice: Small shipments are aggregated and dispatched in the same load. We consider stochastic arrivals of items varying in size and cost parameters. Via dynamic programming, we analyze the optimality structures of shipment consolidation policies based on expected total cost/unit volume, and sensitivities to truck capacity and length of holding period.

2 - Integration of Count Data Analysis in Dynamic Programming Approach for Stochastic Truckload Routing

Ginny Miori, Assistant Professor, Department of Decision & System Sciences, St. Joseph's University, 333 Mandeville Hall, 5600 City Avenue, Philadelphia, PA, 19131, United States, vmiori@comcast.net

We discuss the integration of econometric count data regression into the stochastic truckload routing problem (TRP). A penalty method is applied to the TRP, which is then reformulated as a Markov process. This facilitates a solution using dynamic programming (DP)techniques. The two outpus of count data, predicted counts and the likelihood of those counts, are employed as transition probabilities (likelihoods) and in the generation of the expected cost-to-go for the DP solution.

3 - A Parallelizable Dynamic Fleet Management Model with Random Travel Times and Multiple Vehicle Types

Huseyin Topaloglu, Assistant Professor, Cornell University, 223 Rhodes Hall, Ithaca, NY, 14853, United States, huseyin@orie.cornell.edu

We present a fleet management model to handle random load arrivals, random travel times and multiple vehicles types. Our model decomposes the problem into a sequence of time-indexed subproblems by formulating it as a dynamic program and uses approximations of the value function. To handle random travel times, the state variable of our dynamic program includes all decisions over a portion of the history, but we approximate this high-dimensional value function in a tractable manner.

■ MC37

Piracy and Copyright Issues in Markets for Information Goods

Sponsor: Information Systems Society
Sponsored Session

Chair: Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu

1 - Competing with Free: Impact of Movie Broadcasts on DVD Sales and Internet Piracy

Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu, Rahul Telang

Movie studios have long argued that TV broadcasts serve as a substitute to media purchases, and a complement to Internet piracy. We empirically analyze these concerns and find exactly the opposite effect. DVD sales increase by an average of 360-410% immediately after a movie is shown on broadcast TV. Furthermore, TV broadcasts are not associated with a statistically significant increase in either the supply of or demand for pirated movies on popular Internet file-sharing networks.

2 - Trading Higher Software Piracy for Higher Profits: The Case of Phantom Piracy

Ram Gopal, Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States, ram.gopal@business.uconn.edu, Alok Gupta

This paper analytically explores the effect of software bundling on software piracy. We develop an economic model of software piracy and product bundling and derive results for optimal level of piracy and profits for individual products as well as for the bundle. Our results indicate that it is possible to trade off the piracy level of one product for overall higher profits, i.e., a seller can derive higher profits even with higher levels of piracy for one of the products in the bundle.

3 - Complementary Benefits of Software Piracy - An Empirical Analysis of Piracy and PC Ownership

Bin Gu, Assistant Professor, University of Texas at Austin, CBA 5.202, B6500, Austin, TX, 78712, United States, Bin.Gu@mccombs.utexas.edu, Prabhudev Konana

This study considers the benefits of software piracy to the PC industry. Using a panel data on piracy and PC ownership from 77 countries from 1994 to 2002, we find that software piracy brings significant benefits to the PC industry. The effects are particularly pronounced for developing countries. The result indicates that prior studies may have overestimated the cost of piracy without taking into consideration its benefits to complementary industries.

■ MC38

Emerging Trends in Intermodal Transportation

Sponsor: Railroad Applications

Sponsored Session

Chair: Krishna Jha, Director, R&D, Innovative Scheduling, Gainesville Technology Enterprise Center, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, krishna@innovativescheduling.com

1 - New Approaches to Solve Load Planning Problem

Krishna Jha, Director, R&D, Innovative Scheduling, Gainesville Technology Enterprise Center, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, krishna@innovativescheduling.com, Ashish Nemani, Ravindra Ahuja

This paper deals with the load planning problem, one of the most important problem in intermodal transportation by railroads. The solution to this problem assigns containers and trailers to railcars. We have formulated this problem as a multicommodity flow problem. We solve the IP formulation to obtain optimal solution. We have also developed several heuristic algorithms.

2 - Optimizing the Aerodynamic Efficiency of Intermodal Freight Trains

Yung-Cheng Lai, Graduate Research Assistant, University of Illinois at Urbana Champaign, B-118 Newmark Lab, 205 N. Matthews Avenue, Urbana, IL, 61801, United States, lai3@uiuc.edu, Yanfeng Ouyang, Hayri Onal, Christopher Barkan

An IP model was developed to optimize aerodynamic efficiency of intermodal trains using available loads. More effective solutions may be possible with advance information on arriving loads and trains. We extend the model to optimize at the system level, and develop a rolling horizon scheme for 24/7 terminal operations.

3 - Capacity Challenges = OR Opportunities

Erick Wikum, Director of Engineering, Schneider National, Inc., 3101 S. Packerland Drive, Green Bay, WI, 54306, United States, wikume@schneider.com

In an attempt to stretch available capacity, railroads have recently implemented various measures including incentives for shipping containers v. trailers, daily ramp inbound limits, and detention charges. Schneider National, an asset-based intermodal provider, is utilizing statistical analysis, optimization, and other OR techniques to respond to the resultant challenges.

■ MC39

Ballroom B

Great Unsolved Problems in OR - II

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Saul I. Gass, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, sgass@rhsmith.umd.edu

1 - Need and Potential for Real-Time Integer Programming

George Nemhauser, Professor, Georgia Institute of Technology, Department of Industrial Engineering, Atlanta, GA, 30332-0205, United States, gnemhaus@isye.gatech.edu

Until recently, most applications of integer programming have been to planning models where solution time is not an issue. Significant improvements in methodology, high-speed computing and data availability have made it possible to apply integer programming at the operational level where solution time may take minutes. The next challenge is real-time integer programming. In this talk we discuss some applications for which optimality in real-time is important and some ideas for making real-time integer programming a reality.

2 - Problems in Air Transportation

Michael Ball, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

As air transportation demand creeps closer to system capacity, congestion and associated poor service levels are becoming widespread, particularly in the US and Europe. Addressing this global problem involves fundamental systems questions and as such clearly falls within the domain of operations research. We define several specific challenges including construction of highly reactive control mechanisms, integrating technical and economic controls and modeling and quantifying safety.

3 - Recent Results and Unsolved Problems in Computational Biology

James Orlin, Professor, Massachusetts Institute of Technology, Operations Research Center, E53-363, Cambridge, MA, 02139, United States, jorlin@MIT.EDU

Computational biology is a field that is rich in analytical problems of great significance. Great strides have been made over the past 15 years including a sequencing of the human genome and other genomes. All of this data provides opportunities for addressing fundamental problems. This talk, which will be based on interviews with those in computational biology, will be a description of some of the key problems in the field as well as descriptions of some recent successes.

■ MC40

Location Modeling

Sponsor: Location Analysis

Sponsored Session

Chair: Rajan Batta, Professor and Associate Dean, Department of Industrial and Systems Engineering, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu

1 - Approaches to Wireless Sensor Network Design and Routing for Prolonged Network Life

Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, uster@tamu.edu, Hui Lin

We present a general model and its variations to consider various objectives that define policies for wireless sensor network design and routing that promote efficiency in energy usage. The objectives include combinations of maximum and average energy usage at a sensor node and the remaining energy distribution at the sensor nodes. We present algorithmic approaches, an analysis of objectives with respect to energy distribution characteristics and computational results.

2 - Ambulance Deployment for Maximum Survival

Armann Ingolfsson, Associate Professor, University of Alberta School of Business, 4-30K Business Building, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca, Gunes Erdogan, Erhan Erkut

We propose location models for emergency medical services (EMS) that incorporate survival functions into existing covering models. Survival functions map EMS response times into probability of survival and allow the calculation of tangible outcome measures, e.g., the expected number of cardiac arrest survivors in case of cardiac arrests. We demonstrate empirically the superiority of survival-maximizing models over covering models using data from the Edmonton EMS system.

3 - A Resource Allocation Model for Protecting Supply System Facilities with Capacity Restrictions

Paola Scaparra, Lecturer in Management Science, University of Kent, Kent Business School, Canterbury, United Kingdom, M.P.Scaparra@kent.ac.uk, Richard Church

We consider a service-supply system where the facilities have finite capacities and develop an optimization model for identifying the most cost-effective way of protecting the facilities against worst-case scenario disruptions due to intentional attacks. We formulate the problems as a tri-level mixed-integer program. We then show how this model can be reduced to a bi-level model and solved through an implicit enumeration approach. Computational results are presented for some benchmark problems.

4 - Performance Evaluation for Current Aeromedical Base Locations of New Mexico with Managerial Insights

Elif Tokar Erdemir, Research Assistant, SUNY at Buffalo, 60 Maple Court Apt. 1, Amherst, NY, 14226, United States, et5@buffalo.edu, Peter Rogerson, Alan Blatt, Rajan Batta, Marie Flanigan, Seth Spielman

The current aeromedical system of New Mexico is designed without considering path demand, i.e. traffic roads with a weight signifying relative crash occurrence. From this perspective, we analyze the loss in accident coverage and location error for current aeromedical bases. We also provide managerial insights that will show the relevance of considering path demand. Additionally, we address the tradeoff issues in adding new trauma centers vs. new aeromedical bases to the current system.

■ MC41

Asymptotic Limit Theorems for Stochastic Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Kavita Ramanan, Associate Professor, Carnegie Mellon University, 6208 Wean Hall, Department of Mathematical Sciences, Pittsburgh, PA, 15213, United States, kramanan@asdf5.math.cmu.edu

1 - Fluid Limits of GI/GI/N Queueing Systems with Many Servers

Haya Kaspi, Professor, William Davidson Faculty of Industrial Engineering and Management, Technion, Haifa, 32000, Israel, iehaya@techunix.technion.ac.il, Kavita Ramanan

The talk focuses on a fluid limit of a GI/GI/N queueing system when the number of servers coverges to infinity. To describe the evolution of the system we use a measure valued process that keeps track of the time in the service of the various customers in service, and in addition a variable that describes the total number of customers in the system. We show that the limiting pair satisfies an evolution equation and discuss some of its properties. This is joint work with Kavita Ramanan.

2 - Accuracy of State Space Collapse for Earliest-Deadline-First Queues

John Lehoczky, Professor of Statistics, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, jpl@stat.cmu.edu, Steven Shreve, Lukasz Kruk

We consider a real-time queueing system in which the customers have deadlines, and the performance measure is the fraction of customers who meet their deadlines using the earliest-deadline-first queue discipline. This paper first reviews the heavy traffic approximation of the system's performance. The main result is the development of a second-order analysis that gives the accuracy of the heavy traffic approximation and the rate of convergence to the heavy traffic limit.

3 - Fluid Limits for SRPT Queues

Christian Gromoll, Assistant Professor, University of Virginia, Department of Mathematics, Charlottesville, VA, 22904, United States, gromoll@math.stanford.edu, Doug Down, Amber Puha

Consider a GI/GI/1 queue in which the server employs the SRPT policy: it works on the job with the Shortest Remaining Processing Time, allowing preemption by arriving jobs. We propose a fluid model, and present a functional limit theorem justifying it as an approximation of this system. A key step is to keep track of the frontier, the largest service time of any job that has been in service during the current busy period. This is accomplished using a measure valued state description.

4 - Fluid Limit of Transport Processes, and Applications to Queues with Impatient Customers

Pascal Moyal, CEREMADE- Université Paris Dauphine, Place du Maréchal DeLattre de Tassigny, Paris, 75016, France, pascal.moyal@ceremade.dauphine.fr, Laurent Decreusefond

We study a queueing system with impatient customers, represented by a measure-valued process keeping track of the residual time-credits of the customers. This process is a Feller Process whose generator emphasises an integral transport equation. We prove the convergence in distribution of a normalized sequence of such processes towards a fluid limit using compactness/uniqueness techniques, and apply this result to derive the fluid limits of the congestion and lost processes in some cases.

■ MC42

Discrete Manufacturing Problems

Cluster: Scheduling
Invited Session

Chair: Nicholas G. Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States, hall.33@osu.edu

1 - A Complete Polyhedral Description for the K-Median Problem when K=n-2

Wenhui Zhao, Graduate Research Associate, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, zhao.108@osu.edu, Marc Posner

The polyhedral structure of the K-median problem for an arbitrary graph is examined. An extended formulation with integral polytope is presented. Then, we project out some of the extended variables. Finally, for K = n - 2, we project out all the extended variables and hence find the complete polyhedral description.

2 - Minimizing Makespan in Two-Machine Flowshops with Exact Delays

Joseph Leung, Distinguished Professor, New Jersey Institute of Computer Science, Department of Computer Science, Newark, NJ, 07102, United States, leung@oak.njit.edu, Hairong Zhao, Haibing Li

We consider two-machine flowshops with exact delays with the goal of minimizing the makespan. We first show that the problem is strongly NP-hard even if there are only two delay values. We then show that some special cases are solvable in polynomial time. Finally, we design constant approximation algorithms for the general case.

3 - Search for a Computationally Tractable Formulation for Contiguous Cave Formation

Anita Parkinson, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, anita.parkinson@sauder.ubc.ca, S. Thomas McCormick, Maurice Queyranne

In planning the period-by-period development of a block cave mine, the most challenging constraint is that the open drawpoints form a contiguous cave. Since these mines and the resulting models are very large, finding an integral formulation is of great interest. In this paper we compare several formulations and other computational approaches on several sets of actual mine data.

4 - Selection of Layouts: Flow Lines vs. Job Shop

Kejian Yang, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States, yang.12@osu.edu, Marc Posner

We study a problem of selecting a layout, where each job is assigned either to a dedicated Flow Line or a Job Shop. The objective is to minimize total cost. We develop a heuristic and provide an attainable constant worst-case bound. A computational study is conducted.

■ MC43

Operations Research in Public Sector

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Zachary Waltz, IBM Global Business Services, Fairfax, VA, 22033, zwaltz@us.ibm.com

Co-Chair: Qingying (Ally) Lu, IBM Global Business Services, Fairfax, VA, 22033, qingying.lu@us.ibm.com

1 - Operations Research in The Public Sector

Christer Johnson, IBM Global Business Services, Fairfax, VA, christer.johnson@us.ibm.com, Paul Thompson

Exciting opportunities for OR analysis have recently emerged in the public sector, including emergency management, homeland security and military logistics. Advances in computer technology and mathematical science are allowing OR to move into real-time decision-making. We discuss what the OR professional needs to successfully meet these challenges.

2 - Scheming the Postal Service: An Algorithm for Delivery Point Sequencing
Mariah Jeffery, IBM Global Business Services, Fairfax, VA, mjeffery@us.ibm.com, Michael Gibbs

We discuss the development of a tool for creating sort schemes for the United States Postal Service's Delivery Point Sequencing (DPS) operation. The tool uses a polynomial time algorithm to assign ZIP codes to DPS machines for processing with an objective of minimizing the total equipment required while meeting service standards.

3 - A Column Generation Approach for Heterogeneous Workforce Tour Scheduling
Hua Ni, IBM Global Business Services, Fairfax, VA, huani@us.ibm.com, Hernan Abeledo

We present an IP model for heterogeneous workforce tour scheduling, which has wide range of applications in public services. Its modeling capabilities include multiskill workforce, productivity, multiple tour types, variable start-times, and multiple breaks. We report on the computational performance of a column generation approach to solve this model efficiently.

4 - Business Mail Discount Verification for the U.S. Postal Service
Zachary Waltz, IBM Global Business Services, Fairfax, VA, 22033, zwaltz@us.ibm.com

This discussion will focus on the business mail environment and the Operation Research techniques employed in the U.S. Postal Serviceís new method to verify the validity of claimed work share discounts.

■ MC44

An Interactive Panel/Audience Discussion: Balancing Research and Teaching - An Academic Dilemma (Joint JFIG/ED Session)

Sponsor: Junior Faculty Interest Group (JFIG), Education (INFORM-ED)
Sponsored Session

Chair: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au

1 - An Interactive Panel/Audience Discussion: Balancing Research and Teaching - An Academic Dilemma
Moderator: Gal Raz, Assistant Professor, Australian Graduate School of Management (AGSM), Australian Graduate School of Management, UNSW, Sydney, NS, Australia, galr@agsm.edu.au, Panelists: Gilvan Souza, Tasha R. Inniss, Feryal Erhun

In this interactive panel discussion, we will discuss the balance of research and teaching. Panel members will discuss their experiences as junior faculty in managing this balance in different environements such as business schools, Engineering departments and OR/Math Departments. A large part of the panel will be dedicated to interactive discussion with the Audience.

■ MC45

Tutorial: Agent-Based Modeling and Simulation

Cluster: Tutorials
Invited Session

1 - Tutorial on Agent-Based Modeling and Simulation
Charles M. Macal, Center for Complex Adaptive Agent Systems Simulation (CAS2) Decision & Information Sciences Division, Argonne National Laboratory, 9700 S. Cass Avenue, Building 900, Argonne, IL, 60439, United States, macal@anl.gov, Michael North

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

■ MC46

Supply Chain Disruptions

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Lawrence Snyder, Assistant Professor, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu

1 - Disruption-Management Strategies for Short Life-Cycle Products
Brian Tomlin, Assistant Professor, University of North Carolina, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, brian_tomlin@unc.edu

Diversification, contingent sourcing, and demand management are key building blocks of a disruption-management strategy. In this paper, we investigate the influence of key attributes of the firm, its supplier(s), and its products on the firm's preference for various strategies. These attributes include supplier reliability, supplier failure correlation, payment responsibility, product contribution margin, product substitutability, demand uncertainties and correlation, and loss aversion.

2 - Supply Risk, Information Asymmetry, and Backup Production Option
Zhibin (Ben) Yang, PhD Candidate, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, zhibiny@umich.edu, Volodymyr Babich, Goker Aydin, Damian Beil

We consider a one-period model in which the supplier is subject to random disruptions. The probability of a disruption, high or low, is known to the supplier but not to the buyer. In case of a disruption, the supplier either pays a penalty or uses a backup production source to meet the order. We derive the buyer's optimal contract, find that it may penalize the less reliable supplier while forcing the more reliable supplier to use the backup source, and compute the cost of information asymmetry.

3 - A Hurricane-Supplies Stocking Problem with Wind-Speed Information Updates
Emmett Lodree, Assistant Professor, Auburn University, Industrial and Systems Engineering, 207 Dunstan Hall, Auburn, AL, 36849, United States, elodree@auburn.edu, Selda Taskin

Several manufacturing, service, and government agencies are involved with responding to needs that arise after a hurricane makes landfall. These organizations are responsible for ensuring the availability of critical supplies needed to successfully carry out emergency response and recovery activities. This presentation defines a procurement/production problem characterized by information updates associated with hurricane wind speeds and describes algorithms for solving the problem optimally.

4 - Infinite-Horizon Models for Inventory Control Under Yield Uncertainty and Disruptions
Amanda Schmitt, PhD Student, Lehigh University, 1859 Mansfield Street, Hellertown, PA, 18055, United States, amanda@lehigh.edu, Lawrence Snyder

We analyze the costs and optimal policies for an inventory system with an unreliable supplier that is subject to regular variance in supply as well as complete disruptions. We also consider a second, reliable (but more expensive) supplier. We compare the optimal policies to those us found using two common approximations: horizon trucation and variance bundling. We show that these approximations distort the order quantities, under-utilize the reliable supplier, and increase costs.

■ MC47

Equilibrium and Allocation Models in Operations

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Sriram Dasu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, sriram.dasu@marshall.usc.edu

1 - Dynamic Pricing and Input Control in Multi-Class Queues
Sriram Dasu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, sriram.dasu@marshall.usc.edu, Chunyang Tong

We consider multiple servers system with multiple customer classes. The duration of service is class dependent. We are interested in pricing and input control policies that maximize revenues. Based on diffusion approximations we derive properties of the optimal policies

2 - Computing Stable Farsighted Outcomes in Coalitional Games
Mahesh Nagarajan, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Mahesh.Nagarajan@sauder.ubc.ca

We provide the first set of results on the computational complexity of computing stable outcomes in dynamic coalitional games, namely the LCS and EPCF. We present a set of sufficient conditions that ensure that computing the LCS is NP hard. We then propose algorithms that approximately compute the LCS in an asymptotic sense. We discuss implications to computation of the EPCF and applications to supply chain games.

3 - A Stochastic Programming Duality Approach to Inventory Centralization Game
Xin Chen, Assistant Professor, University of Illinois, 1206 West Green Street, 224 MEB, MC-244, Urbana, IL, 61801, United States, xinchen@uiuc.edu, Jiawei Zhang

A class of cooperative games arising from inventory centralization is studied in this paper. The optimization problems corresponding to the inventory games are formulated as stochastic programs. We observe that the strong duality of stochastic linear programming not only directly leads to a series of recent results concerning the non-emptiness of the cores of such games, but also suggests a way to find an element in the core.

4 - Duality Approach to Economic Lot Sizing Game
Jiawei Zhang, Assistant Professor, New York University, Stern School of Business, New York, NY, 10012, United States, jzhang@stern.nyu.edu, Xin Chen

We use duality to analyze economic lot sizing game with concave ordering cost. The standard formulation of the corresponding optimization problem is a concave minimization problem and hence linear programming duality does not directly apply. However, we present a new formulation for the problem and construct a dual of it without duality gap.

■ MC48

MSOM Fellows: Awards and Presentations

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Fangruo Chen, Ira Rennert Professor of Business, Columbia Business School, 3022 Broadway, Uris Hall, Room 407, New York, NY, 10027, United States, fc26@columbia.edu

1 - MSOM Fellows: Awards and Presentations

Every year the MSOM Society recognizes outstanding research and scholarship in operations management by presenting the MSOM Fellows Award to a few individuals (no more than three). This year the winners are Professors Linus Schrage and Harvey Wagner. This session provides a rare opportunity for members of the society to hear their lifelong contributions to the field of operations management.

■ MC49

Consumer, Production and Sustainability: Topics in Closed Loop Supply Chains

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

Chair: Pranab Majumder, Assistant Professor of Operations, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu

1 - Optimal Manufacturing-Remanufacturing Policies in a Lean Production Environment
Sergio Rubio, Assistant Professor, University of Extremadura, Department of Business Management, Escuela de Ingenierias Industriales, Badajoz, 06071, Spain, srubio@unex.es, Albert Corominas

This study analyses a production-management model that considers the possibility of implementing a reverse-logistics system in a lean production environment, as opposed to models that use EOQ approaches. Decision variables are identified (including manufacturing and remanufacturing capacities) and optimal policies are determined. The conclusion drawn is that mixed policies can be optimal unlike the results published in earlier studies, which are based on more restrictive assumptions.

2 - The Role of Leadership in Encouraging Sustainability in Agro-Based Supply Chains
Pranab Majumder, Assistant Professor of Operations, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, majumder@duke.edu, Ashok Srinivasan

We examine the issue of promoting sustainability in long supply chains with agricultural inputs, which has a high impact on the environment. Sustainability in also includes reliability of supply from marginal farmers. We use a model where the leader has the ability to offer contracts to any other member of the chain. Our model shows that by directly offering contracts to the input producer, the supply chain leader can promote sustainability; in many cases the chain efficiency also increases.

■ MC50

Econometric Applications in Operations Management

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

1 - Incentives, Information and Supply Chain Performance
Taylor Randall, Associate Professor, University of Utah, 201 South Presidents Circle, Salt Lake City, UT, 84112, United States, acttr@business.utah.edu, Shoshanah Cohen, Susan Kulp

This research examines the crucial role of incentives and information sharing in the supply chain. We posit that greater use of incentives and information will be associated with supply chain performance, but that the effect will be contingent on the organizational structure of the firm. We test these hypotheses using performance data collected from 37 make-to-stock manufacturing firms.

2 - Inventory Productivity and Financial Performance in the US Retail Sector
Vishal Gaur, Assistant Professor, Leonard N. Stern School of Business, New York University, 44 West 4th Street, 8-72, New York, NY, 10012, United States, vgaur@stern.nyu.edu, Marshall Fisher, Ananth Raman

We use public financial data on US retailers to investigate whether high inventory turnover is positively associated with financial performance as measured by contemporaneous and abnormal stock returns of firms.

3 - Estimating the Impact of Stock-Outs on Demand: An Empirical Analysis of a Spanish Retailer
Marcelo Olivares, PhD Student, Operations and Information Management, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, maolivar@wharton.upenn.edu, Christian Terwiesch, Andres Musalem, Eric Bradlow, Daniel Corsten

We present a large scale empirical study on the effect of stock-outs on demand. Using a unique, proprietary data set, we measure specifically what percentages of demand are lost, back-ordered, or substituted to other SKUs. We present and evaluate various estimation models, including a store level estimation method and a consumer level estimation models.

4 - The Impact of New Product Introduction on Assembly Productivity in the N.A Automotive Industry
Manu Goyal, Assistant Professor, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States, mgoyal@rhsmith.umd.edu, Matthew Reindorp, Serguei Netessine

Choosing the right manufacturing facility is a key element in the launch of a new or updated automotive product. From a study of recent data on North American automobile production, we find that prior productivity is a significant predictor of productivity during launch and positively influences a plant's chances of being chosen as a launch site. We also demonstrate that productivity during launch is improved when the launch is larger and/or flexible production methods are employed.

■ MC51

Joint Session Planning & Responding/Counter Terrorism: Planning for and Responding to Explosive Terrorist Attacks

Cluster: Planning for and Responding to Disasters, Counter Terrorism and OR
Invited Session

Chair: Moshe Kress, Professor, Naval Post Graduate School, 1 University Circle, Monterey, CA, 93943, United States, mkress@nps.edu

1 - Nature Plays with Dice - Terrorists Do Not: Allocating Resources to Counter Strategic and Probabilistic Risks
Boaz Golany, golany@ie.technion.ac.il, Edward Kaplan, Abraham Marmur, Uriel G. Rothblum

Probabilistic uncertainty is caused by ``chance" whereas strategic uncertainty is caused by an adverse interested party. Using linear impact functions, the problems of allocating a limited resource to defend sites that face either probabilistic risk or strategic risk are formulated as optimization problems that are solved explicitly. The resulting optimal policies differ — under probabilistic risk, the optimal policy is to focus the investment of resources to priority sites where they yield the highest impact, while under strategic risk, the best policy is to spread the resources so as to decrease the potential damage level of the most vulnerable site(s). Neither solution coincides with the commonly practiced proportionality allocation scheme.

2 - The Bombs Bursting in Air?: Explosions Aboard Commercial Aircraft
Arnie Barnett, abarnett@mit.edu

The Transportation Security Administration has identified explosive devices as the greatest current threat to US aviation. In recent years, bombs have been smuggled onto airplanes within checked luggage, in carry-on bags, in cargo, and strapped to the bodies of suicidal terrorists. In 2004, simultaneous bombings in Russia caused the destruction of two passenger jets. We discuss some security measures now taken—and others not taken—aimed at preventing such horrors, and explore whether existing policies make sense from a cost-benefit perspective.

3 - Search for a Malevolent Needle in a Benign Haystack
Donald P. Gaver, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, dgaver@nps.edu, Patricia A. Jacobs, Moshe Kress

Terrorist suicide attacks occur in small, crowded arenas, or in larger maritime domains. Suppose one such terrorist (Red) is present and moves randomly and clandestinely to avoid detection and locate vulnerable target groupings. Blue searches for and detains suspicious elements. We model the probability that Blue neutralizes Red before detonation.

4 - Scheduling Policies for Counter-Terrorist Surveillance System
Kyle Lin, Assistant Professor, Operations Research Department, Naval Postgraduate School, Glasgow Hall 260, Monterey, CA, 93943, United States, kylin@nps.edu, Moshe Kress, Roberto Szechtman

A counter-terrorist surveillance system usually does not have the capacity to screen all suspects in an open area. If the sojourn time distribution of a terrorist is different from that of the others, then potentially we can improve the probability of catching a terrorist by carefully choosing which suspect to inspect. We use a queueing model and develop a heuristic policy that works well in an area with heavy traffic.

■ MC52

Panel Discussion: Is Revenue Management Working in Practice?

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Tito Homem-de-Mello, Associate Professor, Industrial Engineering & Management Sciences, Northwestern University, Evanston, IL, 60208, United States, tito@northwestern.edu

Co-Chair: Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu

1 - Is Revenue Management Working in Practice?
Moderator: Anton Kleywegt, Associate Professor, Georgia Institute of Technology, School of Industrial Systems Engineering, Atlanta, GA, 30332, United States, anton@isye.gatech.edu, Panelists: Garrett van Ryzin, Robert Phillips, Andrew Boyd

Revenue management has been an important application area of operations research for several decades, and revenue management is often touted as one of the success stories of operations research. All of these are for good reasons. However, some recent findings and episodes have led some to question the validity of those techniques. The purpose of the panel discussion is to shed some light on this issue. Particular topics that deserve critical evaluation include difficulties with demand modeling, consumers' perception (real or imagined) of dynamic pricing practices as unfair, and new practices from airline companies such as simplification of the fare structure.

■ MC53

Inventory Management I

Contributed Session

Chair: Suresh Sethi, Ashbel Smith Professor, University of Texas at Dallas, School of Management, SM30, 2601 N. Floyd Road, Richardson, TX, 75080, United States, sethi@utdallas.edu

1 - Modeling the Service Level of a Two Customer Make-to-Stock Production System
Sean Willems, Assistant Professor of Operations Management, Boston University, School of Management, SMG 673, 595 Commonwealth Avenue, Boston, MA, 02215, United States, willems@bu.edu, Feng Tian

We model a single product make-to-stock production system with two-priority customers. The inventory rationing policy is studied for the system. Different service level criterion, such as order filling rate, and average waiting time, are derived. The focus is on the relationship between system parameters and the service level that different customers can experience. We also take a look at whether the optimality of the rationing policy will change when customers' service level requirements exist.

2 - A Mixed Lost-Sales Backordering Inventory Problem with Two Customer Classes
Paul Enders, PhD student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, penders@cmu.edu, Geert-Jan Van Houtum, Ivo Adan

We study a prioritized inventory model with rationing, inspired by spare parts management. High priority demand is met from stock if possible, otherwise lost. Low priority demand is satisfied if stock is above a critical level, otherwise backordered. We show how the performance of an inventory policy can be determined using a two-dimensional Markov process with level dependent transition rates. We develop an efficient algorithm to find the optimal policy, and perform computational experiments.

3 - An Embedded Markov Chain Approach to the Analysis of Inventory Systems Under Rationing
Murat Fadiloglu, Professor, Bilkent University, Bilkent Universitesi, Endustri Muh. Bol. Oda:309, Ankara, 06800, Turkey, mmurat@bilkent.edu.tr, Onder Bulut

We propose a new method for the analysis of inventory systems with backorders under rationing. We show that if such a system is sampled at multiples of supply leadtime, the state of the system evolves according to a Markov chain. We provide a recursive procedure to generate the transition probabilities of the embedded chain. We demonstrate that it is possible to obtain the steady-state probabilities of interest with desired accuracy by considering a truncated version of the infinite chain.

4 - Lot Sizing with Random Yield and Different Qualities
Bacel Maddah, Assistant Professor, American University of Beirut, Engineering Management Program, AUB, PO Box 11-0236, Riad El Solh, Beirut, 1107 2020, Lebanon, bacel.maddah@aub.edu.lb, Moueen Salameh

This paper considers an inventory system where items produced/purchased are of different qualities: Type A and Type B. Type A items are of perfect quality, and Type B items are of imperfect quality; but not necessarily defective; and have a lower selling price. The percentage of Type A (the yield rate) is assumed to be a random variable with a known distribution. We extend the classical newsvendor and EOQ models by accounting for random supply and for imperfect quality (Type B) items.

5 - On the Optimal Control of Partially Observed Inventory Systems: A Review
Suresh Sethi, Ashbel Smith Professor, University of Texas at Dallas, School of Management, SM30, 2601 N. Floyd Road, Richardson, TX, 75080, United States, sethi@utdallas.edu, Alain Bensoussan, Metin Cakanyildirim

We review recent developments in the analysis of inventory systems with partial observations. System states are conditional distributions evolving over time. Unnormalized probabilities are introduced to reduce nonlinear state transition equations to linear ones to prove the existence of the optimal feedback policies. In some cases, it is possible to give a sufficient statistic to serve as a state, but in most cases, further analysis is needed to develop computational methods for the solution.

■ MC54

Interface of Operations and Marketing I

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu

1 - Marketing and Operations in Emerging Markets: A Research Agenda
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

This session will discuss strategies for linking operations and marketing in emerging market countries, and how they differ from strategies for industrialized countries. We describe new areas for operations management and supply chain management research.

2 - Does Hospital-Level Management Drive Service Quality?
Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Xin Wang

A hospital has multiple medical units treating different diseases. It has been observed that there exists wide variation in service quality across those medical units within a hospital. This brings to the question: Does hospital-level factors such as upper-level management matter in improving the service quality for all medical units?

3 - Optimal Strategies for Exploiting Product Innovations
Sinan Erzurumlu, Doctoral Student, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States, Sinan.Erzurumlu@phd.mccombs.utexas.edu, Karthik Ramachandran, Stephen Gilbert

We analyze the issue of when and how an innovator would transfer its technology to another firm with which he also competes in the product market. Our analysis focuses on the structure of the network effects, the transferability of the innovation, and the market position of the innovator, and we explore how these parameters affect the optimal strategy for exploiting an innovation.

4 - An Empirical Study: Service Capacity and Demand
Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu, Lorin Hitt, Jun Zhang

This paper presents an empirical study of the relationship between service capacity and demand in a multi-channel service delivery system with internal (inter-channel) and external competition using a large panel data set from retail banking. In addition, it studies how customer characters important to service operations, e.g. customer efficiency, influence the relationship.

■ MC55

Data Envelopment Analysis and Resource Allocation

Cluster: Data Envelopment Analysis
Invited Session

Chair: Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

1 - A DEA Approach to the Allocation of Funding for Regional Ambulance Service
Tarja Joro, Assistant Professor, University of Alberta School of Business, 3-40F Business Building, Edmonton, AB, T6G2R6, Canada, tarja.joro@ualberta.ca, Susan Budge, Armann Ingolfsson

In March of 2004, the Government of Alberta made the decision to transfer the governance and funding of emergency medical services from municipalities to the regional health authorities. We take a DEA approach and examine the relevant inputs and outputs of ambulance service in Alberta in order to construct an appropriate allocation of funding for a regional ambulance service.

2 - Using the DEA to Achieve A Fair Globalization
Ruzanna Tarvedyan, Research Economist, International Labour Office, 4 Route des Morillons, CH-1211 Geneva 22, 1204, Switzerland, tarverdyan@ilo.org, Nicole Adler

Delivering on U.N. declarations for an integrated analysis of development goals, capturing not only economic but also non-economic dimensions of well-being, we propose analyzing globalization through the use of DEA. We develop a surveillance instrument aimed at improving country performance and policy effectiveness and a management tool identifying optimal policies and ensuring policy coherence that will enable countries to maximize the benefits and minimize the costs of globalization.

3 - Global Millennium Development Goals: Which Policies are Effective?
Nicole Adler, Assistant Professor, School of Business Administration, Hebrew University of Jerusalem, Mount Scopus 91905, Israel, msnic@huji.ac.il

We benchmark developing countries and analyze which are most effective in achieving the United Nations agreed Millennium Development Goals using data envelopment analysis. These goals range from eradication of extreme poverty, provision of universal primary education, promotion of gender equality and reduction in child and maternal mortality rates. The second stage analysis utilizes regression to explain the efficiency scores in an attempt to identify useful policy measures.

Monday, 4:30pm - 6:00pm

■ MD01

Matching Markets

Sponsor: Optimization/ Network and Combinatorial Optimization
Sponsored Session

Chair: Nicole Immorlica, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, nickle@microsoft.com

1 - Fair Allocation Over Time
Stergios Athanassoglou, PhD Student, Columbia University, IEOR Department, 500 West 120th Street, Room 313 Mudd Building, New York, NY, 10027, United States, sa2164@columbia.edu, Jay Sethuraman

We consider the problem of allocating a divisible resource over a fixed time horizon. We assume a continuum of agents, competing for the same infinitesimal fraction of the resource in each period. An agent decides to demand the resource after observing his utility for the resource. In the interest of fairness, priority classes are determined by the number of times an agent has chosen to participate in the past. We describe the equilibrium of this game and ways to compute it in special cases.

2 - Incentives and Stability in Large Two-Sided Matching Markets
Fuhito Kojima, PhD Candidate, Department of Economics, Harvard University, 1875 Cambridge Street, Cambridge, MA, 02138, United States, kojima@fas.harvard.edu

The paper analyzes the scope for manipulation in college admission problems under the student-optimal stable mechanism when the number of participants is large. The fraction of colleges that have incentives to misrepresent their preferences approaches zero as the market becomes large. Truthful reporting is an approximate equilibrium in large markets that are sufficiently thick, a condition that allows for certain types of heterogeneity in the distribution of student preferences.

3 - Pairwise Kidney Exchange and Beyond
Utku Unver, Assistant Professor, University of Pittsburgh, Department of Economics, 4506 Posvar Hall, 230 S. Bouquet Street, Pittsburgh, PA, 15260, United States, uunver@pitt.edu, Alvin Roth, Tayfun Sonmez

Initially, kidney exchanges are likely to be between just two patient-donor pairs. We show that, although this constraint eliminates some potential exchanges, there is a wide class of constrained-efficient mechanisms that are strategy-proof when patient-donor pairs and surgeons have 0-1 preferences. This includes deterministic mechanisms and stochastic mechanisms.

4 - Random Popular Matchings
Mohammad Mahdian, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, mahdian@gmail.com

We consider matching markets where a centralized authority must find a matching between agents (with preferences) and items (without preferences). The objective is to find a popular matching, or a matching that is preferred by a majority of the agents to any other matching. The main drawback of this concept is that popular matchings sometimes do not exist. We partially address this issue by proving that in a probabilistic setting popular matchings almost surely exist.

■ MD02

Joint Session Open-Source/ICS: Open Source, Distributed Computing, and Operations Research

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

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

1 - A Library Hierarchy for Implementing Scalable Parallel Search Algorithms

Yan Xu, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27519, United States, yan.xu@sas.com, Ted Ralphs, Matt Saltzman, Laszlo Ladanyi

We discuss a library hierarchy for implementing scalable parallel search algorithms: ALPS, BiCePS and BLIS. ALPS forms the base layer, which is also the search handling layer, BiCePS is the data handling layer, and BLIS implements LP-based branch and bound algorithms. We present computational results for solving large integer programs.

2 - Incorporating Cutting Planes into the PICO Mixed Integer Solver

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, jeckstei@rutcor.rutgers.edu, William Hart, Cynthia Phillips

PICO is an open source, massively parallel branch-and-bound search framework under development at Sandia National Labs. This talk focuses on the incorporation of cutting planes into PICO's mixed integer programming layer. We describe our cut finder scheduling strategy, experience with COIN's Cut Generation Library (CGL), new general cutting planes implemented in PICO, support for user-defined cutting planes, and parallelization issues.

3 - MW—Master-Worker Middleware for Grids

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

MW is an open-source software package that enables master-worker computations to be carried out on computational grids. We will give an overview of the MW design, discuss recent software enhancements, and provide success stories in using MW to solve large-scale numerical optimization problems on a computational grid.

■ MD03

Large-Scale Nonlinear Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Michael Friedlander, Assistant Professor, University of British Columbia, Department of Computer Science, Vancouver, BC, Canada, mpf@cs.ubc.ca

1 - Box-Constrained Least-Squares and Nonlinear Optimization

Michael Friedlander, Assistant Professor, University of British Columbia, Department of Computer Science, Vancouver, BC, Canada, mpf@cs.ubc.ca

Box-constrained least-squares problems in their own right represent a rich class of applications. They also arise as subproblems in algorithms for optimization. We describe BCLS, a software package specially designed for the solution of such problems.

2 - Interior-Point Methods for Nonconvex Nonlinear Programming: Regularization and Warmstarts

Hande Benson, Assistant Professor, LeBow College of Business, Drexel University, Academic Building, 2nd Floor, Philadelphia, PA, 19104, United States, hvb22@drexel.edu, David Shanno

In this talk, we investigate the use of an exact primal-dual penalty approach within the framework of an interior-point method for nonconvex nonlinear programming. This approach provides regularization and relaxation, which can aid in solving ill-behaved problems and in warmstarting the algorithm. We present details of our implementation within the LOQO algorithm and provide extensive encouraging numerical results.

3 - The Zoom Strategy for Accelerating and Warm-Starting Interior Methods

Michael Saunders, Professor, Department of Management Science & Engineering, Stanford University, 380 Panama Way, Stanford, CA, 94303-4026, United States, saunders@stanford.edu, Leo Tenenblat

Interior methods using iterative solvers for each search direction can require drastically increasing work per iteration as higher accuracy is sought. The Zoom strategy solves first to low accuracy, and then solves for a correction to both primal and dual variables, again to low accuracy. We "zoom in" on the correction by scaling it up, thus permitting a cold start. The same strategy applies to warm-starting in general.

4 - An Interior-Point l_2 Penalty Method for Large Scale Nonlinear Programming

Lifeng Chen, Student, Columbia University, IEOR Department, New York, NY, 10027, United States, lc2161@columbia.edu, Donald Goldfarb

We present an interior-point l_2 penalty method for large scale nonlinear programming. A detailed description of the algorithm is provided, including computation of search directions, backtracking line search, second-order corrections and heuristics for motivating faster convergence. A comprehensive numerical study with several options of regularization and line search is presented. A comparison is provided with state-of-the-art interior-point codes for nonlinear programming.

■ MD04

Recent Advances in Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@mgmt.purdue.edu

1 - Separation and the Stable-Set Polytope

Illya Hicks, Associate Professor, Texas A&M University, Industrial and Systems Engineering MS 3131, Zachry Engineering Center, College Station, TX, 77843-3131, United States, ivhicks@tamu.edu, Sandeep Sachdeva, Benjamin McClosky

A k-separation of a graph G is a pair of edge disjoint subgraphs whose union of nodes and edges form G and whose intersection of vertices has order k. We offer preliminary research for a facet generation procedure for the well-studied stable set polytope of a graph G that contains a 3-separation. The procedure is based upon the composition of polyhedra corresponding to two subgraphs of G related to a 3-separation of G. This work is based upon the earlier work of Barahona and Mahjoub.

2 - New Facets of the (Directed) Cycle Polytope

Egon Balas, Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, eb17@andrew.cmu.edu, Ruediger Stephan

Earlier work on the directed cycle polytope P showed how to lift and project facets of the asymmetric traveling salesman polytope (ATSP) into facets of P. Here we introduce a different class of facets, unrelated to the ATS polytope, whose support spans the entire digraph and whose defining inequality is tight for every two-cycle.

3 - Cutting Planes Selection

Miroslav Karamanov, PhD, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, miroslav@andrew.cmu.edu, Gerard Cornuejols

Cutting planes have established their important role for improving the performance of branch and bound. Today, improved algorithms and increased computational power allow generation of a large number of cuts in a short time. Selecting a subset of them while preserving the cutting power of the pool of cuts is a problem of great practical importance. We address this problem from several different points of view and discuss the effectiveness of different cut selection rules.

4 - A Benders Decomposition Approach to Solving an Evacuation Problem

J. Cole Smith, Associate Professor, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, cole@ise.ufl.edu, April Andreas

Consider a network in which individuals are evacuated to a safe point. Source nodes could represent offices, and the safe node could represent any point away from danger. We consider methods of modeling capacity and objectives, focusing on the minimization of the latest evacuation time. To capture evacuation dynamics, we examine a time-expanded network, and employ Benders decomposition using implied dual values to avoid directly solving optimization problems over the temporal dimension.

■ MD05

Control and Analysis of Queues

Sponsor: Applied Probability
Sponsored Session

Chair: David Kaufman, Postdoctoral Associate, Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh PA 15261, United States, davidk@engr.pitt.edu

1 - Approximating Time-Dependent Ph_t and MAP_t Queueing-Models

Michael Taaffe, Graduate Program Director, Associate Professor, The Grado Department of Industrial and Systems Engineering, Durham Hall, Virginia Tech, Blacksburg, VA, 24061, United States, taaffe@vt.edu, Walid Nasr, Javier Rueda

We develop numerical methods based on partial-moment differential equations and closure approximations for time-dependent moments of the system state and the distribution function and moments of virtual sojourn time for queueing nodes having Ph_t, MAP_t, and MSP_t arrival/service processes. We discuss our approximation for [M_t/M_t/s]^K queueing networks. We also allow for time-based control of system parameters (number of servers and queue capacity) and entity arrivals/deletions.

2 - Tandem Lines with Collaborative Flexible Servers

Hayriye Ayhan, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, hayhan@isye.gatech.edu, Sigrún Andradóttir, Doug Down

Consider a tandem queueing network with two stations, infinite supply of jobs in front of station 1, infinite room for completed jobs after station 2, finite buffer between stations, and two flexible servers. Under the assumption that two servers can work together on a single job, we study how the optimal dynamic server assignment policy changes as a function of how well these two servers work together.

3 - Staffing a Helpdesk with Two Queues Connected by Abandonment

Yusik Kim, PhD Student, University of California at Berkeley IEOR, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, ykim@ieor.berkeley.edu, Ronald Wolff, Rhonda Righter, Vijay Mehrota

Consider a helpdesk that has two methods of providing customer service: replying to email and answering phone calls. Each service has its own queue and arrival process, but customers may abandon the email queue to enter the phone queue. We analyze the system under the assumption of exponential service, inter-arrival and abandonment times, develop a cost model as a function of the number of servers and discuss its convexity structure. We also study properties of the optimal staffing levels.

4 - Dynamic Load Balancing in Parallel Networks with Heavy-Tailed Service Distributions

Luz Caudillo, PhD Candidate, University of Michigan IOE, 1205 Beal Avenue, Industrial and Operations Engineering, Ann Arbor, MI, 48109-2117, United States, fuentesl@umich.edu, Mark Lewis, David Kaufman

We consider dynamic load balancing for parallel processing networks (PPNs) with service times that follow a heavy-tailed distribution. With non-exponential services, the control problem is intractable. As an approximation, we consider a two station, two class exponential model with "usual" and "slow" customers. This amounts to a hyper-exponential approximation of the service times. Structural results for the exponential model are used to develop a heuristic for the original model.

■ MD06

Quality Management

Contributed Session

Chair: Bernardo Villarreal, Professor, Universidad de Monterrey, Avenue I. Morones Prieto 4500 Pte., Sn Pedro Garza Garcia, 66238, Mexico, bvillarreal@udem.edu.mx

1 - The Causality of EFQM Model in Public Management of Turkey

Baris Çarikci, Researcher, Kosulolu Cad Baris Mah No 48 TUSSIDE, Gebze, Turkey, bcarikci@yahoo.com, Orhan Dursun

EFQM Model is the most known and used model in Europa for public and private institutions to improve organizational excellence. Although the validity of the model is definite, the causality among the criterians are not clear. In our project, we try to propose a model to explain the causality of the EFQM Model for Turkish public instutions.

2 - A Model for Analyzing the Competitive Strategy in Environments Hyper-Competitives

Maria Auxiliadora Melo, Universidade Federal de Pernambuco/Departamento de Engenharia de Produção, Av. Acadêmico Hélio Ramos, s/n, Cidade U, Recife, Pe, 50740-530, Brazil, madonmelo@hotmail.com, Denise de Medeiros

The aim of this paper is to present a formulation of the System of Competitive Intelligence that is up-to-date and which enables the constant upgrading and improvement of business management practices, so that a competitive edge may be maintained and a market differentiation established. The system is based on the intelligence cycle and also on the four areas of competition described by D'Aveni for the analysis of businesses which operate in highly competitive arenas.

3 - Design of Manufacturing Systems with Complex Configurations for Product Variety and Change

Jeonghan Ko, University of Michigan, 2250 GG Brown, 2350 Hayward Street, Ann Arbor, MI, 48109, United States, jeonghan@umich.edu, S. Jack Hu

Classical line design methods have usually concerned serial configurations and single-generation products, while product variety and model changes are increasing. To design a manufacturing system for product variety, we are developing new configuration-design methods for systems that asymmetrically branch. We are also developing new mathematical models for task-machine assignment and workload balancing over multiple generations of products to minimize the impact of product changes on systems.

4 - The Effect of Six Sigma Projects on Customer Satisfaction

Mahour Parast, Assistant Professor, University of South Dakota, 414 E. Clark Street, Vermillion, SD, 57069, United States, mahour.parast@usd.edu, Anthony Williams, Stephanie Adams

The paper investigates the effect of Six Sigma process improvements on customer satisfaction. Five constructs have been developed to measure customer satisfaction: reliability, availability, completeness, responsiveness, and professionalism. This research attempts to examine the relationship between customer satisfaction and the five constructs and how Six Sigma implementation affects customer satisfaction. The results show that all constructs are significantly related to customer satisfaction.

5 - Manufacturing Lead Time Reduction: A Simulation Approach

Bernardo Villarreal, Professor, Universidad de Monterrey, Avenue I. Morones Prieto 4500 Pte., Sn Pedro Garza Garcia, 66238, Mexico, bvillarreal@udem.edu.mx

It is well known that manufacturing lead time is vital to determine the degree of responsiveness of a firm to satisfy market demand. The prioritization of investment projects in a resource-constrained environment is of major concern, and in particular if our objective is to become faster and more flexible to respond to customers requirements. This paper proposes a scheme to rank investment projects with the goal of minimizing manufacturing lead time utilizing simulation.

■ MD07

Software for Semidefinite Programming

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

Chair: Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

1 - Infeasibility Detection 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

While infeasibility detection is a routine task in linear optimization, conic optimization solvers often have difficulty dealing with it. The problem is further complicated by weakly infeasible conic models. We present a new set of stopping criteria for interior point conic optimization methods with self-dual embedding. The technique preserves the polynomial complexity of the interior point method and it can be further enhanced by preprocessing. The method is illustrated with the SeDuMi package.

2 - Recent Developments in SDP and SOCP Software

Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States, beck@plato.la.asu.edu

After an intense development period some years ago, further improvements of SDP and SOCP codes have taken considerable time. We will try to assess the current state-of-the-art.

3 - A Conic Interior Point Decomposition Approach for Block Angular Semidefinite Programs

Kartik Krishnan Sivaramakrishnan, Assistant Professor, Department of Mathematics, North Carolina State University, Box 8205, Raleigh, NC, 27695, United States, kksivara@ncsu.edu

We recently developed a conic IPM approach for block angular SDPs. The idea is to solve such an SDP using existing primal-dual IPMs in an iterative fashion between a mixed conic master problem over linear and smaller dimensional semidefinite cones; and decomposed and distributed subproblems (smaller SDPs) in a high performance computing environment. In this talk, we present our algorithm, discuss issues for an efficient implementation, and also our computational experiences with the algorithm.

4 - The Continuing Development of CSDP

Brian Borchers, Professor, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

CSDP is a subroutine library and stand-alone solver for semidefinite programming problems that has been under development since 1997. The software is now being made available as an open source project through the COIN-OR repository. The current status of CSDP and future development plans will be described. Computational results will also be presented.

■ MD08

TMS Distinguished Speaker

Sponsor: Technology Management

Sponsored Session

Chair: Diane Bailey, Assistant Professor, Stanford University, Management Science and Engineering, 428 Terman Engineering, Stanford, CA, 94305, United States, diane.bailey@stanford.edu

1 - Technology as a Tradable Commodity? Unresolved Questions in Markets for Technology

Ashish Arora, Professor of Economics and Public Policy, Heinz School of Public Policy & Management, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, ashish@andrew.cmu.edu

In this session, TMS Distinguished Speaker Ashish Arora will discuss important questions that remain unresolved in the area of markets for technology. In considering the conditions under which technology can be made into a tradable commodity, Ashish will explore when and why integration has value. The organization of inventive activity and the subsequent efficiency effects are a central issue in this discussion.

■ MD09

Open Innovation, Open Source, Networks

Cluster: New Product Development

Invited Session

Chair: Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

1 - Markets for Innovation: An Equilibrium Models of R&D Contests

Christian Terwiesch, Associate Professor, University of Pennsylvania, 548 JMHH, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Yi Xu

We present an analytical model of a community of R&D problem solvers. Firms can post R&D problems to this community and offer potential rewards for satisfactory solutions. We explain why such markets exist, how the function, and how the should me managed.

2 - Portfolio Management and Organizational Structure in Software Development

Manuel Sosa, Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

Portfolio management decisions typically result in the execution of a mix of incremental and radical innovation projects. Using a sociometric approach in a distributed software development firm, I investigate the organizational implications of concurrently working on both incremental and radical innovation.

3 - Startup Strategies for Participation in Open Innovation Systems

Lee Fleming, Professor, Harvard Business School, 485 Morgan Hall, Boston, MA, 02163, United States, lfleming@hbs.edu, Dave Waguespack

While research has shown why individuals contribute to open innovation communities, little research has considered why a firm would contribute. We investigate how firms should engage open innovation communities and demonstrate strong causal effects upon liquidity events for startups in telecommunications technology.

■ MD10

Software Demonstration

Cluster: Software Demonstration

Invited Session

1 - Ziena Optimization, Inc. - An Overview of the KNITRO Optimization Solver

Richard Waltz, Ziena Optimization, Inc., 1801 Maple Avenue, Evanston, IL, 60201, waltz@ziena.com

This software demonstration will provide an overview of how to effectively use KNITRO in a variety of environments and applications. The presentation will demonstrate usage of KNITRO as both an embeddable callable library and through various modeling languages. The demonstration will highlight some of the newer and most relevant features.

2 - Lumina Decision Systems, Inc. - Analytica: What It Does That Spreadsheets Can't

Max Henrion, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, henrion@lumina.com

A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

■ MD11

New Methods in Economic and Environmental Modelling

Sponsor: Minority Issues

Sponsored Session

Chair: Kobi Abayomi, Visiting Professor, Haverford College, PO Box 250219, Manhattan, NY, 10025, United States, kobi.abayomi@columbia.edu

1 - Sustainably Selective Welfare Functions

Kobi Abayomi, Visiting Professor, Haverford College, PO Box 250219, Manhattan, NY, 10025, United States, kobi.abayomi@columbia.edu

"Sustainability", in the economic sense, is a criteria in need of definition. Chichilnisky has proposed an axiomatic standard: that a welfare function is "sustainable" if, and only if, it is non-negligible on both the finite and infinite parts of its domain - the space of utility streams. I investigate statistical approaches to Chichilnisky's axiomatization, which can be regarded as finite time tests of the "sustainability" of a utility, and, thusly, a development path.

■ MD12

Work Life Balance

Sponsor: Women in OR/MS

Sponsored Session

Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Work Life Balance - A Mom's Perspective

Alice Smith, Professor and Chair, Department of Industrial & Systems Engineering, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, aesmith@eng.auburn.edu

Combining an academic career, parenting and personal life is the topic. Achieving success with all while maintaining sanity, and even serenity, is the goal. Synergies of academic work with home life is an occasional, and welcome, byproduct.

2 - Some Personal Observations Regarding an Academic Career in Operations Research

Martin Wortman, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843-3131, United States, wortman@mwx.tamu.edu

Over a 20 year academic career, there have been occasions upon which the author asked himself, "What was I thinking?" In this talk, we will review some of the approaches taken by the author to achieve a balanced and well ordered career that were not entirely successful.

3 - Juggling Tasks: Mine, Yours and Ours...

Reha Uzsoy, Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, uzsoy@ecn.purdue.edu, Lucia Mendez

We show that the NP-hardness of simple scheduling problems achieves completely new heights when applied to families involving professional parents with children. We present some empirical observations from the field, and discuss directions for future research into this important open problem.

■ MD13

Joint Session INFORMS-ED/WORMS: Academia and Industry Collaboration: Education and Training

Sponsor: Education (INFORM-ED), Women in OR/MS
Sponsored Session

Chair: Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

Co-Chair: Sila Cetinkaya, Associate Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States, sila@tamu.edu

1 - Partnerships in Training

Jill Hardin, Assistant Professor, Virginia Commonwealth University, 1001 W. Main Street, PO Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu, Jason Merrick, Russell Walker

Capital One Financial Corporation partnered with Virginia Commonwealth University to develop three training courses in forecasting, optimization, and simulation for their analysts. These courses have been well received and have led to considerable early return on investment with one class project forecasted to reduce costs at the firm's Richmond, Virginia, mail center by more than $2 million annually. We discuss the partnership and the course designs.

2 - Industry/University Collaboration: The Use of Design and Project Courses

Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, SEOR Department, 4400 University Drive, Fairfax, VA, 22030, United States, khoffman@gmu.edu

Seniors in systems engineering take a one-year design course, while all graduate students take a one-semester project course. We divide classes into teams working with an industrial partner. These courses have improved our student's analytic skills and enhanced our relationships with multiple companies. This talk describes the successes and challenges of running such courses.

3 - Lean Academy: Using Rockwell Collins as a Real-Time Case Study

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, Philip Jones, Tom Bednar

This talk discusses the Lean Academy offered through the University of Iowa's Tippie College of Business in conjunction with Rockwell Collins and the Lean Aerospace Initiative. Key features of the course are the tours, senior executive lectures, and practitioner interviews that Rockwell offers to students in the course.

■ MD14

Empirical Studies of e-Commerce

Sponsor: e-Business
Sponsored Session

Chair: Mu Xia, Assistant Professor, University of Illinois, Department of Business Administration, 1206 S. Sixth Street, Champaign, IL, 61822, United States, mxia@uiuc.edu

1 - Member Dynamics In an Online Sharing Community: An Empirical Analysis

Mu Xia, Assistant Professor, University of Illinois, Department of Business Administration, 1206 S. Sixth Street, Champaign, IL, 61822, United States, mxia@uiuc.edu, Yun Huang, Andrew B. Whinston, Wenjing Duan

A great number of online sharing communities have emerged and thrived in the past decade. Many of them are member-based and voluntary, and they allow users to share files with one another. In this research, we use a five-year log data set collected in an online music sharing community to examine how different types of users affect each other's activities and how their individual behavior is affected by the community overall.

2 - Internet Exchanges for Information Goods

Michael Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15213, United States, mds@cmu.edu, Rahul Telang

We use a unique dataset documenting new and used markets for CDs and DVDs at Ama-zon.com, to analyze the degree to which sales of these used products cannibalize new sales. Our results show that the cross price elasticity of new product sales with respect to used product prices is significantly higher for CDs and DVDs than for books. One implication of these find-ings is that used product markets pose a larger threat to the CD and DVD industries than they do to the book publishing industry.

3 - Price Dispersion in Electronic Markets: New Evidence from Transaction Prices

Anindya Ghose, Assistant Professor, Stern School of Business, New York University, 44 West Fourth Street, KMC 8-94, New York, NY, 10012, United States, aghose@stern.nyu.edu, Yuliang Oliver Yao

We use transaction prices for more than 30,000 products, collected from both the electronic and traditional markets to re-evaluate price dispersion. We find price dispersions in the electronic market is as small as 0.03%, a level substantially lower than those reported in the literature. We estimate the consumer surplus gain from the use of the electronic market is about $181 millions per year.

■ MD15

Online Auctions III

Cluster: Auctions and e-Commerce
Invited Session

Chair: Peter Popkowski Leszczyc, Associate Professor of Marketing, School of Business, University of Alberta, Edmonton AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - A Semi-Parametric Investigation of the Effect of Reserve Prices on Selling Prices Using Identical Auctioned Items from eBay

Dawit Zerom, Assistant Professor of Business Statistics, School of Business, University of Alberta, Business Building 2-43, Edmonton, Alberta, T6G 2R6, Canada, dawit.ZeromGodefay@ualberta.ca, Peter Popkowski Leszczyc

In this paper we investigate the nature of the effect of reserve prices on the price of internet auctions with a semi-parametric model where a) all continuous covariates that affect the auction outcome are allowed to enter non-parametrically b) number of bidders is allowed to be endogenous, and c) the response variable can be censored. We apply the proposed model to data on five identical items from eBay.

2 - Analysis of Sellers' Behavior in the eBay Marketplace

Paulo Goes, Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, Paulo.Goes@business.uconn.edu, Yanbin Tu, Alex Tung

While the behavior of bidders has received widespread attention, sellers' behavior in online auctions has not been well studied in the literature. In this study, we find that new sellers have higher listing error rates, lower auction success rates, lower auction prices, lower positive feedback rates, higher negative feedback rates, and higher frustration rates than experienced sellers.

3 - Charitable Intent and Bidding in Charity Auctions
Michael H. Rothkopf, Professor, Rutgers, The State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, rothkopf@rutcor.rutgers.edu, Peter Popkowski Leszczyc

We modeled and conducted controlled field studies of regular and charity auctions. Results indicated that charity auctions had fewer bidders but higher revenue. The data are consistent with our model in which bidders in charity auctions act like volunteer shills, increasing prices. Bidders in charity auctions paid relatively higher prices for common value items and frivolous items.

■ MD16

Revenue Management and Pricing

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu

1 - Robust Revenue Management: Booking Control with Limited Demand Information
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, Yingjie Lan, Huina Gao, Michael Ball

We analyze the single resource (leg) revenue management problem when no or limited demand information is available. We devise both static and dynamic policies via competitive analysis of online algorithms. The policies come with performance guarantees. We further test the average performance of these policies are using extensive computational experiments.

2 - On the Multi-Product Competitive Price-Setting Newsvendor Problem
Soulaymane Kachani, Professor, Columbia University (IEOR Department), S.W. Mudd Building Room 334, New York, NY, United States, kachani@ieor.columbia.edu, Kyrylo Shmatov

We address the problem of simultaneous determination of pricing and inventory decisions for multiple firms, where each firm offers a line of complementary and substitute products with multiple attributes, under stochastic demand. We consider several models of consumer demand and propose an iterative relaxation algorithm that computes Nash equilibrium solutions. We study a large-scale real-life problem and compare "cooperative" and "competitive" situations.

3 - An Efficient Approach for Solving the Revenue-Maximizing Mixed Bundling Problem
Mihai Banciu, PhD Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, mibanciu@katz.pitt.edu, Prakash Mirchandani

The mixed-bundling problem (MB) entails finding the optimal revenue-maximizing prices for product lines consisting of individual products, or bundles of these products combined in any proportion. We investigate MB in a monopolistic setting with limited product availability, develop a decomposition approach derived from the underlying mathematical programming model, and present encouraging preliminary results.

4 - Online Advertising: Revenue Management Approach
Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kristin@london.edu, Victor Araman

Internet advertising is the fastest growing area in the advertising industry. Webhosts providing advertising space for their customers face complex problems of advertising planning, pricing and capacity management. We develop a stylized model for revenue management of a webhost considering the uncertainty of both the demand and supply side.

■ MD17

Data and Pricing

Cluster: Dynamic Pricing and Forecasting
Invited Session

Chair: W. Tim Huh, Assistant Professor, Columbia University, 500 W. 120th Street, MC4704, New York, NY, 10028, United States, th2113@columbia.edu

1 - Dynamic Learning and Optimization with Operational Statistics
George Shanthikumar, Professor, University of California at Berkeley, Department of IEOR, Berkeley, CA, 94720, United States, shanthikumar@ieor.berkeley.edu, Andew Lim, Zuo-Jun Max Shen

Consider a stochastic system characterized by a parametric model with unknown parameters. The classical approach is to assume that parameters are known, find the optimal policy, and implement it using estimated values for parameters. When data available is limited, or the underlying uncertainty is nonstationary, these policies may not perform well. We use Operational statistics to find the optimal policies directly from the data. Inventory control and dynamic auctions are considered.

2 - Stochastic Choice Models of Demand and Applications to Pricing
Catalina Stefanescu, Assistant Professor of Decision Sciences, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, CStefanescu@london.edu, Guillermo Gallego

In this paper we investigate several classes of stochastic models for customer choice, and their calibration from shopping data. We discuss different specifications of these models in terms of choice attributes, and study the implications for ticket pricing. These methodologies are exemplified with a large data set of customer purchases of airline tickets.

3 - Capacity Contracts in Air-Cargo Revenue Management
Kannapha Amaruchkul, Doctoral Student, University of Minnesota, Department of Mechanical Engineering, Room 1101 MechE 0691, 111 Church Street, SE, Minneapolis, MN, 55455, United States, amar0017@me.umn.edu, William L. Cooper, Diwakar Gupta

We study air-cargo capacity contracts between a carrier and a freight forwarder in settings where the forwarder possesses some private information. Working in the principal-agent paradigm, we propose contract schemes that overcome inefficiencies associated with the asymmetric information.

4 - Dynamic Pricing and Inventory Control: Centralized and Decentralized Analysis of Dual-Channel Supply
Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, tyy1@engr.psu.edu, Terry Friesz, Yongma Moon

We deal with manufacturer°Øs redesign of traditional channel structures by engaging in direct internet sales. Consumer demand for the two channels depends on the prices and customer acceptance of these channels. For a vertical integration case, a continuous time optimal control problem is modeled and necessary (sufficient) conditions are provided. For a competition situation, a differential variational inequality formulation is applied to solve it as a Cournot-Nash-Bertrand game.

■ MD18

Joint Session Counter Terrorism/DAS: Risk and Decision Analysis Applications for Homeland Security III

Cluster: Counter Terrorism and OR, Decision Analysis Society
Invited Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Boulevard, Claremont, CA, 91711, United States, martonosi@math.hmc.edu

1 - Equity and Uniformity of the U.S.-Mexico Border Inspections Process
Patrick Gurian, Assistant Professor, Department of Civil, Architectural, and Environmental Engineering, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States, pgurian@drexel.edu, Ward Nicholas Dudley, Cheryl Howard, Hilma Villegas, Josiah Heyman

Observations of non-commercial vehicle inspection as the U.S.-Mexico border indicate that most of the inspections were of limited duration and detail. A number of policy options are considered to improve the border inspection process. While none of these options have the potential to completely resolve concerns over equity and thoroughness of the process, several are amenable to incremental implementation at minimal cost.

2 - Analyzing Official Advice for Sheltering from Nuclear Fallout
H. Keith Florig, Senior Research Engineer, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, kf0f @andrew.cmu.edu

Several federal agencies have published advice on how to prepare for or react to an act of terrorism involving a nuclear explosive. In this presentation, this advice is analyzed from the perspective of the user. Advice on preparing a shelter in the home is subjected to a household cost-benefit test. Advice on sheltering vs. fleeing is evaluated in light of expectations for the dispersion of radioactive fallout and speed of flight. Finally, official advice is assessed for completeness.

3 - The Critical Asset and Portfolio Risk Analysis Methodology: Overview, Implementation, and Directions

William McGill, Center for Technology and Systems Management, University of Maryland, College Park, MD, 20742, United States, wmcgill@umd.edu, Bilal Ayyub

This paper describes the Critical Asset and Portfolio Risk Analysis (CAPRA) methodology for informing critical infrastructure protection resource allocation decisions. The results from the CAPRA analysis are communicated to all relevant stakeholders as actionable risk assessments. A case study highlighting implementation issues will be provided.

4 - Deterring the Determined: Quantitative Models for the Deterrence of Terrorists

Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Boulevard, Claremont, CA, 91711, United States, martonosi@math.hmc.edu, Daniel Walton

Many homeland security models focus on system reliability in the event of an attack and neglect deterrence: terrorists might choose not to attack, or might shift their focus to less desirable targets, if the costs of attack become too high relative to the benefits. We present a model for resource allocation in which a defender must invest in protecting a target knowing that the attacker will either respond with heightened effort or give up. We characterize the optimal defender and attacker strategies and find that it is never optimal to leave the target undefended.

■ MD19

Risk Management in Energy Markets

Sponsor: Energy, Natural Resources & The Environment
Sponsored Session

Chair: Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu

1 - Systematic Optimistic Biases in Energy Market Equilibria

Ming-Che Hu, PhD Student, Johns Hopkins University, 313 Ames Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States, mchu@jhu.edu, Benjamin Hobbs

The well-known Winner's Curse in auctions and the less familiar Optimizer's Curse in mathematical programming are closely related phenomena that arise from errors in objective function coefficients and lead to systematic optimistic biases. They are important because they lead people to be overoptimistic about the actual performance of solutions. This paper will extend these ideas to consider optimistic biases in competitive and oligopolistic Cournot market equilibria.

2 - Price Volatility in Electricity Auctions: A Strategic Analysis

Shanshan Hu, PhD Candidate, University of Michigan Ross School of Business, 2007 Huron Parkway, Apt. 9, Ann Arbor, MI, 48104, United States, husz@bus.umich.edu, William Lovejoy, Roman Kapuscinski

The wholesale electricity markets have exhibited great price volatility and are of regulatory and practical interests. We directly model the electricity auction and show that price stochasticity results jointly from demand uncertainty and bidders' strategic randomization. Based on numerical studies, we establish the profiles of demand variability, capacity utilizations and price volatility.

3 - Shipper Valuation and Hedging of Network Contracts for Natural Gas Pipeline Transport Capacity

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

In the U.S., natural gas shippers buy the commodity at supply market hubs and contract with pipeline companies to transport it to demand market hubs where they sell it. This talk illustrates optimization-based models to value and hedge pipeline network contracts, consisting of multiple receipt points connected to multiple delivery points, as real options on natural gas futures prices.

4 - Stochastic Co-Optimization for Hydro-Electric Power Generation

Shi-Jie Deng, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, deng@isye.gatech.edu, Haibin Sun, Youxun Shen

We propose a stochastic programming framework for solving the optimal scheduling problem faced by a profit-maximizing hydro-electric power producer who simultaneously participates in multiple markets. The impact of market uncertainties on the co-optimization problem over a pre-specified time horizon is analyzed through the stochastic programming formulation incorporating both market participation and price uncertainties.

■ MD20

DAS Awards

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Eva Regnier, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Road, Monterey, CA, 93943, United States, eregnier@nps.edu

1 - 2006 Decision Analysis Society Practice Award Winner and Finalists

Kazuo Ezawa, PhD, R&D Decision Analysis, Daiichi Sankyo Pharma Development, 399 Thornall Street, Edison, NJ, 08837, United States, kezawa@daiichisankyo-us.com

The Decision Analysis Society (DAS) of INFORMS is seeking entries for the DAS Practice Award competition every year. The intent of this award is to recognize, promote, and publicize good decision analysis practice. We will announce the winner of DAS Practice Award for 2006.

2 - Decision Analysis Student Paper Award

Jeffrey Stonebraker, Decision Sciences, A2RT — Analysis Applications, Research and Technologies, Biomedical Data Sciences, GlaxoSmithKline, jeffrey.s.stonebraker@gsk.com

The Student Paper Competition Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. Students who did not complete their Ph.D. prior to May 1, 2005 are eligible for this year's competition.

3 - 2006 Decision Analysis Publication Award

Vicki Bier, Professor, University of Wisconsin-Madison, 1550 Engineering Drive, Room 3158 Engineering Centers Building, Madison, WI, 53706, United States, bier@engr.wisc.edu

The Decision Analysis Publication Award is given annually to the best decision analysis article or book published two years earlier. To be considered for this year's award, a work must have been published during 2004. The intent of the award is to recognize the best publication in decision analysis, broadly definedóincluding theoretical work on decision analysis methodology, descriptions of applications, and/or experimental studies.

4 - Ramsey Award

James Dyer, University of Texas at Austin, McCombs Business School, 1 University Station B6500, Austin, TX, 78712, United States, j.dyer@mccombs.utexas.edu

The Frank P. Ramsey Medal is the highest award of the Decision Analysis Society. It was created to recognize distinguished contributions to the field of decision analysis. The medal is named in honor of Frank Plumpton Ramsey, a Cambridge University mathematician who was one of the pioneers of decision theory in the 20th century. The Ramsey Medalists are recognized for having made substantial further contributions to that theory and its application to important classes of real decision problems.

■ MD21

Bring OR into Your Local High School: Mission Not Impossible

Sponsor: Education (INFORM-ED)
Sponsored Session

Chair: Kenneth Chelst, Chairman, Dept of Industrial and Mechanical Engineering, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States, kchelst@wayne.edu

1 - Workshop on Reaching Out to High Schools

Kenneth Chelst, Chairman, Dept of Industrial and Mechanical Engineering, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States, kchelst@wayne.edu

We present a set of OR activities that were designed to enrich high school math. The session will provide guidance on reaching out to your local high schools. INFORMS goal is to create a network of like-minded operations researchers interested in outreach and can nurture this mission. We provide an update of efforts in North Carolina and Georgia. All attendees committed to outreach receive a complimentary copy of the book, Does this line ever move? Everyday Applications of Operations Research.

■ MD22

Military Logistics Research at RAND (Session 1 of 2)

Sponsor: Military Applications
Sponsored Session

Chair: Ronald McGarvey, Operations Researcher, RAND, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States, ronm@rand.org

1 - Littoral Combat Ship Modularity: Exploring Operational and Logistical Opportunities
Brien Alkire, Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407-2138, United States, brien@rand.org, John Birkler

The Littoral Combat Ship will be capable of defeating anti-access and asymmetric threats in the littorals. Its modular design allows a core seaframe to be reconfigured in a matter of days with an antisubmarine, surface or mine warfare mission package. We describe the methods and models we developed to examine operational, logistical and cost implications of the number of mission packages of each type acquired and the locations of homeports and installation sites.

2 - Improving Health Departmentsí Abilities to Receive and Utilize the Strategic National Stockpile
Edward Chan, Associate Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407-2138, United States, echan@rand.org

RAND is developing tools to assess and increase the readiness of local health departments to provide medical countermeasures to its citizens in a public health emergency. In this presentation we will talk about the approach we have used in designing a set of assessments that includes checklists, simulations, and exercises. The goal is a portfolio of tools that is economically feasible and where the strengths and weaknesses of the various assessments complement one another.

3 - Global Combat Support Basing: Prepositioning Strategies for Air Force War Reserve Materiel
Ronald McGarvey, Operations Researcher, RAND, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States, ronm@rand.org, Tom Lang, Louis Luangkesorn, Rachel Rue

The US Air Force relies on prepositioned War Reserve Materiel, stored at multiple sites across the globe, to enable global responsiveness via rapid deployments. RAND has worked with the Air Force over a number of years, building optimization models that can help to identify prepositioning postures that can achieve the desired responsiveness at minimum cost. Of particular interest to the current research are an examination of alternative packaging configurations and maintenance options.

■ MD23

Implementing Best Practices for Sourcing

Cluster: Global Services Sourcing
Invited Session

Chair: Mark Paulk, Senior Systems Scientist, Carnegie Mellon University, IT Services Qualification Center, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, mcp@cs.cmu.edu

1 - Operations Management and Strategic Outsourcing: Coordinating the Relationship for Success
Bill Phifer, EDS Fellow, EDS, 1101 Shadow Wood Drive, Downingtown, PA, 19335, United States, bill.phifer@eds.com

The explosion of outsourcing of non-core business functions and its mixed results in operations management is explored, with a focus on the client and service provider relationship. Of primary concern is the ability of the business to effectively outsource appropriate functions, meet operational expectations, and maintain control. The eSourcing Capability Models® will be considered as best practices for clearly establishing and managing performance objectives, governance, and transparency.

2 - Multi-Site Implementation of the eSourcing Capability Model for Service Providers
Keith Heston, Accenture, Penn Center West, Building 8, Suite 100, Pittsburgh, PA, 15276, United States, keith.m.heston@accenture.com

The purpose of this paper is to provide an overview of considerations and approaches to implementing eSCM-SP across multiple sites and geographies. It will discuss issues associated with culture, commitment, and terminology, as well as degree of process change required between sites.

3 - Performance Improvements by Implementing Best Practices in an IT Outsourcing Service Provider
William Hefley, Associate Teaching Professor & Associate Director, IT Services Qualification Center, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, hefley@cmu.edu

The eSourcing Capability Model for Service Providers (eSCM-SP) is a best practices model for IT-enabled services. This case addresses the impact of eSCM-SP adoption on both service delivery and business effectiveness. This case addresses two units of LG CNS, located in Korea, that first achieved certification against the eSourcing Capability Model for Service Providers (eSCM-SP) in late 2003.

4 - Knowledge Transfer and Quality Practices in the Implementation of a Capability Model for Outsourcing
Bryon Balint, PhD Student, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, bbalint@andrew.cmu.edu, Chris Forman, Sandra Slaughter, Elaine Hyder, Mark Paulk

We examine the factors influencing the implementation of the eSourcing Capability Model (eSCM-SP) in a large multinational offshore service provider. The eSCM-SP is a quality program that enables outsourcing service providers to improve their existing capabilities in both service design and delivery. We study how implementation success is influenced by such factors as knowledge characteristics, implementation of prior quality practices, and characteristics of the knowledge recipient.

■ MD24

Daniel H. Wagner Prize Competition

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Joe Discenza, President and CEO, SmartCrane LLC, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States, jhdiscenza@smartcrane.com

1 - The Daniel H. Wagner Prize for Excellence in Operations Research Practice

Five finalist teams have been selected for 2006 and these five will be presented in three sessions on Monday and the winning entry announced on Tuesday morning.

2 - Development of a Codeshare Flight Profitability System at Delta Air Lines
Jerome W. O'Neal, oneal.jerry@gmail.com, Michael Jacob, Adam Farmer, Kristi G. Martin

Airlines form alliances to expand the network of markets each carrier can serve through a process known as codesharing. Codesharing allows a carrier to place its marketing code on alliance partner's flights. Codeshare flights can then be sold by a carrier even though they are operated by their alliance partner. Alliances can improve the revenue streams of their members; however, the amount of revenue increase depends significantly on which flights are chosen for codeshare. A codeshare flight profitability system can automate the codeshare selection process by choosing a set of codeshare flights that maximize total system revenue for a carrier while satisfying the rules that have been set by the alliance, the government and the airlines' unions.

■ MD25

OR Aplications at HP

Cluster: OR Practice
Invited Session

Chair: Dirk Beyer, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1140, Palo Alto, CA, 94598, United States, dirk.beyer@gmail.com

1 - Hewlett Packard's Personal Systems Group Shapes its Distribution Strategy Using Optimization
Alper Sen, Assistant Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Dirk Beyer, Shailendra Jain

In 2005, HP's PSG decided to evaluate its supply chain strategy in North America for its commercial division and investigate opportunities to decrease its supply chain costs and improve its order cycle times. As part of a larger project, a detailed optimization model was set up to help PSG develop a distribution strategy. A software tool is created to evaluate various distribution alternatives and understand the trade-off between the transportation costs and order cycle times.

2 - Workforce Planning Under Uncertainty
Pano Santos, Senior Scientist, Hewlett Packard Labs, 1501 Page Mill Road, MS 1140, Palo ALto, CA, 94304, United States, cipriano.santos@hp.com, Dirk Beyer, Ernesto Brau, Qi Feng, Shailendra Jain

Workforce planning under uncertainty is done based on a funnel of project opportunities. We compute the probability distribution of workforce demand at each period of the planning horizon, and determine an allocation of available workforce to opportunities. Gaps between workforce requirements and availability are fulfilled by determining a minimum cost policy of training or hiring.

3 - Building Customer Response Models from Transaction Data
Dirk Beyer, Principal Scientist, Hewlett-Packard Laboratories, 1501 Page Mill Road, MS 1140, Palo Alto, CA, 94598, United States, dirk.beyer@gmail.com, Troy Shahoumian, Hsiu-Khuern Tang, Alex Zhang

In order to use transaction data as training data for customer response models, it needs to be transformed into records describing the state of a customer at the time of an interaction. In this talk, we are describing a solution that enables the user to easily describe the transformations desired without writing DB queries, to generate rich training dataset and to automatically build customer response models across different classes of models.

■ MD26

Multidimensional Scaling and Manifold Learning

Sponsor: INFORMS Computing Society/Data Mining
Sponsored Session

Chair: Michael Trosset, Professor, Indiana University, Department of Statistics, Bloomington, IN, 47405, United States, trosset@math.wm.edu

1 - Local Multidimensional Scaling for Nonlinear Dimension Reduction, Graph Layout & Proximity Analysis
Andreas Buja, The Liem Sioe Liong/First Pacific Company Professor of Statistics, University of Pennsylvania, The Wharton School, Department of Statistics, 3730 Walnut Street, 400 JMHH, Philadelphia, PA, 19104, United States, buja@wharton.upenn.edu, Lisha Chen

We introduce a new nonlinear dimension reduction method, called Local Multidimensional Scaling (LMDS). Its novel feature is that it uses ideas from the area of graph layout to balance attractive forces between near points and repulsive forces between non-near points against each other. Our methods generally do a superior job compared with LLE and Isomap. Our work contributes to, and ties together, three areas: non-linear dimension reduction, graph layout, and proximity analysis.

2 - How to Extend an Inner Product Embedding
Michael Trosset, Professor, Indiana University, Department of Statistics, Bloomington, IN, 47405, United States, trosset@math.wm.edu

It is well known that squared Euclidean distances can be transformed to Euclidean inner products. Classical multidimensional scaling (CMDS) applies this transformation to squared dissimilarities, then approximates the resulting matrix with a matrix of inner products. Suppose that, after CMDS has been performed, we observe dissimilarities of new objects from the original objects. We consider how to embed the new objects without disturbing the original configuration.

3 - Extensions of Classical Multidimensional Scaling for Molecular Embedding Problems
Robert Michael Lewis, Associate Professor, College of William & Mary, Department of Mathematics, PO Box 8795, Williamsburg, VA, 23187-8795, United States, buckaroo@math.wm.edu, Michael Trosset, Ian Grooms

We discuss an approach to the embedding problem in structural molecular biology. For an n-atom molecule we treat the n(n-1)/2 interatomic distances (dissimilarities) as independent variables. We use the strain criterion from classical MDS to steer the dissimilarities to a set of physically realizable interatomic distances. Our approach results in a large-scale constrained nonconvex spectral optimization problem. As we discuss, the solution of this problem is computationally tractable.

■ MD27

Reliability Optimization 1

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, Piscataway, NJ, 08844, United States, coit@rutgers.edu

1 - Optimization of Accelerated Life Testing Plans with Multiple Stresses
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

Multiple-stress-type ALTs have been employed as a means of overcoming such difficulties. In this paper, we design optimum multiple-stress-type ALT plans based on the proportional odds model. The optimum combinations of stress levels and the optimum number test units allocated to each combination are determined such that the variance of the reliability prediction of the product over a pre-specified period of time is minimized. The proposed ALT plans are illustrated by numerical example.

2 - Stochastic Optimal Dispatch of Electricity Considering Transmission Line Failures
Mainak Mazumdar, Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15206, United States, mmazumd@engr.pitt.edu, Lizhi Wang

We present a procedure for dispatching electricity with a view to providing protection against transmission line failures. This optimal dispatch procedure has the following features: (1) Credit contingencies are determined by considering individual transmission line reliabilities and network topology. (2) Preventive and corrective actions are integrated to protect the system in both pre- and post-contingency phases. (3) It models the probability of cascading failures after a contingency occurs.

3 - Reliability of Weighted Voting Systems from a Multistate Perspective
Jose Emmanuel Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, jmarquez@stevens.edu

This research presents reliability modeling, estimation and optimization techniques for Weighted Voting Systems. The functional structure of WVS is used to model its reliability as a multi-state system. Next, an exact computational approach based on multi-state minimal cut and path vectors is introduced. Similarly, a Monte-Carlo simulation approach that estimates system reliability efficiently is provided. Finally, an optimization heuristic is presented for maximizing the reliability of WVS.

4 - Multiobjective Multi-State Genetic Algorithm for Power Systems Reliability Optimization Problems
Heidi Taboada, Graduate Student, Rutgers University, Department of Industrial Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854-8018, United States, heidita@eden.rutgers.edu, David Coit, Jose Espiritu Nolasco

A multiobjective multi-state genetic algorithm (MOMS-GA) was developed to solve multiple objective reliability optimization design problems of multi-state power systems. The multiobjective genetic algorithm developed uses the universal moment generating function approach (UMGF) to evaluate the different reliability indices of the power system. The solution to the multiobjective multi-state (MOMS) problem is a set of solutions, known as Pareto front.

■ MD28

IEEE Transactions on Automation Science and Engineering Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Assistant Professor, Texas A&M University, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

Co-Chair: Jianjun Shi, Professor of IE/OR, Department of Industrial and Operations Engineering, The University of Michigan Ann Arbor, 1205 Beal Avenue IOE1784, Ann Arbor, MI, 48109-2117, United States, shihang@umich.edu

1 - The Sensor Selection Problem for Bounded Uncertainty Sensing Models

Volkan Isler, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Lally 207, Troy, NY, 12180, United States, isler@cs.rpi.edu, Ruzena Bajcsy

We address the problem of selecting sensors so as to minimize the error in estimating the position of a target. In our model, the measurements are polygonal, convex subsets of the plane which are merged by intersecting corresponding subsets. After presenting an approximation algorithm which guarantees that the resulting error is within factor 2 of the least possible error, we conclude the talk with an overview of recent results for related sensor management problems.

2 - Semidefinite Programming Approaches for Sensor Network Localization with Noisy Distance Measurements

Pratik Biswas, Graduate Student, Stanford University, Department of Electrical Engineering, Stanford, CA, 94305, United States, pbiswas@stanford.edu, Kim-Chuan Toh, Yinyu Ye

A sensor network localization problem is to determine the positions of the sensor nodes in a network given incomplete and inaccurate pairwise distance measurements. We describe a general semidefinite programming (SDP) based approach for solving the graph realization problem, of which the localization problem is a special case. We investigate the performance of this method on problems with noisy distance data and propose ideas to improve the estimation accuracy.

3 - Sensory-Updated Residual Life Distributions for Components with Exponential Degradation Patterns

Nagi Gebraeel, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States, gebraeel@engineering.uiowa.edu

Research on the interpretation of sensory data streams and their utilization in making critical logistical decisions stands to provide significant advancements across various application domains. We develop a stochastic degradation modeling framework for computing and continuously updating component residual life distributions - in support of a sense and respond logistics environment - by combining population specific degradation characteristics with real-time component specific sensory data.

■ MD29

Applications of Operations Management in Acute Care Settings

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

Chair: Ayse Pinar Gurses, University of Maryland, agurs001@umaryland.edu

1 - Optimizing State Access to Trauma Centers

Charles Branas, Assistant Professor, University of Pennsylvania, 936 Blockley Hall, 423 Guardian Drive, Philadelphia, PA, 19104, United States, cbranas@cceb.med.upenn.edu, Justin Williams

The TRAMAH model seeks to optimize the locations of trauma centers and ambulances in terms of the number of severely injured people that can reach a trauma center in a short period of time. The first phase of the model was tested in a single state. The second phase was applied to 13 states in a multi-objective framework that considers coverage of severely injured people and patient volumes per trauma center. The third phase applies portions of the model to all states in a web-based platform.

2 - An Empirical Analysis of New Practice Implementation in Intensive Care Units

Anita Tucker, Assistant Professor, University of Pennsylvania, 551 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19066, United States, tuckera@wharton.upenn.edu, Ingrid Nembhard, Amy Edmondson

We investigate learning activities undertaken by improvement-project teams in neonatal intensive care units (NICUs). To test our hypotheses, we surveyed 23 NICUs that implemented new practices. We find that a high level of supporting evidence for a unit's portfolio of improvement projects was associated with implementation success. Learn-how activities were positively associated with implementation success. Psychological safety mediated the link between learn-how and implementation success.

3 - Benchmarking in the Intensive Care Unit

Brian Nathanson, OptiStatim LLC, PO Box 60844, Longmeadow, MA, 01116, United States, brian.h.nathanson@att.net

There have been recent advances in benchmarking based on frontier estimation that are underutilized in critical care. A revised Rapoport-Teres Graph for benchmarking will be presented that is now based on regression models derived from 124,855 patients in the Project IMPACT database from 2001-2004: the Mortality Probability Model (MPM0 - III) and a length of stay model. Frontier efficiency models will then be introduced as alternatives and their benefits and limitations will be discussed.

4 - Performance Obstacles in Intensive Care Units

Ayse Pinar Gurses, University of Maryland, agurs001@umaryland.edu, Pascale Carayon

We investigated the impact of performance obstacles on workload, quality of working life (QWL) and quality of care in ICUs. A cross-sectional, survey study was conducted among 300 nurses from 17 ICUs. Obstacles (e.g., misplaced charts, inadequate information) were significantly related to higher workload, lower QWL and quality of care. High workload increased stress and tension of ICU nurses and had a negative impact on quality of care. Findings have implications for ICU redesign efforts.

■ MD30

Panel Discussion: Operational Issues Facing Health Care Practitioners

Sponsor: Health Applications Section
Sponsored Session

Chair: Murray Côté, Associate Professor, University of Colorado at Denver and Health Sciences Center, Health Care Policy and Research, 13611 East Colfax Avenue, Suite 100, Aurora, CO, 80045, United States, murray.cote@uchsc.edu

1 - A Panel Discussion: Operational Issues Facing Health Care Practitioners

Moderator: Murray Côté, Associate Professor, University of Colorado at Denver and Health Sciences Center, Health Care Policy and Research, 13611 East Colfax Avenue, Suite 100, Aurora, CO, 80045, United States, murray.cote@uchsc.edu, Panelists: Sandra Sullivan, M.D., Dave Eitel, M.D., Keith Willoughby, Ph.D.

Given the growing interest in applying management science/operation research techniques in health care, this session will consider important operational issues in health care delivery from the perspective of health care practitioners. A panel of three experts (two physicians, one senior operations research consultant) will share their views and experiences on this topic and lead a discussion to assist us in becoming better versed in health care issues.

■ MD31

Frontiers of Financial Engineering

Cluster: Financial Engineering and Risk Management
Invited Session

Chair: Jim Primbs, Assistant Professor, Stanford University, 444 Terman Engineering Center, Stanford, CA, 94305-4026, United States, jim.primbs@stanford.edu

1 - Utility Indifference Valuation of Weather Derivatives and Their Hedge Effect on Energy Businesses

Yuji Yamada, Associate Professor, Graduate School of Business Sciences, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We develop two types of pricing approaches based on the utility indifference valuation and the non-parametric trend prediction, and estimate their hedge effect on energy businesses using empirical data. First, we consider an OTC market for weather derivatives between an insurance company and an industry that run a project affected by a weather index, and derive the equilibrium price and volume. We then analyze the hedge effect of weather derivatives on energy businesses.

2 - Finance and Revenue Management of Callable Products
Steve Kou, Associate Professor, Industrial Engineering and Operations Research, Columbia University, 312 S.W. Mudd, New York, NY, 10027, United States, sk75@columbia.edu, Guillermo Gallego, Robert Phillips

A callable product is a unit of capacity sold to self-selected low-fare customers who willingly grant the capacity provider the option to ``call" the capacity at a pre-specified recall price. We show that callable products provide a riskless source of additional revenue to the capacity provider. We illustrate how the benefits from offering callable products can be significant, especially when high-fare demand uncertainty is large.

3 - Comparisons of Taxable Index-Fund Portfolios to Individual-Asset Portfolios
John R. Birge, Professor, University of Chicago, Graduate School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States, john.birge@chicagogsb.edu, Song Yang

Optimizing taxable portfolios of many assets presents a considerable computational challenge due to the exponential increase in the state space as the number of assets grows. We developed an approach to approximate the many-asset portfolio with an asset-continuum portfolio. In this talk, we will present comparisons of this approach with optimal decisions for an index-fund portfolio that holds a single index fund for each factor.

4 - Efficient Simulation for American Option Pricing Under Stochastic Volatility
Farid AitSahlia, Assistant Professor, Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States, farid@ise.ufl.edu

In this talk I will present a Markov Chain Monte Carlo approach that integrates the Longstaff-Schwartz technique to price American options when the volatility of the underlying is stochastic.

■ MD32

Exploring the Meaning of Project Control: Panelists' Perspectives & Research Recommendations

Cluster: Project Management
Invited Session

Chair: Laurie Kirsch, Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Roberto Clemente Drive, Pittsburgh, PA, 15260, United States, lkirsch@katz.pitt.edu

1 - Project Governance and Control
Ray Henry, Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States, rhenry@clemson.edu

The assignment of authority and accountability is a question of project governance that has important implications for understanding the enactment of control. When projects include multiple groups the determination of roles can be complex, leading to questions about how and by whom controls are implemented. The results of a study looking at the distribution of governance in large IT projects will be presented and used discuss the relationship between project governance and project control.

2 - An Extended Model of IS Project Control
Cecil Eng Huang Chua, Assistant Professor, Nanyang Technological University, Nanyang Avenue, Singapore, Singapore, aehchua@ntu.edu.sg

This paper demonstrates that indifference curve theory can be applied to explain the relative quantities of all modes of project control, because it can model control modes as simultaneous complements and substitutes. Furthermore, indifference curve theory is compatible with and obtains identical results as existing theory. Furthermore, the mathematical nature of indifference curves enable us to simulate control problems, and helps to explain why minimum levels of formal control are preferred.

3 - Two Observations on Control from an Agency Theory Perspective
John Harry Evans III, Professor, University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA, 15260, United States, jhe@katz.pitt.edu

Agency theory is the prevailing paradigm for understanding control in organizations from an economic perspective. Agency theory provides a rigorous general perspective for analyzing how organizations reconcile the conflicting objectives of principals and agents. This presentation discusses two recent sources of empirical evidence concerning the results of applying the agency paradigm in interesting specific applications. The first is an experimental budgeting application. The second concerns the transformation of a large government bureaucracy.

■ MD33

Airline Industry Applications I

Sponsor: Aviation Applications
Sponsored Session

Chair: Judy Pastor, Principal, OR&DS, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, judy.pastor@aa.com

1 - Local and Connecting Traffic in Single and Multiple Airport Cities
Cumhur Gelogullari, Operations Research Analyst, American Airlines, 4333 Amon Carter Boulevard MD 5358, Fort Worth, TX, 76155, United States, Cumhur.Gelogullari@aa.com, Tassio Carvalho

The presence of commercial service at multiple airports in a metro area is frequently due to capacity constraints at the main facility. We present a study on the impact of the presence of commercial service at multiple facilities on local and connecting traffic in large metro areas.

2 - Improving the Transfer Baggage Operation at American Airlines
Tuell Green, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, tuell.green@aa.com, June Ma, Alejandro Scalise

We present an approach using simulation and optimization to analyze and improve the connecting baggage operation of American Airlines at DFW airport. We will include a description of the simulation model and some simulation results, an overview of the optimization approach and some sample test cases, and some observations regarding the transition from laboratory to daily operations.

3 - Using Multi-Dimensional Plots to Examine Passenger Behavior and Applications to RM
Judy Pastor, Principal, OR&DS, American Airlines, 4333 Amon Carter Boulevard, MD 5358, Fort Worth, TX, 76155-2664, United States, judy.pastor@aa.com

We will use trellis plots in the software package, R, to examine patterns in PNR attributes. Airline RM models can take advantage of these patterns to detect sell-up opportunities.

■ MD34

Urban Transportation Planning Models V: Public Transit

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Grisselle Centeno, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, gcenteno@eng.usf.edu

1 - Parking Capacity Planning Models Considering Transit Availability
Grisselle Centeno, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, 33620, United States, gcenteno@eng.usf.edu, Aldo Fabregas

We present a synthesis for parking capacity planning models incorporating demand uncertainty, and public bus transportation availability. Efforts include developing mathematical programming formulations to evaluate strategies that may increase the use of transit services. Models will assist decision-makers when determining future parking expansions in terms of timing, dimensions, and locations.

2 - Route Design in a Fast-Bus Urban Transportation System
Andrés L. Medaglia, Centro de Optimización y Probabilidad Aplicada (COPA) Departamento de Ingeniería Industrial Universidad de los Andes, amedagli@uniandes.edu.co, German Riano, Juan Camilo Acero

We present a mixed-integer programming model to design the set of routes for a fast-bus urban transportation system by minimizing overall passenger travel time while limiting the number of routes so that the system remains manageable and understandable. Several solution techniques are explored taking advantage of the model's structure.

3 - Admission Regulation of Traffic to Improve Public Transport in Urban Areas
Carlos Bispo, Assistant Professor, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal, cfb@isr.ist.utl.pt

We correlate rate of entering traffic in Lisbon, Portugal, and the speed of buses. The admission rate was reduced by varying green and red light times at one entry point of the city, permitting buses on some routes to maintain constant average speed during rush hour, rather than dropping.

4 - Mobility Allowance Shuttle Transit (MAST) Services: Description, Formulation and Optimization

Luca Quadrifoglio, Assistant Professor, Zachry Department of Civil Engineering, Texas A&M University, College Station, TX, 77843, quadrifo@usc.edu

Mobility Allowance Shuttle Transit (MAST) vehicles follow a fixed route with checkpoints, but deviate from the path to pick up and drop off passengers. The static MAST scheduling problem is formulated as an NP-Hard mixed integer linear program. Three sets of logic cuts greatly speed up the optimal solution search.

■ MD35

Urban Transportation Modeling Session IV: New Problems and Methods

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 - Stochastic Network Retrofit with Recourse

Changzheng Liu, Yueyue Fan, Department of Civil and Environmental Engineering, University of California, Davis, czliu@ucdavis.edu

Our research explores retrofitting strategies for highway bridge networks considering uncertainties in natural and human-induced hazards, and their impacts. We formulate a 2-stage stochastic integer program with recourse that minimizes total system operation and recourse cost caused by nonanticipativity of random events. An L-shaped solution method and examples are presented.

2 - Approximation of GEV Models Using Mixed Models with Error Components

Laurie Garrow, Assistant Professor, School of Civil and Environmental Engineering, Georgia Institute of Technology, 790 Atlantic Drive, NW, Atlanta, GA, 30332, United States, laurie.garrow@ce.gatech.edu, Tudor D. Bodea

Mixed models with error components are approximate correlation structures of GEV models. Convergence of mixed models and recovery this structure depends critically on the number of observations, the frequency of chosen alternatives, and the correlation in the nests. Even when convergence is reached, we observe systematic bias in correlation estimates.

3 - Evaluating Capacity Investments Using a GIS-Based Tool - Network-Wide Full Marginal Cost Approach

Kaan Ozbay, Associate Professor, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, kaan@rci.rutgers.edu, Ozlem Yanmaz-Tuzel, Sandeep Mudigonda, Bekir Bartin

We propose a constrained k-shortest path algorithm to estimate the trip-based FMC of a trip along a set of feasible paths between each O-D pair. The tool is developed in ArcGIS, using Visual Basic and C-programming. In the developed tool, origin and/or destination of a trip can be either a single node, or a set of nodes within a Traffic Analysis Zone/county/whole-network. In addition, the developed tool assesses short term impacts of infrastructure investments on the FMC of trips.

4 - Risk Analysis in Transportation Infrastructure Investments

Joseph (Yossi) Berechman, CN Chair Professor in Transportation and International Logistics, Sauder School of Business, 2053 Main Mall, University of British Columbia, Vancouver, BC, V6T 1Z2, Canada, Berechman@sauder.ubc.ca

Transportation infrastructure investments are quite complicated to plan and built and require huge amounts of capital. Once committed to politically, legally and financially, these investments are irreversible and thus represent considerable sunk costs. On the demand side, travel demand tends to vary significantly over time and space and across modes. Hence, the risks of cost over-runs, delayed schedules, lower than expected demand and, at times, even financial insolvency. Against this background, this paper focuses on the three key questions. First, how to define and measure the various risk components of a transportation investment project and, subsequently, its overall risk level? Second, in the context of Public Private Partnership projects, how should risk be shared? Third, how should risk analysis be incorporated into the overall process of project evaluation?

■ MD36

Warehousing and Facility Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Samir Amiouny, Senior Consultant, ILOG Inc., 8545 Orphee, Brossard, QC, J4Y 3E3, Canada, samiouny@ilog.com

1 - Warehouse Order Picking with Cart Constraints

Samir Amiouny, Senior Consultant, ILOG Inc., 8545 Orphee, Brossard, QC, J4Y 3E3, Canada, samiouny@ilog.com

We describe a warehouse order picking optimization problem in which there are constraints on the placement of boxes on picking carts. We present a solution based on generating a number of promising feasible pick routes and selecting the best among them using CPLEX. The implementation at a national retailer resulted in substantial improvements in picking efficiency.

2 - Optimal Design of Discrete Order Picking Technologies Along a Line

Donald Eisenstein, Professor of Operations Management, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, don.eisenstein@chicagogsb.edu

In discrete order picking a single worker picks all items in an order. There are two ways to reduce the walking distance: The use of technology - convey or systems and/or the ability to transmit order information via mobile device. And through design - where best to locate depots (where workers receive pick lists and deposit completed orders) and how best to lay out the product. We build a stochastic model to determine how to minimize walk time for various configurations.

■ MD37

Tutorial — Social Networks and e-Markets: Incentives and Monetization

Sponsor: Information Systems Society
Sponsored Session

Chair: Ravi Bapna, Associate Professor, Department of Operations and Information Management, University of Connecticut, Storrs, CT, 06269, United States, ravi.bapna@business.uconn.edu

1 - Complex Networks in Business and Economics

Arun Sundararajan, Professor, New York University, 44 West 4th Street, KMC 8-93, New York, NY, 10012, United States, asundara@stern.nyu.edu

This session will feature a joint tutorial (with Professor Ravi Bapna)on the applications of ideas from complex network theory to problems in OR, business and economics. Assuming a basic understanding of graph theory and random graphs, we will cover selected recent advances in the theory of complex networks that can be used in applied problems, and outline promising high-impact open research areas. This tutorial is especially recommended for doctoral students.

2 - Building Loyalty and Reducing Friction in e-Markets Using Social Networks

Ravi Bapna, Associate Professor, Department of Operations and Information Management, University of Connecticut, Storrs, CT, 06269, United States, ravi.bapna@business.uconn.edu

We distinguish between buyer-side, seller-side, trading and personal network structures in the context of a social network based e-market. We show how these different network structures play different roles in building market loyalty, reducing friction and accelerating growth.

■ MD38

Academic Contributions to Railroad Operations Research

Sponsor: Railroad Applications
Sponsored Session

Chair: Christopher Barkan, Associate Professor, University of Illinois at Urbana-Champaign, 1201 Newmark Lab, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, cbarkan@uiuc.edu

1 - Optimizing Ballast Sourcing and Delivery Operations

Xiajun Pan, University of Texas at Austin, McCombs School of Business, 1 University Station B6000, Austin, TX, 78712, United States, Xiajun.Pan@phd.mccombs.utexas.edu, Brian Roth, Anant Balakrishnan

Given the ballast requirements for geographically-dispersed track maintenance jobs, we develop an integer-programming model to select the source quarry for each job and route available trains to deliver ballast on time at minimum total purchasing and transportation cost. We propose valid inequalities to strengthen the model, and report computational results.

2 - Optimal Production Gang Scheduling for Railway Maintenance Operations

Gang Li, PhD Student, The University of Texas at Austin, McCombs School of Business, 1 University Station B6000, Austin, TX, 78712, United States, gang.li@mail.utexas.edu, Brian Roth, Anant Balakrishnan

Given a set of railway maintenance jobs with time windows and inter-job coordination requirements, production gang scheduling seeks to select and assign production gangs to jobs, sequence the jobs, and route the gangs between jobs to minimize the total cost for employing, assigning, and re-positioning gangs. We formulate the problem as a large-scale integer program, develop valid inequalities to strengthen the model, and report computational results using real data.

3 - Optimal Location of Railroad Wayside Defect Detection Installations

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, 61801, United States, yfouyang@uiuc.edu, Yung-Cheng Lai, Christopher Barkan

This paper presents network optimization models that select cost-effective installation sites for wayside defect detection systems over a rail network. These systems monitor the mechanical health and performance of railcars and can help prevent derailments. We develop efficient solution techniques to solve the problems and present case studies with empirical data.

4 - Tank Car Safety Design vs. Infrastructure Improvements in Reducing Hazardous Materials Transportation Risk

Mohd. Rapik Saat, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 205 N. Matthews, B-118, Urbana, IL, 61801, United States, mohdsaat@uiuc.edu, Christopher Barkan

This study analyzed the marginal benefits in reducing hazardous materials transportation risk by improving tank car safety design versus improving railroad infrastructure. A cost-benefit model is being developed that compares tank car replacement to railroad accident rate reduction to determine the conditions when one is more effective than the other.

■ MD39

Ballroom B

Great Unsolved Problems in OR - III

Cluster: Great Unsolved Problems in OR

Invited Session

Chair: Arjang Assad, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, aassad@rhsmith.umd.edu

1 - Responsibility of OR/MS for Disaster Management

Martin Starr, Professor Emeritus, Crummer Graduate School of Business, Rollins College, 1000 Holt Avenue, Winter Park, FL, 32789, United States, mstarr@cfL.rr.com

Disasters occur in three ways: first, by intentional malevolence; second, by human errors and technological failures; third, by acts of nature (e.g., hurricanes and tsunamis). Such regional disasters often trigger catastrophes such as dams breaking. This paper starts to examine how OR/MS models can begin to structure the three types of situations before they occur, during emergency periods, and after their occurrence. Emphasis is on the before scenarios.

2 - Are We There Yet? The Marriage Between Simulation and Optimization

Michael Fu, Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States, mfu@rhsmith.umd.edu

Arguably the two most powerful operations research techniques implemented in software are simulation and optimization, so it is natural to consider wedding these two techniques, and over the past decade most commercial simulation software packages began offering some sort of an "optimization" module. However, continuing a theme in my 2002 INFORMS Journal on Computing Feature Article, I argue that current software offers mainly marriages of convenience rather than well-integrated partnerships.

3 - Can There be a Unique OR Paradigm?

Heiner Müller-Merbach, Professor, Technische Universität Kaiserslautern, Erwin-Schrödinger-Strafle, Geb. 42-434, Kaiserlautern, D-67653, Germany, hmm@bior.de

Will or can the "Science of Better" campaign in the US bring about some unification of the OR understanding within the OR community and outside: i.e. a step toward a unique OR paradigm? And is this at all desirable? (i) I doubt that it will happen, due to the many different schools (and sub-schools) of thought within OR; (ii) It is not desirable because unification can easily kill any vivid competition between the schools. No single science seems to have a unique paradigm.

■ MD40

Location and Layout

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, CA, 92834, United States, zdrezner@fullerton.edu

1 - The Variable Radius Covering Problem

Oded Berman, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca, George O. Wesolowsky, Dmitry Krass, Zvi Drezner

We propose a covering problem where the covering radius of a facility is controlled by a decision maker. The problem is to cover all demand points at a minimum cost by finding optimal number, locations and coverage radii for the facilities. Both, the planar and network versions of the model are considered.

2 - Cost and Aggregation Error Tradeoff Analysis for Some Location

Richard Francis, Professor Emeritus, Department of Industrial & Systems Engineering, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States, francis@ise.ufl.edu, Tim Lowe

Every mathematical modeler faces the problem of how much detail to build into the model. We consider this problem for a class of location models, where detail is inversely proportional to demand point aggregation error. We show the problem can be formulated, and analyzed, as a multicriteria decision problem. The law of diminishing returns plays an important role.

3 - Models of Facility Reliability

Michael Lim, PhD Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60201, United States, m-lim2@northwestern.edu, Mark Daskin, Sunnil Chopra

We extend the fixed charge facility location model to account for reliable and unreliable facilities. We derive structural results from the analytic variant of the model and show how the discrete model may be effectively solved using Lagrangian relaxation. Computational results are provided for moderate sized datasets.

4 - Multi-Story Space Assignment Problem

J. MacGregor Smith, Professor, Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, MA, 01003, United States, jmsmith@snail.ecs.umass.edu, Peter Hahn

We provide a formulation of the Multi-Story Space Assignment Problem (MSAP) which allows one to model the location of activities with multi-story facilities as a Generalized Quadratic Assignment Problem (GQAP). The MSAP also inlcudes the evacuation planning for the facility. The formulation and its transformation into a GQAP along with some preliminary computational results are presented.

5 - The Hub Covering Flow Problem

Thaddeus Sim, Graduate Research Assistant, Tippie College of Business, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52240, United States, thaddeus-sim@uiowa.edu, Timothy J. Lowe

We develop a hub location model that solves for hub locations by minimizing hub installation costs and total flow costs subject to distance constraints. The model allows for the use of multiple coverage radii with transportation costs depending upon coverage zones. The model can be used to assist in the design of hub-and-spoke networks and in the selection of types of carriers to serve demand points from hubs.

■ MD41

Many-Server Queues in the QED Regime

Sponsor: Applied Probability
Sponsored Session

Chair: Josh Reed, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, je-reed@isye.isye.gatech.edu

Co-Chair: Tolga Tezcan, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, ttezcan@isye.isye.gatech.edu

1 - Fixed-Queue-Ratio Routing in Call Centers

Itay Gurvich, PhD Student, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ig2126@columbia.edu, Ward Whitt

We study large call centers with multiple customer classes and agent pools. In order to balance the service levels for the different classes, we propose a fixed-queue-ratio (FQR) routing scheme. Together with a very simple staffing rule, FQR is asymptotically optimal for minimizing the total staffing level subject to per-class service-level constraints. The asymptotic optimality is proved in the QED many-server heavy-traffic regime via state-space collapse.

2 - Steady-State Analysis of a Multi-Server Queueing System in QED Regime

David Gamarnik, Assistant Professor, MIT Sloan School of Management, E53-353, 77 Massachusetts Avenue, Cambridge, MA, 02139, gamarnik@mit.edu, Peter Momcilovic

We consider a multi-server GI/GI/N queueing system in Halfin-Whitt (QED) regime. The analysis of this system for the case of non-exponentially distributed service times presents a significant challenge. We consider the case of discrete service time distributions and show that in the large N limit the queue length process can approximated by a simple discrete time continuous state Markov chain. We then establish an interchange of steady state and large N limits using tightness arguments.

3 - The G/GI/N Queue in the Halfin-Whitt Regime

Josh Reed, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, je-reed@isye.gatech.edu

Consider the G/GI/N queue in the Halfin-Whitt regime. Our first result is to obtain a one dimensional limiting approximation for the properly centered and scaled queue length process. We then proceed to establish an equivalent characterization of our limiting process involving the renewal function associated with the service time distribution. Finally, we conclude by discussing several interesting directions for future research.

4 - Optimality of a Static Priority Policy in an N-Model with Many Servers

Tolga Tezcan, Georgia Institute of Technology, Industrial & Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, gte778y@mail.gatech.edu, Jim Dai

We consider a parallel-server system that consists of two customer classes and two server pools. The servers in one of the pools can only process jobs from one buffer, whereas the servers in the other server pool can process jobs from either buffer. Service times are assumed to have exponential distribution and to depend only on the server pool providing the service. We show that a static priority scheduling rule is asymptotically optimal in the Halfin-Whitt many-server regime.

■ MD42

Recent Advances in Scheduling Research

Cluster: Scheduling
Invited Session

Chair: Chung-Lun Li, Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, lgtclli@polyu.edu.hk

1 - Scheduling Under Stochastic Order

Xiaoqiang Cai, Professor, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, xqcai@se.cuhk.edu.hk, Liming Wang, Xian Zhou

We study the problem of scheduling a set of jobs on a single machine, to minimize the maximum lateness ML under stochastic order. The processing time, the due date, and the weight of each job may all be random variables. We obtain the optimal sequences in a number of situations.

2 - A Decomposition Technique for Speeding Up Single Stage Scheduling Algorithms

Stefan Bock, Professor, University of Paderborn, Warburger Strafle 100, D-33098, Paderborn, Germany, stbo@uni-paderborn.de, Michael Pinedo

We propose a new decomposition technique that restricts the use of unforced idle time in an optimal schedule for single stage systems with equal processing times and release dates. Based on the decomposition technique, we can solve a variety of well-known single stage scheduling problems $O(n^3)$ times faster if p is constant.

3 - Scheduling Competing Agents with Controllable Processing Times

Guohua Wan, Faculty of Business Administration, University of Macau, Information Systems Program, Taipa, Macau, ghwan@umac.mo

We consider several scheduling problems for competing agents, each having a set of jobs and an objective function, and competing for common processing resources. The processing times of jobs are controllable with additional cost. We study the complexity issues and provide some algorithms for the problems.

4 - Minimizing Weighted Completion Time on a Two-Machine Flowshop

Ya-Mei Tian, PhD Student, National Chiao Tung University, Institute of Information Management, 1001 University Road, Hsinchu, 300, Taiwan, ytian2@gmail.com, Bertrand M.T. Lin

This study considers minimizing weighted completion time in a two-machine flowshop. In view of strong NP-hardness,an efficient exact solution algorithm is demanded. Several branch-and-bound algorithms for the uni-weighted counterpart have been suggested in the literature. We propose a branch-and-bound algorithm incorporating a lower bound and several dominance properties for the weighted version. Computational experiments demonstrate improvement of execution time for composing optimal solutions.

5 - Level Workforce Schedules for 2-Stage Transfer Lines

George Vairaktarakis, Associate Professor, Case Western Reserve University, Weatherhead School of Management, 10900 Euclid Avenue, Cleveland, OH, 44106, United States, gxv5@case.edu, Joseph Szmerekovsky

We define two different workforce leveling objectives for transfer lines - maximin workforce size and range - which seek schedules that minimize workforce size fluctuations from cycle to cycle. For maximin size we develop a polynomial algorithm. The range problem is NP-complete. We develop a very fast optimal alg by finding Hamiltonian cycles in bipartite graphs. We show that range schedules minimize size fluctuations with minor increase in the workforce size.

■ MD43

Threats to Life and Limb in 2006

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Arnie Barnett, abarnett@mit.edu

1 - Evaluating the Allocation of Homeland Security Grants
Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, Yale School of Medicine, Yale Faculty of Engineering, New Haven, CT, 06520-8200, United States, edward.kaplan@yale.edu, Boaz Golany

"Al Qaida and its allies do not attack based on a formula." So stated Sen. Dianne Feinstein in arguing for new legislation mandating that the Department of Homeland Security allocate grants to states based on risk. Comparing the (formula-based) 2005 and (risk-based) 2006 grant allocations reveals no change in the state shares of the homeland security grants pie, with awards remaining proportional to population. Whether such appropriations are appropriate is the subject of this talk.

2 - Modelling Drug Market Supply Disruptions: Where Do All the Drugs Not Go?
Jon Caulkins, Professor of Operations Research and Public Policy, Heinz School of Public Policy and Management, Carnegie Mellon University - Qatar, PO Box 24866, Doha, Qatar, caulkins@andrew.cmu.edu, Haijing Hao

This model predicts how illicit drug production deficits will be "allocated" across downstream markets. Plausible parameterization suggests cocaine markets outside the US serve as a sort of "shock absorber", partially shielding US markets from supply fluctuations, limiting US source country control efforts' ability to reduce domestic drug use.

3 - Exploration of Parole as a Transient State Between Prison and Liberty in the Community
Al Blumstein, University Professor and J. Erik Jonsson Professor of Urban Systems and Operations Research, Heinz School of Public Policy and Management, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, ab0q@andrew.cmu.edu

We examine cross-state variation in the parole process, whereby California is seen to churn their offenders considerably more than others, but their recommitments for new crimes in not anomalous. This study also involves extension of an earlier study of the factors contributing to the dramatic growth of the U.S. incarceration rate.

■ MD44

Panel Discussion: The Industry Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Bala Shetty, Professor and Associate Dean, Texas A&M University, INFO Department, 322 Wehner Building, College Station, TX, 77843-4217, United States, b-shetty@tamu.edu

1 - Panel Discussion: The Industry Job Search
Moderator: David Kim, Associate Prof., Oregon State University, 121 Covell, Corvallis, OR, 97330, United States, david.kim@orst.edu, Panelists: Stephan Biller, Alicia Wilson, Rajiv Saxena

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments by current and former recruiters, time will be provided for questions and answers.

■ MD45

Tutorial: Decision Making Under Conflicting Criteria

Cluster: Tutorials
Invited Session

1 - Decision Making Under Conflicting Criteria
Ravi Ravindran, Professor, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States, aravi@psu.edu, Jyrki Wallenius

Multiple Criteria Mathematical Programming (MCMP) involves simultaneous optimization of several objective functions, usually conflicting, subject to a system of constraints. We will define MCMP terminology, provide introductory examples, discuss basic concepts, and present general formulations. Then, methods for the solution of MCMP problems will be reviewed. Goal programming, Compromise Programming and Interactive Methods will be discussed as examples of broad categories of MCMP approaches.

■ MD46

Applications of Robust Optimization

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Daniel Bienstock, Professor, Columbia University, Department of IEOR, New York, NY, 10027, United States, dano@columbia.edu

1 - Robust Inventory Management and Piecewise Linear Optimization
Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States, aut204@lehigh.edu

We investigate piecewise linear models that arise in inventory management and present robust optimization approaches to incorporate demand uncertainty without the precise knowledge of the underlying demand distributions. We explain why some models may lead to overconservatism and develop techniques to achieve a tradeoff between the number of parameters deviating from their mean and the robustness of the resulting solution.

2 - Robust Knapsack Polyhedron
Alper Atamturk, Associate Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States, atamturk@ieor.berkeley.edu, Muhong Zhang

We present a polyhedral study of a knapsack problem with uncertain coefficients in the objective and constraint. We discuss the strength of the valid inequalities and the corresponding separation problems. We also give some simple special cases.

3 - Robust Inventory Management Problems
Nuri Ozbay, nso2001@columbia.edu

We consider setting inventory control policies when the demand is uncertain, in a robust framework. Unlike traditional inventory models which assume that the demand is random with a known distribution, there exists an adversary who picks the demand from a deterministic uncertainty set. We consider the problem for several different types of inventory control policies such as basestock policies and safety stock policies. We present algorithms that scale well to large scale problems.

4 - Popularity versus Optimality: A Consensus Solution for Models of Uncertainty
Geoffrey A. Chua, NUS Business School, Mabel Chou, Melvyn Sim

We propose a new approach for modeling decisions under uncertainty. Our framework integrates the concept of certainty equivalent from expected utility theory with the notion of target setting from the satisfying literature. Given a decision with an uncertain payoff, different decision makers will have varying assessments due to differences in risk attitudes. In response to this, we offer a consensual solution obtained via approval voting, i.e. one that maximizes the number of decision makers who find the proposed solution acceptable in terms of some target certainty equivalent. Interestingly, our results show that the consensus model preserves the problem complexities of convex optimization, discrete optimization, and dynamic programming. Moreover, an appealing by-product of the model is its robustness with a provision for adjusting the conservatism level using the target certainty equivalent. Finally, we provide examples to illustrate the applicability of our model to a wide range of problems.

■ MD47

Relational Contracts, Information-sharing and Negotiation

Cluster: Supply Chain and Operations Engineering
Invited Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu

Co-Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, plambeck_erica@gsb.stanford.edu

1 - Sharing Forecast Information in a Long-Term Supply Chain Relationship

Justin Ren, Assistant Professor, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States, ren@bu.edu, Morris Cohen, Teck-Hua Ho, Christian Terwiesch

It is well known that forecast sharing in a supply chain using linear price contracts often leads to inefficiencies as the buyer has an incentive to inflate demand forecasts to ensure sufficient supply. In this paper, we establish conditions under which a buyer operating with a linear price contract reveals demand information truthfully assuming that his business relationship with the supplier is long-term.

2 - Interacting Vertical Capacity Investments: Complements vs. Substitutes

Ozge Islegen, PhD Student, Stanford University, Graduate School of Business, Operations, Information and Technology, Stanford, CA, 94305, United States, oislegan@stanford.edu, Erica Plambeck

In the solar photovoltaic and airplane industries, the timing and level of capacity investment by a manufacturer influences her supplier's capacity investment. When the supplier has complementary capacity and little bargaining power, the manufacturer should build more capacity early. Otherwise, the manufacturer should delay her investment.

3 - Renegotiation-Proof Relational Contracts in Supply Chains

Harish Krishnan, Assistant Professor of Operations and Logistics, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Harish.Krishnan@sauder.ubc.ca, Xuan Zhao, Derek Atkins

Relational contracts often rely on trigger strategies: a permanent breakdown in the relationship is threatened as a response to any deviation. But this is not renegotiation-proof: once punishment starts, firms have an incentive to let bygones be bygones. We propose a "punishment-fits-the-crime" strategy which is renegotiation-proof. This approach can also be viewed as defining the set of self-enforcing Nash-bargaining outcomes. Supply chain applications and extensions of our model are discussed.

4 - Delegation vs. Control of Component Procurement Under Multi-level Asymmetric Information

Enis Kayis, Graduate Student, Stanford University, Management Science and Engineering, Stanford, CA, 94305, United States, ekayis@stanford.edu, Erica Plambeck, Feryal Erhun

Should a manufacturer delegate component procurement to her contract manufacturer, or contract with the component supplier directly, given that both have private cost information? Under simple price-only contracts or complex optimal contracts, the manufacturer should maintain control. We recommend simple-but-effective quantity discount contracts, under which delegation becomes optimal under general conditions.

■ MD48

Competitive Inventory Models

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Tava Olsen, Associate Professor, Washington University in St. Louis, 1 Brookings Drive, St. Louis, MO, 63130, United States, olsen@wustl.edu

Co-Chair: Rod Parker, Assistant Professor, Yale School of Management, PO Box 208200, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu

1 - Subsidizing a Supply Chain to Facilitate Coordination

Nicolas Stier-Moses, Assistant Professor, Columbia University, Uris Hall 418, 3022 Broadway, New York, NY, 10027, United States, stier@gsb.columbia.edu, Patrick Maille

It is well known that self-interested agents may introduce inefficiencies in a supply chain. We consider a mechanism based on subsidies that allows agents to redistribute the gains arising from a coordinated solution. Indeed, the budget for subsidies comes from the savings arising from the more efficient solution. The main insight is that the inefficiency of an equilibrium can be reduced by the correct selection of subsidies.

2 - Price and Inventory Competition Between New and Old Technologies

Fernando Bernstein, Associate Professor, Duke University, PO Box 90120, Durham, NC, 27708, United States, fernando@duke.edu, Preyas Desai

We consider a retailer that sells a manufacturer's product line over multiple periods. Upon the introduction of a new product, the manufacturer sets the terms of trade and the retailer selects the price and stocking quantities for both the old and new technologies. We investigate the impact of offering competing technologies on the efficiency of the channel and on the retailer's decisions regarding the breadth of product offerings.

3 - Inventory and Pricing Competition with Strategic Consumers

Gerard Cachon, Professor of Operations and Information Management, University of Pennsylvania, 543 JMHH, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu, Robert Swinney

We consider a model with a retailer selling to consumers, some of whom are strategic. A strategic consumer forms rational expectations regarding prices and availability during a selling season and chooses the optimal time to make a purchase. We study how the presence of strategic consumers influences the retailers quantity and pricing decisions. We also consider how a retailer performs if the retailer is unaware of the presence of strategic consumers.

4 - Inventory Management Under Market Size Dynamics

Rod Parker, Assistant Professor, Yale School of Management, PO Box 208200, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu, Tava Olsen

We investigate the situation where a customer experiencing an inventory stockout at a retailer potentially leaves the firm's market. In classical inventory theory a unit stockout penalty cost has been used as a surrogate to mimic the economic effect of such a departure; in this study we explicitly represent this aspect of consumer behavior, incorporating the diminishing effect of the consumers leaving the market upon the stochastic demand distribution in a time-dynamic context.

■ MD49

Planning and Control Issues in Closed-Loop Supply Chains

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

Chair: Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu

1 - The Optimal Disposition Decision for Product Returns

Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Luk N. Van Wassenhove, Evrim Didem Gunes, V. Daniel R. Guide, Jr.

We model the optimal disposition decision for consumer returns: remanufacturing versus recycling. High congestion in the remanufacturing facility delays the product sale at the secondary market, making recycling more attractive. We show that the optimal policy is: if remanufacturing time is larger than k*, then the product is recycled; otherwise it is remanufactured. Our policy provides a 25% median profit improvement compared to a policy that ignores the time value of money.

2 - Remanufacturing Planning with Different Quality Levels for Product Returns

Mark Ferguson, Assistant Professor, Georgia Institute of Technology, College of Management, 800 W. Peachtree Street NW, Atlanta, GA, 30308, United States, Mark.Ferguson@mgt.gatech.edu, Gilvan Souza, Daniel Guide

We consider a remanufacturing production planning problem observed in such firms as Pitney Bowes and HP. Returns are categorized into a finite number of quality categories. Cost depends on the quality category; it is higher at worse levels of returns quality. We solve for the amount of each quality type return to remanufacture, inventory, or recycle each period so that all demand is met and total cost is minimized. Comparisons in costs are made against traditional production planning methods.

3 - Cascade Reuse Over Product Life Cycle

Kate Li, Doctoral Student, Penn State University, 419A Business Building, University Park, PA, 16802, United States, jzl120@psu.edu, Gilvan Souza, Daniel Guide

We explore the options for product reuse over the life cycle of a product by taking into account volume, quality and timing of product returns, technology diffusion, and market potential. We develop a model focused on profit maximization for reverse supply chains based on the system of cascade reuse.

■ MD50

Adaptive Inventory Policies in Information-Rich Supply Chains

Sponsor: Manufacturing & Service Operations Management
Sponsored Session

Chair: Yossi Aviv, Associate Professor of Operations Management, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63141, United States, aviv@olin.wustl.edu

Co-Chair: Julia Miyaoka, Assistant Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, jmiyaoka@sfsu.edu

1 - Dynamic Work Release Control in an E-Tailer Warehouse

Jeremie Gallien, Associate Professor, Sloan School of Management, Massachusetts Institute of Technology, E53-389, 30 Wadsworth Street, Cambridge, MA, 02142, United States, jgallien@mit.edu, Theophane Weber

We consider the release control of picking work into a semi-automated pick-to-pack process used by a large e-tailer. The objective is to achieve a high average throughput while maintaining the probability of congestion-induced collapse under an acceptable threshold. Our methodology involves the transient analysis of a serial queueing model, approximate dynamic programming, and simulation. This applied study was conducted in collaboration with an industrial partner.

2 - Optimal Policies and Approximations for a Bayesian Linear Regression Inventory Model

Julia Miyaoka, Assistant Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, jmiyaoka@sfsu.edu, Katy Azoury

We consider the periodic review inventory problem where the demand in each period is modeled by a normal simple linear regression model. The state space includes a backward look due to the Bayesian approach and a forward look due to the regression modeling of demand. We show that a base stock policy is optimal and give some strucural results. We also propose a heuristic that provides near optimal results.

3 - New Product Introduction and the Role of Inventory Control

Ozalp Ozer, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, oozer@stanford.edu, Onur Uncu

To bring a new product to the market at the right time to ensure profitability is critical for many high technology companies. We will present a stochastic programming framework used to optimize time-to-market and inventory decisions in a high tech firm. We will discuss how inventory decisions impact the strategic NPI decision and the firm's profitability.

4 - Collaborative Forecasting in Supply Chains: Can Trading Partners Trust Each Other?

Yossi Aviv, Associate Professor of Operations Management, Olin School of Business, Washington University, Campus Box 1133, 1 Brookings Drive, St. Louis, MO, 63141, United States, aviv@wustl.edu

We discuss the authenticity of information transferred under an ongoing (multi-period) collaborative forecasting (CF) partnership. Our supply chain consists of two trading partners that are privy to private streams of information that they suppose to share under a CF agreement. However, in equilibrium, actual information shared may be distorted by the parties. Our models enable us to explore conditions under which collaboration may or may not be effective.

■ MD51

Planning for and Responding to a Flu Pandemic

Cluster: Planning for and Responding to Disasters
Invited Session

Chair: Richard C. Larson, Professor, Massachusetts Institute of Technology, Engineering Systems Division, E40-231b, Cambridge, MA, 02139, United States, rclarson@mit.edu

1 - Modeling the Transmission of Pandemic Influenza

Marc Lipsitch, Associate Professor, Harvard School of Public Health, Department of Epidemiology, 677 Huntington Avenue, Boston, MA, 02115, United States, mlipsitc@hsph.harvard.edu, Christina E. Mills

Mathematical/computational epidemiology has been pushed to new frontiers by the effort to prepare for pandemic influenza. Key findings will be presented in the context of what questions remain, with examples including logistics, decision-making, ecological understanding, and mathematical characterization of the transmission system.

2 - The Sick Supply Chain: When the Pandemic Hits

Yossi Sheffi, Professor of Engineering Systems, Massachusetts Institute of Technology, 1 Amherst Street, Cambridge, MA, 02139, United States, sheffi@MIT.EDU

How will supply chains be affected by an pandemic outbreak? The US is now more dependent on Chinese manufacturing than on Mideast oil! Which products will be affected by an outbreak in that region of the world? How will US retailers, manufacturers and distributors react? We will discuss these and related questions.

3 - Social Distancing Models to Reduce the Spread of Pandemic Influenza

Richard C. Larson, Professor, Massachusetts Institute of Technology, Engineering Systems Division, E40-231b, Cambridge, MA, 02139, United States, rclarson@mit.edu, Karima Robert Nigmatulina, Katsunobu Sasanuma, Kelley M. Bailey

'Social distancing' implies policies aimed to reduce proximate contacts between healthy people and those who might be infected and contagious. Examples include school closings, tele-commuting, isolation and quarantine. Mathematical reasoning and historical analyses of the 1918-1919 "Spanish Flu" and the more recent SARS demonstrate the effectiveness of social distancing measures to reduce spread of flu infection.

■ MD52

Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing
Sponsored Session

Chair: Giuseppe Paleologo, IBM Research, Yorktown Heights, NY, 10598, United States, gappy@us.ibm.com

1 - A Model on Decentralized Dynamic Price and Lead-Time Quotation

Pinar Keskinocak, Associate Professor, ISYE, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta GA 30332, United States, pinar@isye.gatech.edu, Banu Yuksel Ozkaya

We study the impact of decentralized decision making within the context of dynamic price and leadtime quotation in a market where the customers are sensitive to quoted price and leadtime. We consider the effect of different market characteristics, decision-making sequences on the optimal decisions and profitability of the system and analyze the inefficiencies that are due to the decentralization of the pricing and lead time decisions.

2 - Right Product, Right Price, Right Time - A Framework for Profitable New Product Introduction

Duru Ahanotu, Decision Architect, Rapt Inc., 625 2nd Street, 2nd Floor, San Francisco, CA, 94107, United States, duru.ahanotu@rapt.com, Michael Goldbach

New product introductions (NPIs) are the life blood of growth in many segments. In high-tech, products introduced within 18 months often contribute over 50 percent of revenue. While mispricing at introduction can have a devastating impact on margin, these pricing decisions are often the most uncertain due to lack of data. This session introduces a framework to improve NPI decisions by providing a typology of NPI decisions each calling for a different pricing strategy and analytical technique.

3 - Theories of Behavior in Principal-Agent Relationships with Hidden Action

Claudia Keser, Research Staff Member, IBM, T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, ckeser@us.ibm.com, Marc Willinger

In a laboratory experiment on a principal-agent game we evaluate the predictive success of agency theory to and the FAIR-OFFER theory suggested by Keser/Willinger (2000). We find that fair-offer theory generally predicts observed contract offers better than agency theory. However, the predictive success of the fair-offer theory decreases, while the one of standard agency theory increases when we increase the agent's effort costs (i.e. reduce expected net surplus of a contract).

■ MD53

Inventory Management II

Contributed Session

Chair: Oguzhan Vicil, PhD Candidate, School of Operations Research and Industrial Engineering, Cornell University, 285 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, ov24@cornell.edu

1 - Integrated Capacity-Inventory Management with Capacity Acquisition Lead Times

Gergely Mincsovics, Technische Universiteit Eindhoven, PO Box 513, Eindhoven, NB, 5600MB, Netherlands, g.z.mincsovics@tm.tue.nl, Tarkan Tan, Osman Alp

We discuss an integrated model for inventory and flexible capacity management under non-stationary, stochastic demand and positive lead times for temporary capacity acquisition. We analyze the characteristics of the optimal policy and evaluate the value of utilizing flexible capacity as well as the value of shortening acquisition lead times.

2 - Inventory Policies for Selective Assembly

Tim Urban, Professor, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74104, United States, urbantl@utulsa.edu

Selective assembly entails classifying and matching two or more mating components prior to assembly in order to achieve a high-precision assembly with relatively low-precision components. A great deal of research has been conducted on identifying suitable binning strategies for selective assembly, yet very little has been done on determining appropriate inventory-control policies. We present a stochastic inventory model in which the relevant quality characteristic follows a known distribution.

3 - Learning and Forgetting in Setups: Algorithm, Forecast Horizons and Managerial Insights

Sunantha Teyarachakul, Assistant Professor, Minnesota State University Moorhead, 1104 Seventh Avenue South, Moorhead, MN, 56563, United States, teyarach@mnstate.edu, Suresh Chand

Our paper addresses the impacts of learning and forgetting in setups on the batch-sizing decisions. Our optimal dynamic-programming algorithm and the important model properties are applicable to any realistic functional forms of learning and forgetting in setups. A number of interesting properties result in computation reduction. Finally, we are the first to analyze the issue of decision/forecast horizon under the presence of setup learning and forgetting.

4 - Managing Stochastic Inventory with Free Shipping Option

Bin Zhou, PhD Candidate, Rutgers University, 180 University Avenue, Newark, NJ, 07102, United States, zhou@rbs.rutgers.edu, Michael Katehakis, Yao Zhao

We consider a periodic-review inventory model where the ordering cost is a linear function of the order quantity, and the shipping cost is a fixed constant whenever the order size is less than the minimum free shipping quantity (MFS), and it is zero whenever the order size is larger than MFS. Demands in different time periods are independent random variables. We present the optimal policy and its structural properties. An efficient heuristic policy of simple structure is also provided.

5 - An Exact Optimal Solution to a Threshold Inventory Rationing Model for Two Priority Demand Classes

Oguzhan Vicil, PhD Candidate, School of Operations Research and Industrial Engineering, Cornell University, 285 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, ov24@cornell.edu, Peter Jackson

We consider a model consisting of two priority demand classes exhibiting mutually independent stationary Poisson demand, i.i.d order lead times, an (S-1,S) ordering policy, and a threshold level-based allocation and backorder clearing policy. Heuristic solutions for this model have been proposed in the past. Our contribution is an exact analysis of the stationary probabilities and an efficient algorithm for finding the minimal stock required to satisfy demand class-specific fill rate constraints.

■ MD54

Interface of Operations and Marketing II

Cluster: Operations and Marketing for Emerging Markets
Invited Session

Chair: Mei Xue, Assistant Professor, Boston College, 350 Fulton Hall, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States, xueme@bc.edu

1 - The Effect of Capital Budgeting on a Multi-Product Stocking Problem

Avi Giloni, Associate Professor, Sy Syms School of Business, Yeshiva University, 500 West 185th Street, New York, NY, 10033, United States, agiloni@ymail.yu.edu, Vishal Gaur, Ganesh Janakiraman

We model the inventory decisions of a retailer serving demand for several products, and facing a capital budget constraint. Demand processes evolve with time requiring forecast updating by the retailer. Our analysis shows the impact of product variety and capital budgeting on the bullwhip effect along with methods to mitigate this effect. The paper is motivated by a production planning problem encountered at a bicycle manufacturer selling through multiple independent small-scale retailers.

2 - Supply Chain Contracting Under Asymmetric Information and Competition

Shilu Tong, Department of ISMT, 408A, Tower B, HKUST, Hong Kong, China, tongsl@ust.hk, Albert Ha

We consider the problem of designing optimal contracts for supply chains under horizontal competition and asymmetric information. Based on a three-stage contracting game model, we conduct a comprehensive comparison of the performance of the supply chains as well as the individual firms under different information structures. We also consider the issue of investing in vertical information sharing in the context of supply chain competition.

3 - Pricing and Inventory Control with Two-Sided Uncertainty

Thomas Weber, Assistant Professor, Stanford University, Management Science and Engineering, Terman Engineering Center, Stanford, CA, 94305-4026, United States, webert@stanford.edu, Claire Tomkins

We consider the optimal pricing and inventory control in the presence of correlated supply and demand uncertainty. The results are applied to the pricing and inventory decisions of a large intermediary in the California water market.

4 - Optimal Capacity Investment of a Multiple Channel Service Delivery System

Jun Zhang, Assistant Professor, Tulane University, A. B. Freeman School of Business, New Orleans, LA, 70123, United States, jzhang4@tulane.edu, Mei Xue

We study the optimal capacity investment problem of a multiple channel service delivery system that consists of a physical employee- serviced channel and one substitutable virtual self-serviced channel. We study the impact of demand variability and customer efficiency on the capacity investment levels.

■ MD55

Technology Management Applications in Service Industry

Contributed Session

Chair: Avnish Rastogi, Providence Health Care System, 11308 SW 68th Parkway, Tigard, OR, 97223, United States, avnish.rastogi@providence.org

1 - Roadmapping Technologies for Energy Services

Tugrul Daim, Portland State University, Portland, OR, 97201, United States, tugrul@etm.pdx.edu, Mike Hoffman

Technology roadmapping (TRM) is a comprehensive approach for strategy planning to integrate science/technological considerations into product and business aspects as well as to provide a way to identify new opportunities in achieving a desired objective from the development of new technologies. This paper presents a technology roadmap developed for Energy Efficiency and Power Transmission at Bonneville Power Administration (BPA). The paper presents the technology roadmaps developed through workshops with experts to identify the important R&D items to accomplish in the next few years for energy efficiency and power transmission in the northwest.

2 - Impact of Information Technology on Competitiveness in Financial Services

Ferhan Cebi, Technical University, cebife@itu.edu.tr, Dundar Kocaoglu

This paper presents the results of an exploratory study to measure and evaluate the benefits of IT and its impact on competitiveness of organizations in the financial services sector. More than 1,900 executives in U.S. financial institutes were contacted to identify the "Competitiveness Factors" resulting from IT, and to develop a series of indices such as the Factor Index, the Competitiveness Measure Index, and the System Competitiveness Index to quantify the judgments of the decision makers about the impacts of IT in banks, insurance companies and other financial institutions.

3 - Optimizing Decisions for Improved Health: Applications in Childbirth and Domestic Violence Patient Decision-Making

Karen Eden, Assistant Professor, Oregon Health & Science University, BICC, Portland, OR, 97239, United States, edenk@ohsu.edu, Dondar F. Kocaoglu

Basic concepts in decision sciences are now emerging in healthcare. This paper describes two computerized decision aids developed and deployed on childbirth and domestic violence, based on the analytic hierarchy process. Decision aid feedback is matched with appropriate community and healthcare resources to aid the user in optimizing her decision for improved health.

4 - Exploring Emerging Technologies in Health Care Services

Avnish Rastogi, Providence Health Care System, 11308 SW 68th Parkway, Tigard, OR, 97223, United States, avnish.rastogi@providence.org, Tugrul Daim

Emerging technologies in healthcare are converging to revolutionize home and self-care systems in the United States. These technologies are making it possible for people to play a greater role in maintaining their health. These systems are stirring towards a proactive prevention-oriented, consumer-driven model for healthcare that includes innovations such as "smart devices" that can "think" for themselves, customized wearable devices, electronic patient records, and wireless Internet-linked systems - all expected to deliver convenient, user-friendly, intelligent health care in the home. This paper explores emerging technologies in healthcare services and utilizes technology forecasting tools to determine their adoption in the market.