How to Navigate the Technical Sessions

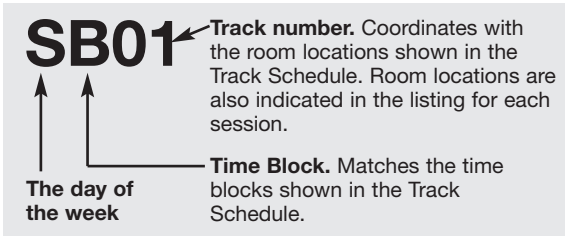
There are three primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Session Chair, Author, and Session indices provide cross-reference assistance (pages 456-496).
- The Track Schedule is on pages 50-57. This is an overview of the tracks (general topic areas) and when/where they are scheduled.

Quickest Way to Find Your Own Session

Use the Author Index (pages 460-485) — the session code for your presentation(s) will be shown along with the track number. You can also refer to the full session listing for the room location of your session(s).

The Session Codes



Time Blocks

Sunday - Tuesday
A - 8:00am – 9:30am
B - 11:00am - 12:30pm
C - 1:30pm - 3:00pm
D - 4:30pm - 6:00pm

Wednesday
A - 8:00am – 9:30am
B - 11:00am - 12:30pm
C - 1:30pm – 3:00pm
D - 3:30pm - 5:00pm

Room Locations/Tracks

All tracks and technical sessions will be held in the Austin Convention Center and the Hilton Austin. Room numbers are shown on the Track Schedule and in the technical session listing.

Sunday, 8:00am - 9:30am

■ SA01

C - Ballroom D1, Level 4

Simulation Modeling in Energy Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Augusto Ruperez Micola, Assistant Professor, Universitat Pompeu Fabra, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - A Decentralized Mechanism for Market Coupling
Alfredo Garcìa, Associate Professor, University of Virginia, 151 Engineer's Way, P.O. Box 400747, Charlottesville, VA, United States of America, ag7s@virginia.edu, Mingyi Hong, Himanshu Gupta

Several electricity markets in Europe have been integrated through a procedure known as "market coupling" which combines electricity trading with the allocation of cross-border transmission capacity. We analyze a decentralized mechanism for market coupling in which TSOs procure cross-border transmission capacity on behalf of their own markets while maintaining control of internal trading.

2 - A Multi-agent Energy Trading Competition
Wolfgang Ketter, Assistant Professor, Erasmus University, Rotterdam School of Management, Department of Decision and Information Science, Rotterdam, Netherlands, wketter@rsm.nl, John Collins, Carsten Block

We present the design of an open,competitive simulation approach that will produce robust research results on the structure and operation of retail power markets as well as on automating market interaction by means of competitively tested and benchmarked agents. These results will yield policy guidance that can significantly reduce the risk of instituting competitive energy markets at the retail level.

3 - Test of LSE's Strategic Behavior in a Two Settlement Market
Huan Zhao, Iowa State University, 419 S Walnut Avenue, Ames, IA, 50010, United States of America, hzhao@iastate.edu, Abhishek Somani

In most of the restructured power markets, a centralized power pool is operated in both day-ahead and real-time market. This day-ahead market is supposed to increase the system reliability. In reality, strategic LSE could utilize this two settlement system to reduce its procurement cost. In this study, we plan to utilize an agent-based model AMES to test LSE's bidding strategy between the two markets. This work includes the modification of DCOPF and change of LSE's learning algorithm.

4 - Wind Power, Load Volatility and Spot Electricity Prices
Augusto Ruperez Micola, Assistant Professor, Universitat Pompeu Fabra, Barcelona, Spain, augusto.ruperezmicola@gmail.com, Albert Banal-Estanol

We analyse whether supply side load volatility influences prices with a focus on the effects of wind power generation on electricity markets. We address three inter-related questions: Does wind volatility have an influence on spot electricity prices? Do demand volumes influence the results? Does asset ownership influence them? We model the market using simulations in which agents behave following parametrisations of the Experience-Weighted Attractions (EWA) algorithm.

■ SA02

C - Ballroom D2, Level 4

Real Options in the Energy Sector

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Afzal Siddiqui, University College London, Department of Statistical Science, London, United Kingdom, afzal@stats.ucl.ac.uk

1 - Capacity Switching Options Under Rivalry and Uncertainty
Ryuta Takashima, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino-shi, Chiba, 275-0016, Japan, takashima@sun.it-chiba.ac.jp, Afzal Siddiqui

Generators can invest in either a small or a large plant. The former project offers the subsequent option to upgrade capacity. We contrast the direct and sequential investment strategies for a monopolist in order to extract the option value of flexibility. Next, we allow for a symmetric duopoly that can again adopt capacity in either direct or sequential manners. The impact of competition on a typical generator's value is obtained under both direct and sequential strategies.

2 - Valuation of CCS-ready Coal-fired Power Plants: A Multi-dimensional Real Options Approach
Reinhard Madlener, Professor, RWTH Aachen University, Mathieustr. 6, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de, Wilko Rohlfs

The economic valuation of a CCS-ready coal power plant is strongly influenced by the time between the investment and the CCS retrofit. To determine the optimal time delay we develop a real options model with a multi-dimensional optimal threshold value that incorporates uncertainty in the price of fuel input, CO2, electricity, capture, transport and storage (CTS), and investment cost.

3 - Duopolistic Competition Under Risk Aversion and Uncertainty
Afzal Siddiqui, University College London, Department of Statistical Science, London, United Kingdom, afzal@stats.ucl.ac.uk, Michail Chronopoulos, Bert De Reyck

A monopolist typically defers entry into an industry as both price uncertainty and the level of relative risk aversion increase. The former attribute is present in most energy industries, while the latter may be relevant for reasons of market incompleteness or the presence of technical uncertainty. By contrast, it has been shown that the presence of a rival hastens entry under risk neutrality. Here, we examine how duopolistic competition affects the entry decisions of risk-averse investors.

■ SA03

C - Ballroom D3, Level 4

Underground Mining Applications

Sponsor: Energy, Natural Resources and the Environment/ Mining
Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Room 319, Engineering Hall, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - Long-term Extraction and Backfill Scheduling in a Complex Underground Mine
Donal O'Sullivan, PhD Student, Colorado School of Mines, Division of Economics and Business, 816 15th Street, Golden, CO, 80401, United States of America, dosulliv@mymail.mines.edu, Alexandra Newman

We present an integer programming model to optimize the production schedule for a complex underground mining operation. Mine managers seek to maximize metal production while using a mixture of mining methods to extract the ore. We apply a sliding time window heuristic to solve a forty-eight month time horizon.

2 - Undergound and Open Pit Models for Mine Planning
Andres Weintraub, Department of Industrial Engineering, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, Felipe Caro, Rafael Epstein, Marcel Goic

We present a system developed for CODELCO, one of the largest copper mine companies in the world. The system is based on a model for long range planning, where underground, open pit and mixed mines are considered. The production chain from mine to final product is considered. The system is in use in most of the 7 CODELCO mines. Results show that by supporting decisions through use of the model, significant improvements in production and net income have been obtained.

■ SA04

C - Ballroom D4, Level 4

Joint Session Clean Energy/ ICS: Modeling Future Energy Infrastructures

Cluster: Clean Energy/ Computing Society
Invited Session

Chair: William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

1 - Wind Farm Network Design
Richard Chen, Sr. Member of Technical Staff, Sandia National Laboratories, P.O. Box 969, Livermore, CA, 94551-0969, United States of America, rlchen@sandia.gov, Amy Cohn, Duncan Callaway

Wind-generated electricity is widely regarded as the most promising way to reduce pollution and greenhouse gas emissions, but it also presents new challenges not found in the design of conventional generation networks. We present a new model, Wind Farm Network Design (WFND), for generation- and transmission- expansion planning that integrates both wind-based and conventional power generation. An accelerated Benders Decomposition algorithm is proposed to efficiently solve WFND.

2 - Design of Robust Hedging Strategies for U.S. Electric Sector Planning
Joe DeCarolis, Assistant Professor, North Carolina State University, 2501 Stinson Drive, Campus Box 7908, Raleigh, NC, 27695, United States of America, jdecarolis@ncsu.edu, Kevin Hunter, Sarat Sreepathi

This talk describes a multi-stage stochastic optimization of the U.S. electric sector under a climate policy. The model optimizes the retirement, installation, and utilization of generating capacity over the next 40 years. Future CO2 targets are modeled as stage-wise uncertain parameters. To test the robustness of the resultant hedging strategy, a technique called modeling to generate alternatives is discussed.

3 - Optimal Design of Biofuel Production System and Resource Allocation: A California Case Study
Chien-Wei Chen, University of California-Davis, 5000 Orchard Park Cir 7612, Davis, CA, 95616, United States of America, scwchen@ucdavis.edu

A well designed biofuel production system may alleviate greenhouse gas emission and energy security issues. An important question is how to maintain a low-cost and low-risk biofuel supply system under future uncertainties such as demand, supply, and technologies. A two-stage stochastic programming model is developed for an entire biofuel pathway. To overcome the computational challenges, an effective decomposition method based on progressive hedge (PH) method is implemented.

4 - The Role of Storage Facility Design in Disruption Management of Biofuel Supply Chains
Yongxi Huang, University of California-Davis, One Shields Avenue, Davis, CA, 95616, United States of America, yxhuang@ucdavis.edu, Yueyue Fan

A biofuel supply chain consists of various components that are interdependent of each other. A crucial question is how to improve the reliability of the biofuel system against potential disruptions. A stochastic mixed-integer programming model that integrates feedstock seasonality, geographic variation, and demand fluctuation is developed, aiming at minimizing the total expected cost of the entire biofuel supply chain. Progressive Hedging method was used to solve the stochastic model.

■ SA05

C - Ballroom D5, Level 4

A Good Walk Analyzed: Operations Research in Golf

Sponsor: SpORts
Sponsored Session

Chair: Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

1 - Analyzing the Impact of New Groove Rules in Professional Golf
Jason Acimovic, Massachusetts Institute of Technology, 77 Massachusetts Ave, E62-459, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Douglas Fearing, Stephen Graves

In 2010, the USGA implemented new rules regarding golf clubs grooves. Using a model that predicts how well players perform on each hole, we examine data from both before and after the rule change to determine the impact both on outcomes and style of play.

2 - A Proposal for Redesign of the FedEx Cup Playoff Series on the PGA TOUR
Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu, Chris Potts

We propose a redesign of the FedEx Cup playoffs, including a strongly seeded match play TOUR Championship. We analytically estimate the probability that a player with a particular rank before The TOUR Championship finishes in various positions. All players control their own destiny, and are rewarded for strong season performance. Marquee name players are guaranteed participation late in the event. Our design meets the objectives listed by Commissioner Finchem in a 2008 blog about the playoffs.

3 - A Shot Value Approach to Assessing Golfer Performance on the PGA Tour
Mark Broadie, Professor, Columbia University, 3022 Broadway, 415 Uris Hall, New York, NY, 10027, United States of America, mnb2@columbia.edu

Shot value analysis is used to assess the performance of golfers in different parts of the game, e.g., long tee shots, putts, sand shots and others. Using extensive data, we rank PGA Tour golfers in various skill categories. The main factor in Tiger Woods' scoring advantage is his exceptional long game. Long game shots explain more than half the difference in scores between the top 100 and the second 100 golfers on the tour. The impact of the USGA's groove rule change is investigated.

4 - Testing Tournament Predictive Power Theory with PGA Golf Data

Robert Connolly, Kenan-Flagler Business School at the University of North Carolina at Chapel Hill, Chapel Hill, NC, Robert_Connolly@kenan-flagler.unc.edu, Richard Rendleman

An enduring aim of tournament theory is a full understanding of how different tournament structures sort out participants to produce tournament outcomes. Ryvkin and Ortmann (2008) study three different tournament structures, demonstrating analytically and with simulations several important propositions about the predictive power of tournaments (the probability that the best participant wins the tournament). Their analysis focuses on how the number of participants, the noise level in participant performance, and the distribution of player types affects the predictive power of contests, binary elimination tournaments, and round-robin tournaments. Among other things, they document interesting non-monotoniticies in the impact of the number of participants and the noise level on tournament predictive power. In this paper, we exploit an established model of participant skill and random variation in scoring among PGA TOUR players to structure and execute tests of the predictions of the Ryvkin-Ortmann model. Specifically, we apply the skill estimation model in Connolly-Rendleman (2008) to a pool of 354 professional golfers with varying skill levels and scoring volatility. With this pool of participants, we then simulate the tournament structures of Ryvkin-Ortman along with several structures specific to golf, varying the number of participants, the noise level, and the distribution of player skill. We document the extent to which the predictions of Ryvkin-Ortmann are confirmed in our simulations. We also explore the predictive power associated with small field events on the PGA TOUR (like The Tour Championship) vs. regular PGA TOUR events with a typical large field (e.g., the Valero Texas Open).

■ SA06

C - Ballroom E, Level 4

Tutorial: Provably Near-optimal Approximation Algorithms for Operations Management Models

Cluster: Tutorials
Invited Session

Chair: Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Provably Near-optimal Approximation Algorithms for Operations Management Models

Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

The session provides a survey of several recent results on the design and analysis of provably near-optimal approximation algorithms for operations management multistage stochastic optimization models. We will discuss cost-balancing based algorithms for core stochastic inventory control models, and linear programming based control for models concerned with the management of reusable resources.

■ SA07

C - Ballroom F & G, Level 4

JFIG Paper Competition Finalists - I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, hayhan@isye.gatech.edu

1- JFIG Paper Competition

Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta GA, United States of America, hayhan@isye.gatech.edu

The JFIG paper competition aims to encourage research among junior faculty and increase the visibility of research conducted by junior faculty within the fields of operations research and management science. 39 papers are submitted for this year's competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session, three of the six finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SA08

C - Room 11A, Level 4

Service Parts Logistics

Sponsor: Location Analysis
Sponsored Session

Chair: Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com

1 - Network Design and Inventory Management for Service Parts Logistics with System-wide Service Level

Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com, Erhan Kutanoglu

Decision of network design and inventory stocking usually have been made sequentially in practice. We study the integrated problem for Service Parts Logistics with system-wide and time-based service level requirement. We first develop decomposition-based methodology for a special case of the problem with customer-centric service level requirement. Then we extend our approach for the original system-wide problem.

2 - When to use Decentralized Stocks and Lateral Transshipments in Spare Parts Networks

Geert-Jan Van Houtum, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, Netherlands, G.J.v.Houtum@tue.nl, Alan Scheller-Wolf, Bram Kranenburg

On one hand, spare parts generally have low demand rates and hence spare parts stocks should be centralized to create pooling effect. On the other hand, you need them at close distance of installed machines to avoid long down times. A network of decentralized stocks with lateral transshipments meets both wishes. We present analytical and numerical results on the comparison of this network to other basic networks.

3 - A Heuristic to Ddetermine Near-optimal Base Stock Levels in a Two-echelon Distribution Network

Rob Basten, Eindhoven University of Technology, P.O. Box 513, Pav. E.08, Eindhoven, 5600 MB, Netherlands, r.j.i.basten@tue.nl, Geert-Jan Van Houtum

We consider a spare parts network consisting of a central warehouse and local stock points. The local stock points face Poisson demand and backorder any unfulfilled demand, for which they pay a penalty cost. At both echelon levels, we consider holding costs and one-for-one replenishments. We give some useful properties of the cost function and we propose a heuristic that sets near-optimal base stock levels.

■ SA09

C - Room 11B, Level 4

Inventory and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Jeannette Song, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States of America, jssong@duke.edu

1 - Inventory Management with Purchase Order Errors and Rework

Yan Jiang, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, YanJiang2008@u.northwestern.edu, Diego Klabjan, Nicole DeHoratius

In a retail DC, purchase orders occasionally arrive with errors and thus have to be reworked. We study how should retailers adjust their inventory policies in anticipation of purchase order errors and rework. The performance of our adjusted ordering policy is compared with standard policies using real-world data. The comparison helps retailers understand and quantify the cost impact of purchase order errors and rework.

2 - Supplier Diversification with Price-dependent Demand

Tao Li, The University of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX, 75080, United States of America, tao.li@utdallas.edu, Suresh Sethi, Jun Hang

We study sourcing problem of a firm with price-dependent demand and two unreliable suppliers. We show firm's diversification decision does not depend on the correlation of suppliers' reliabilities. In the diversification zone, the firm's total order quantity decreases as suppliers become more correlated. Interestingly, when the two suppliers' reliabilities are independent and their costs are low, the optimal order quantity for a supplier is only affected by his cost and his rival's reliability.

3 - Basestock Policies in Supply Chain Networks: Robust vs. Stochastic Optimization

Alex Rikun, Massachusetts Instititute of Technology - Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, arikun@mit.edu, Dimitris Bertsimas, David Gamarnik

We address the problem of computing basestocks in supply chain networks using the robust optimization approach. Our algorithm handles arbitrary network topologies, fixed costs, and exhibits fast convergence and practical running time. In a numerical study, performance of the algorithm on three types of networks is compared to a stochastic simulation-based heuristic, and our algorithm demonstrates comparable (sometimes better) average performance, while having much lower standard deviation.

4 - Mechanism Design for Supply Chain Sustainability

Fang Liu, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States of America, fang.liu2@duke.edu, Jeannette Song, Tracy Lewis

We consider a supply chain consisting of a supplier and a retailer. The market is sensitive to the product quality. The supplier can invest to improve quality and the retailer can invest to improve market sensitivity to quality .We present an incentive mechanism that induces both parties to choose the system-optimal decisions.

■ SA10

C - Room 12A, Level 4

An Operations Management Perspective to Energy Applications

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu

1 - A New Proposal for Electricity Market Design: A Fairness Based Approach

Dimitris Bertsimas, Professor, Massachusetts Instititute of Technology, 77 Massachusetts Avenue, Building E40-139, Cambridge, MA, 02139, United States of America, dbertsim@mit.edu, Andy Sun

More than half of the electricity in the US is generated in deregulated markets hence its efficient design is important. We propose a family of auction/pricing schemes based on ''fairness" for the uplift problem. Fairness has not been considered in electricity market design. We review current practices, outline our contributions and discuss our proposal based on the real-world data of ISO New England's day-ahead market.

2 - Consumer Choice Model for Forecasting Demand and Designing Price Incentives for Solar Technology

Ruben Lobel, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, rlobel@mit.edu, Georgia Perakis

We model the adoption of solar panels as a technology diffusion process. Customers are assumed to follow a discrete choice model. The policy maker is designing incentives (subsidies) in order to achieve a desired adoption target with minimum cost for the system, taking advantage of network externalities such as imitating social behavior and learning-by-doing. We demonstrate how to use this model for forecasting and subsidy policy design with an empirical study of the German solar market.

3 - Loss of Efficiency in Deregulated Electricity Markets: A Supply Function Equilibrium Approach

Jonathan Kluberg, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, kluberg@mit.edu, Georgia Perakis

This work proposes a novel definition of efficiency for electricity markets, which presents several advantages compared to existing metrics. It accounts for the surplus of consumers and producers, it is well defined in the case of elastic demand, and it allows us to compare markets across network structures. After defining the notion of efficiency, we establish theoretical guarantees on the maximum loss of efficiency induced by deregulation with and without network constraints.

■ SA11

C - Room 12B, Level 4

Models for Operational Flexibility

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Reza Ahmadi, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, rahmadi@anderson.ucla.edu

1 - A Tactical Planning Model for a Serial Manufacturing System

Pallav Chhaochhria, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E40-149, Cambridge, MA, 02139, United States of America, pallavc@mit.edu, Stephen Graves

We develop a tactical planning model for a serial manufacturing system that produces multiple families of discrete parts in a make-to-order setting. There is uncertainty in demand, yield and raw material lead-time. The model segments the production line with decoupling inventories, and determines the rules for work release and production in each segment. It also decides the safety stock level for finished goods and decoupling buffers, work-in-process inventory and raw material ordering policy.

2 - Incorporating Forecast Revisions in Inventory Management of Multiple Products

Foaad Iravani, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, firavani@anderson.ucla.edu, Sriram Dasu, Reza Ahmadi

The Markovian Model of Forecast Evolution (MMFE) is a useful tool for modeling advance demand information, which embraces a diverse range of well-known time-series models. Past literature has applied MMFE to various inventory control models for a single product. We incorporate MMFE into a multi-product inventory model and investigate the impact of interdependent information updates, product substitution and co-production on the optimal policy.

3 - Operational Flexibility in Strategic Supply Chain Trading with Spot Market

Chen Peng, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Hau Lee

We investigate a supply chain where a buyer procures a commodity from an oligarchy seller via two channels: a fixed-price contract and a spot market. Firstly, the seller allocates his production capacity between the two channels, which may affect the spot price. Then the buyer signs a fixed-price contract with the seller. Finally, the buyer decides how much to actually procure from the two channels after observing demand. The equilibrium outcome is discussed and managerial insights are provided.

■ SA12

C - Room 13A, Level 4

Incentives in Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Wenqiang Xiao, New York University, KMC 8-72, 44 W 4 Street, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu

1 - Motivating Suppliers in a Dynamic Moral Hazard Environment

Hao Zhang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, zhanghao@marshall.usc.edu, Hongmin Li, Charles Fine

We study a supply chain triad with a risk-neutral manufacturer (the principal) and two risk-averse suppliers who can make private efforts to improve the quality of supplies. We consider two incentive structures over an infinite horizon: rewarding suppliers with higher profit margins or with greater business volumes. We show that in both cases there exist certain trapping positions in terms of future arrangements. The suppliers are motivated to make high efforts to secure a favorable position.

2 - Transparency of Information Acquisition in Supply Chains
Li Tian, Hong Kong University of Science and Technology, Department ISOM, HKUST, Clear Water Bay, Hong Kong - PRC, litian@ust.hk, Hongtao Zhang, Shilu Tong

A retailer attempts to acquire demand information but his attempt may have successful or unsuccessful outcome. Should he keep the outcome secret, or should he make it transparent to the upstream manufacturer? When facing a powerful manufacturer, such as one who can dominate the terms of trade by offering a quantity bundle contract menu, the retailer may become less disadvantageous, and gain more from his information, by making his information acquisition process transparent to the manufacturer.

3 - Procurement Bundling: How to Acquire Technology for Almost Free
Leon Chu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Yunzeng Wang

We study a procurement mechanism when a buyer would like to acquire technologies along with products and compete current suppliers in the future market. For the two-supplier case, each supplier has a dominant bidding strategy for the technology provision that specified by the difference of the suppliers' technology strength and the ratio between the current project size and the future market size. The suppliers' technology provision can vary non-continuously with the market size ratio.

4 - Pre-order Price Guarantee in Advance Selling
Xuying Zhao, University of Notre Dame, 361 MCOB, Notre Dame, IN, United States of America, xzhao1@nd.edu, Zhan Pang

When consumers pre-order not-yet-released items, they may observe a price drop after release. Under a pre-order price guarantee policy, consumers get refund for the price difference if the pre-order price is higher than the price right after release. We study the pre-order price guarantee policy. Our research questions include: when should a firm offer such a policy? With pre-order price guarantee, at what price should a firm sell during the advance selling period and during the selling season?

5 - Selling to Competing Newsvendors with Non-discriminating Contracts
Stephen Shum, Hong Kong University of Science & Technology, School of Business and Management, Hong Kong - PRC, sshum@ust.hk, Qian Liu, Ruirui Li

It is a common practice for a supplier to offer the same contract to different buyers. In the United States, the Robinson-Patman Act forbids selling to different retailers at discriminating prices. We study a supplier's contracting problem under non-discriminating practice. We show that a retailer's ordering quantity may be increasing in the wholesale price. We also characterize the supplier's optimal strategy under wholesale price contract, return contract and rebate contract.

■ SA13

C - Room 13B, Level 4

Retail Supply Chains and Product Variety

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Mumin Kurtulus, Assistant Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, mumin.kurtulus@owen.vanderbilt.edu

1 - Private Label Introduction: Does it Benefit the Supply Chain?
Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, Spain, valbeniz@iese.edu, Marc Sachon

This paper analyzes the channel dynamics in a category where a private label is introduced. We focus on the impact of private labels on retail and wholesale equilibrium prices, as well as on the profits of each firm of the supply chain. While private label introduction helps the retailer reduce manufacturer brand's prices, we find that it does not always improve the total profits of the supply chain, only when cross-elasticities are small, i.e., competitive interactions are weak.

2 - A Complexity Model of Assembly Supply Chains in the Presence of Product Variety
Hui Wang, PhD, Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu, Goker Aydin, S. Jack Hu

We propose a metric for the complexity of an assembly supply chain. The metric takes into account the supply chain configuration, product variety offered by the supply chain, and the demand split among the products. We investigate how this complexity metric relates to the cost of the supply chain and show that complexity and cost are equivalent under certain conditions. We illustrate how this complexity measure can be used as a proxy for cost in decision making.

3 - Assortment Planning and Pricing in the Presence of Returns
Alex Grasas, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, alex.grasas@upf.edu, Aydin Alptekinoglu

Using a nested-MNL-based consumer choice model, we study a retailer's assortment, pricing and return policy decisions. The retailer must choose its assortment from an arbitrary set of differentiated products, and determine the price and refund amount for every product. We derive a simple metric to rank products, which reveals the optimal assortment quite efficiently. Results are then compared to the case when no returns are allowed.

4 - How to Select Category Captains for Category Management?
Alper Nakkas, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, alper.nakkas@owen.vanderbilt.edu, Mumin Kurtulus

Category captainship refers to the practice where a retailer relies on one of the leading manufacturers in a category for strategic recommendations regarding category management. We investigate the impact of category captain selection decision on the profits in a supply chain with multiple manufacturers selling through a single retailer. We show that retailers should create an environment in which the benefit for the retailer is endogenously determined by the competition among manufacturers.

■ SA14

C - Room 14, Level 4

Innovative OR/MS Applications for the Hospitality Industry

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Rohit Verma, Cornell University, 338 Statler Hall, Ithaca, NY, United States of America, rv54@cornell.edu

1 - Sequence Effects in Service Bundles: Marketing and Operational Implications
Michael Dixon, PhD Candidate, Cornell University, G-80 Statler Hall, Ithaca, NY, 14853, United States of America, mjd295@cornell.edu, Rohit Verma

We investigate whether the sequence schedule of discrete events within a service bundle impacts customer repurchase behavior. Using a unique data source provided by a renowned performing arts venue, we build and test an econometric model to predict season ticket subscription repurchase and to determine if the temporal placement of events impacts repurchase. We find evidence of peak, end, and trend effects and discuss the importance of sequence in determining service design and scheduling.

2 - An Examination of Factors Driving Fractional Service Ownership: Evidence From Resort Timeshares
Gregory Heim, Assistant Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, GHeim@mays.tamu.edu, Bedanta Talukdar

Little research examines timeshares or other fractional ownership services. We examine whether timeshare vacation experiences or options more strongly affect the valuation and ownership of timeshare units. We empirically evaluate several timeshare option types, facility brand and location, facility service experiences, and nearby amenities and landmarks. Several option types contribute to timeshare unit values and purchases. Options tend to contribute as much value as resort experience features.

3 - Heuristic Approaches to Setting Prices on Priceline
Chris Anderson, Cornell University, Ithaca, NY, United States of America, canderson@cornell.edu

Priceline's name-your-own-price model has become increasingly popular for both consumers and services providers - consumers looking for travel deals and service providers looking to reach price sensitive customers. During this talk I will outline Priceline's inventory allocation model and its implications for service providers. I will summarize approaches for setting prices and allocations at Priceline -highligting a case study at a large convention hotel.

4 - In Search of Optimum Service Scripting: Comparing Manager and Customer Perceptions

Rohit Verma, Cornell University, 338 Statler Hall, Ithaca, NY, United States of America, rv54@cornell.edu, Liana Victorino

Service scripting is a commonly used approach to enhance the effectiveness of a service encounter between a customer and an employee. This study addresses an important question related to service scripting - is there an optimum level of scripting for different types of service processes? We will present results of a video experiment designed to compare manager and customer perceptions for service scripting and its relationship to performance.

■ SA15

C - Room 15, Level 4

Behavioral Operations in Practice

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Kay-Yut Chen, Principal Scientist, HP Labs, MS 1U-2, 1501 Page Mill Road, Palo Alto, Ca, 94303, United States of America, kay-yut.chen@hp.com

1 - The Use of Human Subjective Probabilitistic Information in Work Force Planning

Kay-Yut Chen, Principal Scientist, HP Labs, MS 1U-2, 1501 Page Mill Road, Palo Alto, Ca, 94303, United States of America, kay-yut.chen@hp.com, Pano Santos, Maria-Teresa Gonzalez, Alex Zhang

One important piece of information, to resource management in the consulting business, is the probability of winning of the deals being pursued. Inside HP, sales managers are required to report a "win" probability for each deal. With a behavioral model, sale managers are found to be bounded rational, prone to positive biases but nevertheless informative. The model is also used to "adjust" the reports. The adjustment cuts down the error rate by half while increasing information revelation by 20%.

2 - Human Behavior Challenges for Workforce Planning Mathematical Models

Pano Santos, HP Labs, 1501 Page Mill, Palo Alto, CA, United States of America, cipriano.santos@hp.com, Alex Zhang, Kay-Yut Chen, Maria-Teresa Gonzalez

Services labor planning is ideal for Behavioral OM research. Business complexity - many services, labor skills, regions, is perfect for large scale optimization. Also, there are many behavioral issues, from the evaluation of workforce planning decisions - what are the proper criteria to allocate an employee to a job; to the solicitation of preferences of project assignments. In this talk, we outline an optimization model of labor resources & discuss related behavioral issues.

3 - Kindness Can be Expensive: A Model of Reciprocity in a Service Firm

Claudia Marquez-Nava, Instituto Tecnologico de Estudios Superiores de Monterrey, 2000 Eduardo Monroy Càrdenas, San Antonio Buenavista, Toluca, MX, Mexico, A00961076@itesm.mx

Reciprocity, as a behavioral factor, has a strong effect on employee productivity. This paper incorporates this factor into a dual service-labor market where two service firms compete. The results show that reciprocity can be harmful for employees' and firms' profitability. Service firms should consider these counterintuitive results before determining their strategies on both markets.

■ SA16

C - Room 16A, Level 4

Integer Programming Based Scheduling & Dispatching

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Myoungsoo Ham, Member of Technical Staff, Samsung Austin Semiconductor, 12100 Samsung Blvd, Austin, TX, 78754, United States of America, m.ham@samsung.com

1 - Real Time Scheduling of Cluster Tools using Binary Integer Programming

Jaehyung An, PhD Student, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, jaehyung.an.2013@anderson.ucla.edu, Myoungsoo Ham, Wonyup Ko

Cluster tools are widely used in wafer fabrication processes. The most predominant problems with cluster tools are the scheduling issues that are characterized by the added complexity due to the physical structure and job flow patterns. In order to address this prevalent problem, a job shop scheduling model for cluster tools is introduced to minimize the makespan via binary integer programming. The model is solved using XpressMPTM then the result is compared with other dispatching rules.

2 - A Dynamic Bottleneck Capacity Modeling

Dongjin Kim, Industrial Engineering Lead, Micron Technology Inc, 6581 Creek Run Drive, Centreville, VA, 20121, United States of America, djkim@micron.com

Wafer fabrication is a dynamic system due to the high variability from both equipment and process. The dynamic bottlenecks consistently shift in a daily and hourly basis that can cause the WIP bubbles in the line. We developed an optimization-based Linear Programming and Queuing modeling approach to predict Fab bottlenecks for the next 12 hours, which utilizes current tool and WIP prediction by part/step level.

■ SA17

C - Room 16B, Level 4

Inventory and Pricing Applications in Supply Chains

Cluster: Practice of OR/MS
Invited Session

Chair: Markus Ettl, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, msettl@us.ibm.com

1 - Managing Inventory Freshness for Perishable Products

Zhengliang Xue, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, zxue@us.ibm.com, David D. Yao, Markus Ettl

We study optimal depletion and replenishment strategies in an inventory system with perishable products. Fresh products are sold at full price. Aged products can either be sold at full price in the primary retail channel, or at a discounted price in a secondary channel. Expired products are discarded. In each period, the retailer decides a depletion amount for aged preducts, and a replenishmen quantity for fresh products. The goal is to maximize the total expected discounted profit.

2 - Inventory Management Under Competitive Pricing

Yiwei Chen, Massachusetts Institute of Technology, Sloan School, Cambridge, MA, United States of America, ywchen@mit.edu

We investigate the impact of stochastic pricing on inventory replenishment decisions in a competitive pricing environment. A market follower is able to forecast prices of products offered by a market leader to make optimal joint pricing and inventory decisions.

3 - Planning Work Releases with Workload Dependent Lead Times and Stochastic Demand

Reha Uzsoy, Clifton A. Anderson Distinguished Professor, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, ruzsoy@ncsu.edu, Seza Orcun, Karl Kempf

We address the problem of planning production releases in a serial multistage production-inventory system with workload dependent lead times and stochastic demand. We propose a chance-constrained mathematical programming model and an iterative scheme by which lead times and safety stock levels are updated. Computational experiments evaluating the performance of the approach are presented.

4 - Differentiated Configuration Pricing Strategies for Multi-commodity RFQs

Markus Ettl, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, msettl@us.ibm.com, Karthik Sourirajan, Zhengliang Xue

In this paper, we model pricing strategies for request-for-quotes (RFQs) in multi-commodity bid configurations with unconstrained execution. We develop win probability estimation models that compute the probability of winning a bid at a given price, and profit optimization models that compute the optimal price for a bid by balancing the probability of winning a bid at a price with the profitability of the bid at the given price.

■ SA18

C - Room 17A, Level 4

Optimization Modeling

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Tarun Kumar, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, ktarun@us.ibm.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Class Rostering at Roosevelt University using AMPL and LPsolve
Barry King, Butler University, 4600 Sunset Ave, Indianapolis, IN, 46208, United States of America, king@butler.edu, Terri Friel

This paper outlines successful efforts taken at Roosevelt University to construct semester class schedules using a mixed integer linear programming problem to develop a schedule of classes at two campuses. A variety of scheduling constraints are handled by the modeling language. The paper discusses using the AMPL modeling language and the LPsolve mixed integer solver. It further discusses the ease of using Microsoft Access as an input interface for clerical personnel.

2 - AMMLE- Bridging the Can Between Development and Deployment of Mathematical Models
Tarun Kumar, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, ktarun@us.ibm.com, Kai Pan, David Jensen

We present an innovative approach to seamlessly develop and deploy mathematical models in an enterprise environment. We showcase the ability to auto-generate production code that can be deployed to a corporate enterprise environment to improve decision making by leveraging Predictive and Prescriptive analytics. We also review the object model and API that we have developed that enables platform independent formulation of the optimization models.

3 - Semester Assignment of United States Air Force Academy Cadets to Courses
Gerardo Gonzalez, Colorado School of Mines, Division of Economics and Business, Golden, CO, United States of America, gegonzal@mymail.mines.edu

We present an integer program that offers courses during appropriate periods and then schedules students into those courses. The model accepts course offerings and student's course requirements and seeks to find a feasible schedule for the greatest number of students while minimizing the penalties associated with breaking any of the flexible (f) constraints. Constraints include: classroom size, instructor availability and preferences (f), and student military and athletic responsibilities (f).

■ SA19

C - Room 17B, Level 4

Customer Behavior Models

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Dan Zhang, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, dan.zhang@mcgill.ca

1 - Advance Demand Information, Price Discrimination, and Pre-order Strategies
Fuqiang Zhang, Washington State University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, fzhang22@wustl.edu, Cuihong Li

This paper studies the pre-order strategy that a seller may use to sell a perishable product in an uncertain market. By accepting pre-orders, the seller is able to obtain advance demand information for inventory planning and price-discriminate the consumers. We study the value of advance demand information and investigate the seller's optimal pre-order strategy choice (i.e., whether the pre-order option should be offered and whether it should be coupled with price guarantees).

2 - Risk Pooling with Strategic Customers
Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, Swinney_Robert@GSB.Stanford.Edu

We investigate the value of various risk pooling strategies when a firm sells to strategic, or forward-looking, customers. Such customers anticipate future changes in price and product availability due to multiperiod pricing strategies, and may take this information into account when making their own purchasing decisions. We consider the impact of this behavior on the value of risk pooling both for a single firm and for a supply chain.

3 - Dynamic Pricing Competition with Strategic Customers Under Vertical Product Differentiation
Dan Zhang, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, dan.zhang@mcgill.ca, Qian Liu

We consider multi-period dynamic pricing competition between two sellers offering vertically differentiated products to strategic customers that are inter-temporal utility maximizers. We establish a unique Markov perfect equilibrium, which admits simple recursive expressions. An extensive numerical study reveals the key role of product quality. Furthermore, we show that dynamic pricing is often undesirable for both sellers and commitment to charge a fixed price is often very valuable.

■ SA20

C - Room 18A, Level 4

Pricing and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Hongmin Li, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu

1 - Dynamic Pricing of Substitutable Products Under Logit Demand
Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu, Minsuk Suh

We consider the problem of dynamically pricing two substitutable products over a predetermined, finite selling season. We use a choice model that captures the effect of prices and stock-outs on customer choice. Interestingly, the optimal price of a product may decrease as the end of the season approaches or the other product's stock level decreases. We prove, however, that the optimal price difference between the two products and the optimal purchase probabilities behave in predictable ways.

2 - Dynamic Pricing with Restocking Opportunities
Jian Li, Assistant Professor, Northeastern Illinois University, College of Business and Management, Chicago, IL, 60625, United States of America, JLi@neiu.edu, Xiaowei Xu

This paper studies a joint dynamic pricing and inventory control problem, in which the retailer dynamically adjusts the product price and has multiple opportunities to replenish her inventory at preset time spots. Each replenishment incurs both fixed and variable costs. By significantly extending the sample-path method in Zhao and Zheng (2000) and using the concept of K-concavity, we prove that the optimal inventory control policy in the presence of dynamic pricing is (s, S)-polices.

3 - Consumer Memory-dependent Pricing and Product Introduction Policies
Hasan Arslan, Sawyer Business School, Suffolk University, 73 Tremont Street, Boston, MA, 02108, United States of America, harslan@suffolk.edu, Soulaymane Kachani, Kyrylo Shmatov

We analyze how pricing and product introduction decisions for successive product generations can be formed when demand is impacted by the reference price formed by consumers. We characterize the product introduction timing and pricing policies explicitly for two successive generations, and propose a general quasi-analytic solution. We also extend the analysis to a competitive environment.

4 - Pricing Multiple Products with the Multinomial Logit and Nested Logit Models
Hongmin Li, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu, Tim Huh

We consider the problem of pricing multiple differentiated products with the Multinomial Logit model and the Nested Logit model, and show a concavity property of the revenue function under each model even when the price sensitivity parameters may vary with products. We compare the optimal solution to the oligopolistic equilibrium solution. In addition, we apply it to problems of inventory control and revenue management, and establish structural results on the optimal policies.

■ SA21

C - Room 18B, Level 4

Healthcare Modeling, Evaluation, and Optimization

Sponsor: Service Science
Sponsored Session

Chair: Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu

1 - Biologically Guided Intensity Modulated Radiation Therapy Planning Optimization

Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Ronald Rardin, Mark Langer

Biologically guided radiation therapy incorporates the biological responses of tissues to radiation or "sensitivities" changing over the course of the treatment. Updated information on tumor sensitivity over time invites adjusting radiation delivered across the treatment volume in order to yield more effective plans. We propose an optimization approach that adapts IMRT plans in response to the changes in the tumor sensitivity subject to both cumulative and per-session limits, and present some preliminary results.

2 - Models for Evaluation of Supply Chain Risk with Application to Health Care Management

Guangfu Zeng, University of Texas at Arlington, 1609 Lake Meade Dr., Allen, TX, 75002, United States of America, guangfu.zeng@mavs.uta.edu

Today's uncertain business environment requires supply chain managers to assess the degree of risk across a whole gamut of activities in a supply chain and develop suitable strategies to mitigate them. Our research will develop a new methodology in supply chain risk analysis, and build several quantitative models for evaluation of general supply chain risk, by using data envelopment analysis and rough set theory. We apply the risk evaluation models to health care supply chain risk management.

3 - Cardinal Scales for Health Evaluation

Charles Harvey, Professor, Retired, University of Houston, 5902 NW Pinewood Place, Corvallis, OR, 97330, United States of America, cmharvey1@earthlink.net, Lars ÿsterdal

Policy studies often evaluate health for an individual or for a population by using ordinal scales or expected-utility scales. This paper develops scales of a different type, commonly called cardinal scales, that measure changes in health. Also, we argue that cardinal scales provide a meaningful and useful means of evaluating health policies. Thus, we develop a means of using the perspective of welfare economics as an alternative to ordinalist and expected-utility perspectives.

4 - The Impact of EMR Capability on Hospital Performance

Wei Wu, University of Tennessee Knoxville, 329 Stokely Management Center, Knoxville, TN, 37996, United States of America, wwu3@utk.edu, Bogdan Bichescu, Randy Bradley

There is limited evidence that Electronic Medical Record (EMR) systems lead to better hospital performance. There is increasing pressure on hospitals to adopt EMR systems, despite the lack of empirical evidence to support such investments. Using a sample of 130 hospitals that are in the upper echelon of EMR capabilities, we examine the impact of EMR on control-adjusted measures of hospital performance. Our findings have implications regarding the realistic impact of EMR on hospital performance.

■ SA22

C - Room 18C, Level 4

Technology and Service Optimization

Sponsor: Service Science
Sponsored Session

Chair: Tugrul Daim, Portland State University, P.O. Box 751, Portland, OR, 97224, United States of America, tugrul@etm.pdx.edu

1 - Decision Making Process for Off-shore Outsourcing IT Services and Software Development

Rosine Hanna, PhD Student, Portland State University, P.O. Box 751, Portland, OR, 97207, United States of America, rosine@pdx.edu

Several studies presented frameworks that focus on guiding decision makers in performing offshore outsourcing. Yet, none of these frameworks provided a systematic, methodical direction concerning how to implement the entire process of offshore outsourcing for information technology projects. The goal of this research is to present a framework of offshore outsourcing that incorporates the entire offshore outsourcing processes, relationship and risk management processes.

2 - Capability Maturity Model: The Case of Care Coordination and HIT Adoption

Nima A. Behkami, Oregon Health & Science University, 3181 Southwest Sam Jackson Park Road, Portland, OR, United States of America, behkamin@ohsu.edu, David A. Dorr, Tugrul Daim

Adopting Health Information technology, especially to improve the quality of care management, has been a challenge for organizations. We adapt the Capability Maturity Model (CMMI) to the use of Health Information Technology (HIT) to better manage the care of patients with multiple chronic illnesses. We study the implementation of the Care Management Plus (CM+) model, a program intended to redesign primary care teams and health information technology use.

3 - Study of the Efficiency and Efficiency Patterns of the U.S. University Technology Commercialization

Jisun Kim, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, kimjisun73@gmail.com, Tugrul Daim, Timothy Anderson

The main purpose of this study is to provide better understanding of U.S. university technology commercialization (UTC) activity by evaluating the efficiencies of their practices and identifying efficiency changing patterns over time. The influencing factors are explored to understand their impact on the performances and define the characteristics of the patterns. The study also presents some significant time-lags observed among the technology transfer variables.

4 - Technology Roadmapping in the Energy Sector: Energy Efficiency in the Pacific NW

Tugrul Daim, Portland State University, P.O. Box 751, Portland, OR, 97224, United States of America, tugrul@etm.pdx.edu, Joshua Binus, Jisun Kim

This paper presents the process and the results of a regional roadmapping project. The project identified the market drivers, available and required products and services, available and required technologies and finally the gaps and the R&D programs to fullfill these gaps. The focus of the roadmap was energy efficiency in the pacific NW. More than 20 organizations took part in the effort.

■ SA23

C - Room 18D, Level 4

Service Innovation in Developing Economies I

Sponsor: Service Science
Sponsored Session

Chair: JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn

1 - Pricing, Capacity Decisions and Financing in Two-tier Service Systems

Pengfei Guo, Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Hong Kong, Hong Kong - PRC, lgtpguo@polyu.edu.hk, George Zhang

There exist many two-tier service systems with a toll-free subsystem and a toll subsystem coexisting. We study the second-best price and capacity decisions for the toll subsystem with the consideration of self-financing constraint.

2 - The Impact of Government Intervention on Airline Operations in China

JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn, Chenbo Zhu

In 2007, the Chinese aviation authority asked the five airlines with service between Shanghai and Beijing to form an express shuttle alliance so that their tickets could be interchanged. In this paper, we will study the impact of such government intervention on the competitiveness of the market and airline operations. We first investigate the existence of Nash equilibrium in such an environment. We then analyze how seat allocations, airfares, and revenues of the airlines will be affected.

3 - Provide Financial Risk Management as Service

Tie Liu, IBM Research - China, Bld19 Zhongguancun Software Park,Haidian, Beijing, 100193, China, liultie@cn.ibm.com

We present an innovative financial risk management service framework for small-media sized commercial banks which require quantitative risk management from Basel II accord. Risk calculation models and external data collection are two difficult issues for banks. We propose a SOA based system to deal with the challenges, where flexible computation support services are provided with a much less cost for banks, such as risk computation service, business logic service and data management service.

■ SA24

C - Room 19A, Level 4

Joint Session SPPSN/ HAS: Health and Humanitarian Applications of Revenue Management

Sponsor: Public Programs, Service and Needs/ Health Applications Sponsored Session

Chair: Mallory Soldner, Georgia Institute of Technology, 609 Virginia Ave. NE, Apt. 8206, Atlanta, GA, United States of America, msoldner@gatech.edu

Co-Chair: Melih Celik, Georgia Institute of Technology, 765 Ferst Drive, NW, 30332-0205, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu

1 - Scaling Up HIV Treatment in Resource-limited Settings Under Supply Uncertainty

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Charles Corbett

HIV clinics operating in developing countries have to contend with an uncertain supply of drugs. This creates a trade-off between enrolling new patients and providing uninterrupted treatment to those already enrolled. We formalize this trade-off using a stochastic dynamic program, derive the optimal policy for the number of new enrollments and compare its performance with that of policies used in practice.

2 - Capacity Allocation Model for Chronic Care

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Tingting Jiang, Steve Samuelson, Seyed Iravani, Karen Smilowitz

Most health care operation models focus either on efficiency improvements in the delivery system or improvements in clinical decisions. We consider a novel setting of community-based delivery of chronic asthma care, where it is necessary to integrate these two approaches. We develop and analyze a joint disease progression and capacity allocation model to investigate how operational decisions can improve population level health outcomes. We test our findings using data provided by Mobile C.A.R.E, a community-based provider of asthma care to public school students in Chicago.

3 - The Optimality of Myopic Inventory Policies in Blood Banking

Yan Qin, Doctoral Student, ISOM Department, Warrington College of Business Administration, University of Florida, Gainesville, FL, 32611, United States of America, yan.qin@warrington.ufl.edu, Anand Paul, Aydin Alptekinoglu

In this paper, we construct a multi-period finite horizon model of blood bank storage and distribution based on discussions with managers from a local blood bank. Assuming stationary demand and supply distributions, we show - using some new Markov Decision Processes machinery developed in the paper - that there is an optimal myopic policy. Under non-stationary demand and supply, myopic optimality is proved in the two-period case. Empirical analysis is to be conducted based on real data.

4 - Policies for Blood Allocation in Developing Countries

Melih Celik, Georgia Institute of Technology, 765 Ferst Drive, NW, 30332-0205, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu, Mallory Soldner, Ozlem Ergun, Julie Swann

We consider the problem of allocating blood units to hospitals from a collection center in a developing country. We present a tool using an optimization model that aids monthly allocation decisions, then develop dynamic programming models with stochastic demand requests for the real-time allocation decisions, and lastly consider the overall allocation problem when individual hospitals use blood according to different service policies and develop models that incorporate system-optimal behavior.

■ SA25

C - Room 19B, Level 4

Joint Session SPPSN/ HAS: Public Health Models

Sponsor: Public Programs, Service and Needs/ Health Applications Sponsored Session

Chair: Hannah Smalley, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, hkolberg3@gatech.edu

1 - A Simulation Model of Local Public Health Response to Pertussis Events

Travis Worth, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, stworth@ncsu.edu, Jean-Marie Maillard, Erika Samoff, Anne-Marie Meyer, Reha Uzsoy, Javad Taheri, Aaron Wendelboe

We present a discrete-event simulation model of the response of the North Carolina public health system to pertussis events. We model the information transfer between actors of the NC-PHIN (North Carolina Public Health Information Network) and local health departments, and examine the effect of different alerting strategies and resource allocations on the number of confirmed cases.

2 - Cost-effectiveness Analysis of Vaccination and Self-isolation in Case of an H1N1 Outbreak

Hamed Yarmand, PhD Student, North Carolina State University, 373 Daniels Hall, 111 Lampe Dr, Raleigh, NC, 27695-7906, United States of America, hyarman@ncsu.edu, Julie Ivy, Stephen Roberts

We have conducted a cost-effectiveness analysis to examine the relative importance of vaccination and self-isolation in case of H1N1 by developing a simulation model for the spread of H1N1. The optimization model consists of two decision variables, vaccination fraction and self-isolation fraction, and two constraints for the surge capacity and attack rate. The optimization model seeks the most cost-effective control policy by considering the relative marginal costs for each decision variable.

3 - Modeling the Optimal Timing of Joint Replacement Surgery

Diana Negoescu, PhD Candidate, Management Science and Engineering, Stanford University, 206 Rosse Lane, # 201, Stanford, CA, 94305, United States of America, negoescu@stanford.edu, James Huddleston, Margaret Brandeau

The optimal timing of joint replacement surgery is a difficult problem for surgeons and patients alike. For younger patients, the survival of the artificial joint is an important concern, while for older patients, fitness to undergo surgery is an important factor. We develop a stochastic control model that takes as input the patient's current age, overall health, joint functionality and discounting preferences and advises whether the patient should have surgery in the very near future.

■ SA26

C - Room 4A, Level 3

Pattern Search in Scientific Domain

Sponsor: Data Mining Sponsored Session

Chair: Lian Duan, University of Iowa, 523 Hawkeye Ct, Iowa City, IA, United States of America, lian-duan@uiowa.edu

1 - Data Utility Approach Towards K-anonymity

Malika Mahoui, Indiana University-Purdue University, Indianapolis, IN, United States of America, mmahoui@iupui.edu

K-anonymity is an approach proposed to ensure data privacy by ensuring that no one individual can be distinguished within a group of at least k individuals. We present new algorithms that implement k-anonymity and at the same time allow data owners to have more control on the utility of the data they make available.

2 - Robust Hierarchical Linkage

Pramod Gupta, Georgia Institute of Technology, 266 Ferst Drive, Atlanta, GA, 30332-0765, United States of America, pramodgupta@gatech.edu, Maria-Florina Balcan

One of the most widely used techniques for data clustering is agglomerative clustering. However, it is well known, that many of the classic agglomerative clustering algorithms are not robust to noise. We propose and analyze a new robust algorithm for bottom-up agglomerative clustering. We show that our algorithm can be used to cluster accurately in cases where the data satisfies a number of natural properties and where the traditional agglomerative algorithms fail.

3 - Rank Optimization for Survival Analysis
Kaan Ataman, Chapman University, One University Drive, Orange, CA, 92866, United States of America, ataman@chapman.edu, Nick Street

Machine learning algorithms designed for classification or regression tasks are in general not fit for handling censored data commonly seen in customer churn analysis, medical treatment evaluations, and component reliability tests. We present a linear programming-based rank optimization algorithm and show that on several real-world problems our algorithm performs better in general than Cox's Proportional Hazard Regression, the most commonly-used survival analysis method.

4 - Efficiently Finding Maximal Fully-correlated Itemsets in Large Databases
Lian Duan, University of Iowa, 523 Hawkeye Ct, Iowa City, IA, United States of America, lian-duan@uiowa.edu, Nick Street, Lizhen Tong

In this paper, we proposed two techniques to search the maximal fully-correlated itemset (MFCI). First, we identify the correlation upper bound for any good correlation measure to avoid unnecessary IO cost, and make use of their common monotone property to prune many pairs. In addition, we build an enumeration tree to save the fully-correlated value (FCV) for all the MFCIs under a given initial correlation threshold. Experimental results show that our algorithm is efficient.

■ SA27

C - Room 4B, Level 3

Optimizing Uncertain or Noisy Functions

Sponsor: Computing Society
Sponsored Session

Chair: Stephen Billups, Associate Professor, University of Colorado, Denver, Department Math & Stat Sciences, CB 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, Stephen.Billups@ucdenver.edu

1 - Gaussian Process Response Surface Optimization
Dan Lizotte, Postdoctoral Fellow, University of Michigan, 426 Thompson #2067, Ann Arbor, MI, 48109, United States of America, danjl@umich.edu, Dale Schuurmans, Russell Greiner

Response surface methods construct a Gaussian process model of an objective function based on all observed data points. The model is then used to compute which point the method should acquire next in its search for the global optimum of the objective. Although they are intended to be "black-box," these methods are potentially sensitive to tuning parameters and model choice. We examine these issues and suggest rules of thumb for using response surface methods.

2 - Estimating Derivatives of Computationally Noisy Functions
Stefan Wild, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg 240, 1154, Argonne, IL, 60439, United States of America, wild@mcs.anl.gov, Jorge More'

We have recently developed the ECNoise algorithm for quantifying computational noise in deterministic simulation-based functions. Derivative estimates for such functions can be vital to terminating optimization routines and for performing sensitivity analysis. In this talk we show how estimates of the noise can be used to compute optimal step sizes for finite difference schemes. Our numerical results validate derivatives obtained in this manner with an automatic differentiation derivative.

3 - Advanced Uncertainty Quantification for Optimization Under Uncertainty
Brian Adams, Sandia National Laboratories, P.O. Box 5800, MS-1318, Albuquerque, NM, 87185, United States of America, briadam@sandia.gov, Michael Eldred

Numerous uncertainties affect computational model credibility, including parametric uncertainty, numerical error, and model form. I will survey advanced uncertainty quantification algorithms which assess the effect of parametric uncertainties on model outputs. Such methods, available alongside nonlinear optimization methods in DAKOTA, enable optimization under uncertainty, reliability-based design, and extrema robustness assessment. I will describe these, together with relevant applications.

4 - Derivative-free Optimization of Expensive Functions with Errors using Weighted Regression
Stephen Billups, Associate Professor, University of Colorado, Denver, Department Math & Stat Sciences, CB 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, Stephen.Billups@ucdenver.edu, Jeffrey Larson

We propose a derivative-free algorithm for optimizing computationally expensive functions with computational error. The algorithm is based on the trust-region regression method proposed by Conn, Scheinberg, and Vicente, but uses weighted regression to obtain more accurate model functions at each trust region iteration. Weighted regression provides a straightforward means for handling i) differing levels of uncertainty in function evaluations, and ii) errors induced by poor model fidelity.

■ SA28

C - Room 4C, Level 3

Statistical Modeling and Analysis of Biological Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Modeling of Near Field Electrospinning Process using Response Surface Methodology
Binil Starly, Assistant Professor, University of Oklahoma, 202 W Boyd St, Rm 116B, Norman, OK, 73019, United States of America, starlyb@ou.edu, Vivek Kamaraj, Thirumalpathy Padmanabhan

The past decade has seen a tremendous advancement to the production of polymeric nanofibers for applications in biomedical engineering applications. In this investigation, we focus on the 'near field electrospinning process' (NFES) to produce aligned nanofibers of biopolymers. A Response Surface Methodology approach was used to understand the inter-dependance of the manufacturing process parameters that ultimately determine the deposition ability and the final diameter of the fibers.

2 - Virtual Instruments for Cardiovascular Healthcare using ECG Signals
Trung Le, Oklahoma State University, Stillwater, OK, United States of America, trung.le@okstate.edu

This research presents a new approach for real-time simulation of the heart dynamics where the heart activation functions are derived from electrocardiogram (ECG) signal. The results show that the model could discern the effect of variations in the electrical activations. The findings support the developing of a virtual instrument for clinical diagnostic in lieu of expensive instrumentation and suggest diagnosis methods for certain cardiovascular diseases not easy to diagnosis from the ECG.

3 - Computer Model of Glycosylation Modulation in Cardiac Cell Action Potentials
Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu, Yun Chen

Cardiac electrical signaling is controlled and modulated by the voltage-gated cellular ionic channel dynamics. This paper presents a computer model for the simulation of regulated and aberrant glycosylation modulated ion channel activity. This study characterizes the mouse ventricular myocyte action potential (AP) based on the experimental voltage-clamp data of ionic currents, and analyzes the cardiac pathological behaviors in the microscopic levels.

4 - Systems Biology Approach Towards Drug Target Identification for Type 2 Diabetes Mellitus
Soundar Kumara, Pearce Chair Professor, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, skumara@psu.edu, Manini Madireddy

The number of morbidly obese diabetics world is rising. Many of these patients undergo bariatric surgery; in some of the cases it was found that these patients turned non-diabetic after the surgery. We use network science based approach to build Protein Interaction Networks (PIN) and conducted topological analysis to infer the important proteins. We formulate a new metric which is able to generate a list of proteins that maybe important to T2DM.

■ SA29

C - Room 5A, Level 3

Journal of Quality Technology Invited Papers

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Daniel Apley, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, apley@northwestern.edu

1 - Sensitivity Analysis for Optimal Designs for Accelerated Life Testing
Eric Monroe, Six Sigma Blackbelt, Intel Corporation, 5000 W. Chandler Blvd., Mailstop CH2-117, Chandler, AZ, 85226-3699, United States of America, eric.m.monroe@intel.com, Rong Pan, Douglas Montgomery, Connie Borror, Christine Anderson-Cook

In experimental testing, we strive to select combinations of input factors that yield optimal results. Alphabetic optimal designs are commonly used in such applications. We examine the issue of model parameter sensitivity to the selection of an accelerated life test based on the UC-optimality criterion, minimizing of the prediction variance at the usage condition, using a generalized linear model framework. We examine the implications of choice of experimental design, sample size, and censoring.

2 - Likelihood Ratio-based Distribution-free EWMA Control Charts
Fugee Tsung, Professor and Head, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong - PRC, season@ust.hk

Nonparametric or distribution-free charts are useful in statistical process control when there is a lack of or limited knowledge about the underlying process distribution. Most existing approaches in the literature are for monitoring location parameters. They may not be effective with a change of distribution over time. This paper develops a new distribution-free control chart based on the integration of a powerful nonparametric goodness-of-fit test and the EWMA control scheme.

3 - Self-starting CUSCORE Control Charts for Individual Multivariate Observations
Guido Masarotto, Department of Statistical Sciences, via Cesare Battisti 241/243, Padova, Italy, guido@stat.unipd.it, Giovanna Capizzi

During the process start-up or in the case of short runs, process parameters are unknown, and Phase I samples cannot be gathered to accurately estimate control limits for prospective monitoring. Self-starting schemes can be applied to these low-volume applications. We propose two new self-starting CUSCORE-type control charts for monitoring the mean of a multivariate normal distribution. These novel procedures are able to outperform the previously suggested self-starting control charts.

■ SA30

C - Room 5B, Level 3

Nanomanufacturing & Nanoinformatics I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu

1 - Quantitative Characterization and Modeling of Nanoparticle Dispersion in Polymer Composite
Chia-Jung Chang, PhD Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States of America, cchang43@gatech.edu, Lijuan Xu, Qiang Huang, Jianjun Shi

TEM images are commonly used to represent the nanoparticle dispersion and developing the quantitative measure of it is strongly needed. We propose the engineering-driven nonhomogenous Poisson process model incorporated with Gaussian random field to capture the dispersion. The model parameters are estimated through Bayesian MCMC. Both simulation and case studies of nano-silica/epoxy composites images are conducted. The approach is generally applicable to other nanocomposite materials as well.

2 - Space Filling Design with Unknown Constraints
Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu, Li Zhu

This research explores space filling designs with complex constraints. We propose sequential methods that will generate designs with space-filling properties within unknown yield regions of the operable design space by systematically carving out regions of no-morphology.

3 - Modeling the Interaction Among Nanostructures for Local Morphology Control
Lijuan Xu, PhD Student, University of Southern California, 3715 McClintock Avenue, GER 236, Los Angeles, CA, 90089, United States of America, lijuanxu@usc.edu, Qiang Huang

Due to limited understanding of local growth mechanisms, control of local nanostructure morphology is extremely challenging. In this talk, we employ Gaussian Markov random field model to characterize the area specific variability by specifying interaction among neighboring nanostructures and then link the estimation with physical parameters for local morphology control. Both simulated data and real collected nanowire growth data are studied to validate the approaches.

4 - Sequential Synthesis of Nanomaterials via Level Expansion
Xu Xu, University of Wisconsin, Madison, Department of Statistics, 1300 University Ave, Madison, WI, 53706, United States of America, xuxu@stat.wisc.edu, Young Deok Hwang, Taewan Kim, Fei Wang, Xudong Wang, Peter Qian

We propose a new design argumentation method, called level-expansion, for sequential synthesis of nanomaterials. Given an initial design at two levels, this method creates a follow-up design by expanding some factors into four levels. Unlike the fold-over method, the proposed scheme can accommodate non-linear effects and also achieve some degree of dealiasing. The effectiveness of this method is illustrated by simulation examples and a case study of sequential synthesis of Zinc-Oxide nanowires.

5 - A Statistical Method for Analyzing the Morphology of Nanoparticles
Chiwoo Park, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, chiwoo.park@tamu.edu, Subrata Kundu, Bani Mallick, David Huitink, Jianhua Huang, Yu Ding, Hong Liang

We propose a statistical method to analyze morphology of nanoparticles. This study is motivated by the fact that the properties of materials synthesized with nanoparticles are highly correlated to the sizes and shapes of the nanoparticles. One could attain desired properties if the sizes and shapes are controlled. The method simultaneously infers boundaries of nanoparticles from noisy micrographs and classifies the particles by similarity of the boundaries with a unified probability model.

■ SA31

C - Room 5C, Level 3

Data Mining in Healthcare Informatics and Clinical Decision Support

Sponsor: Data Mining
Sponsored Session

Chair: Sung Won Han, Post-doctoral Researcher, University of Pennsylvania, 423 Guardian Drive, Philadelphia, PA, 19104, United States of America, hansungw@mail.med.upenn.edu

1 - Healthcare Surveillance Under Regional Correlated Data
Sung Won Han, Post-doctoral Researcher, University of Pennsylvania, 423 Guardian Drive, Philadelphia, PA, 19104, United States of America, hansungw@mail.med.upenn.edu, Jiang Wei, Kwok Tsui, William Woodall

In healthcare surveillance, the timely detection of disease clusters is crucial. Most health surveillance research is based on the assumption that observations are independent. We propose healthcare surveillance methods that utilize regional correlations. Through simulations, we show that our proposed methods perform better than existing ones and detect outbreaks more efficiently. We also present an example of breast cancer in New Hampshire for the application to correlated data.

2 - Using Data Mining to Schedule Clinic Appointments Over Multiple Days
Michele Samorani, PhD Candidate, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309-0419, United States of America, Michael.Samorani@Colorado.EDU, Linda Laganga

Overbooking appointments is a common way to improve a clinic performance in presence of no-shows. Existing works use the no-show rate to determine the optimal clinic setting (number of slots and length of each slot), but they assume that patients have the same no-show probability. We use classification techniques to predict the no-show probability of individual patients, and, through simulation studies, we show that using this information leads to a higher clinic performance.

3 - A Machine Learning-based Healthy Lifestyle Recommender
Nick Street, Professor, University of Iowa, Pappajohn Business Building, Iowa, IA, 52242, United States of America, nick-street@uiowa.edu, Chih-Lin Chi, Jennifer Robinson

Machine learning techniques used in health care decision making allow robust and easily-updated prediction of risk, but are rarely used as a tool to minimize that risk. We present a framework that combines inductive learning with optimization to suggest an action (or set of actions) that maximizes the patient's chance of a desirable outcome. Our case study is a healthy lifestyle recommendation system that provides individualized, customizable recommendations to minimize heart disease risk.

4 - Health-care Fraud Detection with Machine Committee
Yeolwoo An, Master Student, Ajou University, Ajou University, Suwon, 443-749, Korea, Republic of, willism81@gmail.com, Hangseok Kim, Hyunjung Helen Shin

Health care bill claim review process is heavily dependent on human assessment, which can be subjective and error-prone. One way to reduce the possible human mistakes is to use an objective backup reference, i.e.,the assessment result from a machine trained on the bill claim dataset. If a consensus from a committee of different machines can be made, the assessment becomes more objective than that of a single machine. We evaluate the proposed committee on the dataset offered by HIRA, 2007.

■ SA32

C - Room 6A, Level 3

Joint Session ICS/ QSR: Statistical Methods for Optimization

Sponsor: Computing Society/ Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Associate Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53706, United States of America, szhou@engr.wisc.edu

1 - Annealing Evolutionary Stochastic Approximation Monte Carlo for Global Optimization

Faming Liang, Texas A&M University, Department of Statistics, College Station, TX, United States of America, fliang@stat.tamu.edu

We present a new algorithm, the so-called annealing evolutionary stochastic approximation Monte Carlo (AESAMC) algorithm as a general optimization technique. AESAMC possesses a self-adjusting mechanism, which makes it less likely get trapped by local energy minima. AESAMC is tested on multiple optimization problems. The numerical results indicate that AESAMC can potentially outperform simulated annealing, the genetic algorithm, and some other metaheuristics in function optimization.

2 - Penalty Decomposition (PD) Approach for General Sparse Pursuit Problems

Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca, Yong Zhang

We propose PD methods for general l_0-norm minimization problems. Under some suitable assumptions, we establish that any limit point of the sequence generated by the methods when applied to the l_0-norm constrained problems satisfies a first-order optimality condition that is generally stronger than one natural optimality condition. Finally, we apply the methods to compressed sensing, sparse logistic regression and sparse inverse covariance selection.

3 - Adaptive Evolutionary Monte Carlo for Heuristic Optimization

Yuan Ren, interCLICK Inc., 900 River Reach Dr, Apt 414, Fort Lauderdale, FL, United States of America, renyuan1010@gmail.com, Yu Ding, Faming Liang

This talk presents an adaptive evolutionary Monte Carlo algorithm (AEMC), which hybrids a tree-based predictive model with an evolutionary Monte Carlo sampling procedure for the purpose of global optimization. AEMC falls into the category of adaptive Markov chain Monte Carlo algorithms and is the first one that simulates multiple Markov chains in parallel. AEMC is used to optimize a sensor placement problem in a manufacturing process, as well as to optimize a suite of standard test functions.

4 - A New Optimization Framework for the Network Reliability Design Problem

Andrew Kiekhaefer, PhD Student, University of Iowa, 248 ERF, The University of Iowa, Iowa City, IA, United States of America, akiekhae@engineering.uiowa.edu, Yong Chen

We present a new optimization framework for the general network reliability design problem, focusing on efficient evaluation. This framework consists of a population-based global guidance system, a selection-of-the-best-subset procedure, and a duplicate evaluation process for fast independent evaluation of duplicate designs. Overall, this framework shows runtime improvements of over fifteen times that of the baseline method. Numerical examples and parameter robustness are discussed.

■ SA33

C - Room 6B, Level 3

Computational Optimization: Theories and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu

1 - A Framework of GPU-accelerated Evolutionary Algorithms for Global Optimization

Weihang Zhu, Assistant Professor, Lamar University, P.O. Box 10032, Beaumont, TX, 77710, United States of America, humorstar@gmail.com, James Curry, Victor Zaloom

This paper presents a framework of massively parallel evolutionary algorithms with graphics hardware acceleration on global optimization problems. The objective of this study was to determine the effectiveness of using Graphics Processing Units (GPU) as a hardware platform for evolutionary algorithms. The main contribution of this paper was the parallelization analysis and performance analysis of the evolutionary algorithms with GPU acceleration.

2 - An Exact Algorithm for Covering Rectangular Requests with a Single Rectanglular Target

Manish Bansal, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, bans1571@neo.tamu.edu, Kiavash Kianfar

We consider positioning a target rectangle on 2-dimensional plane to partially cover a set of existing rectangular areas (requests) to maximize total coverage reward. Applications include camera surveillance and imaging. We introduce a reduced solution space and present a novel branch-and-bound exact algorithm. Our computational results show that our approach significantly outperforms the existing PVT algorithm in case of large regions or heterogeneous reward rates.

3 - Allocating Ancillary Service Capacity for Energy Suppliers

Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

Ancillary services are reserves to support the transmission of energy while maintaining reliable operation of transmission systems. The ancillary services are procured by the independent system operator (ISO). The current bidding process is sub-optimal and we propose an optimization based approach which allocates the fixed capacity to major ancillary services and apply nesting afterward. The model instance is both convex and smooth and the real world scale problem can be efficiently solved.

4 - Obtaining Tighter Relaxations of Linear Programs with Linear Complementarity Constraints

Bin Yu, Graduate Student, Search ResultsRensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, yub@rpi.edu, Jong-Shi Pang, John Mitchell

Omitting the complementarity constraints from a linear program with complementarity constraints gives a linear programming relaxation. We discuss various methods to tighten the relaxation by exploiting complementarity. Different types of linear constraints are introduced, second order cone constraints are also constructed. Computational results are included, comparing the benenfit of the various constraints on the value of the relaxation.

■ SA34

C - Room 7, Level 3

Network Interdiction and Restoration Problems

Sponsor: Computing Society
Sponsored Session

Chair: Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, United States of America, sharkt@rpi.edu

1 - Exact Interdiction Models and Algorithms for Disconnecting Networks via Node Deletions

Siqian Shen, PhD Candidate, Department of ISE, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, siqian.shen@gmail.com, Roshan Goli, J. Cole Smith

Node deletion problems have received much attention due to their importance in applications of military, medicine, and social activities. We aim to maximize the graph disconnectivity by deleting nodes, and formulate the problem using mixed integer programming interdiction models. We demonstrate the computational efficacy of the MIP models, and study valid bounds by examining intermediate dynamic programming solutions to k-hole subgraphs.

2 - Dispatching Rules for Network-based Scheduling

Sarah Nurre, Rensselaer Polytechnic Institute, 110 8th Street, ISE CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We examine a new class of network-based scheduling problems with applications to restoring infrastructure systems. The objective of these problems captures how well the network comes online. We provide the complexity of these problems and propose novel dispatching rules. Promising computational results are presented for various objectives.

3 - Fortifying Unreliable Facilities in the Public Sector: Finding a Risk Equitable Solution

Hugh Medal, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hugh.medal@uark.edu, Chase Rainwater, Manuel D Rossetti, Ed Pohl

We study the problem of fortifying unreliable facilities with the objective of minimizing the maximum worst case disruption cost over all demand points. This new objective finds solutions that hedge against the worst case and are equitable over all demand points in regard to risk. A mixed integer programming (MIP) model is developed as well as a set covering based exact algorithm. Our findings indicate that this objective is not only practically relevant but also results in a tractable model.

4 - Dynamic Network Interdiction Models with Applications to Law Enforcement

Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Thomas Sharkey, Ajay Malaviya

We propose a class of multi-period network interdiction problems that focuses on scheduling the activities of law enforcement officials in order to successfully interdict criminals in the illegal drug supply chain. This class of problems contains several novel features motivated through collaborations with city-level law enforcement officials. We discuss computational challenges faced when solving real-life problem instances and propose methodology enhancements to address these issues.

■ SA35

C - Room 8A, Level 3

Asymptotic Analysis of Stochastic Network

Sponsor: Applied Probability
Sponsored Session

Chair: Hengqing Ye, Hong Kong Polytechnic University, Kowloon, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk

1 - Asymptotic Analysis of Large Sensor Networks

Kavita Ramanan, Professor, Brown University, Division of Applied Mathematics, Providence, RI, United States of America, Kavita_Ramanan@brown.edu

We will describe an analysis of distributed algorithms for parameter estimation in large sensor networks with imperfect communication. This includes joint work with Soummya Kar and Jose Moura.

2 - Stationary Distribution Convergence for a Multiclass Single-server Queue in Heavy Traffic

Toshiyuki Katsuda, QC com, 1-20-21 Kitano, Yasu-city, Shiga, 520-2361, Japan, ktmail@hera.eonet.ne.jp

In the recent work of Katsuda, established was the stationary distribution convergence for a multiclass single-server queue in heavy traffic. The key to the proof is to show state-space collapse in stationarity and the tightness of the stationary scaled workload under the conditions of finite moment generating functions on the residual primitive variables. In this talk we show such convergence result under much weaker moment conditions, following the recent work of Budhiraja and Lee.

3 - Optimal Admission to M/M/k/N Queues with Several Customer Types and Holding Costs

Eugene Feinberg, Stony Brook University, Department of Applied Math. & Stat., Stony Brook, NY, 11794-3600, United States of America, efeinberg@notes.cc.sunysb.edu, Fenghsu Yang

We study optimal admission to an M/M/k/N queue with several customer types. Rewards consist of revenues collected from admitted customers and holding costs, both of which depend on customer types. The goal is to find an admission policy that maximizes average rewards per unit time. This paper describes the structures of optimal, canonical, bias optimal, and Blackwell optimal policies. Problems with one holding cost function for all customers have been studied previously in the literature.

4 - Control and Staffing for Call Center Outsourcing with Rework

Jiheng Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, Hong Kong - PRC, jiheng@ust.hk, Eser Kirkizlar

We study a system with both in-house and outsourcer call centers. We assume that the service quality of the outsourcer is not as high as the in-house one and hence some customers are rerouted to the in-house call center for further help after receiving service at the outsourcer. Using a fluid approximation, we jointly determine the optimal control rule and the staffing policy that asymptotically minimize the long-run average staffing, holding, and reneging costs under heavy traffic regime.

5 - A Stochastic Network Under Proportional Fair Resource Control - Diffusion Limit with Multiple Bottlenecks

Hengqing Ye, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk, David D. Yao

We study a network operating under the proportionally fair allocation, by which each server is shared among job classes that requires its service, proportional to the queue lengths. We establish the diffusion limit of the network, allowing multiple bottlenecks in the network, and without some of the conditions required in prior studies. We also provide a characterization of the class of allocation schemes among which the proportional fair allocation minimizes a quadratic cost objective function.

■ SA36

C - Room 8B, Level 3

The First Undergraduate OR Course

Sponsor: INFORM-ED
Sponsored Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - OR: The Physics of Day-to-day Life

Richard Larson, Professor, Massachusetts Institute of Technology, E40-233, Cambridge, MA, 02139, United States of America, rclarson@mit.edu

OR is much more about problem framing and formulation and a lot less about rigorous math and optimization. We propose OR for high schoolers and/or liberal arts majors: OR as physics for daily life, in queues, delivering mail, avoiding infectious diseases, waiting for busses, understanding elections, etc. We draw from a new on-line learning project, BLOSSOMS, Blended Learning Open Source Science or Math Studies. http://blossoms.mit.edu We invite others to contribute to BLOSSOMS.

2 - Introductory Optimization for Undergraduates

James Orlin, Professor, Massachusetts Institute of Technology, E53-363, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

We teach a traditional optimization class at MIT, but in a non-traditional approach. I will discuss some aspects of teaching that may be useful for other courses. I will show my approaches for (i) algorithm animation in PowerPoint, (ii) making tutorials more engaging, and (iii) making Excel more user friendly for students.

3 - One Mathematician's Approach to Linear Optimization

Glenn Hurlbert, Arizona State University, School of Math & Stat Sciences, Tempe, AZ, United States of America, hurlbert@asu.edu

I teach Linear Optimization from the point of view of learning mathematics, proving theorems, and making connections to other areas of mathematics. This approach necessitates different goals and objectives than a more applied approach that may involve using modern software to model and solve large toy problems, for example. In this talk I will outline what seems most fundamental to build such a course around, along with what more peripheral material I have included from one semester to the next.

4 - The First (and Often Only) O.R. Course: Something for Everyone

Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

Introduction to O.R. is offered as a technical elective for our math and general engineering majors. Because this is often the only O.R. course students take before deciding whether or not to pursue a graduate degree in O.R., I offer something for everyone by showing both the power of O.R. to solve complex, real-world problems and its rich theoretical underpinnings. In this talk, I will address some of the costs and benefits incurred by the trade-offs I have made in designing this course.

■ SA37

C - Room 8C, Level 3

Stochastic Network Bounds and Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jhas@mail.utexas.edu

1 - Computing Stationary Distributions for Diffusion Limits of G/Ph/n+GI Queues

Shuangchi He, Georgia Institute of Technology, 2500 Pleasant Hill Road, Duluth, GA, 30096, United States of America, heshuangchi@gatech.edu, Jim Dai

We develop an algorithm to compute the stationary distribution of a diffusion process that serves as an approximation for G/Ph/n+GI queues in QED regime. The algorithm is based on the finite-element method. A critical part of the algorithm is to choose an appropriate reference density. Using a conjecture for the tail behavior of the stationary distribution of the limit diffusion process, we propose a systematic method to choose the reference density. Computational experiences will be discussed.

2 - A Lower Bound on the Cost of Assemble-to-order Inventory Systems

Martin Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, marty@research.bell-labs.com, Qiong Wang

Dogru, Reiman and Wang (2010) showed that a particular stochastic program (SP) provides a lower bound on the cost in an assemble-to-order (ATO) inventory system where all components have identical lead times. We extend this result to ATO systems with non-identical lead times. We also discuss properties of this SP as lead times grow large.

3 - Positive Recurrence of Semimartingale Reflecting Brownian Motions

Jim Dai, Edenfield Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332, United States of America, dai@gatech.edu, Maury Bramson, J. Michael Harrison

Multidimensional semimartingale reflecting Brownian motions (SRBMs) arise in applied probability as diffusion approximations for multi-station stochastic processing networks. We study the positive recurrence of a d-dimensional SRBM. Building on prior work by El Kharroubi et al. (2000, 2002), we provide necessary and sufficient conditions for positive recurrence in dimension d = 3. I will also discuss the implication of a recent example by Bramson for an SRBM in dimension d=6.

4 - Optimal Paths in Large Deviations of RBM in 3-D

Ziyu Liang, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, liangzy@mail.utexas.edu, John Hasenbein

We analyze a variational problem which arises from large deviations for reflected Brownian motion in three dimensions. In particular we provide results on the form of the minimizing paths for certain RBM's in the three dimensional positive orthant.

■ SA38

C - Room 9A, Level 3

Convex Optimization Tools in Nonlinear Optimization

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Agustin Bompadre, Postdoctoral Fellow, California Institute of Technology, 1200 E. California Boulevard, Mail Code 205-45, Pasadena, CA, 91125, United States of America, abompadr@gmail.com

1 - Latent Variable Graphical Model Selection Via Convex Optimization

Venkat Chandrasekaran, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D570, Cambridge, MA, 02139, United States of America, venkatc@mit.edu, Alan Willsky, Pablo Parrilo

Suppose we have sample observations of a subset of a collection of random variables, with no knowledge of the relationship between the observed and latent variables, nor the number of latent variables. We describe identifiability conditions and a tractable convex program to learn a statistical model over the full set of variables. This program consistently estimates model structure in the "high-dimensional" regime, with the number of observed/latent variables growing with the number of samples.

2 - A Lagrangian Decomposition Based Branch and Bound Approach to Quadratic 0-1 Programs

Zhen Zhu, Purdue University, Department of Computer Science, LWSN, 305 N University Street, West Lafayette, IN, 47907, United States of America, zzhu@purdue.edu, Nan Kong, Oleg A. Prokopyev

In this paper, we present an innovative Lagrangian decomposition based branch and bound method to solve Quadratic 0-1 programs (QBP) with linear constraints. We introduce a set of nonlinear constraints that duplicate the original decision variables. The quadratic binary program is then decomposable. So we can obtain a Lagrangian relaxation bound by solving a number of linear binary programs. An effective variable selection rule along with other computational improvement strategies is discussed.

3 - Convergence Rate of McCormick Relaxations

Agustin Bompadre, Postdoctoral Fellow, California Institute of Technology, 1200 E. California Boulevard, Mail Code 205-45, Pasadena, CA, 91125, United States of America, abompadr@gmail.com, Alexander Mitsos

Theory is developed for the convergence order of convex relaxations of factorable functions by McCormick [Math. Program. 10 (2), 147-175, 1976]. The convergence rate of addition, multiplication and composition are proven and then the propagation of these rules is discussed. The convergence properties are compared with alternative methods theoretically and for numerical examples. Consequences for the efficiency of global optimization of nonconvex nonlinear programs are discussed.

■ SA39

C - Room 9B, Level 3

Joint Session OPT/ MIF: Branchwidth, Treewidth, and Integer Programming

Sponsor: Optimization/ Integer Programming/ Minority Issues Sponsored Session

Chair: Illya Hicks, Associate Professor, Rice University, 6100 Main St., Houston, TX, 77251-1892, United States of America, ivhicks@rice.edu

1 - A Combinatorial Optimization Algorithm for Solving the Branchwidth Problem

J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu, Elif Ulusal, Illya Hicks

We consider the problem of computing an optimal branch decomposition of a graph. Branch decompositions have proven to be useful in solving many NP-hard problems, such as the traveling salesman, independent set, and ring routing problems, by means of combinatorial algorithms that operate on branch decompositions. We develop an implicit enumeration algorithm for the optimal branch decomposition problem and examine its performance on a set of classical graph instances.

2 - The Cunningham-Geelen Algorithm in Practice: Branch-decompositions and Integer Programs

Susan Margulies, Pfeiffer-VIGRE Post-doctoral Instructor, Rice University, 6100 Main St. MS #134, Houston, TX, 77005, United States of America, susan.margulies@rice.edu, Jing Ma, Illya Hicks

Consider the integer program max(^{C}Tx : Ax = b, x >= 0,) where A is non-negative and the column-matroid M(A) has constant branch width. Cunningham and Geelen introduce a pseudo-polynomial time algorithm for solving this IP that takes a branch decomposition T of M(A) as input. We report on computation results of a C++ implementation of this algorithm, where the branch decomposition T is produced by a heuristic. We test against various problem instances, and compare the algorithm with Gurobi.

3 - A Branch-and-price-and-cut Method for Computing the Bramble

Sibel Sonuc, PhD Student, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, sibel.bilge@ufl.edu, Illya Hicks, J. Cole Smith

We examine the problem of finding the bramble number of a graph. A bramble is a set of connected subgraphs such that every pair of subgraphs is adjacent in the sense that they contain a common node, or an edge connects the two subgraphs. The bramble number is the largest cardinality of a minimum hitting set over all bramble elements. We provide a branch-and-cut-and-price methodology that generates columns corresponding to bramble elements, and rows corresponding to hitting sets.

■ SA40

C - Room 9C, Level 3

Interfaces and Metaheuristics in COIN-OR

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Joao Goncalves, IBM Research, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, jpgoncal@us.ibm.com

1 - The Optimization Services Project

Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

In this talk we provide an update on recent developments in the COIN-OR project Optimization Services.

2 - Modeling Cone Optimization Problems with COIN OS

Imre Polik, Lehigh University, Department of Industrial and Systems Engineering, 200 West Packer Avenue, Bethelehem, PA, 18015, United States of America, imre@polik.net

We present the extension of COIN OS to model cone optimization problems. We discuss the design principles of the extension. In the end we are able to model problems with matrices, thus extendeing the general modelling capabilities of COIN OS. This is joint work with Kipp Martin, Horand Gassmann and Jun Ma.

3 - Pulp a Linear Programming Toolkit for Python

Stuart Mitchell, Research Fellow, University of Auckland, Private Bag 92019, Auckland, 1142, New Zealand, s.mitchell@auckland.ac.nz

PuLP https://www.coin-or.org/PuLP/ is a Toolkit for modelling and solving linear and mixed integer programs in Python. PuLP was created by J.S. Roy and released under a MIT licence. PuLP development focuses on ease of use and quick development. Dippy is a recent extension of PuLP to interface with DIP https://projects.coin-or.org/Dip a framework for implementing a variety of decomposition-based branch-and-bound algorithms for solving mixed integer linear programs.

4 - METSlib: A Metaheuristics Framework in Modern C++
Mirko Maischberger, University degli Studi di Firenze, Dipartimento di Sistemi e Informatica, Via S. Marta, 3, Firenze, 50129, Italy, maischberger@dsi.unifi.it

As framework for the rapid development of search strategies based on the exploration of a neighborhood METSlib offers the basic building blocks to assemble customized solvers using fully modular algorithms such as Tabu Search, SA and LS, combined in complex strategies. The user can implement a single model and neighborhood and easily try different algorithmic variations. We also present a Parallel Iterated TS solver for some extensions of the Vehicle Routing problem.

■ SA41

C - Room 10A, Level 3

Recent Advances in Mixed-Integer Nonlinear Optimization I

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

1 - QP Diving for MINLP
Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

We present a new algorithm for solving MINLPs that exploits hot-starting capabilities of QP solvers by performing a series of QP dives. The resulting algorithm is globally convergent for convex MINLPs. Unlike traditional branch-and-bound approaches, the new algorithm re-uses the factors that are computed in each QP solve, resulting in order-of-magnitude performance improvements. We present preliminary numerical results with an implementation in MINOTAUR, our new open-source MINLP solver.

2 - Global Optimization with MINOTAUR
Ashutosh Mahajan, Post Doc, MCS Division, Argonne National Lab, 9700 S Cass Avenue, Argonee, IL, 60527, United States of America, mahajan@mcs.anl.gov, Sven Leyffer

We describe MINOTAUR, a solver designed for solving mixed-integer nonlinear programs. The focus of the talk will be on methods and algorithms that are specifically designed for global optimization of nonlinear programs. These include methods for presolving, branching and generating valid inequalities. We demonstrate the effects of these techniques on benchmark instances.

3 - MILANO: A New Matlab-based Toolbox for MINLP
Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, LeBow College of Business, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

In this talk, we present details of MILANO (Mixed-Integer Linear and Nonlinear Optimizer), a Matlab-based toolbox for solving mixed-integer optimization problems. For MINLP, it includes implementations of branch-and-bound and outer approximation algorithms and solves the nonlinear subproblems using an interior-point penalty method introduced by Benson and Shanno (2005) for warmstarts. Special consideration is given for problems with cone constraints. Numerical results will be presented.

4 - Convex Outer Approximations for Bounded Multilinear Functions
Mahdi Namazifar, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, United States of America, namazifar@wisc.edu, Pietro Belotti, Andrew Miller

This research studies linear envelopes for single-term and bounded multilinear functions defined over a hyper-rectangle. Tight convex relaxations for such nonconvex functions are crucial in finding reasonable lower bounds in a spacial branch-and-bound framework for global optimization problems. This is motivated by the fact that many global optimization solvers use polyhedral relaxations to compute lower bounding solutions.

■ SA42

C - Room 10B, Level 3

Scenario Generation in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: James Luedtke, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, jrluedt1@wisc.edu

1 - A Probability Metrics Approach for Bias and Variance Reduction in Optimality Gap Estimation
Guzin Bayraksan, Assistant Professor, University of Arizona, Systems & Industrial Engineering, Tucson, AZ, 85721, United States of America, guzinb@sie.arizona.edu, Rebecca Stockbridge

Monte Carlo sampling-based estimators of optimality gaps for stochastic programs are known to be biased. We present a bias reduction method via a probability metrics approach, which can be done in polynomial time in sample size. We focus on A2RP procedure and present extensions for MRP procedure. We show that the resulting estimators produce consistent point estimators and asymptotically valid confidence intervals. Our computational results show that this procedure can also reduce variance.

2 - Statistical Generation of Scenarios for Stochastic Programs
Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Scenario generation is a critical aspect of the Sample Average Approximation method in stochastic programming. I will discuss several new classes of space-filling designs for generating scenarios in more flexibly and efficiently than the sample Monte Carlo method. Specific designs to be covered inlude nested Latin hypercube designs, sliced Latin hypercube designs and nested U designs.

3 - Scenario Generation in Unit Commitment with Intermittent Wind Energy
Ali Koc, Postdoctoral Researcher, IBM TJ Watson Research Center, Yorktown Heights, NY, 10598, United States of America, akoc@us.ibm.com, Jayant Kalagnanam

Power system operators typically solve a unit commitment problem to minimize total start-up and fuel costs of the generators while meeting their demand over a planning horizon. Recent regulations require grids accept renewable energy such as wind. Due to the intermittency of wind, grid operators need to obtain representative probability distributions from a set of wind forecasts. We compare two scenario generation schemes in terms of their effect on the system profitability and reliability.

4 - First Order Convergence of Sparse Grid Method in Two-stage Linear Problem
Michael Chen, Assistant Professor, York University, 4700 Keele Street, Toronto, M3J 1P3, Canada, chensy@galaxy.math.yorku.ca, Sanjay Mehrotra

Theoretical analysis of sparse grid method for numerical integration is based on mixed-derivative function spaces. However the recourse function in two-stage linear problem is multivariate piecewise linear and does not belong to a mixed-derivative space. We overcome this difficulty by constructing a logarithmic mollifier function, and prove the first order convergence rate of the method.

■ SA43

C - Room 1, Level 2- Mezzanine

Patient Flows, The Emergency Department, and Healthcare Operations Management

Sponsor: Health Applications
Sponsored Session

Chair: Mark Van Oyen, Associate Professor, University of Michigan, Industrial & Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, vanoyen@umich.edu

Co-Chair: Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu

1 - Optimization of Overbooking Decisions for Patient Appointment Scheduling
Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Brian T. Denton, Thomas R. Rohleder, PhD

No-shows adversely affect the daily operations of outpatient clinics by contributing unnecessary resource idle time and decreasing anticipated reimbursements. Balancing patient waiting time and resource utilization with no-shows is a challenge to many providers. The L-shaped method is used to solve a stochastic programming formulation of overbooking for scheduling patient arrivals with attendance and duration uncertainty. Results are presented based on an endoscopy suite as a case study.

2 - Improving the Performance of a Hospital ER Fast-track
Amy Ward, USC, Marshall School of Business, BRI 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Linda Green

Many ERs have set up "fast-tracks" for non-urgent patients in order to reduce their waiting times and hence the fraction who leave without being seen (LWBS). However, this reduces the pool of physicians treating urgent patients, increasing their waiting times and the risk of adverse outcomes. We show how a flexible policy which dynamically gives scheduling priority to urgent or non-urgent patients better balances waiting times for urgent patients with the fraction of LWBS.

3 - A Multiclass Queueing Model for Kidney Transplant
Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

There have been calls to revise the cadaver kidney allocation policy because of kidney shortage. We propose a categorization-based policy in which patients are divided into exclusive queues by their choices of kidney qualities. We show that a unique equilibrium queue-lengths exits and the queue lengths converge to an Ornstein-Uhlenbeck process centering at that equilibrium. The conclusion lends managerial insights for policy design.

4 - Overcoming Crowding in Emergency Departments: A New Streaming Mechanism
Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu, Mark Van Oyen, Jeffrey Desmond, Steven Kronick, Wallace Hopp

We consider a new process and patient flow mechanism to overcome crowding in Emergency Departments (EDs). "Streaming" classifies patients based on admission to hospital. We use (1) Queueing Theory and (2) high fidelity simulation based on hospital data. We clarify the operational performance of the streaming and pooling mechanisms. We also generate insights into how EDs can improve their performance by better use of final disposition predictions.

■ SA44

C - Room 2, Level 2- Mezzanine

Panel Session: Critical Areas of Research at the Intersection of Industrial and Systems Engineering and Health Care

Sponsor: Health Applications
Sponsored Session

Moderator: Rupa Valdez, University of Wisconsin-Madison, 3261 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53711, United States of America, rsvaldez@wisc.edu

1 - Panel Discussion: Critical Areas of Research for Industrial and Systems Engineering and Health Care
Panelists: Rupa Valdez, University of Wisconsin-Madison, 3261 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53711, United States of America, rsvaldez@wisc.edu, Cerry Klein, National Science Foundation, 4201 Wilson Boulevard, Arlington, United States of America, cklein@nsf.gov, Jose Zayas-Castro,Professor and Chair, University of South Florida, Department of Industrial & Management Sy, Gainesville FL, United States of America, josezaya@usf.edu, Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor MI 48109, United States of America, msdaskin@umich.edu, James Benneyan,Northeastern University, 360 Huntington Avenue, Boston MA, United States of America, benneyan@coe.neu.edu

Accelerating progress toward a ubiquitous, resilient, patient-centered, and accountable health care system requires innovation in and adoption of industrial and systems engineering (ISyE) knowledge. In a workshop jointly sponsored by AHRQ and NSF in September 2009, a research agenda was developed which detailed the domains of ISyE knowledge needed to meet the challenges of health care. This session provides an opportunity to learn about and discuss the completed research agenda and report.

■ SA45

C - Room 6, Level 2- Mezzanine

Joint Session HAS/ SPPSN: Resource Allocation Modeling for Infectious Disease Control

Sponsor: Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu

1 - A Multi-level HIV Resource Allocation Model
Greg Zaric, Associate Professor, Ivey Business School, 1151 Richmond St., London, Canada, gzaric@ivey.uwo.ca, Monali Malvankar, Xinghao Yan

HIV resource allocation models often assume a single decision maker and a single level of decision making. However, real allocation processes involve multiple decision makers at different levels. A donor may allocate to countries, with further allocations being made to lower level jurisdictions before funds are allocated to programs. We introduce a multi-level resource allocation model and investigate the use of incentive schemes to align the objectives of decision makers at different levels.

2 - Recommendations for Increasing the use of Resource Allocation Models in Public Health
Anke Richter, Associate Professor, Naval Postgraduate School, 699 Dyer Rd, Bldg 234, Monterey, CA, 93943, United States of America, arichter@nps.edu, Arielle Lasry

Resource allocation models have not had a substantial impact on public health funding decisions. We highlight several difficulties encountered in attempts to implement such models including: model complexity, data requirements, multiple stakeholders, funding issues and political and ethical considerations. We then make recommendations as to how these difficulties may be overcome.

3 - Decision Making in HIV Prevention and Treatment Scale Up: Bridging the Gap From Theory to Practice
Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu

Significant scale up of global HIV prevention and treatment efforts is needed to control the epidemic. Model-based tools can help determine the optimal allocation of resources. Decision makers have little guidance as to which packages of interventions at what scale will yield the best results in their particular settings. We discuss the features required by a practical decision making model that will include the key relevant theoretical insights for accurate modeling of intervention effects.

4 - The Cost-effectiveness of PCR to Control TB in a Mature TB/HIV Co-epidemic
Abra Jeffers, Stanford University, Stanford, CA, 94309, "United States of America, abra@stanford.edu

We compare the cost-effectiveness of the use PCR for TB diagnosis versus the current diagnostic algorithm comprised of sputum microscopy, microbiological culture, chest x-ray and empirical diagnosis in an urban population in South Africa. A compartmental model incorporating dynamic transmission of both HIV and TB is used to evaluate the costs and effects of this strategy.

■ SA46

C - Room 7, Level 2- Mezzanine

Panel Discussion: Social Networking and Operations Research

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Panel Discussion: Blogging and Tweeting about Operations Research: A Panel Discussion about Social Networking
Panelists: Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Aurelie Thiele, Associate Professor, Lehigh University, 200 W. Packer Ave., Bethlehem PA 18015, United States of America, aurelie.thiele@lehigh.edu, Wayne Winston, Professor, Indiana U School Of Business, 10th and Fee Lane, Bloomington IN 47401, United States of America, winston@indiana.edu, Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst MA 01003, United States of America, nagurney@gbfin.umass.edu

How can blogs, twitter, FaceBook, LinkedIn and other social networking tools be used in conjunction with operations research? In this panel discussion, we discuss a number of ways in which operations research has been successfully used to improve scientific literacy, recruit students, and increase knowledge about our field in the general public. We will also discuss new social networking challenges.

■ SA47

C - Room 8, Level 2- Mezzanine

Stochastic Models for Biological Systems

Cluster: Computational Biology and Bioinformatics
Invited Session

Chair: Ming-Ying Leung, Professor, The University of Texas at El Paso, 500 W. University Avenue, El Paso, TX, 79968, United States of America, mleung@utep.edu

1 - Effect of Data Set Size on Support Vector Machine Feature Selection for O-Glycosylation Sites
Raul Cruz-Cano, Assistant Professor, University of Maryland, Department Epidemiology and Biostatistics, College Park, MD, 20742, United States of America, raulcruz@umd.edu, Ming-Ying Leung

Support Vector Machines (SVMs) are supervised learning methods widely used for classification. Using a set of known input/output vectors as training set, SVMs can predict the classification of unseen examples. Moreover, the SVM approach allows feature elimination to be conducted to suggest which input variables are relevant for this task. In this research we examined how the size of the training set influence the rankings of the input variables needed to identify O-Glycosylation sites.

2 - Stochastic Model of Bistability in Gene Regulatory Modules
Marek Kimmel, Professor, Rice University, Department of Statistics, Houston, TX, 77005, United States of America, kimmel@rice.edu

Decision making in cells may involve switching to different modes of gene expression, e.g., in the differentiation of blood cell precursors. In the deterministic framework, bistability leads to hysteresis-like phenomena. However, when stochastic component plays a role in transcription, tunneling from one equilibrium to the other occurs and the dynamics may change. We explore the range of behaviors possible based on an exact stochastic model, its diffusion approximation, and a simulation study.

3 - Methods for Cluster Detection of Patterns in Biological Sequences
Wendy Lou, Professor, University of Toronto, Division of Biostatistics, Dalla Lana School of Public Health, Toronto, ON, M5T 3M7, Canada, wendy.lou@utoronto.ca

The detection of clusters of patterns (identical or non-identical) in a long biological sequence is often of interest in establishing genetic signals. The probability of occurrence of a cluster for a given sequence, assuming some underlying distribution for the bases that make up the biological sequence, can be used as a tool for this purpose. Computational methods for cluster detection will be presented, followed by an example involving palindrome clusters in DNA sequences.

4 - Growing, Slowing, Growing Again: A Branching Process Model of How Cells Survive Telomere Shortening
Peter Olofsson, Associate Professor, Trinity University, Department of Mathematics, San Antonio, TX, 78212, United States of America, Peter.Olofsson@Trinity.edu, Alison Bertuch

Telomeres are regions at the ends of chromosomes. As chromosomes divide telomeres shorten progressively, a process which is counteracted by the enzyme telomerase. In the absence of telomerase, cells eventually stop dividing and become senescent. However, a small fraction of cells may develop alternative processes of telomere maintenance independent of telomerase. A branching process is proposed to model a population of yeast cells and its growth pattern in response to telomere dynamics.

■ SA48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS Global Academic Program- Enterprise Guide Demonstration
Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

This demonstration shows how one can use the menu driven tasks in SAS Enterprise Guide 4.2, the point and click interface to SAS, to perform common reporting and research tasks: querying, reporting, and analyzing data. SAS Enterprise Guide provides a SAS graphical point-and-click interface that helps you exploit the power of SAS and publish dynamic results in a Microsoft Windows client application.

2 - Automatic Forecasting Systems - Capabilities of Autobox
Tom Reilly, Automatic Forecasting Systems, P.O. Box 563, Hatboro, PA, 19040, United States of America, tomreilly@autobox.com

Autobox launched in 1976 adjusts for outliers and adds variables to fix the data to where it should have been so that the model and forecast isn't skewed. Adapting to changes like trends, level shifts and seasonal pulses. Adjusting for lead/lag effects for causal variables like price, promotion, holidays, etc.

■ SA49

C -Room 10, Level 2- Mezzanine

Software Development, IT Outsourcing and Productivity

Sponsor: Information Systems
Sponsored Session

Chair: Kunsoo Han, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, kunsoo.han@mcgill.ca

1 - Managerial Attention and Performance in IT Outsourcing: Integrating Categorization and Interruptions
Anand Gopal, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, agopal@rhsmith.umd.edu, Balaji Koka

We examine why almost 50% of technology outsourcing projects fail by framing it as a resource deployment problem - how do managers choose between competing projects to deploy scarce resources? We identify managerial attention as a critical determinant of managerial priorities. We develop a framework that integrates both categorization and contextual approaches to explain managerial priorities and its effect on resource deployment, thus arguing for a nuanced view of attention in outsourcing.

2 - The Impact of IT on the Relative Productivity of Transaction and Production Labor
Barrie R Nault, Professor, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, nault@ucalgary.ca, Tracey Dean Stock

We partition the labor input into different sectors of the US economy by whether the input is transaction-based or production-based. Using this partition we are able to measure the relative productivity of transaction- and production-based labor inputs. In addition, employing a specialized formulation, we can determine the impact of information technology investment on the productivity of these different labor inputs.

3 - A Study of Development Approaches, Design Quality and Energy Efficiency in Open Source Software
Sandra Slaughter, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, Sandra.Slaughter@mgt.gatech.edu, Chiara Francalanci, Eugenio Capra

We examine the effects of traditional development approaches on design quality and energy efficiency for open source software applications. Our analysis reveals an intriguing pattern: for smaller applications, a greater use of traditional approaches including frameworks and external libraries has a beneficial effect on software energy efficiency, but a detrimental effect on design quality. The opposite is true for larger applications. This poses an interesting decision trade-off for managers.

4 - IT Labor, IT Outsourcing and Productivity
Kunsoo Han, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, kunsoo.han@mcgill.ca, Kangbae Lee, Barrie R Nault

We examine the impact of IT labor on productivity and the relationship between IT labor and IT outsourcing. We find that IT labor has made a significant contribution to industry output separate from that of IT capital. More importantly, IT labor has a positive impact on the output elasticity of IT outsourcing, and that impact appears to come mostly from high-skill IT labor. This supports the view that IT labor and IT outsourcing can be complements.

■ SA50

C -Room 11, Level 2- Mezzanine

Economics of Digital Goods

Sponsor: Information Systems
Sponsored Session

Chair: Ramesh Sankaranarayanan, Assistant Professor, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06074, United States of America, Ramesh.Sankaranarayanan@business.uconn.edu

1 - Collective Dynamics in Resolving Uncertainty in Crowdsourced Markets

Vandana Ramachandran, University of Utah, Operations and Information Systems, Salt Lake City, UT, 84112, United States of America, vandana@business.utah.edu, Chris Ward

We study crowdsourced markets for digital goods (designs), characterized by simultaneous voting contests and repeated interactions across participants who submit goods, vote to determine winners and consume winning goods. The firm here faces uncertainty about the future performance of the good. We model the effects of network interactions, peer influence, and experience as early stage indicators of the success of crowdsourced goods, and discuss implications for the design of crowdsourced markets.

2 - Analysis of Coupon Trading Activities in Online Marketplaces

Bhavik Pathak, Assistant Professor, Indiana University South Bend, 1700 Mishawaka Ave, South Bend, IN, 46530, United States of America, bkpathak@iusb.edu, Sarv Devaraj

Advances in IT enable sellers to offer personalized shopping experience and targeted promotions. Marketers have been practicing price discrimination by selectively distributing promotional coupons to customers. IT-enabled online marketplaces facilitate trading of coupons between customer segments. In this paper, we explore the trading of coupons on eBay, formulate the seller's profit maximization problem under this phenomenon, and analyze the drivers of coupon trading in online marketplaces.

3 - Digital Goods and Markets: Emerging Issues and Challenges

Ramesh Sankaranarayanan, Assistant Professor, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06074, United States of America, Ramesh.Sankaranarayanan@business.uconn.edu, Ram Gopal, Sudip Bhattacharjee, James Marsden

We explore the nature of digital goods, and how technological advances continue to cause disruptive change in a range of digital goods industries, such as movies, music, video games, software, and print media - sometimes in the nature of a market, sometimes in the products themselves. In our paper, we highlight the questions addressed by prior research, and draw upon emerging industry trends to present a framework for further research in this area.

■ SA51

C -Room 12, Level 2- Mezzanine

Operations Research Support to the Warfighter

Sponsor: Military Applications
Sponsored Session

Chair: James Treharne, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 20151, United States of America, james.treharne@us.army.mil

1 - Predicting Outcome of a Counter-insurgency

Justine Blaho, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 22033, United States of America, justine.blaho@us.army.mil

This analysis, using historical data of over 100 irregular wars, examines the relationship between underlying data and the outcome of the conflict, and estimates the likelihood of success of the counter-insurgent force. This analysis, using binary logistics regression, has been used to inform Operation Enduring Freedom, and is continuing to be explored and adapted to inform future requirements for the US Army.

2 - Wartime Polling Analysis

Sang Sok, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States of America, sang.sok@us.army.mil

This work focuses on the use of polling analysis to inform planning and assessments of Operation Enduring freedom in Afghanistan. The Center for Army Analysis has consolidated polling analysis from seven different sources, and created tools to provide feedback to senior commanders. This feedback is used to inform the assessment of progress and to inform future planning efforts.

3 - Afghanistan Growth and Retention Analysis

David Smith, US Army, United States of America, david.a.smith@us.army.mil

Study focuses on the force requirements in Operations Enduring freedom for both Coalition Forces and the indigenous Afghan Security Forces, risk incurred in those force levels, and the generation process in place to create that force. This study, requested and used senior commanders in Afghanistan, includes a suite of models developed using binary logistic regression, multi-variate regression, Monte-Carlo simulation, discrete-event simulation, and case study analysis.

■ SA52

C -Room 13, Level 2- Mezzanine

OR, Management, and the Enterprise

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

1 - Balanced Quality Management: Concept and Implementation

Deokhwan Kim, Senior Researcher, Defense Agency for Technology and Quality, Cheongryang P.O. Box 276, Dongdaemun-gu, Seoul, 130-650, Korea, Republic of, thekany@hotmail.com, Yongseop Kim, Jaeseung Choi, Insik Kim

Balanced Quality Management (BQM) is a new concept of quality management for a defense acquisition that balances the effort to manage the quality on each phase of its acquisition life-cycle (i.e., design-manufacturing and operation) based on collaborative links among phases. This study introduces the concept of BQM and proposes three strategies to implement it.

2 - MIST - Management Innovation as a Strategic Technology

Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

Increasingly, the term Business Intelligence (BI) is used to encompass both "analytics" and the data processes and technologies used for collecting, managing, and reporting decision-oriented information. Nonetheless, management is often impeded by organizational pathologies. A complementary relationship between DSS and MIS is needed to fully capitalize on the promise of BI. Ultimately, it is this management innovation approach that will enable senior leaders and managers to generate knowledge and better decisions from the growing amounts of information and improved situational awareness made available by advances in information systems technologies.

■ SA53

C -Room 14, Level 2- Mezzanine

Network Algorithms

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

1 - Medium Access Algorithms

Jinwoo Shin, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, jinwoos@mit.edu, Devavrat Shah

Medium access control (MAC) is essential for efficient operation of well engineered communication networks. Despite of exciting progress in the past few decades, the desired solution has been remained illusive till recently. In this paper, we present an extremely simple, distributed and high-performance MAC algorithm. Methodically, our framework can be applied to a wide class of dynamic network resource allocation problems.

2 - Scheduling for Small Delay in Multi-channel Downlink Wireless Networks

Shreeshankar Bodas, The University of Texas at Austin, Dept of Electrical and Computer Engg, 1 University Station C0803, Austin, TX, 78712, United States of America, shreeshankar@mail.utexas.edu, Sanjay Shakkottai, R Srikant, Lei Ying

We investigate the wireless downlink network scheduling problem in a multi-user multi-channel (e.g., OFDM-based) setting, with the aim of guaranteeing small per-user delay. We show that the classic MaxWeight algorithm results in a very poor delay performance in a large deviations sense. We present an iterative algorithm called Server-Side Greedy (SSG) that, in addition to being throughput-optimal, guarantees a good per-user delay performance, and also has small computational complexity.

3 - Load Balancing in the Cloud
Yi Lu, University of Illinois, 1406 W. Green Street, Urbana, IL, United States of America, yilu4@uiuc.edu

Efficient resource sharing is key to the performance of cloud applications, such as search and map-reduce clusters. The randomized load balancing algorithm, also known as "power of twois popular for its ease of implementation. However, existing analysis does not extend readily to general service time distributions. We propose a new framework of analysis and found that more than two choices are needed to cross the performance threshold for general distributions.

4 - Utility Optimization in Congested Queueing Networks
Neil Walton, University of Cambridge, Centre for Mathematical Sciences, Wilberforce Road, Cambrige, CB3 0AJ, United Kingdom, N.S.Walton@statslab.cam.ac.uk

We consider a multi-class single server queueing network as a model of a packet switching network. The rates packets are sent into this network are controlled by queues which act as congestion windows. By considering a sequence of such congestion windows we allow the network to become congested. We show the stationary throughput of routes on this sequence of networks converges to an allocation that maximizes aggregate utility subject to the network's capacity constraints.

■ SA54

C -Room 15, Level 2- Mezzanine

Technology Assessment and Forecasting I

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Fred Phillips, Professor, Alliant International University, Avenue of Nations, San Diego, CA, 92131, United States of America, fphillips@alliant.edu

1 - Helping Public Schools Help Students Succeed - Now!
Rick Goldgar, CTO / Deputy CIO, Texas Education Agency, 1701 N. Congress Ave., MS 4-115, Austin, TX, 78701, United States of America, rickeclectic@yahoo.com

The Texas PEIMS system annually collects detailed student, personnel and finance data for 4.6M students, 300,000 teachers and 1200 districts. A 2009 investigation criticized PEIMS as a costly and mostly retrospective, compliance oriented system. In response, Texas is creating a new system, TSDS, to provide districts with timely, actionable data to improve student performance and ease collection burdens. This presentation describes the goals, architecture, status and expected outcomes for TSDS.

2 - Technology Assessment Through Multiple Perspectives and Gap Analysis: Case of Pyrolysis Oil As an Alternative District Heating Fuel
Inthrayuth Mahapol, Portland State University, 1900 SW 4th, Portland, OR, United States of America, zign_in@hotmail.com, Tugrul Daim, Josh Ailes, Marwan Lingga

This paper reviews the prospects of Pyrolysis Oil as a district heating fuel. The analysis is done through a case at Portland State University in Portland, Oregon. The case in first analyzed through Linstone's multiple perspectives of technical, organizational and personal. A multi criteria hierarchical model is built to evaluate the technologies. Constant-sum approach is used for quantifying expert judgements.

3 - Technological Forecasting by Citation Network Analysis
Yuya Kajikawa, Assistant Professor, The University of Tokyo, 2-11-16 Yayoi Bunkyo-ku, Tokyo, Japan, kaji@ipr-ctr.t.u-tokyo.ac.jp, Naoki Shibata, Junichiro Mori, Hisashi Kashima

Citation mining is becoming important because of the information flood. In this contribution, methodology, examples, and limitations of citation mining are illustrated. Topics include illustration of academic landscape, detection of emerging domains, prediction of future core papers, and extraction of difference among corpus. It also includes the limitations of the analysis such as validity of corpus, selection of link creating method, time lag and granularity of analysis.

4 - Using Data-driven Social Network Analysis for Insights on Innovation and Change
Martha Russell, Senior Research Scholar, Stanford University, #230 Wallenberg Hall, Bldg. 160, 450 Serra Mall, Stanford, CA, 93405, United States of America, marthar@stanford.edu, Jukka Huhtamaki, Neil Rubens, Kaisa Still

We apply the concept of innovation ecosystems - systems of innovation networks - to an analysis of links between firms and their human and financial resources to observe indicators of the broad system of innovation networks for value co-creation. In the context of a case study, we present a theoretical framework for our work and use network analysis of a socially constructed data on firms and actors, evaluated as drivers of convergence in innovation ecosystems.

■ SA55

C -Room 16, Level 2- Mezzanine

What Can We Learn From Patents?

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu

1 - Project Ambiguity and Solution Search in Fluid Design Teams
Enno Siemsen, University of Minnesota, 3-150 Carlson School of Management, 321 - 19th Ave S, Minneapolis, MN, 55455, United States of America, siems017@umn.edu, Mani Subramani, Min Li, Dishan Kamdar

Most design projects require some degree of search for solutions. Communication within or around the project design team should help facilitate such search. We differentiate between internal direct, external direct and indirect search patterns. What type of communications patterns improve search? Do highly ambiguous projects require different search patterns? We analyze the interplay between project ambiguity, communication patterns and performance using data from outsourced design projects.

2 - R&D Investments and Operational Performance
Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Jürgen Mihm

We examine the effect of the variability in R&D investments on a firm's operational performance. We hypothesize that firms that increase or decrease R&D investments in a short period of time, reduce the effectiveness of these investments irrespective of the absolute level of the investment.

3 - The Impact of Fit on Inventor Performance
Lee Fleming, Harvard Business School, Morgan 485, Boston, MA, 02163, United States of America, lfleming@hbs.edu, Eric Lin

Surrounded by similar colleagues, inventors may be less likely to explore beyond the boundaries of their own expertise. In this paper, we explore how the degree of inventor fit influences inventor output. Using over 30 years of patent data, we find that high degrees of fit as measured by similarity in technical focus between an inventor and an organization may have a positive effect on the impact of an inventor's work, but a negative effect on his creativity.

4 - Understanding the Adoption of Good Ideas
Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu, Jürgen Mihm

Why are some good ideas more easily adopted than others? We address this question by examining the entire population of US design patents and identifying important determinants of successful patents. We measure patent success as the number of references made by other patents.

■ SA56

C - Room 1, Level 1

Simulation Modeling Best Practices

Sponsor: Simulation Society
Sponsored Session

Chair: Rainer Dronzek, Director, Operations Research, McDonald's, 1253 N Schmidt Road, Romeoville, IL, 60446, United States of America, rainer.dronzek@us.mcd.com

1 - Autonomous Agents for Healthcare: Above the Process Oriented Analysis
Maxim Garifullin, Sr. Consultant, Genpact, 1 Research Circle, Niskayuna, NY, 12309, United States of America, Maxim.Garifullin@ge.com

We consider moving from process oriented approach for modeling healthcare systems to incorporating sets of essentially active and independent components interacting with each other. Using the combination of agent based and discrete event simulations we imitate behavior of hospitals components and study the emerging behavior. We will present architectures and approaches we use at the workshop.

2 - Thinking Agile: Taking a Milestones Approach to Simulation Project Management
James Sawyer, Managing Consultant, IBM, 4111 Northside Pkwy NW, Atlanta, GA, 30327, United States of America, jim.sawyer@us.ibm.com, Ben Fuqua

Change is inevitable in the course of any project - and how you manage it can make the difference between project success and project failure. We'll explore how simulation practitioners can take advantage of best practices from the software development community to better manage change, using what we call the "Milestones Approach". Learn how thinking agile can help you improve your project management processes and deliver better results to your customer.

3 - Right Tool for the Right Job - Leveraging a Suite-of-Models Approach to Problem Solving
James Burke, McDonald's Corporation, 1253 N Schmidt Road, Romeoville, IL, 60446, United States of America, james.burke@us.mcd.com

Models are often built for a specific purpose, but companies then may want to leverage that investment and re-use the model to explore other research, usually requiring additional development. Extending the original model adds for re-use on a similar problem has many obstacles. This presentation describes a multi-tool, right-tool for the right job approach where keeping models closer to their original intent, and having more of them is explored.

■ SA57

C - Room 2, Level 1

Risk Sharing and Forecasting in Supply Chains

Cluster: Risk Management
Invited Session

Chair: John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jrbirge@uchicago.edu

1 - Supply Chain Contracting: Procurement From Distant Markets
Ayhan Aydin, PhD Candidate, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, aaydin@chicagobooth.edu, John Birge, Izak Duenyas

Distant manufacturers provide significant opportunities for large global brand owners. However, overseas procurement has less flexibility than domestic options. We investigate an alternative contracting scheme with the distant manufacturers, which allows risk sharing, and study the benefits under different circumstances. We observe significant savings in procurement costs and increased efficiency of the chain under moderate conditions.

2 - Trade Credit in Supply Chains: Multiple Creditors and Priority Rules
Song Alex Yang, University of Chicago/London Business School, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, syang1@chicagobooth.edu, John Birge

We study how different priority rules influence trade credit terms and supply chain efficiency when multiple creditors are present. We find that in general, trade credit with low priority allows suppliers to earn high profits. However, trade credit with high priority may improve chain efficiency.

3 - On the Quantification of Future Uncertainty by Assessing Past Forecast Accuracy
Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Constructing prediction intervals is an effort to quantify the level of uncertainty in forecasts and is an important first step of risk management. We propose an estimation method for prediction intervals which is based on finding an empirical distribution of past forecast errors. We give an asymptotic justification of the method and evaluate the performance of the method by simulation and empirical study. We find that the method is robust against model misspecification.

■ SA58

C - Room 3, Level 1

Current Developments in Quantitative Finance

Cluster: Quantitative Finance
Invited Session

Chair: Thaleia Zariphopoulou, University of Texas at Austin, IROM Department, Austin, TX, 78712, United States of America, zariphop@math.utexas.edu

1 - CAPM Revisited: Forward-looking Betas
Jean-Pierre Fouque, Professor, UC Santa Barbara, Statistics and Applied Probability, South Hall 5504, Santa Barbara, CA, 93106 3110, United States of America, fouque@pstat.ucsb.edu

In this talk we will show how to calibrate betas of stocks using implied volatility skews (joint work with E. Kollman). Stressed-beta models and explicit formulas will also be presented (joint work with A. Tashman).

2 - Recent Developments in Volatility Derivatives
Peter Carr, Morgan Stanley, 1585 Broadway, New York, NY, 10036, United States of America, Peter.P.Carr@morganstanley.com

Volatility derivatives include variance swaps, volatility swaps, optons on realized variance, and timer options. The recent spikes in volatility have enhanced interest in these products. We survey the financial landscape and discuss approaches for pricing and hedging.

3 - Optimal Trading Between Heterogeneous Risk-Averse Investors in the Derivatives Market
Tim Leung, Assistant Professor, Johns Hopkins University, 3400n Charles Street, Baltimore, MD, 21218, United States of America, timleung@jhu.edu

The derivatives market has grown rapidly, and has played a key role in the recent financial crisis. In this talk, we will discuss a stochastic model for the bid-ask prices of derivatives in an incomplete market, and solve for the optimal static positions for the derivatives buyers and sellers who may have different risk aversion levels and market views. We will examine analytically and numerically the impacts of various factors on the optimal trading volume.

4 - Risk Measures in a Multiasset Model with Transaction Costs
Birgit Rudloff, Assistant Professor, Princeton University, ORFE department, Princeton, NJ, 08544, United States of America, brudloff@princeton.edu

We consider a market with d assets and proportional transaction costs and extend the notion of set-valued risk measures to the case of random solvency cones at terminal time. This accounts for random exchange rates and/or random transaction costs. Dual representations are given in terms of vector probability measures, allowing for an interpretation close to the scalar case. We present several examples including the average value at risk and the superhedging price.

■ SA59

H - Salon A, 4th Floor

Combinatorial Optimization I

Contributed Session

Chair: Minghe Sun, Professor, University of Texas at San Antonio, College of Business, One UTSA Circle, San Antonio, TX, 78249, United States of America, minghe.sun@utsa.edu

1 - A Dual Bounding Scheme for a Territory Design Problem
Monica Elizondo, Master Student, Universidad Autonoma de Nuevo Leon, CIDET-FIME, AP 111 - F,Cd. Universitaria, San Nicolas, NL, 66450, Mexico, melizondo.amaya@gmail.com, Roger Z. Rìos-Mercado, Juan Diaz

A real-world territory design problem arising in a beverage distribution firm is addressed. This problem involves finding a p-partition of a set of geographic units to minimize a p-center measure of dispersion, subject to balance constraints. Dual bounds are obtained using a binary search over a range of coverage distances and considering a maximal covering model. Empirical work includes an evaluation of the algorithmic performance. Keywords: territory design, Lagrangian relaxation.

2 - Application of Genetic Algorithms to Gene Interactive Rules
Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 40 William Street, South Dartmouth, MA, 02748, United States of America, fazadivar@umassd.edu

Creation of cancer cells are the result of changes induced to gene interactive rules. In this paper a genetic algorithm is applied to a simulated model of gene interactions rules to determine the optimum alterations of these rules to prevent formation of cancerous cells.

3 - Heuristics and Approximation Algorithms for Optimization Problems with Submodular Costs
Dan Stratila, Rutgers University, 640 Bartholomew Rd, Rm 107, Piscataway, NJ, 08854, United States of America, dstrat@rci.rutgers.edu

We consider several discrete optimization problems with costs that are given by submodular functions, such as the facility location problem with submodular costs. We introduce a new approach for obtaining heuristics and approximation algorithms for such problems that involves iteratively solving a certain submodular optimization problem. Time permitting, we will discuss applications to computational methods, and applications to other problems, such as network design and inventory problems.

4 - A Simplex-based Primal-dual Algorithm for the Perfect B-matching Problem
Jingjie Xiao, PhD Student, Purdue University, School of Industrial Engineering, West Lafayette, IN, 47907, United States of America, xiaoj@purdue.edu, Joseph F. Pekny, Paul Bunch

Although standard computational tools are used, in the algorithm engineered for the perfect b-matching problem (PBMP), we are able to exploit problem physics by controlling primitive operations of the simplex method such as selection of entering and exiting variables. Specifically, a cutting plane approach is used to solve the PBMP so that only 1/2 integral solution values are encountered en route to the optimal solution, allowing for economical detection of violated facet defining constraints.

5 - A Tabu Search Procedure for a Variable Selection MIP Model in Multiple-Class Classification

Minghe Sun, Professor, University of Texas at San Antonio, College of Business, One UTSA Circle, San Antonio, TX, 78249, United States of America, minghe.sun@utsa.edu

A tabu search procedure is developed to solve an MIP model for variable selection in multiple-class classification problems. Discriminant functions are constructed while variables are selected. Strategies are designed to select variables to enter and leave the discriminant functions. Recency based tabu conditions are used and aspiration criteria are developed to override tabu conditions. Very good results are obtained when the tabu search procedure is applied to publically accessible data sets.

■ SA60

H - Salon B, 4th Floor

Decision Quality - In Search of Theoretical Foundation

Sponsor: Decision Analysis
Sponsored Session

Chair: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - The Practitioners Wish List for DA Research

Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

We will discuss the results of a survey of leading practitioners conducted by the Society of Decision Professionals. The survey will determine which kind of research topics could be most helpful to advancing the practice of decision analysis and achieve greater market penetration of strategic decisions. A panel of practitioners will expand on the top five items on the wish list.

■ SA63

H - Room 404, 4th Floor

Real Options and Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Tianyang Wang, University of Texas at Austin, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@PhD.mccombs.utexas.edu

1 - Flexibility and Uncertainty in Agribusiness Projects: Investing in a Cogeneration Plant

Luiz Brandao, Professor, Pontifical Catholic University of Rio de Janeiro, Rua Marques de São Vicente 225, Gavea, Rio de Janeiro, RJ, 22451-900, Brazil, brandao@iag.puc-rio.br, Augusto Arenaro, Carlos Bastian-Pinto, Joe Hahn

Energy generation from biomass has become a source of increasing interest. We analyze a sugar cane mill in Brazil that has an option to add a bioelectricity cogeneration unit. We model sugar, ethanol and electricity prices as stochastic mean reverting processes and solve using a mean reverting lattice under the real options approach. The results indicate that significant value can be derived from the flexibility to choose the optimal timing of investment in the cogeneration unit.

2 - Copulas-based Decision Tree

Tianyang Wang, University of Texas at Austin, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@PhD.mccombs.utexas.edu, James Dyer

There is a growing need for the ability to specify and generate multivariate dependent random variables as primitive inputs to stochastic models. This paper proposes a copulas-based approach to model multiple dependent factors in decision trees allowing general marginal distributions and general copulas functions. The approach can serve as an efficient and practical tool for multifactor decision analysis and real options pricing.

3 - Value of Information as an American Option

Babak Jafarizadeh, PhD Researcher, University of Stavanger, Dept of Petroleum Engineering, N-4036, Stavanger, Norway, babak.jafarizadeh@uis.no

Some information acquisition activities can be postponed within a predefined time-frame. In the uncertain situations, the option to postpone this activity to a later, more favorable time may create additional value for the decision maker. In this paper we discuss the value that comes from holding an option to acquire information in a time period and suggest a Simulation-based numerical approach to calculate the associated value.

4 - Oilfield Asset Valuation with Multiple Sources of Uncertainty

William J. Bailey, Principal, Schlumberger-Doll Research, 1 Hampshire Street, Cambridge, MA, 02139, United States of America, wbailey@slb.com, David Wilkinson, Benoit Couet

The valuation of an oilfield asset with multiple sources of uncertainty is presented using a modified form of the Smith & Nau multi-lattice scheme. Private and public uncertainties are treated in a systematic manner (with a practical management 'roadmap' for hedging) such that the valuation (with or without optionality) has explicable and unambiguous meaning. All reservoir-related subjective probabilities are retained and a consistent valuation, irrespective oil price path, is forthcoming.

5 - A Non-censored Binomial Lattice Approach for Modeling Mean Reverting Stochastic Processes

Joe Hahn, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA, 90263, United States of America, Joe.Hahn@pepperdine.edu, Carlos Bastain, Luiz Brandao

In this paper we propose a non-censored binomial lattice model that is more precise and has some other distinct advantages over the existing models used for approximating mean reverting processes. We compare the alternative approaches and apply them to a hypothetical real option valuation problem.

■ SA68

H - Room 415, 4th Floor

Supply Chain Management in eBusiness

Sponsor: eBusiness
Sponsored Session

Chair: Daewon Sun, University of Notre Dame, 359 MCoB, Notre Dame, IN, United States of America, dsun@nd.edu

1 - Bundling in a Supply Chain

Hemant Bhargava, University of California, Davis, Davis, CA, United States of America, hemantb@ucdavis.edu

Many retailers serve as aggregators of products from upstream independent manufacturers. This business model occurs in television, online music, and many other settings. We discuss how the existence of double marginalization in these settings fundamentally alters the economic features of bundling.

2 - On and Beyond Information Sharing: An Empirical Analysis of Value of Vendor Managed Inventory

Oliver Yao, Associate Professor, Lehigh University, 621 Taylor St., Bethlehem, PA, 18015, United States of America, yuy3@lehigh.edu, Yan Dong, Martin Dresner

Using a unique, item level dataset, we examine benefits of both the information sharing and decision transfer components of to both upstream firms and downstream firms. Performance is measured using inventory, stockouts and the bullwhip effect ratio. Our major findings are that VMI adds value for both downstream and upstream firms, and that the decision transfer component of VMI adds significant benefits on top of the benefits derived from the sharing alone.

3 - Coordinating a Supply Chain with a Manufacturer-owned Online Channel

Daewon Sun, University of Notre Dame, 359 MCoB, Notre Dame, IN, United States of America, dsun@nd.edu, Xuying Zhao, Jennifer Ryan

We consider a dual channel supply chain in which a manufacturer sells a single product to end-users through both a traditional retail channel and a manufacturer-owned direct online channel. We model each channel as a newsvendor problem, with price and order quantity as decision variables. In addition, the manufacturer must choose the wholesale price to charge to the independent retailer.

■ SA69

H - Salon F, 6th Floor

Student Rail Research Competition

Sponsor: Railway Applications
Sponsored Session

Chair: Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

1 - Rail Applications Section Student Paper Contest - FINALIST Presentations
Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

The entrants in the RAS Student Paper Contest will present their research at this session. The winner will be announced at the RAS Business meeting Sunday night. The finalists were not determined prior to the abstract submission deadline.

2 - Robust Train Dispatching Model Under a Dynamic and Stochastic Environment: A Scenario-based Rolling Horizon Solution Approach
Xuesong Zhou, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Lingyun Meng

This paper aims to solve the robust train dispatching problem under a major disruption with dynamic and stochastic information. Based on a stochastic programming with recourse framework, the proposed model periodically optimizes schedules for a relatively long rolling horizon, while selecting and disseminating a robust meet-pass plan for every roll period. A multi-layer branching solution procedure is developed to systematically generate and select meet-pass plans under different stochastic scenarios. Illustrative examples and numerical experiments are used to demonstrate the importance of robust disruption handling under a dynamic and stochastic environment.

3 - Delay Management with Re-Routing of Passengers
Twan Dollevoet, Econometric Institute and ECOPT, Erasmus University RotterdamDepartment of Logistics, Netherlands Railways , P.O. Box 1738, NL-3000, NL-3000 DR Rotterdam, Netherlands, dollevoet@ese.eur.nl, Marie Schmidt, Anita Schobel, Dennis Huisman

Delay management answers the question whether trains should wait for a delayed feeder train or should depart on time. We present a delay management model that allows passengers to adjust their route in case of delays and give an integer programming formulation. Furthermore, we present a polynomial algorithm for the special case of one origin-destination pair, which can be applied to obtain lower bounds for the general problem. Computational experiments on real-world data of Netherlands Railways show that significant improvements can be obtained by considering re-routing explicitly.

4 - New Jersey Chapter: 2010 Student Contest Winner
David Hunt, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

The winner of the New Jersey Student Contest will present their work. This contest is open to all students attending a NJ school, or any student who is a NJ resident. The finalist this year include two papers on queueing theory, one on supply chain, and one from the airline industry. The winner will be determined at a NJ Chapter meeting in late September.

5 - Flight Sequence Model for Flight Conflict Resolving Problem
Zhe Liang, Rutgers University, 900 Davidson Rd, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse, Elsayed Elsayed

Everyday Oakland ARTCC receives requested flight plans from the airlines entering the Pacific airspace. It is common that the flight plans from different airlines incur conflicts due to FAA safety standards. The flight conflict rescheduling problem is to resolve the conflicts with the minimum cost. We propose a flight sequence model (FSM) for the problem, and use column generation to solve the FSM. The computational results show that the FSM outperforms all other methods in all test cases.

■ SA70

H - Salon G, 6th Floor

Advanced Optimization Approaches to Dynamic Airspace Configuration

Sponsor: Aviation Applications
Sponsored Session

Chair: Shervin AhmadBeygi, Senior Operations Research Analyst, Metron Aviation, 45300 Catalina Ct, Sterling, VA, 20166, United States of America, Shervin.AhmadBeygi@metronaviation.com

1 - Optimal Airspace Partitioning: Cell Based Optimization Approach
Arash Yousefi, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, arash.yousefi@metronaviation.com

We present a methodology for clean sheet partitioning of airspace to air traffic control sectors. We decompose a given piece of airspace into cells and compute metrics for each cell to capture traffic topology. We develop Mixed Integer Linear Programs to cluster cells into airspace sectors. For a given traffic pattern, the goal is to simultaneously minimize the number of sectors and total controller workload, and balance the workload among sectors.

2 - A Math Programming Based Heuristic for Solving an Optimal Sectorization Problem
Shin-Lai Tien, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, alextien@umd.edu

An optimal sectorization problem has been formulated to address demand variation by using time-varying controller staffing. To generate quality solutions within time limit, a heuristic based on math programming is introduced. Various neighborhood definitions for local search will be developed and tested. The experimental results show that the proposed heuristic approach can effectively improve best found solutions.

3 - Dynamic Airspace Configuration using Approximate Dynamic Programming
Rajesh Ganesan, George Mason University, 4400 Univ Dr MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu, Sameer Kulkarni

Dynamic Airspace Configuration is a NextGen Air Transportation System concept that proposes to migrate from the present static structure of the National Airspace System (NAS) to a more dynamic airspace, which is capable of adapting to changing traffic patterns and weather conditions to efficiently utilize the capacity of the NAS. This talk addresses the issue of dynamic restructuring of the airspace to meet capacity requirements on a daily basis using an Approximate Dynamic Programming Algorithm.

4 - Air Traffic Flow Management Under NextGen Mixed Equipage Conditions
Ali Tafazzoli, Senior Analyst, Metron Aviation, Inc., 45300 Catalina Ct. Suite 101, Dulles, VA, 20166, United States of America, ali.tafazzoli@metronaviation.com, Girishkumar Sabhnani, Babak Khorrami, Arash Yousefi

Unlike today's National Airspace System, the NextGen airspace will consist of both ground-controlled and self-separated operations. We define a notion of a feasible region for self-separated airspace in 3D space of percent-equipped aircraft, traffic complexity, and aircraft count based on the human factors studies. Furthermore, we extend an existing traffic flow management model to include requirements for mixed-equipage operations within the NextGen time frame.

■ SA71

H - Salon H, 6th Floor

Transportation, Public

Contributed Session

Chair: Zhang Dong, Tongji University, A227, NO.4800 Cao'an Rd., Shanghai, 210804, China, zhangdong_traffic@126.com

1 - Bus Network Design using Genetic Algorithm
Hadi Sadrsadat, PhD Candidate, University of Maryland, Dept of Civil &Environmental Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, hadisadr@umd.edu, Ali Haghani, Hossein Poorzahedi

This study is devoted to solve bus network design problem using genetic algorithm. The fitness function is defined as the benefit to the users, subject to constraints that distribute bus routes over the study area and do not allow required fleet size exceed available fleet size. Several good solutions were generated in reasonable time through a sensitivity analysis by changing the parameters of the problem affecting bus route geographical distribution.

2 - The Value of Optimization in Dynamic Ride-sharing
Xing Wang, Georgia Institute of Technology, ISYE, 765 Ferst Drive, Atlanta, GA, United States of America, xwang35@isye.gatech.edu, Niels Agatz, Martin Savelsbergh, Alan Erera

While ride-sharing is not new, the ubiquity of Internet enabled smartphones allows practical dynamic ride-sharing. To exploit hardware capabilities, ride-sharing systems need to match riders and drivers on short-notice in ways that reduce system-wide vehicle-miles and costs. In this research we develop optimization-based approaches for ride-sharing. To asses the merits of our methods we present a simulation study based on real-life travel demand data from the Metro Atlanta.

3 - Demand Driven Transport in Developing Nations: Pareto Tradeoffs
Chandrasekhar Prabala, Infosys Technologies Limited, Electronics City, Bangalore, India, venkata_p@infosys.com, G. N. Srinivasa Prasanna, Sunil Kumar Vuppala

We present results on demand driven transportation (DDT), targeted towards demand profiles seen in developing nations. Shared vehicles (e.g. buses) are allocated and scheduled to serve 1000's of potentially conflicting riders (an order of magnitude more than previous work). We present tradeoffs between request advance notice period, demand satisfaction percentage, and fleet size. Initial results indicate that DDT's can approach the cost effectiveness of public & timeliness of private transport.

4 - Modeling Commuter's Departure Time Choice: A Bayesian Theory Perspective
Zhang Dong, Tongji University, A227, NO.4800 Cao'an Rd., Shanghai, 210804, China, zhangdong_traffic@126.com, Teng Jing, Yang Xiaoguang, Chen Guojun

An agent based simulation platform was developed on basis of a commuters' departure time choosing behavior model which described the feedback and revision characteristics of the travel experience forming process from the Bayesian theory perspective. Also, the traveler information's effects were modeled and studied.

■ SA72

H - Salon J, 6th Floor

Innovations in Pricing of Transportation Systems: I

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Gainesville, FL, 32607, United States of America, yafeng@ce.ufl.edu

1 - A Solution Method for Robust Congestion Pricing Under User Equilibrium
Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Tae Il Kim, Terry Friesz

Congestion pricing has been regarded as an efficient method to manage travel demand by affecting travel behavior to minimize social cost or maximize a private firm's revenue. In this talk, we apply a robust optimization (RO) approach to user equilibrium optimal toll problems in the presence of transportation demand uncertainty. A solution method to find robust congestion tolls is proposed and numerical experiments are shown to evaluate the robust solutions.

2 - Pareto-improving Pricing-refunding Schemes in General Bi-modal Transportation Networks
Yu Nie, Assistant Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, y-nie@northwestern.edu, Yang Liu

This paper explores the existence of Pareto-improving pricing-refunding schemes in a bi-modal general network with heterogeneous users. Transit is explicitly modeled as an alternative to a general highway network that is slower but has a operating cost lower than its highway counterpart. The designs of Pareto-improving pricing-refunding schemes are discussed.

3 - Nonlinear Road Pricing
Siriphong Lawphongpanich, University of Florida, Gainesville, FL, 32607, United States of America, lawphong@ise.ufl.edu, Yafeng Yin

Nonlinear pricing refers to a case in which the price is not strictly proportional to the quantity purchased. In road pricing, such schemes generally yield generalized cost expressions not necessarily linkwise additive. However, for a significant number of nonlinear schemes, we show that link-based user equilibrium conditions exist. When they do not, we show how to modified standard algorithms such as the Frank-Wolfe algorithm to find equilibrium flow distributions under nonlinear pricing.

■ SA73

H - Salon K, 6th Floor

Generalized VRP Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

1 - A Lean Vehicle Routing Problem
Jeffrey Ohlmann, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, jeffrey-ohlmann@uiowa.edu, Michael Fry, Chuanjie Liao

Motivated by collaboration with a third-party logistics provider, we consider the management of the supply network for a company adhering to a lean production strategy. The considerations of low work-in-process inventory, production smoothing, and standardized work introduce temporal scheduling complexities in this lean logistics problem. We discuss and compare our modeling approach to alternatives.

2 - Self-imposed Time Windows in Vehicle Routing Problems with Disruptions and Fixed Shift Durations
Ola Jabali, PhD Student, Eindhoven University of Technology, Den Dolech 2 Paviljoen, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, o.gabali@tue.nl, Tom Van Woensel, Roel Leus, Ton de Kok

We consider the situation where a carrier company assigns time windows to serve its customers. The main difference between this setting and the vehicle routing problem with time windows (VRPTW) is that the time windows are decision variables, rather than constraints. This is optimized under disruptions in travel times. Our solution approach is a tabu search procedure coupled with an LP model, used for setting the time-windows. We compare our results with both VRP and VRPTW benchmark sets.

3 - Line-haul Outsourcing as a Solution for the Empty Balancing Problem in Trucking Transportation
Huy-Nhiem Nguyen, PhD Candidate, University of Arkansas, Room 4207, BELL Eng. Ctr., Fayetteville, AR, 72701, United States of America, hxn002@uark.edu, Ed Pohl, Chase Rainwater, Scott J. Mason

The problem of balancing empty containers is common amongst participants in the transportation sector. Most typically, logistics firms utilize only in-house resources to address this challenge. In this work, we consider line-haul outsourcing to rail transportation as an alternative strategy. We evaluate this strategy through the analysis of a service network design problem formulation that seeks to find the optimal set of outsourced line-hauls.

4 - Analysis of an Integrated Maximum Covering and Patrol Routing Problem
Rong (Shirley) Li, University of Alabama, Tuscaloosa, AL, 35487, United States of America, rli4@crimson.ua.edu, Burcu Keskin

We address the problem of determining the patrol routes and stopping locations of state troopers to cover highways with high frequency of crashes. By generalizing the traditional VRPTW to a public domain, we develop a mixed integer linear model with time limitation. As real life cannot be solved via existing software, we develop search-based heuristics. Via experiments using real data, we test the validity and usability of our model and solutions. We also provide detailed recommendations.

■ SA74

H - Room 602, 6th Floor

Advances in Real Time Route Guidance

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - Quantifying the Qualitative Benefits of Real-time Travel Information
Dong Yoon Song, Purdue University, West Lafayette, IN, United States of America, song50@purdue.edu, Srinivas Peeta

The deployment of Advanced Traveler Information Systems (ATIS) entails analyzing the benefits of real-time travel information for the various stakeholders. In this study, we seek to quantify the qualitative benefits of individual drivers in addition to the commonly analyzed quantitative benefits in terms of travel time savings. The level of satisfaction, the level of reliability, and other qualitative variables will be explored to measure qualitative benefits based on driver behavioral analysis vis-‡-vis the value of real-time travel information.

2 - Network Topology Based Vehicle Sensor Locations Under Dynamic Traffic Conditions
Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu, Srinivas Peeta

This study addresses the network sensor location problem under dynamic traffic conditions. It obtains time-dependent link-path incidence matrices for a given network over a planning period and then uses this information to identify the links in the network that enable maximal observability of traffic flows.

3 - A Dynamic Bilevel Formulation to Model Staggered Work Hours
Wilfredo Yushimito, PhD Candidate, Rensselaer Polytechnic Institute, 110 8th St. JEC 4030, Troy, NY, 12180, United States of America, yushiw@rpi.edu, Jeff Ban, Jose Holguin-Veras

Staggered work hours are achieved by varying the starting and release times in firms, for instance, staggering starting times in interval of 15 minutes, and adjusting their end times accordingly. In this paper we present a bi-level formulation to model staggered work hours: The behavior of the firm is modeled in the upper level as a minimization of the profit loss as a result of the firm's productivity loss. The behavior of the workers is modeled in the lower level as the maximization of their utility function which depends on of their departure time and route choice decisions embedded in a dynamic user equilibrium model. The model is used to provide insights about the interaction between workers and the firm, and why a third agent is required to provide incentives to both agents to stagger the starting times.

4 - Strategic Route Choice Behavior in a Driving Simulator
Hengliang Tian, University of Massachusetts-Amherst, 141 Marston Hall, 130 Natural Resources Road, Amherst, MA, 01003, United States of America, thliang17@gmail.com, Song Gao, Donald Fisher, Brian Post

We investigate travelers' strategic route choice behavior in risky traffic networks using data from human subjects on a full-scale driving simulator, specifically whether travelers plan ahead for real-time information that they will receive later en-route, and whether factors such as network complexity and cognitive load affect the ability to do strategic thinking.

Sunday, 11:00am - 12:30pm

■ SB01

C - Ballroom D1, Level 4

Impact of Environmental Regulation and Renewable-based Generation on Power Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Patricio Rocha, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, United States of America, procha@mail.usf.edu

1 - Augmented Screening Curve Approach to Optimizing Generation Capacity Additions Considering Reserves
Ross Baldick, University of Texas, Austin, TX, United States of America, baldick@ece.utexas.edu, Cheol-Hee Cho

A screening curve approach can be useful to estimate optimal additions to generation capacity for a target year. With increasing penetration of renewables, at least two issues need to be considered. First, the load-duration curve used in a traditional screening approach should be replaced with a net load-duration curve. Second, there is an increase in the amount of capacity needed to provide reserves, and both the capital and operating costs of this capacity should be considered.

2 - Optimal Wind Power Bidding in Electricity Markets
Audun Botterud, Energy Systems Engineer, Argonne National Laboratory, Decision and Information Sciences Div., 9700 S. Cass Ave., Bldg. 221, Argonne, IL, 60439, United States of America, abotterud@anl.gov, Jianhui Wang, Hrvoje Keko, Ricardo J. Bessa

We discuss optimal wind power bidding in the electricity market and propose a methodology to derive optimal day-ahead bids under uncertainty in wind power generation and prices. A probabilistic wind power forecast is used to represent the uncertainty in wind power generation. Different decision criteria, including expected profit, expected utility, and conditional value at risk are used to derive the optimal bidding strategy. We show how the optimal day-ahead bids depend on several factors.

3 - Technology Portfolio and Capacity Investments Under Uncertainty
Tiago Filomena, PhD Student, George Washington University, 1776 G Street NW, Washington, DC, 20005, United States of America, tiagopf@gwu.edu, Enrique Campos-Nanez

We present a model which helps to understand the impact of uncertainty in electricity generation investment. The model is a two-stage game with uncertainty on costs and demand. It helps to forecast the short-term portfolio of technologies, capacity availability and electricity clearing price for an oligopoly. The relation between environmental regulatory uncertainty and electricity capacity generation is discussed.

4 - Carbon Revenue Redistribution Strategies for Electric Power Markets
Patricio Rocha, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, United States of America, procha@mail.usf.edu, Tapas K. Das

The implementation of a CO2 emissions control scheme, either a cap-and-trade program with auctioned permits or a carbon tax, will provide the government with a new source of revenue. Economists advocate for the redistribution of this carbon revenue i.e., the emissions control scheme should be revenue neutral. We present an optimization model to redistribute the carbon revenue collected by an electricity-sector emissions control scheme among consumers and green generators over a planning horizon.

■ SB02

C - Ballroom D2, Level 4

Modeling Oil and Natural Gas Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Fernando Oliveira, Associate Professor, ESSEC Business School, Avenue Bernard Hirsch-BP 50105, Cergy, Cergy, 95021, France, oliveira@essec.fr

1 - Risk Diffusion in Natural Gas Networks by using CVaR Analysis
Parviz Darvish, PhD Candidate, ESSEC Business School, Avenue Bernard Hirsch - BP 50105, Cergy, 95021, France, parviz.darvish@essec.edu, Fernando Oliveira

The European natural gas market network as a strategic energy infrastructure in European countries is exposed to many risks, including demand uncertainty and supply disruptions, due to suppliers' policies, domestic resources depletion, weather problems, terrorist attacks, or political conflicts. In this paper we propose a quantitative risk analysis which considers how risk averse, profit-maximizing participants are affected by the different risk factors and how these spread in this network.

2 - Robust Investment Decisions for Disruption Risk in Petroleum Markets
Nalan Gulpinar, Professor, Warwick Business School, The University of Warwick, Coventry, United Kingdom, Nalan.Gulpinar@wbs.ac.uk, Kabir Katata, Ethem Canakoglu

Energy-dependent economies and energy security strategies need to cope with multiple supply risks of simultaneous oil and gas shortages. In this paper, we are concerned with modelling supply disruption risks and robust investment strategies in petroleum markets. We analyze financial and volumetric losses due to supply disruptions and present computational results to illustrate the performance of robust portfolio optimization models.

3 - Gas-based Industrialization and Export Diversification Strategies, A Portfolio Analysis
Olivier Massol, Assistant Professor, IFP School, 228-232 Avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifp.fr

The possession of natural gas resources is generally described as a blessing that should generate export-driven wealth for a small economy. Unfortunately, a casual observation of past performances reveals mixed results, highlighting the large variability of these export revenues. In that context, numerous gas-based industrialization strategies have been advocated as possible remedies. In this study, a mean-variance portfolio analysis is performed to identify optimal diversification strategies.

4 - Design of Financial Contracts and Procurement Risk Management in Oil Markets
Frederic Murphy, Professor, Temple University, Fox School of Business, Philadelphia, PA, United States of America, fmurphy@temple.edu, Fernando Oliveira

We analyze a refiner's procurement risk management strategy when trading in different types of crude oil. We develop a computational model of the decisions faced by a refiner, studying how financial contracts (options and forward contracts) and inventory management interact as insurance policies. We examine the proportion the firm should optimally refine, procure from each type of market, and study how its contractual position is a function of its risk profile.

■ SB03

C - Ballroom D3, Level 4

Open Pit Mining

Sponsor: Energy, Natural Resources and the Environment/ Mining Sponsored Session

Chair: Marcos Goycoolea, Universidad Adolfo Ibañez, School of Business, Peñalolén, Chile, mgoycool@gmail.com

1 - Methods for Improving the Tractability of the Block Sequencing Problem for Open Pit Mining

Marty Gaupp, Lieutenant Colonel, United States Air Force, AETC Studies and Analysis Squadron, 151 J Street E, Ste 2, Randolph AFB, TX, United States of America, Marty.Gaupp@randolph.af.mil, Christopher Cullenbine, Alexandra Newman, Kevin Wood

A surface mine optimizes its profits by maximizing the net present value (NPV) of minerals extracted from the orebody. This is accomplished by creating a production schedule that defines when each section, or block, of ore is removed while adhering to geospatial and operational constraints. We describe the complexities involved in such a formulation and suggest graph-theoretic based methodologies to expedite the solution times for instances of this block sequencing problem.

2 - Robustness, Risk and Recourse in for Open Pit Minning

Daniel Espinoza, Assistant Professor, University of Chile, Av. Republica 701, Santiago, Chile, daespino@gmail.com, Guido Lagos, Eduardo Moreno, Juan Pablo Vielma

In this work we consider the open pit problem with multiple processing methods, no cut-off grade, and uncertainty in the metal grade for each block. We also consider the case where processing decisions have recourse. We compare three different modeling approaches. The robust model of Bertimas-Sim, Chance constraints, and Conditional value at risk. Al three methods use sampling of the random parameters. Extensive testing on simulated ore-bodies and in some actual mines will be presented.

3 - Improving Solution Times of the LP Relaxation Bound for the Open Pit Mine Block Sequencing Problem

Kelly Eurek, MS student, Colorado School of Mines, Golden, CO, 80401, United States of America, keurek@mymail.mines.edu, Alexandra Newman

Using the standard integer programming formulation for the open pit mining block sequencing problem, we implement a sliding time window heuristic to solve large model instances. Examining the LP relaxation bound, we show validity of the heuristic to provide an optimal solution. Applying techniques to expedite solution time of the LP relaxation bound for the monolith, we demonstrate how improved solution times of the LP relaxation bound can be applied at each iteration of the heuristic.

4 - A LP Approach for the Open-pit Production Scheduling Problem

Eduardo Moreno, Universidad Adolfo Ibanez, Santiago, Chile, eduardo.moreno@gmail.com, Daniel Espinoza, Gonzalo Muñoz, Marcos Goycoolea

In this talk we present a scalable methodology for solving instances of the open-pit mine production scheduling problem. This methodology is based on solving the LP relaxation and applying a heuristic to obtain a good feasible solution. We compare this heuristic with others similar methodologies for this problem, and we discuss the impact of incorporate multiple destinations and variable cut-off grade. Finally, we present some analysis on real instances.

■ SB04

C - Ballroom D4, Level 4

Joint Session Clean Energy/ ICS: Power Grid Vulnerability Studies

Cluster: Clean Energy/Computing Society
Invited Session

Chair: Daniel Bienstock, Columbia University, 500 West 120th St., New York, NY, 10027, United States of America, dano@columbia.edu

1 - Online Control of Cascading Blackouts

Daniel Bienstock, Columbia University, 500 West 120th St., New York, NY, 10027, United States of America, dano@columbia.edu

We describe an algorithm that computes an online control algorithm for dampening cascading blackouts. Immediately after the initial event of the cascade, the algorithm is computed. In subsequent stages of the cascade, the algorithm is applied, with the goal of minimizing the amount of demand lost at the end of the cascade.

2 - Estimating Cascading Blackout Extent using Utility Data and a Branching Process

Ian Dobson, Professor, University of Wisconsin-Madison, ECE Department, 1415 Engineering Drive, Madison, WI, 53706, United States of America, dobson@engr.wisc.edu

We derive and test a probabilistic branching process model of the propagation of cascading transmission line outages with utility data. Then we assume the propagation observed in the utility data and estimate the probability distribution of the total number of lines outaged from assumed initial line outages. This novel bulk statistical approach quantifies the effect of cascading failure in making initial line outages more widespread.

3 - Resilience of the Power Grid to Large Scale Physical Attacks

Gil Zussman, Assistant Professor, Columbia University, Electrical Engineering, 500 W 120 st Room 1300, New York, NY, 10027, United States of America, gil@ee.columbia.edu, Daniel Bienstock, David Hay

We consider geographically correlated failures of parts of the power grid that may be caused by a natural disaster or a physical attack (e.g., an EMP attack). Failures of some power lines may lead to cascading failures of additional lines. Hence, failures of several lines in a specific geographical area may lead to a large scale cascading failure. We develop algorithms for identifying the most vulnerable parts of the network that may provide insight into the development of protection schemes.

■ SB05

C - Ballroom D5, Level 4

The Use of Analytics to Improve In-game Strategy in Sports

Sponsor: SpORts
Sponsored Session

Chair: Bret Myers, Villanova University, 442 Hartford Square, West Chester, PA, 19380, United States of America, bret.myers@villanova.edu

1 - The Use of Analytics to Improve Substitutions in Soccer

Bret Myers, Villanova University, 442 Hartford Square, West Chester, PA, 19380, United States of America, bret.myers@villanova.edu

Soccer managers face an important decision regarding substitutions in a particular match. Unlike many other sports, the number of substitutions in soccer is limited to three according to FIFA, the international governing body for soccer. The focus in this research is using past data to analyze the outcomes surrounding substitutions in soccer matches. The evidence from this study serves to provide soccer managers useful information to improve the chances of getting results in matches.

2 - Using MDP's to Decide When to Challenge Calls in Tennis

John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jhas@mail.utexas.edu, Vamsi Nadimpalli

We develop a Markov decision process model to decide when to challenge an umpire's call in tennis. The model incorporates the challenge type, probability of winning a point on serve, and the perceived probability that the umpire made an incorrect call. We solve the resulting average cost multi-chain MDP model using the dual linear program arising from the Bellman equations.

3 - "Punt, Pass or Kick?" A Refined Approach to Fourth-down Decision Making

Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Richard Cassady, Lisa Maillart, Yi Zhuang

We examine the critical decision of whether to attempt a field goal, punt or go-for-it on a fourth down. Our approach utilizes a Markov decision process to maximize the probability that a team will ultimately win the game as a function of the current field position, yards-to-go, time remaining and score differential. The transition probabilities associated with the millions of possible state vectors are estimated using play-by-play data from all NFL games played during the 2001-2009 seasons.

4 - Was Joe Girardi Foolhardy? An Analysis of the New York Yankee Manager's Decision to Use Only Three Starting Pitchers

James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

The 2009 Yankees followed convention by using a 5 man rotation in the regular season, allowing each pitcher 4 days rest between starts. This is done because a pitcher's performance (and probability of winning) is believed to deteriorate with less than 4 days rest between starts. However, the team deviated from this strategy in the World Series and used only its top 3 starting pitchers (allowing each 3 days rest between starts). We use decision analysis to assess the wisdom of this strategy.

■ SB06

C - Ballroom E, Level 4

Tutorial: Using Secondary Data in Operations Management (OM) Research: Overview and Research Opportunities

Cluster: Tutorials
Invited Session

Chair: Vinod R Singhal, Georgia Institute of Technology, College of Management, Atlanta, GA, 30332, United States of America, vinod.singhal@mgt.gatech.edu

1 - A Tutorial on using Secondary Data in Operations Management (OM) Research: Overview and Research Opportunities
Vinod R. Singhal, Georgia Institute of Technology, College of Management, Atlanta, GA, 30332, United States of America, vinod.singhal@mgt.gatech.edu

This tutorial will provide an overview of how to use secondary data in OM research. It will discuss data sources that are available, the research methods and statistics for use with secondary data, and an approach for carrying out this research. Basics of the event study methodology will be discussed. An application that uses this approach will also be discussed.

■ SB07

C - Ballroom F & G, Level 4

JFIG Paper Competition Finalists - II

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, hayhan@isye.gatech.edu

1- JFIG Paper Competition
Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta GA, United States of America, hayhan@isye.gatech.edu

The JFIG paper competition aims to encourage research among junior faculty and increase the visibility of research conducted by junior faculty within the fields of operations research and management science. 39 papers are submitted for this year's competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session, three of the six finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SB08

C - Room 11A, Level 4

Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Variable Radius Max-covering Min-overlap Location Models
Vladimir Marianov, Professor, Pontificia Universidad Catolica de Chile, Department of Electrical Engineering, Vicuna Mackenna 4860, Santiago, RM, 7820436, Chile, marianov@ing.puc.cl, Ha Eiselt

We propose and solve location models that maximize digital terrestrial TV coverage, maximize beneficial multiple coverage and minimize destructive multiple coverage when demands have more than one transmitter within coverage radius, when the covering radius of transmitters is variable. Preliminary computational experience is provided.

2 - Optimizing Capacity, Pricing and Location Decisions on a Congested Network with Balking
Hossein Abouee Mehrizi, University of Toronto - Rotman, Toronto, ON, Canada, H.AboueeMehrizi07@Rotman.Utoronto.Ca, Hassan Shavandi, Oded Berman, Sahar Babri

We consider the problem of making simultaneous decisions on the location, capacity and the price of providing service on a network. We assume that the demand for service from each node follows a Poisson process. The demand is sensitive to both price and distance. Upon arrival to a facility, customers may join the system after observing the number of people in the queue. We develop an algorithm to obtain the optimal capacity, approximate the optimal price and find the optimal locations.

3 - Facility Location and New Product Introduction
Vahideh Sadat Abedi, PhD Candidate, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, VahidehSadat.Abedi07@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

A firm offering a new product would like to locate facilities over a network of demand and use optimal price and advertising strategies to boost the projected demand over the time horizon. The advertising and pricing strategies used enhances the location decisions of facilities over time and hence profitability. Therefore, making location and marketing decisions separately is suboptimal. We derive several structural properties of the problem and investigate the structure of the optimal solution.

4 - Covering Links of a Planar Network
Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, George Wesolowsky

The problem of locating facilities in the interior of a planar network covering the links of the network is analyzed. Both minimization and maximization of cover are considered. The single facility location problem is solved by the global optimization approach called Big Triangle Small Triangle. The multiple facility maximization problem is solved heuristically. Computational experience with problems of up to 40,000 links demonstrate the effectiveness of the single facility location algorithm.

■ SB09

C - Room 11B, Level 4

Fairness in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nikolaos Trichakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building E40-130, Cambridge, MA, 02139, United States of America, nitric@mit.edu

1 - Managing Hospice Operations Under Medicare Reimbursement
Baris Ata, Northwestern University, Evanston, IL, United States of America, b-ata@kellogg.northwestern.edu, Tava Olsen, Rodney Parker, Bradley Killaly

The Medicare's hospice reimbursement policy consists of a daily payment for each patient under care with a global cap of revenues during the Medicare year, which increases for each newly admitted patient. We demonstrate several unintended consequences of the current reimbursement structure analytically. We also examine if the current policy is responsible for a recent spate of hospice bankruptcies. We propose an alternative policy, which overcomes the existing policy's shortcomings.

2 - Moral Hazard and Limited Liability: How Much Does it Cost?
Santiago Balseiro, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Felipe Balmaceda, Nicolàs E. Stier Moses, José R. Correa

We analyze the social welfare loss due to the existence of a moral hazard in the classical principal-agent problem. In the principal-agent problem, a principal hires an agent to perform a task. The agent chooses his effort intensity, which affects the task's return. Since the principal cannot observe the effort intensity, she ties the agent's compensation to the task's return. We show that the performance of the worst equilibrium depends on the complexity of the delegated task.

3 - Incentive Compatibility and Fairness in Organ Allocation
Anicham Kumarasamy, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, anichamk@stanford.edu, Stefanos Zenios

Policymakers in the United States have recently proposed to modify the kidney allocation system by assigning higher priority to patients who are on dialysis. We examine how this change may create an incentive for physicians to start their patients on dialysis prematurely. We then discuss how kidneys may have to be wasted in order for allocation to be fair and to discourage premature dialysis initiation.

4 - Fairness, Efficiency and Flexibility in Renal Transplantation
Nikolaos Trichakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building E40-130, Cambridge, MA, 02139, United States of America, nitric@mit.edu, Dimitris Bertsimas, Vivek Farias

The allocation of deceased-donor kidneys to patients on a waiting list is carried out by ranking them according to a scoring rule. We propose a mechanism for designing scoring rules that allows policymakers to balance efficiency and fairness, taking as input fairness constraints from a broad class of allowable constraints. We use the mechanism to design a scoring rule with the same fairness properties as the rule recently proposed by policymakers, achieving an 8% increase in extra life years.

■ SB10

C - Room 12A, Level 4

Interface of Operations and Finance

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Danko Turcic, Assistant Professor of Operations, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu

1 - Capacity Investments in Power Systems
John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jrbirge@uchicago.edu, Vishal Ahuja

Capacity investments in electric power systems require the consideration of multiple uncertainties in addition to prices and demand, such as future network structure, control, and regulation. This talk will describe models that incorporate these uncertainties in a consistent financial framework and the relative impact of uncertainties in these models on investments in renewable technologies.

2 - Integrating Production and Financial Decisions
Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu, Chunde Dai

We consider a firm whose net earnings evolve according to a Brownian motion which is influenced by the firm's operating strategy. The firm has to decide on the optimal operating policy (controling the drift of the earnings process) as well as the leverage ratio and the distribution of dividends.

3 - Effect of Term Structure of Futures Price on the Spot Procurement Policies
Ankur Goel, Case Western Reserve University, 10900 Euclid Avenue, 324 Peter B Lewis Bldg., Cleveland, OH, 44113, United States of America, axg312@case.edu, Genaro Gutierrez

We explore the effect of additional term structure information of futures prices on the procurement policies from the spot market. We compare a one-factor stochastic price model with a two-factor model. In addition, we explore the benefits of the frequent calibration of stochastic price process parameters. We conclude the efficacy of two-factor model over one factor model in reducing cost. Also, we show significant benefits of including seasonality in the price process parameters estimation.

4 - Why Risk-neutral Manufacturers Ought to Hedge Commodity Material Purchases
Danko Turcic, Assistant Professor of Operations, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu, Ehsan Bolandifar, Panos Kouvelis

We study a linear two-stage supply chain of a risk-neutral supplier (component manufacturer) selling to a risk-neutral manufacturer (intermediate or final good assembler). Both firms rely on credit, require commodity inputs, and face some operational and financial frictions. In the absence of any risk premium, we show that financial hedging increases the expected profits of both firms and improves supply chain efficiency.

■ SB11

C - Room 12B, Level 4

Game Theory in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

1 - Sequential and Simultaneous Pricing Games in Assembly Systems
Xiaowei Xu, Assistant Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, xiaoweix@andromeda.rutgers.edu

We study an assembly system, in which the suppliers are engaged in either a simultaneous or sequential pricing game. If the suppliers' pricing relationship is strategically substitutable (independent, complementary), then the retail, total supplier and system profits in the simultaneous pricing game are higher than (equal to, lower than) the profits in the sequential game. Log-concavity/linearity/convexity of a demand function implies strategic substitutability/independence/complementarity.

2 - Joint Selling Under Downstream Competition
Shuya Yin, University of California Irvine, Paul Merage School of Business, Irvine, CA, United States of America, syin@exchange.uci.edu, Yuhong He

This paper considers a simple system with n competing final products. Each final product is assembled from two complementary components. All the final products share one common component, which is provided by a monopolist supplier. The other component is dedicated and has n different brands and each brand is managed by an independent supplier. We investigate to what extend the common component supplier and the n competing suppliers would like to form a coalition and jointly sell their products.

3 - Invariance of Allocation Rules in Supply Chain Games
Mahesh Nagarajan, University of British Columbia, BC, Canada, mahesh.nagarajan@sauder.ubc.ca

We characterize sufficient conditions under which, when the number of players is large, dynamically stable coalition structures for a significant class of games remain invariant under the specific allocation rules used to divide profit within coalitions. We explore the associated class of games and allocation rules and discuss the implication to supply chain games.

4 - Cooperation and Subcontracting Issues in Project Management
Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu, Xiaoqiang Cai, Feng Zhang

We consider a project management problem where the project owner outsources the tasks to subcontractors. Task crashing, and task lengthening to reduce resource usage, apply. The cooperation of the subcontractors is studied as a cooperative game that is nonconvex. The game is balanced, and a closed form core allocation is found. We study the design of contracts with the subcontractors to maximize profit. The effects of asymmetric information are studied as a Stackelberg game.

■ SB12

C - Room 13A, Level 4

Joint Session MSOM/ SPPSN: Health and Humanitarian Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Public Programs, Service and Needs
Sponsored Session

Chair: Paul Griffin, Professor and Department Head, Penn State University, Department of Industrial Engineering, 310 Leonhard Bldg, University Park, PA, 16802, United States of America, pmg14@engr.psu.edu

1 - Impact of Infrastructure in African Health Care Delivery
Jacqueline Griffin, PhD Student, Georgia Institute of Technology, Atlanta, GA, 30309, United States of America, jackie.griffin@gatech.edu, Paul Griffin, Martin Savelsbergh

There are many characteristics of a region that can impact the efficiency of a health care distribution system including the location of health and population centers. We develop a model of a health care allocation system which examines trade-offs in equity, efficiency, and health impact. Using the model, we study the impact of settlement and health center locations on these trade-offs and the value of road infrastructure improvements.

2 - Robust Emergency Transportation Management
Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Aharon Ben-Tal, Andreas Thorsen, Byung Do Chung

Emergency problems for large scale transportation systems present challenges because of the inherent uncertainty and the complexity of the transportation systems. The main purpose of this talk is to explore the potential of robust optimization (RO) as a general computational approach to manage uncertainty, feasibility, and tractability for large scale emergency transportation problems including dynamic traffic assignment and transportation network design problems.

3 - Agent-based Simulations of Ambulance Diversion
Reidar Hagtvedt, Visiting Assistant Professor of Healthcare Operations Management, Alberta School of Business, University of Alberta, 2-43 Business Building, University of Alberta, Edmonton, AB, T6G2C7, Canada, hagtvedt@ualberta.ca, Gregory Todd Jones

Ambulance Diversion is a problem that is meant to occur only when a hospital cannot accept new patients in a medically responsible manner. However, anecdotal evidence suggests that decentralized systems for managing emergency departments do not always follow such idealistic guidelines. We apply agent-based simulations to investigate system performance, including efficiency, equality of treatment, as well as premature ambulance diversion, by hospital and government policies, as well as geography.

4 - Reducing TB Incidence in Clinical Settings in Resource Constrained Countries

Christina Scherrer, Southern Polytechnic State University, Industrial Engineering, Atlanta, GA, United States of America, cscherre@spsu.edu, Paul Griffin, Iris Yan, Chantelle Minarcine

With the emergence of multidrug (MDR) and extensively drug (XDR) resistant tuberculosis (TB) and its devastating effect on HIV populations, healthcare providers in resource constrained countries are struggling to find cost-effective ways to reduce incidence. We present an analysis for a variety of interventions under administrative, environmental, and respiratory protection controls for hospital and clinical settings. The resulting tool for site-based recommendations for the CDC is discussed.

■ SB13

C - Room 13B, Level 4

Supply Chain Revenue Management and Pricing

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

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

1 - Vendor's Discount Pricing for Product Groups with Price-Sensitive Demand

Ginger Ke, PhD Student, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, y3ke@engmail.uwaterloo.ca, James H. Bookbinder

A vendor offers a group-purchase discount in the case of price-sensitive demand for a set of SKUs, purchased by a single buyer. The problem is analyzed in the framework of a Stackelberg game. In light of the buyer's best reaction to the discount, the vendor determines his discount policy such that his payoff from this policy is maximized. Some insights about the optimal discount scheme are presented.

2 - Contract Design for Inventory and Pricing Decisions Under Stochastic Demand with Slutsky Symmetry

Su Zhao, PhD Student, Texas A&M University, 303K, Zachry Engineering Center, 3131 TAMU, College Station, TX, 77840, United States of America, susy.zhao@gmail.com, Sila Cetinkaya, Eylem Tekin

We study the coordination of inventory and pricing decisions over multiple periods in a decentralized buyer-vendor system. The consumer demand is a price-dependent random variable satisfying "Slutsky Symmetry" and unmet demand is lost. The vendor sets the contract parameters whereas the buyer decides on the order quantity and the retail price. We examine the necessary and sufficient conditions for different contractual mechanisms to achieve system optimal under decentralized decision-making.

3 - When Gray Markets Have Silver Linings: All-unit Discounts, Gray Markets and Channel Management

Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca, Mike Pavlin, Mengze Shi

We study unauthorized distribution channels (gray markets) caused by a reseller's response to a supplier's all-unit quantity discount offering. We perform a closed-form analysis of the reseller's optimal pricing, inventory and gray market diversion decisions. We identify conditions under which it is optimal for the profit-maximizing supplier to accommodate gray market diversion.

4 - Integrated Replenishment & Liquidation Decisions for a Capacitated Inventory System

Abhilasha Katariya, Graduate Student, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States of America, abhilashapk@neo.tamu.edu, Sila Cetinkaya, Eylem Tekin

We consider a multi-period, integrated replenishment & liquidation problem for a capacitated supplier facing stochastic demand from two markets: primary & secondary. The supplier must decide how much to produce & how much excess inventory to retain, to maximize expected profits. We prove that the optimal policy is characterized by two critical numbers; namely, produce-up-to & retain-up-to levels. We study the relationship between the policy & model parameters & examine effect on the policy.

■ SB14

C - Room 14, Level 4

Service Quality: Pricing and Information

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Ramandeep Randhawa, University of Southern California, 3670 Trousdale Pkwy, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu

1 - Revenue-maximizing Price-lead Time Menus: Capacity and Strategic Delay Optimality

Philipp Afeche, Assistant Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, afeche@rotman.utoronto.ca

We study the impact of the capacity level on the revenue-maximizing price-lead time menu of a service provider who faces heterogeneous customers with private information on their valuations and delay costs. We identify at what capacity levels it is optimal to use strategic delay to artificially inflate the lead time of the slower class. In certain cases strategic delay is optimal only if capacity is relatively abundant, but in other cases only if capacity is relatively scarce.

2 - Buying From the Babbling Newsvendor: Availability Information and Cheap Talk

Gad Allon, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Provision of real-time inventory availability information by a firm to its customers has become prevalent in recent years. Often, this information cannot be credibly verified by the customer. We analyze the the problem of how a firm can influence its customers' buying behavior.

3 - Signaling Quality Through Price and Service Rate

Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu, Laurens Debo

We study how a high quality service firm may set its service rates to differentiate from a low quality service firm, when the firm can neither communicate its service value nor its service rate to customers. Rational agents make joining decisions without observing the service rate or quality. We find that the combination of uncertainty about the quality of the service and the service rate can lead to a higher profits for service firms.

4 - Managing Satisfaction in Relationships Over Time

Ioana Popescu, Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ioana.POPESCU@insead.edu, Sam Aflaki

Consider a firm which has the flexibility to adjust and customize service level in order to manage client satisfaction and retention in a repeat-business context. What is the long term value of such flexibility and how should firms manage the service relationship over time? We propose a dynamic model of a firm-client relationship that relies on behavioral theories and empirical evidence to model the endogenous evolution of customer satisfaction and its impact on repurchase decisions.

■ SB15

C - Room 15, Level 4

Behavior in Competitive Markets

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Wedad Elmaghraby, Robert. H Smith School of Business, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu

1 - When Does it Pay to Delay Supplier Qualification? Theory and Experiments

Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu, Zhixi Wan, Damian Beil

We study a procurement setting in which the buyer seeks a low price but will not allocate the contract to a supplier who has not passed qualification screening. The buyer wishes to run a price-only, open-descending reverse auction between the incumbent and the entrant, and faces a strategic choice about whether to perform qualification screening on the entrant before or after the auction. We derive analytical results and test them in the laboratory, with human subjects.

2 - Repeated Distributive Negotiations: How Expectations of Future Transactions Impact Present Behaviors

Shweta Oza, Assistant Professor, Marketing, University of Miami, P.O. Box 248027, Coral Gables, FL, 33124, United States of America, soza@miami.edu, Rajesh Bagchi, Haresh Gurnani, Mahesh Nagarajan

We investigate the role that expectations of future transactions (EFT) play in influencing negotiator behaviors. Our rational model demonstrates that for exogenous probability of FT, behaviors in the current negotiation should remain unaffected by EFT. Using three behavioral experiments, we manipulate EFT and show that negotiator behaviors deviate systematically from model predictions. We also identify a moderator, negotiator role (buyer vs. seller), and investigate how this affects behaviors.

3 - Selling Mechanisms in B2B Secondary Market

Ali Pilehvar, PhD Student, Robert H Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States of America, apilehva@rhsmith.umd.edu, Mirko Kremer, Wedad Elmaghraby

Disposal of surplus inventory in B2B secondary markets is a challenge for any wholesale liquidator. Challenges include uncertainty in number of the buyers, their valuations as well as product quality. A key decision for the wholesale liquidator is the appropriate choice of selling mechanism, such as auctions or fixed-price markets. We investigate this choice problem by both analytically and empirically studying one of the leading wholesale liquidators of surplus inventory in North America.

4 - Why Should Sellers Prefer Sequential Mechanisms?

Andrew Davis, Penn State University, 462A Business Building, University Park, PA, 16802, United States of America, adavis@psu.edu, Anthony Kwasnica, Elena Katok

We investigate two mechanisms used by sellers where buyers must incur a cost to observe their own private value. In the sequential mechanism, a buyer begins by setting a preemptive bid. A second buyer, upon observing this bid, then decides whether or not to enter an auction and compete with the first buyer. In the auction mechanism, the two buyers compete via an auction without any preemptive bid. We find that, counter to theory, the sequential mechanism generates the greatest revenue.

■ SB16

C - Room 16A, Level 4

Next Generation Wafer Fabs

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Jesus Jimenez, Assistant Professor, Texas State University-San Marcos, Ingram School of Engineering, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu

1 - Time Space Tradeoffs in GA Based Feature Selection for Workload Characterization

Clara Novoa, Assistant Professor, Texas State University, 601 University Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu, Daniel Lowell, Dan Tamir

This work explores time/space tradeoffs inherent to genetic algorithms (GA) by implementing record keeping mechanisms such as cache implementation to minimize redundancy. The application motivating this work is workload characterization to analyze the power performance of semiconductors through feature selection. The experimental results demonstrate the utility of record keeping in the GA domain by showing a reduction in execution time with virtually the same solution quality.

2 - A Decomposition of Productivity Change in the Semiconductor Manufacturing Industry

Chia-Yen Lee, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, cylee1980@tamu.edu, Andrew Johnson

This study divides a production system into three components: production design, demand support, and operations. Efficiency is then decomposed via Network Data Envelopment Analysis and integrated into the Malmquist Productivity Index framework. An empirical study using data from 1995 to 2000 for the semiconductor manufacturing industry is presented to demonstrate and validate the proposed method.

3 - AMHS Productivity Detractors Affecting Small Wafer Lot Manufacturing

Jesus Jimenez, Assistant Professor, Texas State University - San Marcos, Ingram School of Engineering, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu, Robert Wright

Small-lot-size manufacturing will enable cycle time reductions in next generation semiconductor wafer fabs by reducing the amount of wafers per carrier. However, the automated material handling system (AMHS) may become a critical factor that constraints the capacity of the 12-wafer-lot systems as a result of the increased load that the AMHS will suffer. In this research, AMHS productivity detractors affecting these systems are studied using simulation. Results show improved AMHS performance.

■ SB17

C - Room 16B, Level 4

Edelman Encore Presentation

Cluster: Practice of OR/MS
Invited Session

Chair: Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

1 - Improving Water Release Policies on the Delaware River Through Operations Research

Peter Kolesar, Professor Emeritus, Columbia University, 314 Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, pjk4@columbia.edu

The Delaware River provides half of New York City's water, is a habitat for wild trout and has suffered major floods. We describe the analyses and the politics that led to the implementation of our optimization based "Adaptive Release" framework that improved fish habitat by 200% at no increase in the City's drought risk . In addition to meeting the stated goals, our algorithm offers modest increases in flood protection during the hurricane season, and is simpler to administer.

2 - Inventory Optimization at Procter & Gamble: Real Benefits Through Adoption of Inventory Tools

Sean Willems, Associate Professor of Operations Management, Boston University, SMG 673, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, willems@bu.edu, William Tarlton, Glenn Wegryn

Four billion times a day, P&G brands touch the lives of people around the world. Familiar brand names - Tide, Crest, Gillette, and 300 more - are supplied to 180 countries via 500 supply networks. P&G leveraged its cross-functional organization with OR in a two-step process. First, spreadsheet models locally optimized. Second, P&G's more-complex supply chains implemented multi-echelon inventory optimization. Today, more than 90% of P&G's business units utilize these inventory management tools.

■ SB18

C - Room 17A, Level 4

Optimization in Practice

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Jeremy F. Shapiro, Professor Emeritus, Massachusetts Institute of Technology, 226 Commonwealth Ave, Boston, MA, 02116, United States of America, jfsinc@attglobal.net

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Optimizing Boat Resources at the U.S. Coast Guard: Deterministic and Stochastic Models

Michael Wagner, Saint Mary's College of California, 380 Moraga Rd, Moraga, CA, United States of America, mrw2@stmarys-ca.edu, Zinovy Radovilsky

We detail the results of an applied research project where we optimally allocate a fleet of boats for the United States Coast Guard. The fleet consists of hundreds of boats of different types, which needs to be allocated to approximately 200 stations on both coasts of the United States, as well as Hawaii and Alaska.

2 - Advanced Analytics for Sales & Operations Planning

Jeremy F. Shapiro, Professor Emeritus, Massachusetts Institute of Technology, 226 Commonwealth Ave, Boston, MA, 02116, United States of America, jfsinc@attglobal.net

Sales & Operations Planning is a methodology for coordinating supply chain and demand management decisions. Many companies have implemented S&OP processes but most rely on software that acquires and integrates relevant data but do not employ advanced analytics - optimization models integrated with descriptive models - to support decision making. We discuss how these analytics can be constructed and applied to S&OP problems arising in industrial commodities and consumer package goods companies.

3 - Modeling and Solving a Large-scale Call Center Network Configuration Problem

Hari Natarajan, University of Miami, Miami, FL, United States of America, hari@miami.edu, Anuj Mehrotra, Geoffrey Meester, Michael Seifert

Service firms are increasingly partnering with independent vendors to create call-center networks that deliver high service quality at low costs. We develop a novel MIP model to configure such a network, addressing the vendor selection and call distribution decisions, while balancing cost and revenue considerations. Results from the application of this approach to data from a large firm suggest that our approach can yield considerable cost savings and additional revenues.

4 - OR Applications at Sears

Mike Baum, Senior Statistical Analyst, Operations Analytics Team, Sears Holdings Management Corporation, 1300 Louis Henna Blvd., Round Rock, TX, 78664, United States of America, Mike.Baum@searshc.com

Sears Holdings Corporation is the nation's fourth largest broad line retailer with approximately 3,900 stores in the US and Canada. The Customer Care Network (CCN) operates 16 call centers within the United States and partners with 5 vendors world wide and answers over 15 million customer calls per year in support or the retail store, online, and service businesses. The CCN analytic team uses O.R. techniques to enhance and improve CCN call center operations.

■ SB19

C - Room 17B, Level 4

Modeling Choice in RM

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu

Co-Chair: Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

1 - Learning and Earning via Iterated Least Squares

N. Bora Keskin, PhD Candidate, Stanford University, 121 Campus Dr. Apt. 3403A, Stanford, CA, 94305, United States of America, Keskin_Bora@gsb.stanford.edu, J. Michael Harrison, Assaf Zeevi

Consider a price-setter who sells a product over a sequence of time steps, observing demand in each sales period. The seller initially does not know the underlying demand model, but can estimate it using observed demand data. We analyze the performance of a dynamic pricing policy that is based on iterated least squares (ILS). We show that the ILS-based policy can perform very poorly due to its dependence on myopic actions. We then propose modifications that guarantee near-optimal performance.

2 - A New Approach to Choice Modeling

Srikanth Jagabathula, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jskanth@mit.edu, Vivek Farias, Devavrat Shah

Customer choice models are critical in decision making; however, identifying the `right' choice model to use is a non-trivial task. Thus motivated, we consider: For a `generic' model of consumer choice (namely, distributions over preference lists) and a limited amount of data on how consumers actually make decisions (such as marginal preference information), how may one predict revenues from offering a particular assortment of choices? We present a framework to answer such questions.

3 - CDLP-based Bid Prices for Network Revenue Management

Gustavo Vulcano, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Isabel Mendez, Juan Manuel Chaneton, Paula Zabala

The primal solution of the linear programming formulation for choice-based revenue management (CDLP) is known to be effective from a revenue perspective. However, from a practical perspective, there is a representation issue since airline systems are in principle incompatible with those offer sets. In this work, we consider a variation of the CDLP that naturally generates bid-prices. From our exhaustive numerical experiments, their performance is promising.

4 - Sparsity in Conjoint Analysis

Garud Iyengar, IEOR Department Columbia University, IEOR Department Columbia University, New York, NY, United States of America, garud@ieor.columbia.edu

In this talk we will motivate the need for sparse part weight vectors in conjoint analysis and then describe fast algorithms for computing these sparse part weight vectors from data in the presence of customer heterogeneity. We will also contrast our proposed methods with semi-parametric statistical techniques such as the Chinese restaurant process and the Indian buffet process.

■ SB20

C - Room 18A, Level 4

Restaurant's Table Top Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Yihua Li, Researcher, Walt Disney World, Coorporate Building, Orlando, FL, United States of America, yihua.li@disney.com

Co-Chair: Lila Rasekh, Researcher, Walt Disney World, Headquarter, Orlando, FL, United States of America, lila.rasekh@gmail.com

1 - Linear Model with Table Combination - A Revenue Management Approach

Yihua Li, Researcher, Walt Disney World, Coorporate Building, Orlando, FL, United States of America, yihua.li@disney.com

This presentation provides an alternative modeling approach to table top revenue management. This linear model enables table combination to satisfy demand from large groups. Compared with alternative models which do not allow table combination, the proposed model brings a substantial amount of additional revenue each year according to the test using operations data.

2 - Market Basket Allocation From Transactional Data: A Heuristic Approach

Jerry Han, Disney, 1375 Buena Vista Drive, Lake Buena Vista, FL, 32830, United States of America, jerry.han@disney.com, Anjali Dange, Laura Beri

An allocation algorithm based on transactional analysis was developed to provide insights into individual purchase patterns within transactions that represent purchases of several individuals. Purchases within each transaction are broken down into individual "basket combinations" according to their relative strength of connections. This method helps identify the impact of product/menu/price changes on purchase patterns as well as strategic impacts for the entire basket purchase patterns.

3 - Forecast Reconciliation Method for a Restaurant Revenue Management SYSTEM (RMS)

Mehmet Gulsen, Walt Disney, Orlando, FL, United States of America, Mehmet.Gulsen@disney.com

The complexity of the demand hierarchy in RMS makes it difficult to implement a straight top-down or bottom up approach. Furthermore, the length of booking window varies significantly from one restaurant to another which makes booking curve based (i.e. pick up) forecasting models less useful. One solution is to employ different forecasting methods in parallel and then consolidate multiple forecasts into a final one based on the characteristics of each restaurant.

4 - A Revenue Management Approach to the Table Top Reservation

Lila Rasekh, Researcher, Walt Disney World, Headquarter, Orlando, FL, United States of America, lila.rasekh@gmail.com

This research is based on the table reservation practice for restaurant business In this paper we present a unique linear model to optimally assign reservations sequentially to table tops to maximize the utilization of the dining tables and their seating capacity in terms of the total revenue. A heuristic provides a quality initial solution to expedite the branch and bound process.

5 - Testing Some Restaurant Revenue Management Models

Bruce Wang, Assistant Professor, Texas A&M University, 3136 TAMU, Zachry Department of Civil Engineering, College Station, TX, 77843, United States of America, bwang@tamu.edu, Yihua Li, Lila Rasekh, Kai Yin

Some optimization models for the restaurant table reservation system have been developed. These static models determine allocation of tables to customer requests with an objective to maximize the total revenue. The presentation will focus on the numerical performances and some analytical results of the models.

■ SB21

C - Room 18B, Level 4

Improving Healthcare Processes

Sponsor: Service Science
Sponsored Session

Chair: John Dulin, Concurrent Technologies Corp, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com

1 - Standardization and its Implications for Service Quality - Evidence From German Hospitals
Roman Mennicken, Research Associate, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, mennicken@wiso.uni-koeln.de, Desdemona Hucke, Ludwig Kuntz

The impact of increasing standardization on quality in service delivery is unclear. We assess the level of standardization with variations in the service time of 70 German hospitals. In-hospital mortality for specific diagnoses is used to assess service quality. Using econometric analyses we identify a clear curvilinear relationship between service quality and level of standardization. While too much or too little worsens service quality, an optimum level can be achieved.

2 - Collaborative Healthcare using Medical Service Cyberinfrastructure
John Jung-Woon Yoo, Assistant Professor, Bradley University, 408 Morgan Hall, Peoria, IL, 61625, United States of America, jyoo@bradley.edu

Medical service providers are not active in sharing their services with other providers. Instead, they provide referrals, which often cause redundant services. In this talk, we define medical operations, examinations, or consultations as medical services and propose a cyberinfrastructure that can provide collaborative healthcare services, in which XML-based medical service description language plays an important role in defining medical services.

3 - Patient Impatience: Merging Process Analysis Techniques to Improve Healthcare Efficiency
John Dulin, Concurrent Technologies Corp, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com, Dave Davis, Norm Reitter, Ashlee Knapp

If a patient's journey through a healthcare organization can be accurately modeled and analyzed with a clear vision of easing the restricting effects of limited funding, increased demand, and reduced resource availability, then various techniques can be effectively merged to establish a successful performance improvement plan. We will demonstrate a flexible general hospital model that we have developed for scenario-based comparisons using simulation software and real-world planning factors.

4 - Doctors, Health Care, and Management Science: Where do They Meet?
Steve Barrager, Publisher, BakerStreetPublishing.com, 2703 Broderick Street, San Francisco, CA, 94123, United States of America, publisher.bakerstreet@gmail.com

I am a highly trained management scientist with over thirty years of professional experience. Three years ago I was diagnosed with Multiple Myloma, a rare bone marrow cancer. Thanks to modern medicine my cancer is now in almost complete remission. To prepare for this talk, I took my patient hat off and put my management scientist hat on. I interviewed several of my doctors. I asked them what my profession could do to help them. This talk summarizes what I learned.

■ SB22

C - Room 18C, Level 4

Improving Sales Productivity

Sponsor: Service Science
Sponsored Session

Chair: Yingdong Lu, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, yingdong@us.ibm.com

1 - Analyzing the Effectiveness of a Loyalty Program: A Case Study in Automobile Industry
Hyun-Jin Kim, Pohang University of Science and Technology, Pohang, Korea, Republic of, brightst@postech.ac.kr, Kwang-Jae Kim, Ryeok-Hwan Kwon

A loyalty program is now a popular marketing tool in various industries. It typically provides customers with loyalty incentives such as membership points redeemable for discounts or prizes and free additional services to induce customers' repurchase. However, its effectiveness is not always guaranteed. In this talk, we present how the structural equation modeling (SEM) can be used to measure and analyze the effectiveness of a loyalty program. A case study on the loyalty program of an automobile manufacturing company is also presented.

2 - Dynamic Modelling of Online Consumer Decision Making Process
K. Nadia Papamichail, Senior Lecturer in Information and Decision Systems, Manchester Business School, University of Manchester, Booth Street West, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk, Sahar Karimi, Christopher Holland

In this paper a dynamic model of online consumer behaviour is proposed and tested using focus groups and video-based assessments of individual online users. A multi-sector approach is taken. The results suggest that purchase decision making on the Internet is highly dynamic. It is influenced by the interaction of consumers with their online environment. In addition, online research and purchase behaviour of customers, and the factors that affect their behaviour vary across different sectors.

3 - Relationship Between Consumer Valuation Distribution and Subscription Pattern in IT Services
Hyoduk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu, Marius Florin Niculescu, Seungjin Whang

We present an analytical relationship between consumer valuation distribution and aggregate subscription pattern over time in the information technology services industry under network externalities. We build up a microeconomics model and a theory based on consumer utility to explain the observed subscription pattern. We illustrate our results empirically using historical data for mobile data services in the Japanese market.

4 - A Framework for Sales Force Productivity Profile Estimation
Mayank Sharma, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, mxsharma@us.ibm.com, Moninder Singh, Aleksandra Mojsilovic

Salesforce productivity, defined roughly as the revenue potential of an employee, is an important metric in evaluating the profitability of a sales organization. Understanding and effectively managing sales productivity profiles would allow a business to improve its earnings without necessarily growing the salesforce. We present a framework for inferring the time-varying productivity profiles of the sales-force, based on the analysis of historical sales data from an ERP system.

■ SB23

C - Room 18D, Level 4

Service Innovation in Developing Economies II

Sponsor: Service Science
Sponsored Session

Chair: Janny Leung, CUHK, SEEM Dept, CUHK, Hong Kong, Hong Kong - PRC, janny@se.cuhk.edu.hk

1 - Handling Medical Emergency Situations in Developing Economy - An Innovative Workflow Model
Sreya Chattopadhyay, Doctoral Student, University of Rajasthan, J L Nehru Road, Gandhi Cricle, Jaipur, RJ, 302055, India, sreyaonline@gmail.com, Nilanjan Chattopadhyay

This article proposes a workflow model to prioritize critical patients in emergency situations. In developing countries, infrastructure cannot support sudden increase in demand of medical attention. This will integrate a unique easy-identifiable coding into the basic patient registration system in the hospital. The coding system helps in identifying the critical patients easily, passing on the information to a network and ensuring prompt treatment for critical patients.

2 - A Simulation Study on Patient Flows for a Hospital Emergency Department
Janny Leung, CUHK, SEEM Dept, CUHK, Hong Kong - PRC, janny@se.cuhk.edu.hk, Yong Hong KUO

In this talk, we present a staffing problem faced by the Accidents and Emergencies Department at Prince of Whales Hospital in Hong Kong. A simulation approach is adopted to analyze how the staffing decision impacts on the patient flows. Simulation techniques for incomplete data are also discussed.

3 - Prospective Surveillance of Healthcare Outcomes by False Discovery Rate Control
Yanting Li, Assistant Professor, Shanghai Jiaotong University, Dongchuan Road 800, Shanghai, SH, 200240, China, ytli@sjtu.edu.cn, Fugee Tsung

The statistical CUSUM charts have been envisaged as powerful tools for healthcare surveillance. We study the multiplicity problem caused by huge numbers of health-care units under surveillance. Multiple Binomial and Poisson CUSUM charts incorporating False Discovery Rate control is proposed to tackle such a problem. The procedures for establishing the new control schemes are presented and their performance is evaluated. The methods for obtaining the p-values of the CUSUM statistics are provided.

■ SB24

C - Room 19A, Level 4

Planning for Extreme Weather Events I

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu

1 - Emergency Shelter Location and Allocation During Extreme Weather Events

Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu, Sara Ghorbani

We present stochastic optimization models that assign vulnerable populations to health care centers based on their condition. We categorize people into three groups depending on their having; cardiovascular, respiratory, or dehydration problems. Demand for health care is random so is mortality due to the lack of treatment. Our objective is to minimize the increase in the mortality rate during extreme heat events.

2 - Vehicle Routing and Evacuations

Douglas Bish, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States of America, drb1@vt.edu

When evacuating a region because of a threat, care must be given to consider the segment of the population that requires specialized evacuation services due to a lack of access to an appropriate vehicle. We study the use of variants of the vehicle routing problem as applied to evacuation management, including the consideration of evacuee behavior and evacuation management issues.

3 - The Use of Hospitalization Records for Assessing Effects of Extreme Weather Events

Elena Naumova, Professor, Tufts University, 136 Harrison Avenue, Boston, MA, 02111, United States of America, elena.naumova@tufts.edu

Due to extreme heat people undergo physiological adaptive processes that compromise immune function, exacerbate chronic health conditions, and increase susceptibility to infections. Failure to consider delays between timing of exposure and medical care utilization results in severe underestimation of health effects. Surge in hospitalizations, given fixed capacities, not only depends on susceptibility to exposure and heterogeneity of affected population, but also time-distributed dose-responses.

■ SB25

C - Room 19B, Level 4

Joint Session SPPSN/MIF/ TSL: Humanitarian Logistics

Sponsor: Public Programs, Service and Needs/ Minority Issues/ Transportation Science and Logistics Society
Sponsored Session

Chair: Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 E. Market St., 424 McNair Hall, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu

1 - Inventory Control Strategies for Uncertain Demand Disruptions Considering Forecasted Storms

Kandace Ballard, Auburn University, 793 Tracy Ct., Auburn, AL, United States of America, kcn0001@auburn.edu, Emmett Lodree

When retailers are faced with an uncertain demand surge, we propose that retailers should select an ordering strategy instead of a specific quantity. If a retailer chooses a reactive strategy, they will maintain their order quantity until the surge is observed, and if they are proactive, they will increase their order quantity before the surge occurs. Minimax decision criterion is used to determine which inventory ordering strategy the retailer should choose considering lead-time and lost sales.

2 - Improving Collaboration for Emergency Resource Allocation

Karl Pfeiffer, Assistant Professor, Naval Postgraduate School, Dept of Information Sciences, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kdpfeiff@nps.edu, Man-Tak Shing, Shawn Kelly, Corey Mazcyk

In many emergencies, key resources are supplied and distributed through government agencies, businesses, charities and other organizations. While these entities may have efficient internal methods for communication and coordination, global collaboration is often hindered by political, social, and technological challenges. This research offers a framework for an open software solution enabling collaboration and coordination among suppliers, logistics organizations, and those managing need.

3 - Logistics Planning for Short-term Needs of Evacuees

Mark Turnquist, Professor, Cornell University, Civil & Environmental Eng'g, Hollister Hall, Ithaca, NY, 14853, United States of America, mark.turnquist@cornell.edu, Carmen Rawls

Natural disasters often result in large numbers of evacuees being temporarily housed in schools, churches, etc. The sudden influx of people seeking shelter creates demands for emergency supplies which must be delivered quickly. A dynamic allocation model is constructed to optimize pre-event planning for meeting short-term demands (over approximately the first 72 hours) for emergency supplies under uncertainty about what demands will have to be met and where those demands will occur.

4 - A Framework for Analyzing Uncertain Supply in a Humanitarian Supply Chain

Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 E. Market St., 424 McNair Hall, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu, Daniel Mota

During times of disaster relief supplies can come in the form of donations which vary in quantity, condition, and receipt timing. The management of these donations can be somewhat complex and hamper the relief effort. We present a framework that analyzes the impact of these donations and provide insight on how the humanitarian supply chain could benefit from improved coordination and information.

■ SB26

C - Room 4A, Level 3

Data Mining Best Student Paper Award Presentations I

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, United States of America, jpbrooks@vcu.edu

1 - Hidden-Markov Model based Sequential Clustering for Autonomous Diagnostics

Akhilesh Kumar, Doctoral Candidate, ISE, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, ax5266@wayne.edu, Finn Tseng, Yan Guo, Ratna Babu Chinnam

We present a novel approach for autonomous diagnostics that employs model-based sequential clustering with hidden-Markov models as a means for measuring similarity of time-series sensor signals. The proposed method has been tested on a CNC machining test-bed outfitted with thrust-force and torque sensors for monitoring drill-bits. Preliminary results revealed the competitive performance of the method.

2 - Interpretable Classifiers From Association Rule Conditions and Markov Boundary Pruning

Houtao Deng, Research Associate, Arizona State University, APT 16 East Orange Street 1020, Tempe, AZ, 85281, United States of America, hdeng3@asu.edu, George Runger, Eugene Tuv

Associative classifiers (ACs) attempt to integrate the simplicity of association rules with classification and their high accuracy makes them promising. However, the combination of many rules often results in models that are difficult to interpret. This research integrates rule ranking, pruning and summarizing together and generates an AC based on rule conditions. Experiments illustrate improved interpretability without loss of accuracy over a state-of-the-art AC and decision trees.

3 - Joint Estimation of Multiple Graphical Models

Jian Guo, University of Michigan, 269 West Hall, 1085 South University, Ann Arbor, MI, 48109, United States of America, guojian@umich.edu, Ji Zhu, Elizaveta Levina, George Michailidis

This paper develops an estimator appropriate for data from several graphical models that share the same variables. This model jointly estimates the graphical models corresponding to the different categories present in the data, aiming to preserve the common structure, while allowing for differences between the categories. We establish the asymptotic theory, and illustrate the superior performance on simulated networks and the term networks estimated from webpages.

4 - Tangent Hyperplane Kernel Principal Component Analysis for Denoising

Joon-Ku Im, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, ijk@u.northwestern.edu, Daniel Apley

Kernel principal component analysis (KPCA) is a method that can be used for denoising multivariate data. Using geometric arguments, we demonstrate a projection operation inherent to all existing KPCA denoising algorithms can sometimes cause poor denoising, and we propose a modification to the projection operation that remedies this problem. Using toy examples and a real data set, we demonstrate that the proposed algorithm can substantially improve denoising performance.

5 - Stochastic Search with an Observable State Variable
Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu

Many stochastic, convex optimization problems have behavior that depends on an observable state variable. We use machine learning to take observations from the joint state-outcome distribution and use them to infer the optimal decision for a given observed state. We propose two solution methods: function based optimization and gradient based optimization. These methods are tested on the hour ahead wind commitment problem and a multi-product newsvendor problem.

■ SB27

C - Room 4B, Level 3

Network Search and Interdiction

Sponsor: Computing Society
Sponsored Session

Chair: J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu

1 - Edge Search for an Immobile Hider with Imperfect Detection Probability
Shantih Spanton, University of Florida, Department of Industrial and Systems Eng, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, J. Cole Smith, Joseph Geunes

We consider the problem detecting an immobile hider on a network with a single searcher. Each arc has a weight that represents the likelihood the hider may be found on the link. After traversing an arc, the weight of this arc is decreased at a rate proportional to some detection probability. We examine the problems of maximizing the probability of finding the hider within some time limit, and minimizing the expected time until the hider is detected.

2 - Interdicting a Maximum Flow Network in Two-dimensional Euclidean Space
Kelly Sullivan, University of Florida, Department of Industrial and Systems Eng, P.O. Box 116595, Gainesville, FL, 32611, United States of America, kmsullivan@ufl.edu, J. Cole Smith

We consider a maximum flow network whose nodes and arcs lie in a two-dimensional Euclidean space. An interdictor chooses a coordinate location to attack, thus reducing the capacity of surrounding arcs. A defender then solves a maximum-flow problem on the resulting network. We formulate the problem of choosing an attack location that minimizes the defender's maximum flow, and use a branch-and-cut approach to solve the problem.

3 - An Integer-programming-based Approach to the Geometric Covering Salesman Problem
Behnam Behdani, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, J. Cole Smith

The geometric covering salesman problem (GCSP) is a generalization of the TSP in which the salesman must visit at least one point in a compact vicinity of each city. We develop an integer-programming-based scheme to solve this problem by providing a sequence of upper and lower bounds for the optimal solution. These bounds are obtained by solving instances of the covering tour problem. We develop equivalent formulations that provide better bounds and propose several groups of valid inequalities.

■ SB28

C - Room 4C, Level 3

Multivariate Analysis and Quality Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Justin Chimka, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, jchimka@uark.edu

1 - The Application of Higher-order Polynomial Models to Nanoparticle Manufacturing
Paul Goethals, Clemson University, Freeman Hall 150, Clemson, SC, 29634, United States of America, pgoetha@clemson.edu, Byung Rae Cho

Unlike the traditional production process, manufacturing at the nano-level requires a greater degree of statistical control and enhanced predictive capability. The tools and methods currently used do not adequately support the level of product quality necessary in the development of nanomaterials. This research specifically addresses the implementation of new statistical techniques that are more suited for advancing the quality of nanomanufactured products and processes.

2 - Developing Quality Control Standards to Evaluate Microarray Studies
Jing Wu, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, jxw067@uark.edu, Justin Chimka

We show how clustering and logistic regression can be used to establish working parameter thresholds relevant to the quality of a DNA microarray image.

3 - R&R Studies for Functional Data
Flavio Fogliatto, Professor, UFRGS - Federal University Rio Grande do Sul, Av. Osvaldo Aranha, 99 - 5o andar, Porto Alegre, RS, 90035-190, Brazil, ffogliatto@producao.ufrgs.br, Alexandre Pedott

We present a method to analyze a measurement system's (MS) performance in a functional data analysis context, based on repeatability and reproducibility (R&R) studies. Functional data are a collection of data points organized as a profile or curve. In the proposed method we adapt ANOVA to be used in MS analysis using distances between curves. Three ANOVA approaches are proposed and applied in a simulated R&R study conceived to analyze scenarios in which the MS was approved or rejected.

4 - A 0-1 Quadratic Program for the Case of Missing Data in Regression
Brian Smith, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, bks07@uark.edu, Heather Nachtmann, Justin Chimka

The problem of choosing what columns and rows with missing data should be discarded before regression analysis will be mathematically formulated and shown to fit the QP description with a caveat that every variable must equal 0 or 1.

■ SB29

C - Room 5A, Level 3

Systems Reliability and Maintenance

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

Co-Chair: Joe Alex Granado, Research Assistant, Texas State University, 601 University Drive, San Marcos, TX, United States of America, jg1509@txstate.edu

1 - Optimal Planning of Life-depleting Maintenance Activities
Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States of America, anahitakhojandi@gmail.com, Lisa Maillart, Oleg A. Prokopyev

We consider a system with a known, deterministic initial lifetime that generates reward at a rate that decreases as the virtual age of the system increases. Maintenance can be performed to reduce the virtual age of the system; however, maintenance also shortens the remaining lifetime of the system. Given this tradeoff, we analyze the lifetime-reward-maximizing maintenance interval under various scenarios.

2 - Post-Pareto Optimality for Multiple Objective Problems using Self Organizing Trees
Heidi Taboada, Assistant Professor in Industrial, Manufacturing and Systems Engineering, Univeristy of Texas at El Paso, 500 W. University Ave., El Paso, TX, United States of America, hataboada@utep.edu, Oswaldo Aguirre

The solution to a multiple objective problem is usually not a single solution but a set of Pareto-optimal solutions. A new method based on self-organizing trees for reducing the size of Pareto-optimal sets is presented. The method is tested on several examples resulting from multiple objective formulations of network reliability problems.

3 - Power Systems Optimization using Genetic Algorithms
Jose Espiritu, Assistant Professor in Industrial Engineering, Univeristy of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, jfespiritu@utep.edu, Vasukumar Chenna

A new genetic algorithm is developed and applied to a radial distribution configuration to obtain optimal replacement policies over a finite time horizon subject to budget constraints. The algorithm considers two decisions to be made at the beginning of each time period which are to either keep the component in the system for one more period or replace it with a new one. The main objective is to minimize the total costs taking into account maintenance, unavailability and purchase costs.

4 - Condition Based Maintenance of Multi-component Systems using Prognostics Information
Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Jialin Cheng

In a multi-component system, economic dependency exists among the maintenance activities on the components. At the component level, prognostics can be performed to obtain the predicted failure time distribution for each component. In this paper, we propose a condition based maintenance of multi-component systems using component-level prognostics information. A numerical method is proposed for the cost evaluation of the proposed maintenance policy.

5 - Maintenance and Spare Provisioning for Wind Turbines with Reliability Growth and Dynamic Population
Tongdan Jin, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Caiwen Zhang, Joe Alex Granado

Maintenance policies are often devised based on the assumption that, after the repair, the system returns to the state as good as new, as good as old, or somewhere in between. In this study, we propose an optimal maintenance strategy for wind turbines under reliability growth with time-varying system populations. Optimal spare provisioning will be developed based on both the equipment reliability and predicted in-service size of equipment.

■ SB30

C - Room 5B, Level 3

NSF Workshop on Sensing and Prognostics Issues in Manufacturing: A Recap

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Produced in the U.S. using Nano Manufacturing
Richard Wysk, Dopaco Chair, NC State University, Daniels Hall, Department of Ind and Systems Engr, Raleigh, NC, 27695, United States of America, rawysk@ncsu.edu, Rohan Shirwaiker

The world has been waiting for the onslaught of nano products but appears disappointed that there are so few. This talk presents a view of nano manufacturing from a manufactured feature-based perspective. That is, many of the products that we use every day have lots of nano scale features and tolerances. A description of the growth of these processes and features is presented.

2 - Reliability Modeling and Prediction of Ultra-thin Diodes
Elsayed Elsayed, Rutgers University, 96 Frelinghuysen Rd, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Haitao Liao, Qiang Huang

We develop a reliability assessment and prediction degradation model for ultra-thin metal-insulator-metal (MIM) diodes. The relationship between applied voltage and measured current over time are utilized in estimating the reliability characteristics. Validation of the model is conducted using nanometer scale gate oxide data.

3 - In-Situ Process Control for Nanopowder Scale-up Production
Jianjun Shi, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, United States of America, jianjun.shi@isye.gatech.edu, Chia-Jung Chang

Nanopower production scale up is an important, yet a challenging task. It is not just a straight-forward expansion of the current manufacturing system in terms of production capability, but also demands innovative in-situ process control. The potential variability sources in the system are multifold and hence increase the control complexity. In this work, we develop in-situ process control and variation reduction methodology, as well as associated tools, for the scale up nanopowder production.

4 - Group Report on Diagnostics and Prognostics
Soundar Kumara, Pearce Chair Professor, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, skumara@psu.edu

Important research problems and future research directions related to diagnostics and prognostics will be discussed. The overall recommendations of the group will be presented.

5 - NSF Workshop on Sensing and Prognostics Issues in Nanomanufacturing
Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu, Ranga Komanduri, Sagar Kamarthi, Abe Zeid

This session attempts to disseminate the outcomes from a recent workshop on Sensing and Prognostics issues in nanomanufacturing, recently held in Boston, MA. A panel discussion will follow overview presentations from domain experts.

■ SB31

C - Room 5C, Level 3

Joint Session DM/ QSR: Quality and Statistical Decision Making in Health Care Applications I

Sponsor: Data Mining/ Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Diagnostic Monitoring of Outcomes in Healthcare
Li Zeng, Assistant Professor, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019-0017, United States of America, lzeng@uta.edu

Outcomes in medical processes are important measures of care providers' performance. Monitoring of outcomes is critical for detecting performance changes and ensuring the delivery of high-quality care. This study presents an outcome monitoring scheme which can not only detect changes, but also indicate the types of change, which is helpful information for root cause identification.

2 - Wavelet Multifractal Analysis and Synthesis of Heartbeat Dynamics
Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu, Yun Chen

This paper presents a novel approach for the analysis and synthesis of multifractal heartbeat dynamics using the wavelet transformation. The new approach not only statistically characterizes but also numerically simulates the scaling properties of heart rate variability (HRV) signals with wavelet lenses. Experimental results show that the proposed approach is promising to solve forward and inverse fractal problems.

3 - An Exact Approach for Multiple Instance Classification
Mohammad H. Poursaeidi, University of Houston, E206 Engineering Bldg. 2, Houston, TX, 77204, United States of America, mhpoursaeidi@uh.edu, Erhun Kundakcioglu

We investigate the classification problem within the Multiple Instance Learning (MIL) context that can be used for drug design, identification of proteins, and content based image retrieval. We present new formulations and enhanced one formulation via a hierarchy of continuous relaxations. Experimental results show that the proposed exact approach outperforms previous methods in terms of solution time.

■ SB32

C - Room 6A, Level 3

Hybrid Methods I

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Faster Integer Feasibility in MIPs by Branching to Force Change
John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca, Jennifer Pryor

Most MIP branching heuristics try to find the branch that has the most impact on the objective function. A different approach is needed when the goal is reaching the first integer-feasible solution quickly. Intuition says that branching to maximize the probability of reaching a feasible solution is best. This is wrong: the most effective strategies branch in the direction that has the least probability of reaching feasibility! This gives rise to the new principle of branching to force change.

2 - Polyhedral Results for Alldifferent Systems

David Bergman, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, bergman.david1@gmail.com, John Hooker

We study the convex hull of integer points satisfying multiple alldifferent constraints. We describe general results for the facial structure of the polytope and describe several classes of facets for particular families of alldifferent systems. We discuss how to separate the inequalities and implement the separation algorithms for a particular family of alldifferent systems. We find that the facets can significantly tighten the relaxation when the constraints have many variables in common.

3 - Logic-Based Benders Decomposition for the Home Health Care Problem

Andre Cire, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, andrecire@cmu.edu, John Hooker, Stefan Heinz

The Home Health Care problem (HHC) consists of scheduling nurse visits to patients in their homes, a growing industry due to its advantages over institutional care. The problem is well suited to hybrid approaches, naturally decomposing into an assignment (nurse/patient allocation) and a scheduling (visit times) portion. We use logic-based Benders decomposition to tackle a specific HHC faced by a German industrial partner. Experiments performed over real-world instances are presented.

■ SB33

C - Room 6B, Level 3

Joint Session ICS/ QSR: Complex Computer Models

Sponsor: Computing Society/ Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Designs for Data Pooling

Devon Lin, Queen's University, Department of Math and Stats, 48 University Ave, Kingston, ON, K7L 3N6, Canada, cdlin@mast.queensu.ca, Peter Qian

With the availability of similar studies, it is increasingly important to combine the results of respective studies. We refer this process to as data pooling. Although there exist many modeling methods for such a process, the issue of data collection is new. In this talk, we will address this important issue. In addition, we will introduce a new type of designs for data pooling. Statistical properties of such designs are discussed and illustrated.

2 - Fractional Brownian Random Fields for Kriging

Daniel Apley, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, apley@northwestern.edu, Ning Zhang

Fractional Brownian random fields (FBRFs) have a number of very attractive properties as spatial random process models for kriging. However, they are not as widely used as other, stationary models. We argue that FBRFs provide convenient and effective solutions to a number of problems associated with stationary spatial random process models in kriging.

3 - Reduction of Model Complexity and the Treatment of Discrete Inputs in Computer Model Emulation

Curtis Storlie, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, storlie@lanl.gov, Brian Reich

When computer models are computationally demanding, emulator approaches to their analysis have been very useful. The input vector to many models is of very high dimension and some of the input variables can be discrete in nature (e.g., pointer variables to alternative models or different materials, etc.). We propose two new approaches that tackle the high dimensionality problem through variable selection and functional ANOVA model construction while accounting for discrete valued inputs.

4 - Weighted Space-filling Designs for Deterministic Computer Codes

Dave Woods, Lecturer in Statistics, University of Southampton, School of Mathematics, University of Southampton, Southampton, SO17 1BJ, United Kingdom, D.Woods@soton.ac.uk

We investigate methods of incorporating known dependencies between variables into design selection for computer codes. Adaptations of computer-generated coverage designs are considered, with "distance" between two input points redefined to include a weight function. The methods can include quantitative and qualitative variables, and different types of prior information. The different approaches are demonstrated through interrogation of a computer model for atmospheric dispersion.

■ SB34

C - Room 7, Level 3

Computational Advances in Freight Terminal Operations

Sponsor: Computing Society
Sponsored Session

Chair: Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, 3815 Central Avenue, Memphis, TN, 38152, United States of America, mihalisgolias@yahoo.com

1 - A Network Flow Approach for Optimal Truck Assignment and Scheduling at Crossdocks

Ti Zhang, Graduate Research Assistant, UT Austin, UT Austin CTR 1 University Station C1761, ECJ 6.2, Austin, TX, 78712-0278, United States of America, tizhang@mail.utexas.edu, Travis Waller, Chi Xie

Various crossdock assignment and scheduling problems have been formulated into integer programming models, which cause solution tractability difficulties for large-scale applications. This talk presents an innovative network model for an integrated crossdock assignment and scheduling problem. In particular, we propose a multicommodity flow model, where the truck-to-door assignment is specified by a set of side constraints and the truck sequencing is fully accommodated by network flow routing.

2 - Berth Scheduling at Marine Container Terminals Under Uncertainty

Georgios Kolomvos, Research Associate, Kathikas Institute of Research and Technology, 303 Ryefield Ridge, Columbia, M0, 65203, United States of America, kolomvos@gmail.com, Stephanie Ivey, Georgios Saharidis, Mihalis Golias

We formulate the stochastic vessel handling times berth scheduling problem as a deterministic bi-objective problem. A Genetic Algorithms based heuristic and a simulation based Pareto pruning algorithm are proposed to solve the resulting problem. Computational examples show that the proposed approach provides a robust schedule and outperforms berth scheduling policies where the expected values of the vessel handling times are used.

3 - Truck Scheduling at a Cross-dock Facility: Accounting for Travel Time Variability

Jeffery Karafa, Research Assistant, University of Memphis, 112A Engineering Science Bldg, 3815 Central Ave, Memphis, TN, 38152, United States of America, jefferykarafa@yahoo.com, Georgios Saharidis, Mihalis Golias, Georgios Kolomvos

We deal with the scheduling of trucks at a cross dock facility where we assume that truck arrival times are stochastic variables with unknown distributions. A modeling framework based on the concept of games is discussed along with a number of solution algorithms.

4 - Simulating the Impact of Various Quay Operational Protocols on Container Load/Unload Efficiency

Greg Harris, Director, Center for Management and Economic Research, University of Alabama in Huntsville, Huntsville, AL, 35899, United States of America, harrisg@uah.edu, Bernard Schroer, Dietmar Moeller

A major issue facing container terminals is how to effectively and efficiently operate expensive resources. Two quay operational protocols are evaluated. A simplified and rapid approach to data collection is presented. Asking the appropriate questions through interviews with personnel directly involved with the application is very important and can be effective, time saving approach to obtaining data. Results of the different scenarios are presented.

■ SB35

C - Room 8A, Level 3

Nonparametric Methods for Learning and Stochastic Optimization

Sponsor: Applied Probability
Sponsored Session

Chair: Andrew Lim, University of California, Berkeley, 4141 Etchverry Hall, Berkeley, CA, 94720, United States of America, lim@ieor.berkeley.edu

1 - First-order Spread Information for Minimax Regret Inventory Problems

Joline Uichanco, PhD Candidate, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, uichanco@mit.edu, Retsef Levi, Georgia Perakis

We study a newsvendor whose objective is to minimize the maximum regret over all distributions with the same mean and spread. We introduce a first-order measure of spread and propose a data-driven procedure for building confidence bounds on the spread given only samples drawn from the true distribution. As the critical quantile increases, the mean-variance regret solution tends to be too conservative; whereas the mean-spread regret solution is close to the optimal solution.

2 - The Generalized Restless Bandit Problem: Algorithms and Applications

Adrian Becker, Massachusetts Institutite of Technology Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu, Xuan Vinh Doan, Dimitris Bertsimas

Motivated by applications including search-based advertising, research budgeting, sensor networks, and clinical trial development, we introduce the generalized restless bandit problem. This generalization models the ability to operate arms at various degrees under a combined budget rather than simply turning them on or off. We discuss a hierarchy of linear relaxations, develop a mixed-integer optimization based decomposition heuristic, and present promising computational results.

3 - Directed Learning for Information Retrieval

Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Yi-hao Kao

We will discuss a directed learning method that improves performance of information retrieval systems using a combination of similarity and diagnostic data in a coherent way.

4 - Objective Operational Learning and Applications

Andrew Lim, University of California, Berkeley, 4141 Etchverry Hall, Berkeley, CA, 94720, United States of America, lim@ieor.berkeley.edu, Ankit Jain, Lian Yu, George Shanthikumar

We introduce an approach to learning and optimization called "objective operational learning". A key feature of this approach is that it delivers good small sample behavior by incorporating (potentially incorrect) modeling assumptions when data is scarce, but guarantees convergence by correcting for these errors as data is accumulated. Applications to the newvendor problem with order-dependent demand will be discussed.

■ SB36

C - Room 8B, Level 3

Tutorial: Managing Student Projects

Sponsor: INFORM-ED
Sponsored Session

Chair: Peter Bell, Richard Ivey School of Business, UWO, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 - Managing Student Projects

Peter Bell, Richard Ivey School of Business, UWO, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

Most OR instructors assign students a 'real world' project as part of one or more of their courses. While such projects provide a powerful learning experience, they do present some management challenges. In this session we will discuss these challenges and draw on the participants for their experiences in working through the challenges to provide the strongest possible student learning experience.

■ SB37

C - Room 8C, Level 3

Design and Control of Many-Server Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Josh Reed, New York University, 44 W 4th Street, New York, NY, United States of America, jreed@stern.nyu.edu

1 - A Fluid Approximation for the Time-varying G_t/GI/s_t + GI Many-Server Queue

Yunan Liu, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

We introduce and analyze a deterministic fluid model that serves as an approximation for the G_t/GI/s_t + GI many-server queueing model. We characterize its performance over alternating intervals in which the system is overloaded and underloaded. We determine the amount of fluid that is in service (in queue) at time t and has been so for time at most y. We also determine the time-varying potential waiting time with an ordinary differential equation.

2 - Minimizing Convex Holding Costs in a Many-server Heavy-traffic Regime with Non-degenerate Slowdown

Itai Gurvich, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Rami Atar

We consider the problem of minimizing convex holding costs in parallel server systems operating in a many-server heavy-traffic regime with non-degenerate slowdown. In this regime the waiting time and service time are of the same order of magnitude. We establish a lower bound and devise a sequence of policies that are asymptotically optimal. Our analysis underscores the relationship between asymptotic optimality in heavy-traffic and the relative time scales of waiting time and service time.

3 - Shadow-routing Based Control of Flexible Multi-server Pools in Overload

Tolga Tezcan, Assistant Professor, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, Tolga.Tezcan@simon.rochester.edu, Alexander Stolyar

We consider a general parallel server system in the many-server asymptotic regime. Service of a customer brings a constant reward. The objective is to maximize the long-run reward rate. We propose a robust routing policy for overloaded systems, SHADOW-RM, which does not require the knowledge of customer input rates and prove its asymptotic optimality. We suggest another policy SHADOW-TANDEM, which automatically and seamlessly detects overload and reduces to SHADOW-RM in overload.

4 - Staffing and Dynamic Outsourcing in a Call Center Under Arrival Rate Uncertainty

Yasar Levent Kocaga, Yeshiva University, Sy Syms School of Business, New York, NY, 10033, United States of America, kocaga@yu.edu, Mor Armony, Amy Ward

Many firms that prefer to keep their call center operations in-house also use outsourcing to manage time periods of overload. Then, there is an upfront decision on the in-house staffing level that must be made when the call arrival volume is uncertain, and dynamic real-time decisions regarding which calls to outsource made after the call arrival volume has become known. We propose a staffing and outsourcing policy that minimizes costs due to staffing, outsourcing, and customer abandonment.

■ SB38

C - Room 9A, Level 3

Nonconvex Optimization: Theory and Algorithms

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Evrim Dalkiran, PhD Candidate, Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu

1 - Comparing Convex Relaxations for Quadratically Constrained Quadratic Programming

Kurt Anstreicher, Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52242, United States of America, kurt-anstreicher@uiowa.edu

We consider convex relaxations for nonconvex QCQP. We show that replacing nonconvex quadratic functions with their convex envelopes is dominated by convexifying the range of the quadratic form (1,x')'(1,x'). We also show that using alphaBB underestimators is dominated by imposing semidefiniteness and diagonal constraints. Finally, we show that the use of a large class of DC underestimators is dominated by combining semidefiniteness with RLT constraints.

2 - Global Optimization Results for the Linear Complementarity Problem

Trang T. Nguyen, PhD Student, University of Florida, 450 Weil Hall, Gainesville, Fl, 32611, United States of America, trang@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

We identify a nonconvex substructure of the linear complementarity problem. We use lifting and disjunctive programming techniques to derive families of valid inequalities for this substructure that strengthen its factorable relaxation. We describe conditions under which the inequalities are the best possible and comment on their applicability for globally solving the linear complementarity problem.

3 - SparsePOP: A Sparse Semidefinite Programming Relaxation of Polynomial Optimization Problems

Hayato Waki, The University of Elector-Communications, Chofu-gaoka 1-5-1, Chofu-shi, Tokyo, Japan, waki@cs.uec.ac.jp

SparsePOP is a MATLAB implementation of a sparse semidefinite programming (SDP) relaxation method proposed for polynomial optimization problems (POPs). The sparse SDP relaxation is based on a method proposed by Lasserre. By exploiting sparsity, we reduce the size of resulting SDP problems. As a result, SparsePOP can solve sparse POP instances up to 1000 variables and often outperforms Lasserre's method. This is a joint work with Masakazu Kojima, Kim Sunyoung and Masakazu Muramatsu.

4 - Convex Envelopes of Lower Semi-continuous Functions Generated by Finite Number of Compact Convex Set

Aida Khajavirad, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, aida@cmu.edu, Nick Sahinidis

We formulate the problem of constructing the convex envelope of a lsc function whose generating set consists of finitely many compact convex sets as a convex optimization problem. We consider functionals which are products of nonnegative convex and component-wise concave functions and reduce the complexity of the envelope representation problem for such functions significantly. We derive closed-form expressions for envelopes of various functions that are building blocks of nonconvex programs.

5 - Reduced RLT Representations for Nonconvex Polynomial Programs

Evrim Dalkiran, PhD Candidate, Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu, Hanif Sherali, Leo Liberti

We explore equivalent, reduced size RLT-based formulations for quadratic and polynomial programs. Utilizing a basis partitioning scheme for an embedded linear equality subsystem, a strict subset of RLT equalities is shown to imply the remaining ones. Certain static and dynamic basis selection strategies are proposed to implement this procedure via an algorithm that assures convergence to a global optimum. Computational results are presented to demonstrate the improvement in overall effort.

■ SB39

C - Room 9B, Level 3

Advances in Combinatorial Optimization and Integer Programming I

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrea Lodi, DEIS, University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, andrea.lodi@unibo.it

Co-Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it

1 - An FPTAS for Optimizing a Class of Low-rank Functions Over a Polytope

Shashi Mittal, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States of America, mshashi@mit.edu, Andreas S. Schulz

We present an FPTAS for optimizing a rather general class of non-linear functions of low rank over a polytope. Our approximation scheme relies on approximating the Pareto-optimal front of the linear functions that constitute the given low-rank function. Unlike existing results in the literature, our approximation scheme does not require the assumption of quasi-concavity on the objective function. Examples include optimizing a class of bi-linear functions and sums of rational functions.

2 - A Partial Characterization of the Induced K-partite Subgraph Polytope

Manoel Campelo, Professor, Federal University of Ceará, Campus do Pici, Bloco 910, Fortaleza, CE, 60455-760, Brazil, mcampelo@lia.ufc.br, Alinson Xavier

We study the maximum induced k-partite subgraph problem. We use an integer linear programming formulation based on class representatives vertices. We partially describe the facial structure of the corresponding polytope. We present two lifting procedures to generate facets. One of them lifts valid inequalities defined by subgraphs. The other one links the studied polytope to the stable set polytope of a related graph. We analize the use of these facet-defining inequalities as cutting-planes.

3 - Separation, Dimension, and Facet Algorithms for Node Flow Polyhedra

S. Thomas McCormick, Sauder School of Business, UBC, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, tom.mccormick@sauder.ubc.ca, Maren Martens, Maurice Queyranne

Consider putting non-negative flows on all source-sink paths. The flow through a node is the sum of the flows on all paths containing it. We characterize the inequalities defining such node flows, which valid inequalities are facets, we give fast algorithms for separation, validity, and dimension, and we put all the pieces together into an algorithm for separating to a facet. All algorithms are very efficient, as they are based on max flow and min-cost flow subroutines.

■ SB40

C - Room 9C, Level 3

Open-Source Software

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu

1 - On Generating Relevant Synthetic Instances for Practical Problems

Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu, Kate Smith-Miles

The features of instances arising from practice are jointly distributed in complex ways that are hard for synthetic generators to replicate. Using the wrong instances to test solvers has led to deployment disasters. To address this, we present a methodology that helps improve instance generators and a statistic that summarizes the generator's ability to produce realistic and discriminating instances. The methodology is supported by an implementation in R available as a Coin-OR project.

2 - OpenSolver - An Open Source Solver-compatible CBC-based Excel Optimizer

Andrew Mason, Dept of Engineering Science, University of Auckland, Private Bag 92019, Auckland, New Zealand, a.mason@auckland.ac.nz

As part of a project on staff scheduling, we have developed OpenSolver, an open-source Excel addin that allows users to optimise their spreadsheet-based Solver models using the Coin-OR CBC integer programming solver. OpenSolver also provides tools for viewing an optimization model directly on a spreadsheet, and for quickly solving related models that differ only in the values of their right hand sides.

3 - Rima: An Experiment in Composing Mathematical Models From Parts

Geoff Leyland, Director, Incremental Limited, 17 Bridgens Ave, Te Atatu Peninsula, Auckland, 0610, New Zealand, geoff_leyland@fastmail.fm

Rima (http://code.google.com/p/rima/) is a yet-another tool for formulating mathematical models implemented in a scripting language. Rima's goal is to make it easy to compose a model from parts, and to create generic parts. To this end, models are defined symbolically, problem data is late bound, models and data can be overloaded, and there are constructs for easy data transformation. Rima is implemented in Lua, binds to CLP, CBC and lpsolve, and is awaiting review to become part of COIN.

4 - Impact of Design Architecture and Developer Networks on Software Project Success

Michelle Liu, Assistant Professor of IT, Marymount University, 2807 N. Glebe Rd., Arlington, VA, 22207, United States of America, xiangl2001@gmail.com

In this study, the author seeks to understand the factors differentiating successful open source software projects from unsuccessful ones. Using data gathered from SourceForge.net, the author empirically tests several hypotheses about the impact of architecture and developer's access to knowledge on a project's success. Theoretical and practical implications are discussed, and several future research directions are outlined.

■ SB41

C - Room 10A, Level 3

Recent Advances in Mixed-Integer Nonlinear Optimization II

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

1 - Separating Cuts for Quadratic Programs

Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu, Hongbo Dong

The convex and concave envelopes for the product of two variables over a rectangle have been known since the early 1980s, and recent research has extended these results to quadratic forms of two variables. We discuss further extensions to three variables over a box. For (linearized) quadratic programs of any size, this allows one to separate cuts involving triples of bounded variables.

2 - A Mixed-integer Optimization Model for Air Traffic Conflict Resolution

Sonia Cafieri, Assistant Professor, Ecole Nationale de l'Aviation Civile, 7, avenue Edouard Belin, Toulouse, 31500, France, sonia.cafieri@enac.fr, Pascal Brisset, Nicolas Durand

The problem of detecting and solving aircraft conflicts, that occur when the distance between two aircraft sharing the same airspace is less than a given safety distance, is crucial in Air Traffic Management. We propose a mixed-integer nonlinear model for air conflict avoidance, where conflicts are avoided allowing aircraft to only accelerate or decelerate in a time window, and velocity changes are minimized together with time windows when they occur. We present some computational experiments.

3 - Comparisons of the Relative Strength of Relaxations for Bilinear Functions in Global Optimization

James Luedtke, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, jrluedt1@wisc.edu, Jeff Linderoth, Mahdi Namazifar

Bilinear functions appear in many optimization problems, including blending and electricity transmission. A classical approach for relaxing such functions is to construct McCormick envelopes for each product term. We show that in some cases the relaxations obtained from this approach are provably close to the convex and concave envelopes of these functions. To our knowledge, these are the first approximation-ratio results for the strength of relaxations in global optimization problems.

4 - MINLPBB Algorithm Performance for Convex Reformulations in a MINLP with Complementarity Constraints

Andres Guerra, Adjunct Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States of America, aguerra@mines.edu, Sven Leyffer, Alexandra Newman

We study a concrete building design problem for a MINLP with complementarity constraints, in which some of the nonconvex constructs can be formulated using Convex Hull and Big-M formulations. We present the mathematical structures and compare MINLPBB performance and solution quality for convex reformulations of two sets of nonlinear equality constraints and three bilinear terms in the objective function.

■ SB42

C - Room 10B, Level 3

Stochastic Integer Programming Algorithm Development

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu

1 - Algorithm Study for Two-stage Stochastic Quadratic 0-1 Recourse Problem

Zhen Zhu, Purdue University, Department of Computer Science, LWSN, 305 N University Street, West Lafayette, IN, 47907, United States of America, zzhu@purdue.edu, Nan Kong, Oleg A. Prokopyev

The difficulties in solving stochastic quadratic binary programming (SQBP) problems are three folds: stage-wise coupling constraints, binary decision variables on both stages, and quadratic objective function. In this research, we explore methods that can effectively deal with the above difficulties and thus efficiently solve the SQBP problems. We also consider the general case with cross-stage quadratic terms in the objective functions.

2 - On Greedy Approximation Algorithms for a Class of Stochastic Assignment Problems

Serdar Karademir, Research Assistant, University of Pittsburgh, 3700 O'hara St., Benedum Hall, 1077B, Pittsburgh, PA, 15261, United States of America, sek73@pitt.edu, Oleg A. Prokopyev, Nan Kong

In this talk we discuss a two-stage stochastic extension of the classical linear assignment problem. The considered problem can be shown to be NP-hard. We discuss some necessary optimality conditions, which are subsequently utilized to develop a greedy approximation algorithm for the problem. Analytical observations as well as extensive computational results show that our approach outperforms two other greedy approximation algorithms from the literature.

3 - A Computational Study of Decomposition Algorithms for Stochastic Programs with Mean-Risk Objectives

Tanisha Cotton, Doctoral Student, Texas A& M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Lewis Ntaimo

To introduce risk into linear stochastic programs, convexity preserving dispersion statistics, quantile- deviation and absolute semideviation can be used to represent mean-risk objectives. In this talk, we present a computational study of decomposition algorithms for this class of SPs. We consider both stage-wise and scenario-wise decomposition algorithms.

4 - Stochastic Optimization of Power Supply System in Isolated Islands with Renewable Energy

Ludwig Kuznia, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, lkuznia@mail.usf.edu, Bo Zeng, Grisselle Centeno, Zhixin Miao

Supplying energy to isolated islands can be very expensive using diesel generators or transmission equipment from mainland. In this work, to meet the demand in one island, we consider a hybrid system with diesel generators, a wind farm, and the transmission line from the mainland. A stochastic mixed integer programming model is developed to account for variability in demand and wind speed. An algorithm utilizing Benders' Decomposition is developed and the computational performance is presented.

■ SB43

C - Room 1, Level 2- Mezzanine

Radiation Therapy Treatment Planning

Sponsor: Health Applications
Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Optimal Stopping in Radiotherapy
Minsun Kim, University of Washington, Department of Radiation Oncology, Seattle, WA, 98195, United States of America, mk688@u.washington.edu, Archis Ghate, Mark Phillips

We recently proposed Adaptive Biologically Conformal Radiation Therapy (ABCRT), a mathematical framework that incorporates a patient's biological response into the planning process to adaptively compute spatiotemporally optimal plans. In line with conventional IMRT, the number of sessions was fixed a priori in ABCRT. In this talk, we present infinite horizon extensions of ABCRT where an optimal treatment stopping point is determined on the fly. Benefits to treatment efficacy are explored.

2 - Exact Method for Volume Metric Modulated Arc Therapy (VMAT) Treatment Plan Optimization
Fei Peng, PhD Candidate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, feipeng@umich.edu, Marina Epelman, Edwin Romeijn

In contrast with traditional IMRT treatments, VMAT machine delivers radiation in a non-stop fashion while the gantry moves continuously during the treatment. Due to the complex setting of VMAT, most literature uses heuristics to design treatment plans. We propose an exact large-scale IP model for VMAT treatment plan optimization under uniform gantry speed and monitor unit output, and use branch-and-price for the IP produced using column generation. Results on real patient data are presented.

3 - A Novel Aperture-based Algorithm for Treatment Plan Optimization of Volumetric Modulated Arc Therapy
Chunhua Men, University of California, San Diego, 3855 Health Sciences Dr. #0843, La Jolla, CA, 92093, United States of America, cmen@ucsd.edu, Xun Jia, Steve Jiang, Edwin Romeijn

This work is to develop a novel aperture-based algorithm for VMAT treatment plan optimization. The problem is formulated as a large-scale convex programming problem and a column generation approach is used to deal with its extreme large dimensionality. Tests on clinical cases showed that the very high quality clinical deliverable treatment plans can be genrated in 5~8 minutes on CPU and in 20~30 seconds on GPU, which is much faster than any existing algorithms on a similar platform.

4 - Optimization Methods for Volumetric Modulated Arc Therapy Planning
Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu, Martin Savelsbergh, Ozan Gozbasi

Volumetric Modulated Arc Therapy (VMAT) is a recent radiation technology where the radiation is delivered continuously during the rotation of the radiation source around the patient. This paradigm has the potential to provide treatments in less time compared to other delivery techniques, thereby enhancing patient comfort. We describe an integer programming based solution approach for VMAT planning. Computational studies on a spinal tumor and a prostate tumor case will be discussed.

■ SB44

C - Room 2, Level 2- Mezzanine

Supply Chains in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Ronald Rardin, Distinguished Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rrardin@uark.edu

1 - Automating Operating Room Logistics Processes with RFID
Nebil Buyurgan, Associate Professor, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, nebilb@uark.edu, Sylvain Landry, Richard Philippe

RFID's successes in industrial logistics sector could translate into a quantum leap in the evolution of materiel management practices in the hospital environment. RFID is able to automate the data collection activities at the point of use, while allowing for proactive inventory management, unit traceability and charge capture. This study presents impacts of the technology on materiel management processes in hospitals, implementation results, and further research areas in healthcare institutions.

2 - Data Standards Adoption in Healthcare Supply Chain Financial Management: Opportunities
Vijith Varghese, Postdoctoral Fellow, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, vvarghe@uark.edu, Ronald Rardin, Raja Jayaraman, Nebil Buyurgan

Data Standards in the context of product and location identification, refers to unique, unambiguous, and universal representation of a product or a location ID. This presentation discusses the healthcare financial-management-system efficiency achieved through data standards adoption in contract management and sales tracing enabling higher accuracy in pricing, rebates and chargeback among healthcare providers, group purchasing organizations, manufacturers and distributors.

3 - Factors Affecting the Identification Standards Adoption Process in the Healthcare Supply Chain
Angelica Burbano, Graduate Research Assistant, University of Arkansas, Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, aburbano@uark.edu, Ronald Rardin, Ed Pohl

This research project reports on the findings related to the factors affecting the adoption of product and location identification standards. This adoption process is compared with the adoption of EHR and EDI; main conclusions from the identification standard's literature are presented. These findings contribute to the elaboration of a causal loop diagram which is fundamental in the development of the second phase of the modeling effort which will allow the test of interventions in the system.

■ SB45

C - Room 6, Level 2- Mezzanine

Surgery Scheduling and Planning

Sponsor: Health Applications
Sponsored Session

Chair: Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu

1 - Operating Room Rescheduling Under Uncertainty
Sakine Batun, University of Pittsburgh, Pittsburgh, PA, United States of America, sab79@pitt.edu, Brian T. Denton, Andrew J. Schaefer, Todd R. Huschka

Operating room (OR) scheduling is an important operational problem for most hospitals. Due to contingencies (such as surgeries that last shorter/longer than their expected duration or emergent cases) that cannot be fully anticipated beforehand, planned schedules should be revised during the day. In our study, we consider a stochastic programming based approach to formulate this problem and to estimate the benefit of rescheduling.

2 - State Discharge Abstract Data to Identify Competitors - Similar Distribution of Operative Procedures
Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu

Surgical scheduling often focuses on assigning cases to staffing (allocated time) planned months in advance (e.g., based on maximizing efficiency of use of operating room time). Extra capacity is sometimes used to encourage growth, but rarely formally linked to marketing as in other industries. Data envelopment analysis forecasts current growth potential by specialty for a hospital. A similarity index identified competition by many hospitals and an unexpected quantitatively important competitor.

3 - Dynamic Appointment Sequencing and Scheduling Under Uncertainty
S. Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, United States of America, saerdoga@ncsu.edu, Brian T. Denton, Alex Gose

We propose a new stochastic programming model for a single-server on-line appointment scheduling problem with uncertain service times. We analyze the structure of the model and discuss computationally efficient solution methods. Finally, we present the results of numerical experiments that illustrate the nature of optimal sequencing and arrival time scheduling decisions for multiple classes of patients.

4 - Stochastic Sequencing of Surgeries for a Single Surgeon Operating in Parallel ORs

Robert H. Storer, Professor, Lehigh University, 200 West Packer Ave., Industrial Engineering Department, Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu, Camilo Mancilla

We develop algorithms for a stochastic two-machine one-server sequencing problem with waiting time and overtime costs. Scheduling surgeries for a single surgeon in two parallel operating rooms motivates the work. The problem is formulated as an integer stochastic program. A decomposition method is proposed that solves real problems to optimality. We further gain insight as to when parallel operating rooms is cost effective.

■ SB46

C - Room 7, Level 2- Mezzanine

Joint Session APS/ MIF: Applied Probability Models for Smart Transportation

Sponsor: Applied Probability/ Minority Issues
Sponsored Session

Chair: Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

1 - Fleet Redistribution for Shared-vehicle Systems

Rahul Nair, Graduate Research Assistant, University of Maryland, Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Robert Hampshire, Elise Miller-Hooks

A chance-constrained stochastic optimization program is presented for management of shared-vehicle systems. These systems involve a fleet of vehicles (cars, bicycles, or electric vehicles) positioned at stations across the network which are used to complete trips. Since there are flow imbalances between stations, the program provides anticipative, corrective actions for operators. The value of accounting for demand uncertainty in demand is demonstrated.

2 - A Dynamic Rate Closed Queueing Network Model of Vehicle Sharing

Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

In the talk, we present asymptotic approximations for a large closed queueing network model with time varying rates. This model is motivated by car sharing services, bike sharing services and person-2-person car sharing services. A decomposition technique and a quasi-steady state assumption lead to accurate and tractable algorithms for the system performance measures.

3 - A Parking Queue Network Model with a Perspective of Behavioral Economics

Kats Sasanuma, PhD Student, Heinz College, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, ksasanum@andrew.cmu.edu, Richard Larson, Robert Hampshire

We analyze parking-induced cruising behavior quantitatively using a queueing model with reneging. We extend our model to a queueing network and investigate the stationary distribution of the system. We further extend the model to include garage parking and non-parking drivers, and argue their impact on the necessary congestion price. Finally, we apply Behavioral Economics to parking congestion problem and evaluate how risk-seeking behavior exacerbates parking congestion.

■ SB47

C - Room 8, Level 2- Mezzanine

Joint Session Computational Bio/ ICS: Optimization in Bioinformatics

Cluster: Computational Biology and Bioinformatics/Computing Society
Invited Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

Co-Chair: Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu

Co-Chair: Oleg A. Prokopyev, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, droleg@pitt.edu

1 - Optimizing Interaction Code Parameters for Zinc Finger - DNA Recognition

Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu, Oleg A. Prokopyev, Nuri A. Temiz, Carlos J. Camacho

We decode protein/DNA interactions using a nonlinear mixed-integer programming model. We remove nonlinearities with multiple reformulations, making it amenable to standard MIP solvers. The solutions highly correlate with empirical data, and modest runtimes allow us to iteratively remove extra parameters to avoid over-fitting training data, yet maintain high R2 values. Our results yield insights into how transcription factors identify and bind their targets with high affinity and specificity.

2 - A Spectral Clustering Based Algorithm for Dimensionality Reduction of Biological Datasets

Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com, Georgios Pyrgiotakis, Vera Tomaino, Panos Pardalos, Mario Guarracino

The main idea of dimensionality reduction is to reduce the initial features into a sufficiently smaller subset that retains all information needed to solve a data mining problem. In this talk we discuss a novel dimensionality reduction technique for reducing highly correlated features in biomedical datasets. The performance of the algorithm is evaluated on a multi class cell death discrimination problem.

3 - Modeling Microtubule Dynamics Inside the Plant Cell

Ezgi Eren, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, ezgieren@tamu.edu, Ram Dixit, Natarajan Gautam

Microtubules are polymers which regulate critical processes inside living cells. In plant cells, microtubules are created in arbitrary locations on the cell wall with a random orientation. Both ends of a microtubule are dynamic with transitions between different states of growth, shortening and pause. The dynamics become more complex due to interactions caused by collision of microtubules with different directions of growth. We model this dynamic pattern and predict the behavior.

4 - A Branch-and-price Approach for Optimal Sibling Reconstruction

Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu, W. Art Chaovalitwongse

We propose a branch-and-price approach for sibling reconstruction problem that is formulated as a combinatorial optimization problem. The objective is to find a minimal set of sibling groups subject to combinatorial constraints derived from Mendelian rules. The proposed approach permit to generate only improving sibling groups to be candidate groups in the subproblem. We test it on real biolgical data sets and better results are shown compared to other existing methods.

■ SB48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Salford Systems-Real-World Data Analysis

Mikhail Golovnya, Salford Systems, 4740 Murphy Canyon Rd., Ste. 200, San Diego, CA, 92108, United States of America, golomi@salford-systems.com

This tutorial, intended for the modeler wanting to apply data mining methodology, will emphasize real-world data analysis. The main concepts behind 3 well-known data mining algorithms will be discussed: CART®, MARS®, TreeNet®. Additionally, the course will discuss what is novel in the software, cover implementation, and show where the software fits in terms of other data mining software

2 - GAMS Development Corporation-Application Prototyping with GAMS

Steven Dirkse, Director of Optimization, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, 20007, United States of America, sdirkse@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application.

■ SB49

C -Room 10, Level 2- Mezzanine

Electronic Auctions and Markets

Sponsor: Information Systems
Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E Building, Lexington, KY, United States of America, de.liu@uky.edu

1 - The Role of Organic Lists in Search Advertising
Lizhen Xu, The University of Texas at Austin, 1 University Station B6500, Austin, TX, 78712, United States of America, lizhen.xu@PhD.mccombs.utexas.edu, Jianqing Chen, Andrew Whinston

We set up a game-theoretic model in which firms with different market preference are placed at different organic slots and bid for sponsored advertising slots. We aim to answer three questions related to the unexplored role of organic list in search advertising: (1) Should advertisers already at top organic slots bid actively for sponsored positions? (2) Does organic list benefit or harm search engine revenue, social welfare, and overall sales diversity? (3) How can organic ranking be improved?

2 - Bundle Auction Market Design and Implementation
Zhiling Guo, University of Maryland-Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21044, United States of America, zguo@umbc.edu, Andrew Whinston, Gary J. Koehler

This study focuses on a market-based resource allocation mechanism in which self-interested agents iteratively trade bundled resources in a double auction market run by a dealer. We first present a robust, flexible, and scalable algorithmic implementation of the market framework. We further investigate how various market design factors including the dealer's inventory policies, market communication patterns, and agent learning strategies affect the computational market efficiency and operations.

3 - Outsourcing Competition with Cost Uncertainty and Asymmetric Information
Xia Zhao, Assistant Professor, University of North Carolina-Greensboro, Bryan 479, P.O. Box 26165, Greensboro, NC, 27402, United States of America, X_ZHAO3@uncg.edu, Ling Xue, Fuqiang Zhang

This paper uses a common-value auction to examine a service outsourcing problem where two providers compete for a service contract from a client in presence of cost uncertainty and information asymmetry. We characterize when the decrease in information asymmetry between providers intensifies or softens the provider competition. We find that the client may not always strive to reduce the information asymmetry between providers or reduce service cost of providers.

4 - Payment Schemes for Internet Advertising
De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E Building, Lexington, KY, United States of America, de.liu@uky.edu, Siva Viswanathan

This paper examines publishers payment scheme choice (pay-per-sale, pay-per-click, and pay-per-sale) in keyword auctions with two sided information asymmetry. We find that the high-type publisher may use pay-per-sale to signal its type at the cost of lowered allocation efficiency. High-type publishers may not want to offer multiple payment formats to screen advertisers because they invite mimicry from low-type publishers.

■ SB50

C -Room 11, Level 2- Mezzanine

Crowdsourced Markets and Communities

Sponsor: Information Systems
Sponsored Session

Chair: Vandana Ramachandran, University of Utah, Operations and Information Systems, Salt Lake City, UT, 84112, United States of America, vandana@business.utah.edu

1 - Online Social Investing and the New ROI - Return on Influentials
Abrar Al-Hasan, Student PhD Information Systems, Robert H. Smith School of Business, University of Maryland, College Park, United States of America, aalhasan@rhsmith.umd.edu, Siva Viswanathan

We study the online market for social stock investing where individuals follow other investors in the community for their investment decisions. We investigate how various aspects of an individual's social network affects her investment performance; and how different modes of herding strategies impact performance. We find that the structure of a network is a contributory factor that impacts performance, and that different herding strategies lead to different performance outcomes.

2 - Crowdfunding the Next Hit: Microfunding Online Experience Goods
Chris Ward, PhD Student, University of Utah, 1645 E Campus Center Dr., Salt Lake City, UT, 84112, United States of America, chris.ward@business.utah.edu, Vandana Ramachandran

Crowdfunding combines wisdom of the crowd and microinvestments, offering a new way for raising funds in markets for experience goods. Yet many projects never reach full funding, giving anecdotal evidence of market inefficiencies. The combination of limited individual information and costly information gain suggests that peer effects drive investment decisions. We study the role of network structure to determine funding success and speed, controlling for outside popularity and unobserved quality.

3 - Crowdsourcing Contests and Internet-based Labor Markets
Arun Sundararajan, New York University, 44 West 4th Street, New York, NY, United States of America, asundara@stern.nyu.edu

I analyze some mechanism design issues relating to the crowdsourcing contests and discuss their long-run labor economic implications as the use of large decentralized Internet markets becomes more widespread.

4 - Forward-looking Reputation Building in an Online P2P Lending Network
Hossein Ghasemkhani, PhD Student, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, hossein@uw.edu, Arvind Tripathi, Yong Tan

The study aims to model, analyze and test the strategies of forward-looking agents in an online peer to peer lending market. In particular, we explore the reputation management and its effect on the utility of agents in this market. Reputation of agents is updated as a result of their actions-borrowing, repayment and lending. We explore how agents can manage their reputation over time to maximize their payoffs. Agents with higher reputation are more likely to get loans with lower interest rates.

■ SB51

C -Room 12, Level 2- Mezzanine

Military Manpower and Human Performance

Sponsor: Military Applications
Sponsored Session

Chair: Warren Sutton, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, suttonw@cna.org

1 - An Exploration into the Complexity of Navy Manpower, Personnel, Training, & Education (MPT&E)
Warren Sutton, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, suttonw@cna.org

The Navy operates a complex MPT&E enterprise with many decision having unplanned and/or unknown consequences in the long-term planning horizon. This research studies the interactions of the complex dynamics of Navy manpower planning and presents a simulation based approach to forecast future Navy personnel needs.

2 - Modeling and Simulation of Engagement Decision-making Processes and Soldier Encumbrance
Daniel Rice, Director R&D, Technlology Solutions Experts, 209 W. Central St., Suite 300, Natick, MA, 01760, United States of America, daniel.rice@tseboston.com

This research investigates the modeling and simulation of Ground Soldier behavior to represent engagement choices made by the individual Soldier in the battlespace. We describe current and ongoing research including representation of stressors on a Soldier's perception, attention, psychomotor, physical, and cognitive abilities and methodologies to represent the impact of stressors on Soldier task and decision-making performance.

3 - Military OR in the Iraq Theater of Operations
Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

This presentation provides an overview and observations on the organization, applications, challenges, and contributions of military operations research in the Iraq Theater of Operations (ITO) as United States Forces-Iraq (USF-I) transitions from a focus on counter-insurgency operations to stability operations, foreign internal defense, economic development, and governance capacity.

■ SB52

C -Room 13, Level 2- Mezzanine

Homeland Security

Sponsor: Military Applications
Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - Applying Target-oriented Utility Theory to Homeland Security
Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu, Fuat Kosanoglu

Many game-theoretic models of homeland security assume that the defender wishes to minimize some quantity like the expected damage from an attack. However, these models can result in wasted resources if less investment would be sufficient to deter an attack. We formulate this in terms of target-oriented utility, with the defender uncertain about the level of investment needed to deter attacks.

2 - Maritime Terrorist Attacks Against Ports 1968-2007
Risto Talas, Research Fellow, Hull University Logistics Institute, Cottingham Road, Hull, United Kingdom, R.Talas@hull.ac.uk, David Menachof

The paper examines worldwide terrorist attacks in ports and against shipping in ports from 1968 to 2007 from the RAND database of terrorist attacks and following Gleason (1980) concludes, using the Kolmogorov-Smirnov test that they follow a Poisson distribution. A subsequent model for port security risk is proposed with a new coefficient of terrorist threat.

3 - Decision Making in a Dynamic Multi-stage Attacker-defender Game
Yi Luo, PhD Candidate, Department of Systems and Industrial Engineering, the University of Arizona, 1127 E James E. Rogers Way, P.O. Box 210020, Tucson, AZ, 85721-0020, United States of America, luo1@email.arizona.edu, Ferenc Szidarovszky

In a dynamic non-cooperative multi-stage game, the defender's payoffs at each stage of the game depend on the attacker's and the defender's accumulative efforts, and are considered as random variables due to the uncertainty. These random variables can be approximated by their certain equivalents based on the first and second moments. The best strategies of the defender can be found by solving an optimal control problem. A convergent algorithm is developed based on dynamic programming.

■ SB53

C -Room 14, Level 2- Mezzanine

Distributed Algorithms and Optimization

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: R Srikant, Professor, University of Illinois at Urbana-Champaign, University of Illinois, CSL, 1308 W. Main St., Urbana, IL, 61801, United States of America, rsrikant@illinois.edu

Co-Chair: Lei Ying, Assistant Professor, Iowa State University, Department of Electrical and Computer Enginee, 3219 Coover Hall, Ames, IA, 50011, United States of America, leiying@iastate.edu

1 - Energy-aware Scheduling in Wireless Networks: When Speed Scaling Meets Multiuser Diversity
Lijun Chen, Research Scientist, California Institute of Technology, Pasadena, CA, United States of America, chen@cds.caltech.edu, Steven Low

Speed Scaling is a widely adopted power management technique. In this talk, we discuss speed scaling in wireless communications, which corresponds to an exponential power function, in a multiuser and time-varying setting such as a downlink in cellular networks. We present a speed scaling algorithm that achieves a competitive ratio of 2. Furthermore, we show that no algorithm can achieve better than 2-competitive.

2 - Function Computation Over Networks via Subspace Coding
Massimo Franceschetti, Professor, University of California, San Diego, San Diego, CA, United States of America, massimo@ece.ucsd.edu

We consider the problem of computing functions in a network where multiple sources are connected to a single sink via multiple relays. The relay nodes are constrained to perform the same operation on the incoming vector codewords, irrespective of the target function to be computed at the sink. The objective is to design codebooks which minimize the number of symbols that the sources need to transmit. We follow the the vector-subspace coding approach of Koetter and Kschischang.

3 - Performance Bounds of Distributed CSMA Scheduling
Jean Walrand, Professor, University of California-Berkeley, Berkeley, CA, United States of America, walrand@berkeley.edu, Libin Jiang, Jian Ni, R Srikant

CSMA-based scheduling is recently shown to achieve the maximal throughput. Central to this algorithm is a Markov chain that produces samples from a desired distribution. In this work, we discuss the relationships of the achievable throughput, queueing delay and the mixing time of the Markov chain in the algorithm. This result suggests that a small mixing time is desirable for low delay. We then discuss how a generic bound on the mixing time can be tightened in specific topologies.

4 - Scheduling in Multichannel Wireless Networks with Flow-Level Dynamics
Lei Ying, Assistant Professor, Iowa State University, Department of Electrical and Computer Enginee, 3219 Coover Hall, Ames, IA, 50011, United States of America, leiying@iastate.edu, R Srikant, Shihuan Liu

This presentation considers scheduling in multichannel wireless networks with flow-level dynamics. We consider a downlink network with a single base station, M channels, and multiple mobile users. We also assume mobiles dynamically join/leave the network. We introduce a joint channel-assignment and workload-based scheduling algorithms for multichannel downlink networks with dynamic flow arrivals/departures, and prove that the algorithm is throughput-optimal.

■ SB54

C -Room 15, Level 2- Mezzanine

Knowledge, Learning, Intellectual Capital

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu

1 - Building Theories During Scenario Planning
Nitin Joglekar, Boston University, 595 Commonwealth Ave., Boston, MA, United States of America, joglekar@bu.edu, Leonardo Santiago

We review the literature on scenario planning processes to argue that these processes offer a nexus for building theory. The epistemological aspects of such efforts are examined in terms of trend based, contrast based and normative outcomes. We close by comparing the nature of scenario planning based theories, and their validity, against conventional theory building processes.

2 - Impact of Demand Distribution on Capacity Management in Knowledge - Based Organizations
Senay Solak, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, United States of America, solak@som.umass.edu, Zhuoxin Li

Many knowledge-based firms build a portfolio of capacities to meet uncertain demand from multiple classes of customers and projects. A high capacity level increases the firm's probability of winning project orders, but this happens at the expense of high investment and holding costs. We study this trade-off and analyze the impact of the properties of the demand distribution on optimal capacity management policies using a dynamic programming approach. Several analytical results are presented.

3 - Motivating Organizational Search: The Power of Low-Powered Incentives
Oliver Baumann, Ludwig-Maximilians-University, Munich, Germany, baumann@bwl.lmu.de, Nils Stiglitz

We simulate the effects of incentives on organizational search, and we identify reasons for why low-powered incentives denote the most effective stimulus for innovation. First, the marginal gains from higher-powered incentives decrease with an increasing rate, while the costs of the incentive system increase linearly. Second, in the presence of resource constraints, good projects that fail to get selected further amplify competition and, in turn, lower the agents' motivation for search.

4 - Designing Knowledge Networks for For-Profit Open Innovation
Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu, Nitin Mayande

Recent advances in Web2.0 technologies are enabling for profit peer production and open innovation. This paper discusses an approach that allows firms to design knowledge networks for this purpose.

■ SB55

C -Room 16, Level 2- Mezzanine

Industry Architecture, Technology Forecasting and NPD Performance

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Juliana Hsuan, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk

1 - On the Impact of Technological Changes. Multivariate Time Series Analysis with Interventions

Eric Bentzen, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, eb.om@cbs.dk

Many economic time series are besides seasonality also affected by external events either as known or as unknown events. Inclusion of seasonality and external events in a multivariate analysis is investigated in this paper. Because of the presence of simultaneous relationships the identification is not straightforward, and modeling the structural relationships is similar complex. The impact of technological changes is modelled and a systematic process is being considered.

2 - Addressing R&D Target-setting Through Technology Forecasting using Data Envelopment Analysis

Ann-Marie Lamb, ajlamb@pdx.edu, Timothy Anderson, Tugrul Daim

While the literature has indicated organizations face a wide variety of difficulties in setting R&D targets, few studies have been found which delve deeper into what those difficulties are as well as how to overcome them. The objective of this presentation will be to showcase the continued evolution of an emerging technology forecasting method, Technology Forecasting using Data Envelopment Analysis (TFDEA), and how it can be applied to improve decision-making in R&D target-setting.

3 - Hierarchy in Industry Architecture: Transaction Strategy Under Technological Constraints

Jianxi Luo, PhD in Technology, Management, & Policy, Massachusetts Institute of Technology, 77 Mass Ave, E38-448, Cambridge, MA, 02139, United States of America, luo@mit.edu, Carliss Baldwin, Daniel Whitney, Christopher Magee

We conduct network analysis to analyze how firms are organized at the sector level in terms of hierarchy (one-way flow of transactions), in order to understand how industrial transaction choices of single firms may shape industry architectures, and meanwhile be constrained by technologies. Based on the results, we argue high power technologies constrain transaction strategies, while lower power technologies enable a larger option space of transaction choices, for firms to explore and exploit.

4 - Back-loading the Frontend

Sebastian Fixson, Babson College, Babson Park, MA, United States of America, sfixson@babson.edu, Tucker Marion

Our study investigates the effect of CAD use on changes in process structure (i.e., frontloading) of PD projects, and ultimately on project performance. In addition to positive frontloading we also observe a form of unintended back-loading of work from initial concept development to detail design with detrimental effects for PD performance.

■ SB56

C - Room 1, Level 1

Efficient Simulation Optimization Techniques

Sponsor: Simulation Society
Sponsored Session

Chair: Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, iseleelh@nus.edu.sg

1 - A Minimally Conservative Indifference Zone Policy

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

We construct a fully sequential indifference-zone (IZ) policy for independent normal ranking and selection that is minimally conservative, in the sense that its worst-case probability of correct selection is exactly equal to the target probability. To the author's knowledge, this is the first fully sequential IZ policy that is minimally conservative for more than two alternatives. Surprisingly, the proof of minimal conservatism involves Bayesian methods, linking IZ and Bayesian approaches.

2 - Optimal Computing Budget Allocation for Subset Selection

Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew, Si Zhang, Chun-Hung Chen

In this talk, we will present a new computing budget allocation algorithm for subset selection problem, i.e., OCBAm+. We will show the conditions on when this new algorithm will be better than the existing OCBAm algorithm.

3 - A Class of Assignment Problems with Feasibility Constraints

Qianchuan Zhao, Tsinghua University, Dept Automation, Tsinghua University, Beijing, China, zhaoqc@tsinghua.edu.cn, Chaobo Yan

In a industrial process containing many steps, limited tools or workers are often required to allocated so that key requirements are satisfied. Finding feasible assignments is not trivial especially when the amount of resource is tight. In this talk, we will present some conditions under which this class of problem can be addressed based on simulation based sequential random search with backtracking.

4 - Application of Splitting Methods to Rare-event Problems in Power Grids

John Shortle, George Mason University, 4400 University Dr., Fairfax, VA, United States of America, jshortle@gmu.edu, Chun-Hung Chen

Splitting is a rare-event simulation technique that "splits" a simulation into separate copies whenever it gets "near" the rare event. We give a method that extends splitting to the evaluation of two different alternatives. The method attempts to optimize the computing budget among the alternatives and splitting levels to improve the efficiency of the simulation. We apply the method to the evaluation of rare-event blackout probabilities in power grids.

■ SB57

C - Room 2, Level 1

Risk Management in Supply Chains

Cluster: Risk Management
Invited Session

Chair: Jian Li, Assistant Professor, Northeastern Illinois University, College of Business and Management, Chicago, IL, 60625, United States of America, JLi@neiu.edu

1 - Inviting Selective Early Orders for Informational Gains

Aditya Jain, Assistant Professor, Indian School of Business, Hyderabad, India, aditya_jain@isb.edu, Milind Sohoni, Sridhar Seshadri

Manufacturers often invite few retailers to place orders early to get indication of the demand in market. The operational effect of such early orders are well understood. Using a simple model in which a single manufacturer supplies to multiple competing retailers endowed with private information, we illustrate strategic effect of this practice. We examine incentives of manufacturer and supplier to engage in such practice under various conditions, and its implication on supply chain profit.

2 - Specification Vagueness and Supply Quality Risk

Yimin Wang, Arizona State University, W. P. Carey School of Business, Tempe, AZ, United States of America, Yimin_Wang@asu.edu

We study the effect of a manufacturer's quality specification policy on the supplier's quantity provision decision and the resulting expected delivery quality when the supplier's production process is subject to inherent quality risk. We prove that the manufacturer may benefit from a vague quality specification, and we characterize conditions under which a vague quality specification can be attractive.

3 - Supplier Competition Under the Dual-sourcing Setting

Lian Qi, Rutgers Business School, 1 Washington Park, Newark, NJ, 07059, United States of America, lianqi@business.rutgers.edu, Xiaowei Xu

We study a supplier competition problem in which two suppliers are serving a same retailer. The retailer uses a newsvendor model to determine the order quantity from each supplier, while considering the price and reliability differences of these two suppliers. Based on the retailer's ordering policy, the suppliers adjust their reliability factors and the whole sale prices in order to maximize their own profits. We model this problem as a supplier game and investigate its Nash equilibrium.

4 - Inaccuracy of Inventory and Optimal Stocking Policy: Application of RFID

Jiang Zhang, Adelphi University, 1 South Ave, Garden City, NY, 11539, United States of America, zhang@adelphi.edu

This paper looks three areas of deficiency in an inventory system, namely, inventory inaccuracy, demand distortion, and supply uncertainty, and argues that these issues co-exist and interrelate in practice. We propose a joint model which accounts for these issues simultaneously.

5 - Optimal Operational Versus Financial Hedging for a Risk-averse Firm

Adam Zhu, Assistant Professor, Singapore Management University, 50 Stamford #0401, Singapore, Singapore, adamzhu@smu.edu.sg, Roman Kapuscinski

A Multinational Risk-averse firm produces goods at home country and sells in both home and foreign countries, facing the risks of both demand and exchange rate uncertainty. This paper uses utility function to capture the firm's risk attitude, and to evaluate the impact of operational hedging and financial hedging on the firm value under both exogenous and endogenous price settings. Our study shows that the operational hedging generally outperforms the financial hedging.

■ SB58

C - Room 3, Level 1

Portfolio Credit Risk: New Directions

Cluster: Quantitative Finance
Invited Session

Chair: Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu

1 - Unified Multi-name Credit-equity Modeling: A Multivariate Time Change Approach

Rafael Mendoza-Arriaga, Assistant Professor, McCombs School of Business, University of Texas at Austin, IROM, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

We develop a new class of multiname unified credit-equity models that jointly model the stock prices of multiple firms, as well as their default events, by a multi-dimensional Markov semimartingale constructed by multivariate subordination of JDCEV diffusions. Each of the stock prices experiences state-dependent jumps with the leverage effect, including the possibility of a jump to zero (jump to default). We model idiosyncratic and systematic jumps.

2 - Large Deviations and Rare Events in Large Credit Portfolios

Richard Sowers, University of Illinois, Urbana, IL, 61801, United States of America, r-sowers@illinois.edu

Large deviations theory is designed to formalize the study of rare events in random systems. We discuss the application of this theory to several problems in credit risk in large portfolios. We in particular are interested in nonlinear interactions between different sources of risk. We give both theoretical results and some numerical insights.

3 - Diversity and Arbitrage in a Regulatory Breakup Model

Jean-Pierre Fouque, Professor, UC Santa Barbara, Statistics and Applied Probability, South Hall 5504, Santa Barbara, CA, 93106 3110, United States of America, fouque@pstat.ucsb.edu, Winslow Strong

We explore a method of imposing diversity on market models by a type of antitrust regulation that is compatible with EMMs. The regulatory procedure breaks up companies that become too large, while holding the total number of companies constant by imposing a simultaneous merge of other companies. As an example, regulation is imposed on a market model in which diversity is maintained via a log-pole in the drift of the largest company.

4 - Economic Default and Arcsine-law

Adrien De Larrard, Universite Pierre et Marie Curie, Laboratoire de Probabilites, Paris, France, larrard@clipper.ens.fr, Xin Guo, Robert Jarrow

Recently, an investigation by Guo, Jarrow and Lin (2009) of the distressed debt prices led to a surprising finding about the nature of default, and a new concept of ``economic default" was coined. In this talk, we propose a mathematical model for ``economic default" and apply fluctuation theory in probability to analyze the model. Consistent with the empirical analysis in GJL (2009), we identify an Arcsine-Law type of distributions for the distance between the economic default and the traditional default date.

■ SB59

H - Salon A, 4th Floor

Combinatorial Optimization II

Contributed Session

Chair: Burcu Aydin, Research Scientist, HP Laboratories, 1501 Page Mill Road, Mail Stop 1040, Palo Alto, CA, 94304, United States of America, aydin@hp.com

1 - Creating Contiguous Political Districts using a Scalable Graph Partitioning Model

Douglas King, University of Illinois at Urbana-Champaign, Department of Industrial and Enterprise Systems Engineering, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, dmking@illinois.edu, Wendy Tam Cho, Edward Sewell, Sheldon Jacobson

Geographic zoning is often modeled as a graph partitioning problem with contiguity constraints. For large problems, enforcing these constraints in local search imposes a computational burden. This talk presents a new geographic zoning model that allows scale-invariant enforcement of contiguity constraints without restricting the form of other constraints and objectives.

2 - A Bistellar Flips Approach to Bounding Polytope Diameter

Anand Kulkarni, Department of Industrial Engineering and Operations Research, 4174 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, anandk@berkeley.edu

We present a method for induction over a set of combinatorial types of polytopes via techniques from simplicial topology as a new means to establish their combinatorial properties. In particular, we show how sequences of bistellar flips can be used to generate a superset of all polytopes, and discuss application of this technique to the problem of determining upper bounds on the diameter of polytopal graphs and the related Polynomial Hirsch Conjecture.

3 - On the Expected Value of the Bottleneck Assignment Problem

Michael Spivey, University of Puget Sound, 1500 N. Warner St., Tacoma, WA, United States of America, mspivey@pugetsound.edu

We give a method by which one can find the asymptotic moments of a random bottleneck assignment problem in which costs are chosen from a variety of continuous distributions. Our method uses the time to first matching in a random bipartite graph process and the Maclaurin series for the distribution's inverse cdf. Our results improve on the previous best-known expression for the expected value of a random bottleneck assignment problem and yield the first results on other moments.

4 - A Branch and Bound Algorithm for K-tree-lines

Burcu Aydin, Research Scientist, HP Laboratories, 1501 Page Mill Road, Mail Stop 1040, Palo Alto, CA, 94304, United States of America, aydin@hp.com

This work is a part of a larger study aiming to develop methods to statically analyze populations of tree structured objects. The methods suggested are the use of tree-lines, k-tree-lines and tree-curves. The focus of the talk, the k-tree-line problem, is solved via a branch-and-bound type algorithm to optimality. The results of the method on a real life data set of brain vessel systems of 98 subjects will be presented. A discussion on the running time of the algorithm will also be given.

■ SB60

H - Salon B, 4th Floor

One-Switch Independence, Lifetime Consumption, and Communication of Trade-Offs

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

1 - One-Switch Conditions for Multiattribute Utility Functions

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu, David Bell

We introduce a variety of new independence conditions for multiattribute utility functions which provide simple, easily assessable functional forms that nevertheless permit utility dependence among the attributes. The conditions are stronger than one-switch independence (Abbas and Bell 2008), and vary in the degree to which they specify the functional form, ranging from the more general solutions, with weaker constraints, to the more specific solutions, with stronger constraints.

2 - Habit Formation From Correlation Aversion
Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States of America, lichtendahlc@darden.virginia.edu, Raul Chao, Samuel Bodily

Making lifetime consumption and investment plans is a fundamental economic challenge. The leading models use either correlation neutral or correlation seeking preferences. We consider correlation averse preferences and find exact solutions to this planning problem. Our solutions recommend that a decision maker form and follow a consumption habit. While such habits have traditionally been associated with correlation seekingness, in our model, habit formation follows from correlation aversion.

3 - Decision-focused Transformation: Automated Communication of Tradeoffs as Alternatives are Removed
Rob Dees, Assistant Professor, US Army, 314A South Moore Loop, West Point, NY, 10996, United States of America, Robert.Dees@usma.edu, Matthew Dabkowski

Introduced at INFORMS 2008, the Decision-Focused Transformation (DFT) of additive value models is intended to improve communication. DFT removes common/unavailable value from globally-scaled models, thus highlighting tradeoffs in the discriminatory value space. As the alternative set is reduced, DFT provides a mechanism to iteratively focus on tradeoffs in the reduced space. We offer that DFT, automated in software, is particularly useful in practice to display tradeoffs in real time.

■ SB63

H - Room 404, 4th Floor

Implementing New Ideas in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Larry Neal, Manager, DA Consulting, Chevron, 3667 Cantelow Rd, Vacaville, CA, 95688, United States of America, LarryNeal@chevron.com

1 - Value of Information with Conditional Outcomes
Brian Putt, Manager Decision Analysis, Chevron, Vacaville, CA, United States of America, bhpu@chevron.com

Value of Information with Conditional Outcomes: VOI Analysis of imperfect information for Appraisal wells or 3D/4D seismic is typically analyzed using conditional probabilities. However, assigning conditional probabilities to various appraisal outcomes given a reality state is often difficult and may not be intuitive based on the assumed appraisal outcomes. This presentation will explore an alternative approach that utilizes conditional outcomes, builds on the Subject Matter Experts (SME's) thought process and maintains the principle that when all possible outcomes of the "test" are considered the distribution should correspond to reality.

2 - Adopting and Integrating Game Theory in Your Organization
Paul Papayoanou, President, SGG, 6700 Woodlands Pkwy, Suite 230-267, The Woodlands, TX, 77382, United States of America, paul@stratgaming.com

Game theory has not realized the level of adoption and integration that decision analysis has in the decision-making processes of many large companies, yet game theory is applicable to a wide range of interactive business situations. This presentation reviews why, and what can be done, showing there is a need to build the market within organizations with concerted education, diagnostic tools, and a practical game-theoretic approach that complements existing DA capabilities and processes.

3 - Employing Traded Markets as Experts
Robert Stibolt, Managing Director, Galway Group LP, 3050 Post Oak Blvd., Suite 1300, Houston, TX, 77056, United States of America, bob.stibolt@stanfordalumni.org

For the decision analyst, information quality is a critical element of decision quality. Skepticism about information quality, especially the reliability of expert assessments, remains a significant source of objection by decision-makers to implementing a more disciplined decision quality framework. This paper investigates possibilities for making use of traded markets as a source of information that in many cases can supplement or even replace expert assessments.

4 - Introducing a Unique Approach to Optimization VOI - using a Case Example of an Gas Field Interference
Ellen Coopersmith, President, Decision Frameworks, L.P., 9821 Katy Freeway, Suite 550, Houston, TX, 77024, United States of America, ellen@decisionframeworks.com

This presentation introduces an optimization VOI framing and valuation workflow, using a gas field interference test case example. Soon after a field discovery, the decisions which may be affected by gathering more information transition from typical "go/no go" decisions to "how to go" or optimization decisions. When this occurs it is important to frame the decision problem differently-to understand the decision impact of uncertainty reduction that may occur as a result of new information.

■ SB68

H - Room 415, 4th Floor

Market Segmentation and Demand Management in eBusiness

Sponsor: eBusiness
Sponsored Session

Chair: Subodha Kumar, Mays Business School, 320 Wehner Building 4217 TAMU, Texas A&M University, College Station, TX, United States of America, subodha@tamu.edu

1 - Competition and Coordination in Online Marketplaces
Xuying Zhao, University of Notre Dame, 361 MCOB, Notre Dame, IN, United States of America, xzhao1@nd.edu, Jennifer Ryan, Daewon Sun

Online market places have seen rapid growth in recent years. A marketplace firm such as Amazon may sell products and compete with other retailers selling through its marketplace. We study the cooperation and competition among the marketplace firm and those retailers selling on the marketplace. We provide guidance on whether or not to sell similar products on the marketplace and if so, the optimal price to sell them, for the marketplace firm and the retailers.

2 - Impact of Inventory Status on the Recommender System for DVD Rentals
Emre Demirezen, Texas A&M University, 320 Wehner Building 4217 TAMU, College Station, TX, United States of America, edemirezen@mays.tamu.edu, Subodha Kumar, Milind Dawande, Vijay Mookerjee

We consider a subscription based DVD rental organization, where the satisfaction of customers depends on the availability of requested movies. Hence, it is important to satisfy as much demand as possible. Recommendation systems are being used to help customers in finding the right movie. However, the recommendations can also be used to influence the demand. We address this issue by optimizing the recommendation system based on the inventory status, and show that this approach is more beneficial.

3 - Market Segmentation with Risk: Applications for Electronic Commerce
Ori Marom, Assistant Professor, RSM Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, omarom@rsm.nl, Abraham Seidmann

We characterize an optimal scheme for the sale of multiple identical items by a monopolist in a market comprising risk-averse buyers. We establish that a seller may obtain segmentation benefits by randomizing prices in one channel while also offering a risk-free alternative in another. The optimal vehicle of such randomization is a draw from a discrete two-point probability distribution function. We use the model to offer explanations for observed behavior of online sellers.

■ SB69

H - Salon F, 6th Floor

RAS Problem Solving Competition - 2010

Sponsor: Railrway Applications
Sponsored Session

Chair: Shankara Kuppa, Systems Engineer, Union Pacific Railroad, 1400 Douglas St, Mailstop 0580, Omaha, NE, 68179, United States of America, skuppa@up.com

Co-Chair: Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, 6308 Kristen Dr., Fort Worth, TX, 76131, United States of America, homarjun.agrahari@bnsf.com

1 - RAS Problem Solving Competition
Shankara Kuppa, Systems Engineer, Union Pacific Railroad, 1400 Douglas St, Mailstop 0580, Omaha, NE, 68179, United States of America, skuppa@up.com

The objective of this competition is to spread awareness about these interesting problems in OR community that includes students, academicians and practitioners. In this session, we will have two/three finalists present their approaches to address the problem for this year's competition. Abstracts of the papers will be updated after the finalists are identified. For more information regarding the competition, please visit http://www.informs.org/Community/RAS/Problem-Solving-Competition.

■ SB70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Advances in Airline Scheduling

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Rd., Elk Grove Village, IL, 60007, United States of America, gizem.keysan@united.com

1 - A Decomposition Technique for Itinerary-based Airline Fleet Assignment

Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Rd., Elk Grove Village, IL, 60007, United States of America, gizem.keysan@united.com, Bala Srinivasan

Airline fleet assignment problem involves maximizing profitability while assigning aircraft types to flight legs. Although itinerary-based airline fleet assignment problem incorporates network considerations, the resulting solutions are often suboptimal due to the high computational complexity in practical settings. We introduce a decomposition technique that solves the itinerary-based fleet assignment efficiently without sacrificing solution quality.

2 - Strategic Planning in the Airline Industry Under Jet Fuel Price and Demand Uncertainty

Marc Naumann, Decision Support & Operations Research Lab - University of Paderborn, Warburger Str. 100, Paderborn, 33098, Germany, naumann@dsor.de, Leena Suhl, Achim Koberstein

Fuel costs are a growing part of airlines' costs and their fluctuations become higher. We connect schedule design and fleet assignment in a new strategic planning model under fuel price uncertainty. We present a SP-model that determines the optimal offered flights, passenger routes and aircraft types. To counteract uncertainty, financial hedging is considered. We show that the optimal decisions depend on the fuel price and that the integration of hedging improves profit at given risk levels.

3 - A Gate Assignment Model (GAP) for Schedule Planning and Operations

Kumar Abhishek, Sr. Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Village, IL, 60007, United States of America, Kumar.Abhishek@united.com, Vikrant Sharma

A gate assignment model is developed for the schedule planning group and stations for assigning gates to aircraft turns subject to gate resource availabilities and restrictions including gate rests. The model can also re-time flights to create feasible solutions while accounting for network effects. An integer programming model is formulated to solve this problem. Because of run time considerations, a heuristic decomposition approach is taken that solves the problem an order of magnitude faster.

4 - Multicommodity Gate Flow Network Model Solving Flight-gate Assignment Problem for Hub-spoke Airline

Binod Maharjan, Texas Tech University, 2500 Broadway, Box 43061, Lubbock, TX, 79409, United States of America, b.maharjan@ttu.edu, Timothy Matis

Binary integer (BI) multi-commodity gate flow network model is formulated to find the optimum flight-gate assignment. The objective is to minimize the taxi-in/out fuel burn cost and connecting passengers walking distance from arrival gate to departure gate through judicious assignment policy. BI programs are very difficult to solve due to non-polynomial computational time and high RAM requirements. Therefore, the gate zoning approach is used by grouping certain available gates in an airport to zones and sub-zones reducing the big problem into smaller problems then solved to find optimal solution. Model is tested for the scheduled flight data of Continental Airlines to seek the optimal flight-gate assignment policy at IAH.

■ SB71

H - Salon H, 6th Floor

Strategic Perspectives Through DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Indranil R. Bardhan, Associate Professor, University of Texas-Dallas, School of Management, SM 41, Richardson, TX, 75080, United States of America, bardhan@utdallas.edu

1 - Strategic Efficiency and Innovation as Determinant of Selection and Competition: Insights From a Pareto Efficiency Frontier Analysis

Arie Y. Lewin, Duke University, The Fuqua School of Business, Durham, NC, United States of America, ayl3@duke.edu, Lawrance Seiford, Silvia Massini, Joe Zhu, H. R. Greve

This paper analyzes 23 years of data on the Japanese cement industry. The data has details about inputs such as staffing levels, kiln capacity and outputs of cement production. In addition during that time period the Japanese cement industry introduced four new cement making technologies. The starting assumption was that in a commodity industry firms will minimize costs to achieve cost leadership and those firms on the Pareto efficient production frontier would be the ones to introduce successive technological innovations. The empirical DEA analysis did not support this initial hypothesis. A re-analysis of the data revealed that no firm was consistently on the Pareto efficient production frontier and that the introduction of new technologies was a form of leapfrogging strategy. It involved a small number of firms who were competing for cost leadership but no firm had been able to achieve a sustained cost leadership position. In one case the strategy the firm introducing a new technology is consistent with hyper-competition theory of firm that it is verge of being selected out being the one introducing a new cement making technology. The key finding of the paper is that introduction of new cement making technologies is affected by firm specific strategic considerations which is consistent with other empirical studies of heterogeneity of performance within industries.

2 - Returns to Scale in Public Accounting Firms

Hsihui Chang, Drexel University, Philadelphia, PA, hc336@drexel.edu, Hiu Lam Choy, Benjamin Lev, Iny Hwang

This paper employs DEA to evaluate the returns to scale patterns of public accounting firms in the post Sarbanes-Oxley Act (SOX) period. Analyzing operations data on top 100 public accounting firms over the period 2003-2007, our statistical test results indicate that public accounting firms exhibit decreasing returns to scale in the post SOX period, suggesting that public accounting firms should consider either downsizing and/or divestitures in order to improve their efficiency.

3 - Productivity Differences Between US and Chinese Manufacturing Plants: A Non-parametric Analysis

Indranil R. Bardhan, Associate Professor, University of Texas-Dallas, School of Management, SM 41, Richardson, TX, 75080, United States of America, bardhan@utdallas.edu, Zhiqiang Zheng, Sezgin Ayabakan

Explore differences in productivity between US and Chinese manufacturing plants. Using data from 2007, we use a two-stage DEA approach to identify the determinants of manufacturing efficiencies among Chinese and US plants. We evaluate plant characteristics as well as technology spending in terms of their impact on productivity.

■ SB72

H - Salon J, 6th Floor

Innovations in Pricing of Transportation Systems: II

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Siriphong Lawphongpanich, University of Florida, Gainesville, FL, 32607, United States of America, lawphong@ise.ufl.edu

1 - Congestion Pricing Under Travel Time Uncertainty: A Game Theory Perspective

Qian Wang, Assistant Professor, University at Buffalo, the State University of New York, 231 Ketter Hall, UB North Campus, Buffalo, NY, 14260-4300, United States of America, qw6@buffalo.edu, Jun Zhuang, Peng Zhang

This paper develops a game-theoretic framework to solve the optimal toll design problems given travelers' different attitudes to travel time unreliability. The conceptual framework is a sequential game in which the road authority chooses toll schemes and then travelers determine their routes accordingly. The modeling framework is tested on a small network. As found, tolls work efficiently if and only if the travel time reliability of the tolled roads can be ensured.

2 - Self-Adaptive Tolling Strategy for Optimal Operations on High Occupancy Toll Lanes

Guohui Zhang, University of Texas-Austin, Center for Transportation Research, Austin, TX, 78701, United States of America, guohui.zhanguw@gmail.com, Yinhai Wang

A Self-Adaptive Tolling Strategy (SATS) is formulated for systematically optimizing High Occupancy Toll (HOT) lane system operations dynamically. This strategy aims at fully utilizing the HOT lane capacity while maintaining high speed and/or reliability of travel time for HOT lane traffic to enhance the overall system performance of both HOT and General Purpose (GP) lanes. The test results demonstrate that the proposed tolling strategy performs reasonably well.

3 - Pareto-improving Toll and Subsidy Schemes for Network Optimization

Feng Xiao, Postdoc, UCDavis, Engr III, One Shield's Ave, Room 1001, Davis, CA, 95616, United States of America, evan.fxiao@gmail.com, Michael Zhang

This paper proposes an arc-based toll plus subsidy scheme to improve the system performance in a transportation network. We demonstrate that on a one-origin network, a pareto-improving, system-optimal and revenue-neutral scheme always exists and can be obtained by solving a set of linear equations. For multi-origin network, we define the maximum-revenue problem with pareto-improving constrains (MRPI). We discover that the dual of MRPI is equivalent to a typical Transportation Problem.

4 - Design of More Equitable Pricing Schemes by Capturing Their Distributional Effects

Di Wu, University of Florida, Gainesville, FL, United States of America, wudi@ufl.edu, Yafeng Yin, Siriphong Lawphongpanich

This paper develops a pricing model to determine more equitable pricing schemes for multimodal urban transportation networks. The schemes alleviate congestion or improve social benefit while leading to a more uniform distribution of effects across population groups with different income levels and at different geographic locations. A numerical example is presented to demonstrate the proposed model and the impact of a more equitable pricing scheme.

■ SB73

H - Salon K, 6th Floor

Vehicle Routing I: Vehicle Routing Applications

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - Routing Problems with Commercial Electric Vehicles

Miguel Figliozzi, Portland State University, P.O. Box 97207-0751, Portland, OR, United States of America, figliozzi@pdx.edu, Ryan Conrad, Brian Davis

We present routing models for electric commercial vehicles. In this problem customers can have time windows or other typical routing constraints. In addition charging and energy use constraints are required to adequately represent the limitations of electric vehicles. We present a detailed discussion the modeling approach. In addition, experimental results from a realistic problem in Portland are presented and discussed.

2 - Logistics of Clinical Testing: Heuristics for Routing and Scheduling of Specimen Collection

Lerzan Ormeci, Associate Professor, Department of Industrial Engineering, Koç University, Koç University, Sariyer, Istanbul, 34450, Turkey, lormeci@ku.edu.tr, Eda Yucel, Esma Gel, Sibel Salman

We study the logistics of specimen collection for a clinical testing laboratory that serves clients dispersed in an urban area, motivated by a U.S.-based clinical laboratory. The specimens accumulate by time at the clients throughout a day. We design tours to collect all the specimens with two hierarchical objectives: maximizing the number of specimens processed by the next morning as the first priority, and minimizing the total routing costs as the second.

3 - A Case Study Comparing Two Fleet Routing Algorithms

Douglas A. Popken, Principal Consultant, Systems View, 2127 Mountain Maple Ave., Highlands Ranch, CO, 80129, United States of America, dpopken@systemsview.com

A distributor supplying grocery stores within a major metropolitan area needed to determine efficient, time-window constrained delivery routes. Two algorithmic approaches were compared: a territory-based clustering algorithm with a generalized TSP solver, and a tabu-search based algorithm with insertion heuristics. We examine the practical implications of the approaches and show how a hybrid approach can provide good routes that also appeal to dispatchers and drivers.

■ SB74

H - Room 602, 6th Floor

Advances in Network Equilibrium Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Doan Kien, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States of America, dtkient@gmail.com

1 - Experimental Analysis of User Equilibrium with Real-time Information in Randomly Disrupted Networks

Xuan Lu, University of Massachusetts,Department of Civil and Environmental Engineering, Amherst, MA, xlu@engin.umass.edu, Song Gao, Eran Ben-Elia

The research is the first attempt to study the effectiveness of real-time information and its interactions with route choice behavior in a hypothetic network under uncertain disruptions, using data collected from human subjects who simultaneously make route choices in controlled PC-based laboratory experiments.

2 - Linear Complementarity Formulation for Dynamic Network Equilibirum

Doan Kien, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States of America, dtkient@gmail.com, Satish Ukkusuri

This paper focuses on the dynamic traffic assignment at the network-wide level. Embedding the cell transmission model, this paper proposes an analytical formulation using the linear complementarity techniques. In this model, the trade-off between travel time and schedule delay is also taken into consideration. Thus, the objective is to find the user equilibrium condition for the whole network in which the commuters could choose the time to depart as well as the path to use. The existence of the solution are discussed. After studying the single OD pair, this paper will extend the formulation for the more complicated network. Extensive computational results are conducted to demonstrate the finding in this paper.

3 - Dynamic Traffic Information Generation using Vehicle-to-vehicle Communications

Yong Hoon Kim, Purdue University, West Lafayette, IN, United States of America, kim523@purdue.edu, Srinivas Peeta

We address the problem of generating reliable dynamic traffic information in a road traffic network when vehicles have a capability for V2V communications. The study focuses on the data quality and the spatio-temporal coverage enabled by the V2V communication capability. Insights will be illustrated by comparing the data obtained through the V2V communications and the field data using numerical experiments.

4 - An Improved Traffic Assignment Algorithm that Inherits the Concept of Social Pressure and Slope

Amit Kumar, Research Scholar, Indian Institute of Technology, Department of Mechanical Engineering, Delhi, New Delhi, India, akumar@icfi.com, Srinivas Peeta

We develop a path-based algorithm to solve the static user equilibrium traffic assignment problem, in which the flow update technique inherits some insights from the social pressure algorithm developed by Kupiszewska and Vliet (1998) and the SMPA algorithm developed by Kumar and Peeta (2010). The solution methodology is discussed and computational results are presented for the test network.

Sunday, 1:30pm - 3:00pm

■ SC01

C - Ballroom D1, Level 4

Economics of Renewables Integration and Smart Grid Technologies

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Shmuel Oren, Professor, University of California-Berkeley, IEOR Department, 4135 Etcheverry Hall, Berkeley, CA, 94720, United States of America, oren@ieor.berkeley.edu

1 - Regulating Local Monopolies in Electricity Transmission: A Real-world Application of the StoNED Method

Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

The Finnish electricity market has a competitive energy market in a monopolistic transmission system. To regulate the local monopoly power of network operators, the government regulator uses frontier estimation methods (e.g., DEA, SFA) to identify excessive transmission costs, taking into account outputs and the operating environment. We describe the new regulatory system developed for the Finnish regulator, which utilizes panel data to detect the excessive costs from random noise.

2 - Assessing the Cost and Reliability Impacts of Stochastic Wind Power Through Network Simulation

Lindsay Anderson, Adj. Assistant Professor, Cornell University, 320 Riley Robb Hall, Ithaca, NY, 14853, United States of America, cla28@cornell.edu, Judith Cardell, Chin Yen Tee

It is commonly accepted that wind energy will comprise a significant proportion of total electricity generation in the future, and that systems will be significantly impacted by its intermittent nature. In this work, we quantify the impact of multiple correlated wind farms on a model network, in terms of system costs and reliability metrics. Wind forecast errors are introduced to the economic dispatch methodology using a Monte Carlo approach.

3 - Increasing the Value of Wind with Energy Storage

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

We examine the use of energy storage to mitigate price-suppressive effect of high wind penetrations by shifting wind generation from periods with low prices to periods with higher prices. We show that storage can significantly increase the value of wind generation but that this use of storage can reduce both consumer surplus and the profits of other non-wind generators. We also examine the sensitivity of this value of storage to a number of parameters.

4 - Optimal Transmission Switching: When Economic Efficiency and FTR Markets Collide

Kory Hedman, PhD Candidate, University of California, Berkeley, 4124 Etcheverry Hall, Berkeley, CA, 94720, United States of America, kwh@berkeley.edu, Richard O'Neill, Shmuel Oren

The current push to create a smarter grid has brought to the forefront the possibility of co-optimizing generation along with the network topology. Unfortunately, such co-optimization, while improving social welfare, may be incompatible with prevailing market design practices. We will discuss various market implications resulting from co-optimizing the network topology with generation and, in particular, we examine its affect on the FTR markets.

■ SC02

C - Ballroom D2, Level 4

Reliability, Investment and Restructuring in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Golbon Zakeri, University of Auckland, 70 Symonds St., Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Electricity Markets with Breakdowns

Eddie Anderson, Professor, University of Sydney, Faculty of Economics and Business, Sydney, Australia, edward.anderson@sydney.edu.au, Carlos Ruiz Mora

We model electricity markets with uncertainty in supply as well as demand. There is a two settlement process with a day-ahead market followed by a real time balancing market. Generators may suffer unit outages without warning in which case they buy power in the balancing market to meet their sales in the day-ahead market. We find the two stage equilibrium behaviour and investigate how the equilibrium varies with changes in reliability, and whether there could be an advantage in being unreliable.

2 - Capacity Expansion in the Integrated Supply Network for an Electricity Market

Shan Jin, Iowa State University, Industrial & Mfg. Sys. Engineering, Ames, IA, United States of America, shanjin@iastate.edu, Sarah Ryan

Constraints in fuel supply, electricity generation and transmission interact to affect the welfare of strategic generators and price-sensitive consumers. We use a mathematical program with complementarity constraints to optimize expansions in each level of the electricity supply network. Challenges posed by the discreteness of transmission expansions are mitigated using bounds obtained from a centrally-coordinated version of the model.

3 - Real and Virtual Asset Swaps in the Retail and Wholesale Electricity Sectors

Anthony Downward, University of Auckland, Level 3, 70 Symonds Street, Auckland, 1010, New Zealand, a.downward@auckland.ac.nz, Golbon Zakeri, David Young

In 2009 Prof. Frank Wolak carried out a review of the New Zealand electricity market. In this report he noted that there is a lack of competition in the NZEM, particularly during dry years and suggested that competition could be improved by reallocating generation assets amongst the market participants. We have designed an equilibrium model that encompasses both the retail and wholesale electricity sectors. We consider a variety of reallocation scenarios and analyze their effects on prices.

4 - Path Dependency in Power Sector Investments

Janne Kettunen, Assisstant Professor, University of Calgary, Calgary, Canada, jskettun@ucalgary.ca, Derek Bunn

We analyze the resource-based path dependency in new risk-averse power generation investments under carbon policy uncertainty. Modeling the investment decision making via stochastic dynamic optimization and operations and financing decisions via stochastic optimization, we demonstrate that the investment decision is significantly impacted by the (i) scale effects that are manifested by the number of similar power plants and (ii) diversity effects stemming from the existing power plant mix.

■ SC03

C - Ballroom D3, Level 4

Supply Chain and Production Operations

Sponsor: Energy, Natural Resources and the Environment/ Mining Sponsored Session

Chair: Juan Pablo Vielma, IBM Research and University of Pittsburgh, PO Box 218, Yorktown Heights, NY, United States of America, jvielma@pitt.edu

1 - Synchronization of Planning and Production Processes in a Large Mine

M. Mustafa Kahraman, The University of Arizona, kahraman@email.arizona.edu, Sean Dessureault

Planning and the production processes have different considerations in large coal mines. The critical point between these two processes is 'if the plans are compatible with production'. Production plan could include many concerns; however, these concerns might conflict with production capabilities or in some cases could be very costly. This paper offers approaches that would help improve coordination through engineered processes enabled through data warehousing and OLAP cube analysis.

2 - A Model-Based Decision Support System for Supervision of Coal Blending and Load-Out Processes

Victor Tenorio, Graduate Research Assistant, University of Arizona, 1502 E 10th St Apt 232, Tucson, AZ, 85719, United States of America, vtenorio@email.arizona.edu, Sean Dessureault

A decision support system is designed and implemented in the largest coal mine in North America, to supervise operations and achieve coal quality requirements while maximizing benefits. Operators can adjust parameters to reduce the risk of production variability, blending and shipping processes. Simulators and 5 algorithms take into account key decisions such as; real-time pit-grade assay reconciliation and mining costs, planned train quality valuation and the cost of over/undermining pits.

3 - Simulation-based Planning Framework for Material Handling Network in Mining

Sai Srinivas Nageshwaraniyer, The University of Arizona, Tucson, AZ, ngsaisrinivas@gmail.com, Young-Jun Son, Sean Dessureault

The operations of the largest coal mine in North America are simulated in detail, where major entities include trucks, shovels, silos, conveyors and train load-outs. The functioning of these entities is synchronized using timely shift data from a data warehouse. The model is coupled with a meta-heuristic used to schedule future operations to achieve customer specified train-by-train coal blends over a period of time to maximize the mine's profit. Simulation-based control is also addressed.

4 - Data-Driven Health Management of Mining Equipments
Zhenrui Wang, University of Arizona, Tucson, AZ, United States of America, zrwang@email.arizona.edu, Jian Liu, Sean Dessureault

Maintenance is typically approximately half of all operating costs in an open pit operation. Taking advantage of machine operating and health data stored in large scale data warehouse, this research applies generalized linear regression and statistic process control techniques to identify oversensitive equipments and abusing operators in a real operating mine.

■ SC04

C - Ballroom D4, Level 4

Joint Session Clean/ ENRE Energy: Policy/Incentives for Promoting Renewable Energy

Cluster: Clean Energy/ Energy, Natural Resources and the Environment
Invited Session

Chair: Gireesh Shrimali, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Gireesh_Shrimali@isb.edu

1 - Comparing the Cap-and-trade and Carbon Taxes Policies in Generation Expansion Planning
Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu, Jianhui Wang, Yanyi He

We compare the effectiveness of cap-and-trade and carbon taxes in the context of generation capacity expansion. Policies are compared with respect to five criteria: carbon price and subsidy, renewable portfolio, total energy generation, generation companies' and grid owner's total profit, and government revenue. Numerical experiments show the relative advantages, disadvantages, similarities, differences, and limitations of the policies.

2 - Carbon Capture by Fossil Fuel Power Plants: An Economic Analysis
Ozge Islegen, PhD Candidate, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, oislegen@stanford.edu, Stefan Reichelstein

This study projects the changes in electricity prices if fossil fuel power plants are regulated for their CO2 emissions. We focus on carbon capture and storage (CCS) technology that new power plants may adopt either because of a mandate or because the market price of CO2 emission permits is sufficiently high. We forecast the resulting changes in wholesale electricity prices and identify the break-even price of CO2 emission permits that makes adopting the CCS technology economically attractive.

3 - Performance-based Contracting for Energy Efficiency Projects
Sam Aflaki, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, sam.aflaki@insead.edu, Paul R. Kleindorfer

An Energy Service Company (ESCO) implements energy efficiency projects for customers, which generate positive net cash flows from resulting energy and carbon savings. We characterize Pareto optimal ESCO contracts with the following structure: an upfront payment, ex-post sharing of the realized savings and ex-ante guarantee of customer savings. Extensions of the basic model include joint contracting and investment decisions, moral hazard and allocation of carbon credits.

4 - Optimal Feed-in Tariff Schedules
Gireesh Shrimali, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Gireesh_Shrimali@isb.edu

We examine least cost feed-in tariff schedules in a two-period model that focuses on bringing down the cost of renewable technologies to a predefined target under two dynamics: learning-by-doing (LBD) and returns to scale (RTS). When the target is stringent, subsidies are required in both periods, regardless of the dynamic. However, when the target is moderate, subsidies are required only in one of the two periods, and under LBD (RTS) it is optimal to subsidize as early (late) as possible.

■ SC05

C - Ballroom D5, Level 4

Sports Scheduling

Sponsor: SpORts
Sponsored Session

Chair: Dirk Briskorn, University of Cologne, Cologne, Germany, briskorn@wiso.uni-koeln.de

1 - Scheduling Softball Games in the Rocky Mountain Athletic Conference
Marjorie Cone Saur, Colorado Schoo of Mines, Division of Economics and Business, Golden, CO, United States of America, mcone@mymail.mines.edu, Mark Husted, Kaleigh Starr

The RMAC is a Division II NCAA athletic conference that offers women's softball. Conference games are played against every other conference team according to a temporally constrained schedule. Manually generated schedules result in imbalances such as unequal numbers of home games, strings of multiple home or away games, and away-game season openers and closers for the same team. Our integer programming-based schedules eliminate these imbalances while ensuring that all requisite games are played.

2 - The Quality of Major Sports League Schedules in Finland
Cimmo Nurmi, Research Director, Satakunta University of Applied Sciences, Tiedepuisto 3, Pori, 28600, Finland, cimmo.nurmi@samk.fi, Markus Leinonen, Jari Kyngas

Generating a schedule for a professional sports league is an extremely demanding task. Good schedules have many benefits for the league, such as higher incomes, lower costs and more interesting and fairer seasons. This talk/paper gives an analysis of the quality of schedules. We analyze five major sports leagues in Finland: ice-hockey, soccer, baseball, floorball and basketball. We also share our experiences in scheduling the Finnish Major Ice Hockey Leagues in the past three years.

3 - Team Assignments and Scheduling for the NCAA Basketball Tournament
Sharif Melouk, University of Alabama, Operations Management, Tuscaloosa, AL, 35487, United States of America, smelouk@cba.ua.edu, Burcu Keskin

There are growing concerns of dwindling actual attendance and increasing financial burden with regard to the NCAA tournament. In this paper, we develop an assignment model aimed at minimizing the distance traveled by teams to game sites and the corresponding travel costs. The goal is to increase tournament accessibility to fans and lessen the financial impact to the NCAA while maintaining tournament integrity. We test our model against actual tournament assignments from the past five years.

4 - The Relaxed Traveling Tournament Problem
Michael Trick, Carnegie Mellon, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, trick@cmu.edu

In many sports leagues, off days are built in to the schedule. We extend the Traveling Tournament Problem to include such off days and provide some initial computational results. For some approaches, such as constraint and integer programming, the relaxed version of the problem becomes more difficult. Other approaches, including a Benders approach, are much more promising.

■ SC06

C - Ballroom E, Level 4

Tutorial: Simulation Input Modeling

Cluster: Tutorials
Invited Session

Chair: James Wilson, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, jwilson@ncsu.edu

1 - Introduction to Modeling and Generating Probabilistic Input Processes for Simulation
James Wilson, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, jwilson@ncsu.edu, Mary Ann Wagner, Natalie M. Steiger, Michael E. Kuhl, Emily K. Lada, Julie Ivy

We discuss modeling, fitting, and generating the univariate probabilistic input processes that drive many discrete-event simulation experiments. We emphasize the generalized beta distribution family, the Johnson translation system of distributions, and the Bezier distribution family. Also discussed are techniques for modeling and simulating time-dependent arrival streams using nonhomogeneous Poisson processes. Public-domain software implementations and current applications are presented.

■ SC07

C - Ballroom F & G, Level 4

Joint Session JFIG/ INFORM-ED: Panel Discussion: Improving Teaching Effectiveness: Tips From Seasoned Faculty

Sponsor: Junior Faculty Interest Group/ INFORM-ED
Sponsored Session

Moderator: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

Moderator: Matthew Bailey, Bucknell University, School of Management, Taylor Hall, Lewisburg, PA, United States of America, matt.bailey@bucknell.edu

1 - Joint JFIG/ INFORM-Ed: Panel on Teaching Effectiveness
Panelists: Matthew Bailey, Bucknell University, School of Management, Taylor Hall, Lewisburg, PA, United States of America, matt.bailey@bucknell.edu, Jeffrey Ohlmann, University of Iowa, S210 John Pappajohn Business Building, Iowa City IA 52242, United States of America, jeffrey-ohlmann@uiowa.edu, Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa AL, United States of America, bkeskin@cba.ua.edu, Stephen G. Powell, Professor, Dartmouth College, Tuck School, Dartmouth College, Hanover NH 03748, United States of America, Stephen.G.Powell@tuck.dartmouth.edu, James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston LA 71272, United States of America, jcochran@cab.latech.edu, Jill Hardin, Associate Professor, Virginia Commonwealth University, jrhardin@vcu.edu, Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati OH 45221, United States of America, jeff.camm@uc.edu

This panel is open for all faculty interested in promoting quality teaching in OR/MS courses at all levels: undergraduate, masters, MBA, and PhD. Recognizing the need for diversity of various teaching styles, the panel of experts will share their experiences and tips for improving teaching effectiveness. The panelists will also discuss important topics such as "Transition from a Grad Student to Instructor, "Balancing Research and Teaching", "Teaching methods in Business and Engineering schools", and "Resources for Best Teaching Practices".

■ SC08

C - Room 11A, Level 4

Location Models in Healthcare

Sponsor: Location Analysis
Sponsored Session

Chair: Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca

1 - User-equilibrium Models for Facility Network Design in Healthcare
Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca, Derek Atkins

Motivated by a real case study, this talk describes a methodology for optimizing the facility network of a health service provider to maximize its market share in a competitive environment. Facility locations and capacities are the main determinants. With two different assumptions about patient choice behavior of where to obtain service, we formulate the problems as mathematical programs with equilibrium constraints and develop a location-allocation framework to solve them.

2 - Impact of Model Choice, Aggregation, and Data Preparation for an EMS Station Location Model
Erik Rolland, University of California Riverside, 900 University Ave., Riverside, CA, 92521, United States of America, erik.rolland@ucr.edu, Armann Ingolfsson, Raymond Patterson, Geoff Holmes

We investigate the impact of three modeling choices on solution quality for planning ambulance station locations to maximize covered demand: (1) A deterministic maximum coverage model or a model with probabilistic coverage, (2) the level of demand aggregation, and (3) how distances and probabilities of coverage are determined for aggregated demand regions. Preliminary results indicate that using the probabilistic model greatly increases solution quality, even if demand is highly aggregated.

3 - Facility Location Models for Infectious Disease Outbreak Response
Sean Carr, PhD Student, North Carolina State University, 5406 Silver Moon Lane, Raleigh, NC, 27606, United States of America, smcarr2@ncsu.edu, Reha Uzsoy, Stephen Roberts

This work uses facility location models to aid in the decision to locate disaster or infectious disease outbreak response facilities, such as mass vaccination, antiviral, medical supply, or other provision dispensing and efficiently allocate the population and healthcare resources. Several capacitated facility location problems will be discussed, with various objective functions and constraints. Example scenarios are provided for infectious disease outbreaks in Wake County, NC.

4 - A Novel Probabilistic Ambulance Location Model
Yongke Yuan, Associate Professor, Beijing University of Technology, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, 33620, United States of America, yyuan@usf.edu, Michael Weng, Bo Zeng

Most ambulance location models are to maximize population coverage with consideration of ambulance availability. In this talk, we present a novel location model that minimizes the expected service time with two types of ambulances (servers) and their availabilities. As it is a large-scale mixed integer programming model, a Lagrangian relaxation method is developed to obtain the solution. Numerical results will be presented to show the effectiveness of the model and the solution method.

■ SC09

C - Room 11B, Level 4

Strategic Sourcing/Procurement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Damian Beil, Associate Professor, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

1 - Contracting for Capacity: Partner Preferences and the Value of Anticipating Renegotiation
Eda Kemahlioglu-Ziya, University of North Carolina-Chapel Hill, CB#3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

We study contract renegotiation in a stylized supply chain model. Two original equipment manufacturers reserve capacity at a contract manufacturer prior to demand realization. Contract renegotiation allows the OEMs to use and pay for capacity that is more or less than what they reserved. We aim to understand how an OEM's expected post-renegotiation profit is affected by her ability to negotiate a low wholesale price in the initial contract as well as the ability of the other OEM to do the same.

2 - Asymmetric Information and Enforcement in Supply Contract Design
Fuqiang Zhang, Washington State University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, fzhang22@wustl.edu, Ehsan Bolandifar, Tianjun Feng

This paper studies a supply contracting problem for a buyer who sources a product from a supplier to satisfy uncertain market demand. The buyer faces two issues when designing the supply contract: asymmetric information (i.e., the supplier's cost structure is private information) and enforcement (i.e., supply chain firms may shirk from their responsibilities for capacity risks). We derive the buyer's optimal contracting strategies in such a problem setting and analyze their properties.

3 - Auctions and Ambiguity Within Auto Insurance Markets
Wedad Elmaghraby, Robert. H Smith School of Business, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu, Ali Pilehvar, Canan Savaskan

It is a common practice for car insurance companies to run auctions in order ot dispose of cars that have been damaged beyond repair. Buyers of these damaged cars, Parts disassemblers, must bid on cars in the hopes that there are salvageable components that can later on be sold to downstream repair shops. We investigate the role of auctions within this ambiguous procurement environment.

4 - Strategic Price Quotation by a Tier-two Supplier
Bin Hu, Doctoral Candidate, Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, hub@umich.edu, Damian Beil, Izak Duenyas

We study price quotation decisions made by a tier-two supplier. The tier-two supplier's customers compete in a reverse auction for an OEM's contract, and use the supplier's price quotes as cost inputs when determining their auction price bids. By quoting higher prices the supplier increases its potential profits but reduces the chance that one of its customers will win the OEM's contract. We characterize the supplier's optimal pricing decisions and optimal quoting mechanism.

5 - Group Buying with Endogenous Quantity
Cuihong Li, University of Connecticut, School of Business, Storrs, CT, United States of America, cuihong.li@business.uconn.edu, Rachel Chen, Rachel Zhang

When a seller offers quantity discounts, buyers may aggregate their purchasing quantities to obtain lower prices, referred to as group buying. Due to buyer externality in group buying, the purchasing quantity of a buyer depends on the quantity choices of other buyers. This paper studies group-buying for buyers given a seller's quantity discount schedule. It analyzes the buyers' purchasing quantities and surplus, and reveals the impact of the group size and buyer asymmetry on the outcomes.

■ SC10

C - Room 12A, Level 4

Multi-Echelon Inventory Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Tim Huh, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, V6T1Z4, Canada, tim.huh@sauder.ubc.ca

1 - A Capacitated Assembly Problem
Alexandar Angelus, Singapore Management University, 50 Stamford Road, #04-90, Singapore, Singapore, angelus@smu.edu.sg

We formulate an inventory system with an assembly structure and stochastic demand for the final product. We introduce production capacity limits throughout the assembly, and allow those limits to vary with each component type and stage in the system. We assume backlogging of unsatisfied demand, and carryover of inventory. We find conditions under which such a capacitated assembly system can be reduced to an equivalent (capacitated) series system, thus extending the work of Rosling (1989).

2 - Single-stage Bounds for Optimal Policies in Finite-horizon, Serial Inventory Systems
Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States of America, khshang@duke.edu

We consider a two-stage inventory system in a finite horizon. It is well known that echelon base-stock policies are optimal. We show that the optimal upstream base-stock level is bounded above and below by the optimal base-stock level obtained from a single-stage system in each period. A simple heuristic is proposed by employing an average of the solution bounds. Our results can be extended to general stage systems with Markov modulated demand.

3 - Newsvendor or Not? That is the Question
Ton de Kok, Professor of Operations Planning and Control, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav. E4 NL-5600 MB, Eindhoven, Netherlands, A.G.d.Kok@tue.nl

We consider multi-item multi-echelon systems under periodic review and stationary stochastic demand. We assume linear holding and penalty costs. Several authors have derived generalized newsvendor equations for such systems. We discuss these results, and their underlying assumptions. We show that in general newsvendor equations do not hold by deriving related cost-balance equations. We discuss the consequences of this results for the relation between costs structures and service measures.

4 - A Framework for Revenue Sharing Contract Implementation
Mehmet Sekip Altug, Visiting Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu, Garrett Van Ryzin

Revenue sharing is a popular approach to supply chain coordination. It has had some remarkable successes (ala Blockbuster), but also some notable failures. What accounts for these differences? In this talk, we present a framework for understanding the added value and added costs of revenue sharing contracts that helps explain its implementation success and failure in various industries.

■ SC11

C - Room 12B, Level 4

Advances in Inventory and Risk Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu

1 - Managing Capacity and Inventory Jointly in Large-Scale Manufacturing Systems
Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, bozhang@gatech.edu, Josh Reed

We consider a single-product, parallel-server, make-to-stock manufacturing system under a base-stock policy. We apply first-order diffusion approximations to the joint optimization of production capacity and the base-stock level. We further develop corrected diffusion approximations that enable us to refine the capacity-inventory prescription. The refined prescription achieves a strong form of asymptotic optimality and is accurate even under moderate or low demand.

2 - A Cournot-stackelberg Model of Supply Contracts with Financial Hedging
Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu

We study a supply chain where multiple budget-constrained retailers and a single producer compete in a Cournot-Stackelberg game. At time 0 the retailers order a state-contingent quantity of a single product from the producer and, upon delivery at time T, they sell it in a retail market at a stochastic clearance price. This price depends in part on the realization of some financial market in which the retailers can trade dynamically. We solve for the Nash equilibrium.

3 - New Product Introductions: Improving Demand Information and Supply Responsiveness
Zeina Loutfi, INSEAD, Boulevard de Constance, Fontainebleau, France, zeina.loutfi@insead.edu, Nils Rudi, Aditya Jain

This study addresses the challenge of matching demand and supply in the product introduction phase. We model the effects of prepositioning strategies destined to increase responsiveness and adopt a dynamic approach which permits linking to management of products that have reached steady state. Empirical calibration and evaluation of this strategy is made possible using data from a major cosmetics company marketing their own products in the Middle East and where the approach has been implemented.

4 - Optimal Pricing Under Uniform Allocation Policy: A Model for Online Advertising
Victor Araman, American University of Beirut, Olayan School of Business, Beirut, Lebanon, va03@aub.edu.lb, Kristin Fridgeirsdottir

We consider a web host that generates revenues from displaying advertisements on its website. Each class of advertiser brings a set of requirements including number of hits and length of the ad campaign. We suggest a simple tactical model that depicts the main characteristics of the online problem. One objective we have is to analyze the impact of uncertainty on such system driven on one hand by advertisers demand and on the other by number of viewers visiting the website. The webhost seeks to effectively match demand with supply through pricing and allocating capacity in order to maximize revenues and meet advertisers requirements.

■ SC12

C - Room 13A, Level 4

Supply Chains in Healthcare

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Kevin Taaffe, Associate Professor, Clemson University, 130-A Freeman Hall, Clemson, SC, 29634, United States of America, taaffe@clemson.edu

1 - Analysis of Healthcare Supply Chain Systems Exposed to Random Capacity Disruptions
Alex Savachkin, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue ENB 118, Tampa, FL, 33620, United States of America, alexs@usf.edu, Andres Uribe

Capacity disruption is a profound risk factor for lean health care supply chain systems. We examine capacitated health care supply chain systems using a paradigm of feed—forward flow—matching networks with multiple points of delivery. Two models of stochastic capacity trajectories are analyzed. Our analysis serves as a foundation for decision support for design of resilient health care supply chains.

2 - Routing for Blood Supply Management
Okan Ozener, Assistant Professor, Ozyegin University, Istanbul, Turkey, Orsan.Ozener@ozyegin.edu.tr, Ali Ekici

In many countries, people still die because of inadequate supply of blood products. Blood is needed for several types of treatments including organ transplants, cancer and anemia treatments. In blood supply management, an important step is processing donated blood within a certain amount of time after donation. In this research, motivated by the practices in blood supply management, we study a variant of the Vehicle Routing Problem and develop heuristic algorithms to find good solutions.

3 - Selecting Facilities While Managing Pharmaceutical Manufacturing Risks
Kevin Taaffe, Associate Professor, Clemson University, 130-A Freeman Hall, Clemson, SC, 29634, United States of America, taaffe@clemson.edu, AliReza Madadi, Mary Beth Kurz, Scott J. Mason, Ed Pohl, Sarah Root, Mustafa Sir

In this research, we consider a pharmaceutical supply chain where the firm must select facilities to manufacture a product. These facilities are unreliable, and inspection can be done to reduce the level of tainted materials that reach the marketplace. We use a Conditional Value-at-Risk approach to understand the characteristics of facilities that lead to being selected for operation. Our models allow users to balance operational costs with the risk of catastrophic healthcare delivery.

■ SC13

C - Room 13B, Level 4

Selected Topics in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Osman Alp, Bilkent University, Bilkent University, Industrial Engineering Department, Turkey, osmanalp@bilkent.edu.tr

1 - Exact Optimal Policies for Joint Inventory and Outbound Shipment Decisions
Liqing Zhang, Texas A&M University, Industrial & Systems Engineering Department, 3131 TAMU, College Station, TX, 77843, United States of America, liqing@tamu.edu, Sila Cetinkaya

We consider a periodic review, two-echelon, stochastic inventory problem arising the in the context of VMI. We formulate the problem using stochastic dynamic programming, and examine the optimal joint inventory replenishment and outbound dispatch policies under private fleet transportation. We prove the structure of the optimal policy.

2 - Supply Side Story: Risks, Guarantees, Competition and Information Asymmetry
Mehmet Gumus, Assistant Professor, McGill University, 1001 Rue Sherbrooke West, Montreal, Canada, mehmet.gumus@mcgill.ca, Saibal Ray, Haresh Gurnani

The risk of supply disruption has increased as firms have started procuring more from cheaper, but unreliable, suppliers. In this paper, we model a supply chain comprising a single buyer and two suppliers. The risk level of the unreliable supplier might be private information for her. In such settings, the unreliable supplier often offers a price and quantity guarantee. Our objective is to understand the effects such an offer have on the performance of the chain partners.

3 - Coordination of Inventory Distribution and Price Markdowns at Zara
Felipe Caro, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B-420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

Each year Zara sells inventory during clearance sales accounting for approximately thirteen percent of total revenues. One of the biggest challenges Zara faces in preparation for the clearance season is determining how to distribute 11,000 different fashion designs to over 1,200 stores worldwide. In this talk we describe an ongoing project to distribute merchandise to stores with the highest potential of sale in order to maximize revenues during the clearance period.

4 - Improved Inventory Control in Supply Chains Under Loss Sales and Incomplete Information
Osman Alp, Bilkent University, Bilkent University, Industrial Engineering Department, Turkey, osmanalp@bilkent.edu.tr, Alper Sen, Yasar Altunoglu

Consider a supplier and a retailer operating in a single item, loss sales environment. To maintain the competitive position of the item, supplier imposes penalty costs to the retailer to prevent loss sales and attain high service levels. The retailer makes the ordering decisions accordingly. Supplier has incomplete information of the retailer's observed demand. We propose a new policy that would lead the retailer to make ordering decisions so that the supplier's operating targets are attained.

■ SC14

C - Room 14, Level 4

Panel: Perspectives on Women and Men in the Profession

Sponsor: Women in OR/MS
Sponsored Session

Moderator: Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Moderator: Feryal Erhun, Stanford University, 380 Panama St, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - Panel Discussion: Perspectives on Women and Men in the Profession
Panelists: Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu, Stephen Graves, Abraham Siegel Professor of Managment, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E53-347, Cambridge MA 02139, United States of America, sgraves@MIT.edu, Paul Griffin, Professor and Department Head, Penn State University, Department of Industrial Engineering, 310 Leonhard Bldg, University Park PA 16802, United States of America, pmg14@engr.psu.edu, Karen Donohue, Associate Professor, University of Minnesota, Carlson School of Management, Minneapolis MN, United States of America, donoh008@umn.edu, Feryal Erhun, Stanford University, 380 Panama St, Stanford CA 94305, United States of America, ferhun@stanford.edu, Brenda Dietrich, IBM, T.J. Watson Research Center, Yorktown Heights NY, United States of America, dietric@us.ibm.com

In the era of Computer Engineer Barbie, how are experiences, work styles, and challenges in the OR/MS profession different for women and men? How can the community support and encourage men and women to enter the profession and excel together?

■ SC15

C - Room 15, Level 4

Tutorial on How to Conduct Human Subject Experiments in Behavioral Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu

1 - Tutorial on Designing and Conducting Laboratory Experiments in Behavioral Operations Management
Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu

I will discuss the state-of-the-art issues in designing and conducting laboratory experiments in BOM. Some of the topics I will cover will include incentive alignment, subject pool, and the logistics involved in designing and conducting a study.

■ SC16

C - Room 16A, Level 4

Applications of Operations Research in Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com

Co-Chair: Yiwei Cai, Freescale Semiconductor, 3501 Ed Bluestein Blvd, Austin, TX, 78721, United States of America, Yiwei.Cai@freescale.com

1 - Reducing Manufacturing Cost by Idling-machine Model in Freescale Semiconductor

Yiwei Cai, Freescale Semiconductor, 3501 Ed Bluestein Blvd, Austin, TX, 78721, United States of America, Yiwei.Cai@freescale.com

Most companies are struggling to reduce cost to feather against the economic recession. Keeping machines running in a semiconductor fab incurs great cost. Determining which tools to idle can be complicated. Idling-Machine Model (IMM) is an integer programming model created in Freescale's ATMC fab to identify the machine candidates to be idled. The IMM greatly improves the speed and accuracy of the decision process of idling machines, and is considered a very useful tool by the management team.

2 - Integrated Wafer Procurement Planning and Back-end Planning at AMD

Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com, Javad Ahmadi

After separation from the Global Foundries, AMD started purchasing the wafer products instead of producing them. Having a simplified procurement process with very few operational decisions (wafer-bump and wafer-sort) instead of a very complex production process enabled us to develop an integrated "wafer procurement planning" and "back-end planning" (Assembly-Test-Mark-Pack) system for AMD.

3 - Method for Capable to Promise

Javad Ahmadi, SMTS Operations Research Analyst, AMD, 7171 Southwest Pkwy, Austin, TX, 78735, United States of America, javad.ahmadi@amd.com, Mehmet Candas

AMD utilizes an internally developed production planning system for management of production activities across its supply chain. The planning process is a regenerative weekly process. Regardless of the level of effort in demand forecasting, frequent changes to demand, mostly mitigated by order inquires or order changes occur. We discuss our approach for a better alternative to the ATP or regenerative planning.

4 - Scheduling Back-end Operations in Semiconductor Manufacturing

Yumin Deng, Research Scientist, Amazon, 10352 Stone Ave N APT 6, Seattle, WA, 98133, United States of America, ydeng@amazon.com, Jonathan Bard

The importance of back-end operations in semiconductor manufacturing has been growing steadily in the face of higher customer expectations and stronger competition in the industry. This paper presents a new model and solution methodology aimed at maximizing the weighted throughput of lots undergoing assembly and test, while ensuring that critical lots are given priority.

■ SC17

C - Room 16B, Level 4

The Role of Forecasting in Optimization

Cluster: Practice of OR/MS
Invited Session

Chair: Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

1 - Forecasting and Optimizing Long-Range Plans

Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

The link between forecasting and optimization is critical in long-range planning. We will explore this link in the context of our work to build a drug development pipeline model for Novartis Vaccines & Diagnostics which forecasts long-range R&D performance and optimizes the acquisition schedule for new drugs. We will discuss the practical lessons learned and our modeling methodology, which included Monte Carlo simulation-based forecasting, simulation optimization, and grid computing.

2 - Accounting for Forecast Shift in Estimating the Value Added of Demand Planning

Oscar Rosen, The Procter & Gamble Company, 2 Procter and Gamble Plaza, Cincinnati, OH, 45202, rosen.o@pg.com, Ross Yurovski

Here we show how traditional forecast error metrics can significantly undervalue the changes to the statistical forecast that demand planners make by using their business knowledge about promotions and initiatives. If the magnitude of a promotion is accurately forecasted but the expected timing is slightly off it can lead to a significant forecast error which does not account for the value to manufacturing of knowing the size of upcoming promotions. We call this a Forecast Error Shift Paradox.

3 - Pricing Optimization using Market Simulation in Medical Devices

Michael Kubica, President, Applied Quantitative Sciences, Inc., 1460 South Ocean Boulevard, Suite 1403, Lauderdale-by-the-Sea, FL, 33062, United States of America, mkubica@aqs-us.com

Pricing strategy can be vexing under even the simplest of circumstances. When confronted with the possibility of multiple competing technologies and complex economic pressures among potential consumers the problem becomes even more complex. Using a case study in the medical device arena, this session will explore the utility of combining simulation forecasting with stochastic optimization to identify the launch pricing strategy for a novel medical device.

■ SC18

C - Room 17A, Level 4

Optimization for a Smarter Planet

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Parijat Dube, IBM TJ Watson Research Center, Yorktown Heights, NY, United States of America, pdube@us.ibm.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Co-Chair: Laura Wynter, IBM, Yorktown Heights, NY, United States of America, lwynter@us.ibm.com

1 - Evacuation Route Planning: Novel Spatio-temporal Network Models and Algorithms

Shashi Shekhar, Mcknight Distinguished University Professor, University of Minnesota, 200 Union St. SE #4192, Minneapolis, United States of America, shekhar@cs.umn.edu

Scalable tools are needed for evacuation-route planning in emergency response. Challenges include non-stationary ranking of alternative routes, etc. Time-expanded graphs based mathematical programming does not scale up to large cities due to excessive network duplication. Proposed Capacity Constrained Route Planner (CCRP) uses novel Time-Aggregated Graph. DHS case-studies show that CCRP is much faster than alternatives.

2 - Smarter Transportation Analytics

Laura Wynter, IBM, Yorktown Heights, NY, United States of America, lwynter@us.ibm.com

We will present the optimization work behind some of the Smarter Transportation Analytics developed at IBM Research. We shall discuss the Data Expansion Algorithm which combines least squares estimation with bilevel programming to fill in the gaps in real-time traffic data over a road network. We present also the Traffic Prediction Tool and the Bus Arrival Prediction algorithm that make use of time series-based models to provide real-time forecasts of road traffic and bus arrivals at bus stops.

3 - Routing Optimization for Holidays and Planned Events

Sambit Sahu, Research Staff Member, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, sambits@us.ibm.com, Jing Dai, Milind Naphade, Chang-Tien Lu

Holidays and planned special events can affect not only the traffic towards the events, but also the normal commuters using the adjoining roadways. Accurately predicting traffic during holidays and planned events can support optimized routing for trip planning, and contribute to better roadway performance and safety. This paper proposes an approach to optimize the routing for holiday and planned events based on traffic flow estimation using spatial-temporal information.

■ SC19

C - Room 17B, Level 4

New Directions in Revenue Management and Pricing I

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Marc Dudey, Rice University, 5109 Mimosa Dr., Bellaire, TX, 77401, United States of America, dudey@rice.edu

1 - Tractable Markdown Optimization (MDO) using Uncertainty
Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu, Pavithra Harsha

We study the MDO problem faced by a vendor selling a seasonal item with fixed inventory. Our work bridges the gap between practice and theory in addressing the MDO problem where the former addresses a deterministic demand MDO problem with several business rules (BR) and the latter addresses a stochastic demand MDO problem more or less in the absence of BR. We provide analytical bounds, approximate closed loop-pricing policies and discuss experimental results.

2 - Two-stage Procurement and Price Competition for Short Life Cycle Products
Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca, Philipp Afeche, Yang Li

We study the equilibria of a two-period price-inventory game between duopolists who sell differentiated short life cycle products. Both firms choose their initial inventory prior to resolving the demand uncertainty and have the option to later make inventory adjustment and pricing decisions.

3 - Competition with Partially Refundable Fares
Guillermo Gallego, Columbia University, New York, NY, United States of America, gmg2@columbia.edu

Gallego and Sahin (2009) show that a capacity provider with monopoly power can improve revenues over advance selling by selling partially refundable fares, and such fares are socially optimal. This paper studies a Stackelberg duopoly and shows the benefits of partially refundable fares prevail under competition. The equilibrium is not socially optimal, but our computational results show solutions with partially refundable fares are close to being socially optimal.

4 - Capacity Choice with Equilibrium Price Outcomes
Roger Lederman, Columbia University, New York, NY, United States of America, rlederman13@gsb.columbia.edu, Garrett Van Ryzin, Nicolàs E. Stier Moses

Capacity expansion may impact the product mix and pricing decisions of a firm's competitors, and thus alter prevailing market conditions. To account for this effect, we study capacity investment by firms that compete in multiple markets. The allocation of resources and prices obtained are determined as the equilibrium of a game amongst capacity-constrained producers. We analyze flexibility of capacity and competitive positioning as factors that can influence the optimal capacity configuration.

5 - Quantity Precommitment and Price Competition Yield Bertrand Outcomes
Marc Dudey, Rice University, 5109 Mimosa Dr., Bellaire, TX, 77401, United States of America, dudey@rice.edu

This paper studies a dynamic duopoly wherein firms decide how much to produce before engaging in multi-period price competition. The market becomes perfectly competitive as parameters approach their Bertrand values. This "irrelevance theorem" links Cournot-style outcomes with price inflexibility.

■ SC20

C - Room 18A, Level 4

Revenue Management in Internet Advertising

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Hamid Nazerzadeh, Microsoft Research, One Memorial Dr., Cambridge, MA, United States of America, hamidnz@stanfordalumni.org

1 - Competing Auctioneers
Mallesh Pai, Department of Economics, University of Pennsylvania, Philadelphia, PA, United States of America, mallesh.pai@gmail.com

We study a model where multiple sellers with limited supply choose mechanisms to compete for a fixed pool of buyers. We show that inefficiency in this setting arises both because sellers withhold the good and because they misallocate the good. This contrasts with the findings of the literatures on monopolistic and competing sellers, which suggest that the only form of inefficiency that arises is from sellers withholding the good. Both types of inefficiencies vanish as the market grows large.

2 - Dynamic Revenue Management for Online Display Advertising
Guillaume Roels, Assistant Professor, University of California-Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, guillaume.roels@anderson.ucla.edu, Kristin Fridgeirsdottir

In this talk, we propose a dynamic optimization model to maximize a web publisher's online display advertising revenues. Our model dynamically selects which advertising requests to accept and dynamically delivers the promised advertising impressions to viewers so as to maximize revenue. After characterizing the structural properties of our model, we propose a Certainty Equivalent Control heuristic and then illustrate our approach with a real case study.

3 - Simultaneous Ad Auctions
Itai Ashlagi, Massachusetts Institute of Technology, 27 Everett St., Cambridge, MA, United States of America, itai.ashlagi@gmail.com

We discuss two models for a pair of simultaneous ad auctions, A and B: (i) single-campaign advertisers and (ii) multi-campaign advertisers. We prove the existence and uniqueness of a symmetric equilibrium in the first model. When click-through rates in A are point-wise higher than those in B, we prove that the expected revenue in A is greater than the expected revenue in B in this equilibrium. In contrast higher click-rates do not necessarily imply higher revenues in the second model.

4 - Optimal Dynamic Mechanism Design for Internet Advertising
Hamid Nazerzadeh, Microsoft Research, One Memorial Dr., Cambridge, MA, United States of America, hamidnz@stanfordalumni.org, Sham Kakade, Ilan Lobel

Currently, most of online advertisement space are sold through auctions. However, these auctions do not usually take advantage of the repeated interactions of the advertisers with publishers which results in loss of revenue and efficiency. To address this, we design a revenue-optimal dynamic mechanism for online advertising which is built upon multi-armed bandits. Our mechanism balances the trade-off among maximizing revenue, elicitation of information, and incentives of the advertisers.

■ SC21

C - Room 18B, Level 4

Improving Healthcare Productivity

Sponsor: Service Science
Sponsored Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - Effective Management of the Quality and the Supply Chain Drivers in Healthcare Industry
Gangaraju Vanteddu, Assistant Professor, Southeast Missouri State University, One University Plaza MS 5815, Harrison College of Business, Cape Girardeau, MO, 63701, United States of America, gvanteddu@semo.edu

In this research an attempt has been made to study the relationship between the quality drivers and the supply chain drivers in healthcare industry. It is observed that the simultaneous control/management of the quality and the supply chain drivers will lead to a coherent approach that results in avoiding the duplication of effort and cost overruns because of the positive effect quality related goals and the necessary enabling factors will have on different supply chain drivers.

2 - Measuring Healthcare Productivity - From Processes to System Level
Antti Peltokorpi, Aalto University, P.O. Box 15500, Espoo, 15500, Finland, antti.peltokorpi@tkk.fi, Paulus Torkki, Vesa Kamarainen

Healthcare costs are rising rapidly. The current trend can be changed only by doing radical improvements in productivity at process, organization and system levels. In all levels, productivity consists of same elements: doing right things, doing things efficiently and at the right quality level. However, applications for productivity measurement should be different. This presentation demonstrates how to develop productivity measures for different levels and give some practical case examples.

3 - Five Facets of Healthcare Mass Customization
Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu, Emanue Melachrinoudis, Abe Zeid

This paper presents five possible models of health care mass customization, namely, make to stock, assemble to order, make to order, engineer to order, and develop to order mass customization. In practice, health care mass customization requires a combination of these models to varying proportions depending on the focus and specialty of health care providers. The paper also presents the factors influencing each of these models.

■ SC22

C - Room 18C, Level 4

Service Operation Management

Sponsor: Service Science
Sponsored Session

Chair: Eunji Lim, Assistant Professor, University of Miami, University of Miami, Coral Gables, United States of America, lim@miami.edu

Co-Chair: Murat Erkoc, Assistant Professor, University of Miami, Miami, FL, United States of America, merkoc@miami.edu

1 - Simulation-based Optimization for Vehicle Routing Problems with Stochastic Demands and Travel Times
Yao Luo, University of Miami, 1251 Memorial Drive, Coral Gables, FL, 33146, United States of America, ly1987510@gmail.com, Eunji Lim

When dispatching vehicles to different locations, the uncertainty in demands or travel times has to be incorporated into one's operational decisions to prevent stock-outs or long travel times. We formulate the vehicle routing problem with stochastic demands and travel times as constrained simulation optimization, and propose an efficient method that converts the original problem to a minimax problem. We will discuss the potential impact of the proposed method and present numerical examples.

2 - Lumpy Demand Management with Pricing in the Service Sector
Murat Erkoc, Assistant Professor, University of Miami, Miami, FL, United States of America, merkoc@miami.edu, Salvador Romo-Fragoso

We consider a contractor who bids for proposals for "big deals" that are relatively long term service projects. The demand for such requests are lumpy and wining the proposals are contingent upon the price bids and available capacity. We investigate optimal pricing policies under a Markov Decision Process Model. Further we study demand acceptance policies and their impact on pricing when the contractor also carries out "regular jobs" that require short term commitments.

3 - Sustainable Capacity Management in Service Operations
Mehmet Bayram Yildirim, Associate Professor, Wichita State University, 1845 N Fairmount, Wichita, KS, 67260-0035, United States of America, bayram.yildirim@wichita.edu, Mehmet Barut, Timur Keskinturk

Utilization of a system, service or production, can be enhanced significantly by managing the capacity intelligently. In this study, we focus on improving the profitability of limited resources in service operations. Considering different customer segments we utilize revenue management concept in developing guidelines helping manager differentiate the incoming requests. The performance is benchmarked to classical fairness approach and compared to the optimum for effectiveness.

4 - Stochastic Inventory Model for Health Care Supply Chain Under Regular Demand and Surge Demand
Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu, Md Roni

Irregular event such as natural disaster, multiple-car accidents, terrorist attacks, causes sudden huge demand for medicine in health care supply chain system. Hence, demand process in health care can be seen as a combination of regular demand and surge demand. This paper appliers the level crossing theory to derive stationary distribution of the inventory level and furthermore heuristically develop the optimal inventory policy with regular order and emergency order.

■ SC23

C - Room 18D, Level 4

Panel Discussion: Modeling Inter-Cultural Service Encounters

Sponsor: Service Science
Sponsored Session

Moderator: Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Building, Mayaguez, PR, 00680, United States of America, alexandra.medinaborja@upr.edu

1 - Panel Discussion: Modeling Inter-cultural Service Encounters
Panelists: Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Building, Mayaguez, PR, 00680, United States of America, alexandra.medinaborja@upr.edu, William Hefley, Clinical Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Mervis Hall, Pittsburgh PA 15260, United States of America, wehefley@katz.pitt.edu, Kalyan Pasupathy, Assistant Professor, University of Missouri- Columbia, United States of America, pasupathyk@health.missouri.edu, Paul Maglio, Clinical Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Mervis Hall, Pittsburgh PA 15260, United States of America, wehefley@katz.pitt.edu, John Ruggiero, Edmund B. O'Leary Professor of Economics, University of Dayton, Department of Economics and Finance, 300 College Park, Dayton OH 45469-2251, United States of America, John.Ruggiero@notes.udayton.edu, Kostas Triantis, Professor, Virginia Tech, triantis@vt.edu

This panel presents a summary of a 2009 research workshop in Puerto Rico sponsored by NSF's Service Enterprise Systems. The goal of the workshop was to hasten the development of modeling frameworks that include inter-cultural considerations by fostering interdisciplinary research among a variety of fields, academic disciplines and technical clusters.

■ SC24

C - Room 19A, Level 4

Planning for Extreme Weather Events II

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu

1 - Planning for Extreme Heat Events
Endre Boros, Professor, Rutgers University, Rutcor, 640 Bartholomew Road, Piscataway, NJ, United States of America, boros@rutcor.rutgers.edu, Christie Grewe Nelson, Randyn Bartholomew

We present a robust OR model for deciding about locations of and assigning resources to cooling centers to help to cope with extreme heat events. We present numerical results with data from Newark, NJ.

2 - Health Care Needs Planning for Extreme Heat Events
Sara Ghorbani, PhD Candidate, Rutgers, IE Deparment, Piscataway, NJ, United States of America, saraghorbani21@gmail.com, Pooyan Kazemian

We study the shelter location problem in urban environment. Meta-heuristic simulation optimization method is employed to minimize the expected number of extra deaths due to extreme heat. The algorithm decides on where to set up triage and shelters, assigning patients to triage centers, and then to health care centers.

3 - Component Criticality in Disease Spreading Networks with Limited Network Information
David Fajardo, Graduate Research Assistant, University of Texas at Austin, Earnest Cockrell Jr. Hall, 6.204, Austin, TX, 78712, United States of America, davidfajardo2@gmail.com, Travis Waller, Lauren Gardner

We derive estimates of network component criticality in the spread of disease along a human social network based on different degrees of network information. We estimate the impact of removing specific network components on the pattern and magnitude of the disease spreading process. We will further explore the impact that network structure information has on the quality of these estimates.

■ SC25

C - Room 19B, Level 4

Joint Session SPPSN/ TSL: Surveys and Models for Logistics Management in Disasters

Sponsor: Public Programs, Service and Needs/ Transportation Science and Logistics Society
Sponsored Session

Chair: Burak Eksioglu, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, beksioglu@ise.msstate.edu

1 - Optimizing the Use of Transit Systems with Information Updates During No-notice Evacuations
Huseyin Tunc, Mississippi State University, P.O. Box 9542, Industrial & Systems Engineering Department, Mississippi State, MS, 39762, United States of America, ht100@msstate.edu, Burak Eksioglu

Evacuation of transit dependent population during a disaster is necessary in order to minimize casualties and losses. This paper presents a mixed integer model for evacuating transit dependent citizens during a no-notice disaster. The paper also

introduces a framework for using the proposed mathematical model in real-time. Furthermore, a heuristic algorithm is proposed and it is evaluated in a rolling horizon manner.

2 - Development of an Intermodal Transportation Training Program for Disaster Relief Agencies

Han Zhang, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, hz71@msstate.edu, Lesley Strawderman, Kylie Nash, Henry Leggett, Burak Eksioglu

This presentation will provide a demonstration of a training program created for disaster relief agencies. Training content includes information on transportation modes used to provide humanitarian relief, as well as guidance for selecting modes that minimize cost and travel time. The benefits of intermodal transportation are also highlighted. The training program features interactive scenarios and customized trainee feedback through the use of a computer-based self-led training module.

3 - Scarce Resource Allocation in Humanitarian Logistics Systems with Individual Decision Making

Jessica Heier Stamm, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, jheier@isye.gatech.edu, Julie Swann, Nicoleta Serban, Ozlem Ergun

We study supply chain problems motivated by response scenarios where individual decision-makers' choices impact system outcomes. We develop models to assign users (centralization) or allow user choice (decentralization) for service sites and apply them to actual shipment data from an emergency response product. We compare the two allocations and use spatial statistics to explain service inequity as a function of factors such as income, minority population, and availability of shipment locations.

■ SC26

C - Room 4A, Level 3

Data Mining Best Student Paper Award Presentations II

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, United States of America, jpbrooks@vcu.edu

1 - Robust Kernel Based Regression with Bounded Influence for Outliers

Sangheum Hwang, KAIST, 335 Gwahak-ro , Yuseong-gu, Daejeon, Korea, Republic of, sangheum.hwang@gmail.com, Norman Kim, Myong Jeong, Bong-Jin Yum

Kernel based regression method is a well-established methodology for estimating nonlinear functional relationship between response variable and predictor variables. We propose a new robust KBR method which gives reliable results even if the training data set is contaminated with both Y-space and X-space outliers. We develop an efficiently kernelized training algorithm for the parameter estimation based on iteratively reweighted least squares (IRLS) method.

2 - Dependence Maps, a Dimensionality Reduction with Dependence Distance for High-dimensional Data

Kichun Lee, Postdoctoral Researcher, ECE Georgia Tech, Van Leer Building, 777 Atlantic Drive NW, Atlanta, GA, 30332-0250, United States of America, skylee1020@gmail.com, Alexander Gray

We introduce the dependence distance, a new notion of the intrinsic distance between points, derived as a pointwise extension of statistical dependence measures between variables. We then introduce a dimension reduction procedure for preserving this distance, which we call the dependence map. We explore its theoretical property, connection to other methods, and empirical behavior on real data sets.

3 - Follow the Money: Monitoring Cost in Claims Data for Drug Safety Surveillance

Yihan Guan, PhD Candidate, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

We present a novel method for post-marketing drug surveillance. Our method compares post-treatment costs of populations using alternative drugs based on risk-adjusted sequential analysis. The results of monitoring cost in claims data from 2.4 million individuals indicate that our method outperforms traditional methods by raising the alarm considerably earlier. Our model also achieves a balance between the risk of high false positive rate and the risk of delaying the discovery of true signals.

4 - A Novel Distance Measure for Time Series Data Mining

Youngseon Jeong, Rutgers, Camden, NJ, United States of America, ysjeong@eden.rutgers.edu, Myong Jeong, Olufemi A. Omitaomu

This talk presents a penalized dynamic time warping (WDTW) technique, which penalizes more a point with higher phase difference between a reference point and a testing point to prevent minimum distance distortion by outliers. The experimental results show that the proposed distance measures can achieve the improved accuracy for time series classification and clustering problems compared to existing approaches.

5 - Solving the Order-Preserving Submatrix Problem via Integer Programming

Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu, Oleg A. Prokopyev

In this talk we consider the Order Preserving Submatrix (OPSM) problem, which is known to be NP-hard. Although in recent years some heuristic methods have been proposed to solve OPSMs, they lack the guarantee of optimality. We present exact solution approaches based on linear mixed 0-1 programming formulations, and develop algorithmic enhancements to aid in solvability. Encouraging computational results are reported both for synthetic and real biological data.

■ SC27

C - Room 4B, Level 3

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Sigrun Andradottir, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, sa@gatech.edu

1 - Primal-Dual Schema and Lagrangian Relaxation for the k-Location Routing Problem

Timothy Carnes, MIT, 77 Massachusetts Avenue, E62-389, Cambridge, MA, 02139, United States of America, tac45@cornell.edu, David Shmoys

We present a primal-dual 2-approximation algorithm for the k-location routing problem, that models choosing k locations for vehicles and routing each vehicle in a tour to serve a set of requests, where the cost is the total tour length. This is the first constant approximation algorithm for this problem and has real-world applications; this is part of a broader effort for Ornge, which transports medical patients. Our work builds and improves upon work of Goemans & Williamson and Jain & Vazirani.

2 - Stochastic Search with an Observable State Variable

Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu, Warren Powell, David Blei

Many stochastic, convex optimization problems have behavior that depends on an observable state variable. We use machine learning to take observations from the joint state-outcome distribution and use them to infer the optimal decision for a given observed state. We propose two solution methods: function based optimization and gradient based optimization. These methods are tested on the hour ahead wind commitment problem and a multi-product newsvendor problem.

3 - An Unintended Incentive Problem Concerning the Use of Dialysis Treatment in Kidney Allocation Policies

Anicham Kumarasamy, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, anichamk@stanford.edu, Stefanos Zenios

Policymakers in the United States have recently proposed to modify the kidney allocation system by assigning higher priority to patients who are on dialysis. We examine how this change may create an incentive for physicians to start their patients on dialysis prematurely. We find that (1) kidneys may have to be wasted in order for allocation to be both fair and to discourage premature dialysis initiation and (2) all patients may be better off if policymakers could perfectly observe their health.

■ SC28

C - Room 4C, Level 3

Interpolation and Approximation: Theory and Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, yu-ding@tamu.edu

Co-Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Domain Decomposition Approach for Fast Gaussian Process Regression of Large Spatial Datasets
Chiwoo Park, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, chiwoo.park@tamu.edu, Yu Ding, Jianhua Huang

We propose a faster computation method for Gaussian process regression with a focus on large spatial datasets. The method splits the domain of a regression function into subdomains and infers a local piece of the function for each subdomain. We explicitly address mismatch of the local ones on boundaries by imposing continuity and smoothness. The method is as fast as competing methods, but easily parallelized for faster computation. It is adaptive to non-stationary data. We show real examples.

2 - Modeling Large Computer Experiments: More Data Can Be Better!
Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu, Ben Haaland

A large computer experiment produces many observations. While intuitively more data should provide more information, a large number of observations numerically induce inherent singularity in fitting an interpolator. To reconcile this contradiction, we propose a numerically stable and accurate approach to modeling large computer experiments. The driving forces of the proposed method are nested space-filling designs and multi-scale function approximations.

3 - PDE-constrained GP Model for Thickness Profile Modeling and Optimization in Slicing Processes
Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, jinr@gatech.edu, Jianjun Shi, Hongxu Zhao, Su Wu

Thickness uniformity of wafers is a critical quality measure in a wire slicing process. However, it is hard to get analytical solution from engineering models, or determine the basis functions in Gaussian process (GP) models to predict the thickness profile. In this paper, we develop a PDE-constrained Gaussian Process model by deriving the basis functions of a GP model. We use the model to predict the thickness profile and optimize the process variable to improve uniformity.

4 - Fast Calibration of Complex Computer Models
Derek Bingham, Associate Professor, Simon Fraser University, Department of Statistics, 8888 University Drive, Burnaby, BC, V3B6X5, Canada, dbingham@stat.sfu.ca

Computer models enable investigation of real-world phenomena. Statistical calibration enables estimation unknown constants governing the system. Calibration of large, non-stationary model output is not well addressed. We present a new approach that measures the discrepancy between the computer model and field data. One can then construct empirical distributions for the parameters and perform sequential design. The strength of this approach is its simple computation using existing algorithms.

■ SC29

C - Room 5A, Level 3

Statistical Modeling in Production/Service Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Li Zeng, Assistant Professor, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, Tx, 76019-0017, United States of America, lzeng@uta.edu

1 - Event Log Modeling and Analysis for System Failure Prediction
Yuan Yuan, UW-Madison, 1513 University Ave, Madison, United States of America, yyuan4@wisc.edu, Shiyu Zhou

Event logs, commonly available in mechatronic systems, contain rich information on working conditions of the system. This article proposes an effective method to build a statistical model using event logs to predict failures. Prescreening and statistical variable selection are adopted to select best predictor events. In-depth discussion of prediction power in terms of false alarm and misdetection rate is presented. The effectiveness of the proposed method is confirmed by real world examples.

2 - Surrogate Modeling of Multistage Assembly Processes using Integrated Emulation
Qiang Zhou, ISyE Dept, UW-Madison, 1513 University Ave, Madison, WI, United States of America, qzhou3@wisc.edu, Shiyu Zhou, Peter Qian

For the design of multistage assembly processes, a cheap mathematical model that links design parameters with the product quality is highly desirable. We propose a systematic approach to build a surrogate model of multistage assembly processes based on computer simulation. In this paper, a multiple-input-multiple-output surrogate modeling framework is developed using a recently developed integrated emulation technique. Various specific issues in the design of experiments are addressed.

3 - A Hierarchical Space-time Varying Coefficient Model: The Equity of Service Distribution
Nicoleta Serban, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, nserban@isye.gatech.edu

Research in service distribution equity has emerged as economic and social equity advocates recognized that where people live influences their opportunities for economic and social development. In this research paper, service distribution equity is concerned with where and when services have been and are accessed by different population groups. The underlying modeling approach is a (hierarchical) varying coefficient model where the coefficients vary both in time and space.

4 - Quality Bottlenecks in Flexible Manufacturing Systems with Batch Productions
Jingshan Li, Associate Professor, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, jingshan@engr.wisc.edu

In this talk, we introduce a Markovian model to study product quality in a flexible manufacturing system with batch productions. Using this model, we present methods to identify the sequences and transitions that impede the quality in the strongest manner, i.e., the so-called quality bottleneck sequence (QBN-s) and transitions (QBN-t). Moreover, indicators to identify such bottlenecks based on the data collected on the factory floor are proposed.

■ SC30

C - Room 5B, Level 3

Panel Discussion: Research on the Interface of Statistics and OR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Moderator: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Moderator: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

1 - Application of OR in Statistics
Panelist: Roshan Vengazhiyil, Coca-Cola Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

I will discuss some examples of operations research techniques used in statistical research.

2 - Recent Research in System Informatics, Prognostics, and Health Management
Panelists: Kwok Tsui, Georgia Institute of Technology, Atlanta, GA, United States of America, ktsui@isye.gatech.edu, Steve Pollock, University of Michigan, Ann Arbor, Michigan 48109-2117, pollock@umich.edu

Motivated by (i) concerns in public health safety, product reliability, system safety and failure prevention, and (ii) latest advancement in data collection technologies and modeling tools, this talk will address the quantitative modeling research in system informatics (SI) and system prognostics and health management (PHM).

■ SC31

C - Room 5C, Level 3

Data Mining for BioMedical Informatics

Sponsor: Data Mining
Sponsored Session

Chair: Hyunjung Helen Shin, Professor, Ajou University, San 5 Wonchun-dong Yeoungtong-gu, Suwon, 443-749, Korea, Republic of, shin@ajou.ac.kr

1 - Empirical Comparison on Heterogeneous Genomic Data: CNV, Methylation, miRNA, and Gene Expression

Do Kyoon Kim, PhD Student, Seoul National University Biomedical Informatics (SNUBI), Div. of Biomedical Informatics, SNU College of Medicine, Seoul, 110-799, Korea, Republic of, dkkim@snu.ac.kr, Young Soo Song, Hyunjung Helen Shin, Ju Han Kim

Thanks to the recent collaborative initiative against cancer, heterogeneous types of genomic data from cancer patient become available. The aim of the present study is to compare different types of genomic data for Glioblastoma multiforme (GBM) recurrence prediction. The four types of genomic data, Copy Number Variation (CNV), methylation, miRNA, and gene expression data, are employed and tested on 159 GBM patients using the state-of-the-art machine learning algorithm, semi-supervised learning.

2 - Evolution: A Guide to Protein Function and its Rational Redesign

Olivier Lichtarge, Professor, Department of Molecular & Human Genetics, Baylor College of Medicine, One Baylor Plaza, Houston, 77030, United States of America, lichtarg@bcm.tmc.edu

Protein interactions create networks that determine cell fate in health and disease. This work will present new algorithms for Evolutionary Tracing (ET), a method to compare proteins and identify their functional sites in order to guide experiments that selectively block, recode, or mimic their amino acid determinants. In principle, this suggests a scalable approach to perturb individual links in protein networks and to help interpret the impact of amino acids variations in human health.

3 - A New Method for Bi-directional Semantic Similarity of Gene Products Based on Gene Ontology

Ju Han Kim, Professor, M.D., PhD, Seoul National University Biomedical Informatics (SNUBI), Div. of Biomedical Informatics, Seoul National University College of Medicine, Seoul, 110-799, Korea, Republic of, juhan@snu.ac.kr

Wang's semantic similarity utilizes ontology structures to complement Resnik's WordNet-based semantic similarity that is based on information content (or annotation frequency). Wang's measure, however, shows poor distance resolution when both terms are near the root sharing a few terms and poor consistency when both terms share much of their descendents. Here we propose a bi-directional semantic similarity measure of gene products based on Gene Ontology with results from evaluation studies.

4 - A Multiscale Approach to Biological Networks: From Proteome Annotation to Cell Cycle Control

Andreas Martin Lisewski, PhD, Department of Molecular & Human Genetics, Baylor College of Medicine, One Baylor Plaza, Houston, 77030, United States of America, lisewski@bcm.edu, Olivier Lichtarge

Biological systems are difficult to analyze because of their large number of molecular actors, their interactions, and the multitude of phenotypes. Here we present techniques for the analysis of complex networks inspired through semi-supervised machine learning and statistical mechanics to tackle two problems: the propagation of functional information in proteomic networks, and the control of the cell cycle. The techniques are general and can also be applied to other types of complex networks.

■ SC32

C - Room 6A, Level 3

Hybrid Methods II

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Bridging Constraint Reasoning and Machine Learning for Unsupervised Labeling and Decomposition

Ashish Sabharwal, Research Associate, Cornell University, 5160 Upson Hall, Ithaca, NY, 14853-7501, United States of America, sabhar@cs.cornell.edu, Ronan LeBras, John Gregoire, Carla Gomes, Theodoros Damoulas, R. Bruce van Dover

We present a framework for bridging constraint programming (CP) and machine learning methods in order to tackle challenging unsupervised labeling and decomposition problems, particularly in the setting of a phase detection problem arising in material discovery. We demonstrate a clear benefit from combining the strengths of these approaches: handling noise and uncertainty through a global machine learning view while incorporating detailed hard constraints and domain knowledge locally through CP.

2 - Combining Column Generation and Logic-Based Benders' Decomposition for Multi-Machine Scheduling

J. Christopher Beck, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, Ti Kan Feng

We combine column generation (CG) and logic-based Benders' decomposition (BD) to solve a multi-machine scheduling problem. Jobs are assigned to machines using CG, and subsequently scheduled using BD. Using this combination (CGBD), we solve two variations of the unrelated parallel machine problem. Based on these problems, we perform experiments to examine the performance of CGBD, CG, and BD. Finally, we investigate the roles of each component in its overall contribution towards CGBD.

3 - Single-Facility Scheduling Over Long Time Horizons by Logic-Based Benders Decomposition

Elvin Coban, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, ecoban@andrew.cmu.edu, John Hooker

We use logic-based Benders decomposition to combine mixed integer programming (MIP) and constraint programming (CP) to solve single-facility scheduling problems with time windows and long time horizons that are decomposed into segments. The Benders master problem assigns jobs to segments using MIP, and the subproblems use CP to schedule jobs on each segment. A job can overlap two segments. The objective is to find feasible solutions, minimize makespan, or minimize total tardiness.

4 - Grammar-Based Column Generation for Personalized Multi-Activity Shift Scheduling

Louis-Martin Rousseau, Ecole Polytechnique de Montreal, 6079, Succ. Centre-ville, Montreal, Canada, louis-martin.rousseau@polymtl.ca, Bernard Gendron, Marie-Claude Coté

We introduce a new branch and price formulation to solve personalized multi-activity shift scheduling problems, using column generation with grammar-based subproblems, which are solved with dynamic programming. This approach, which uses the expressiveness of context-free grammars to model restrictions over shifts and benefits from the branch and price methodology is able to prove optimality for many instances.

■ SC33

C - Room 6B, Level 3

Computations & Software for Monte Carlo Sampling Methods for Stochastic Programming

Sponsor: Computing Society
Sponsored Session

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

1 - The Sample Approach for Chance Constraint Programming: A Computational Study

Daniel Reich, Postdoc, Universidad Adolfo Ibáñez, School of Business, Diagonal Las Torres 2640, Oficina 516 C, Peñalolén, Santiago, Chile, daniel.reich@uai.cl, Marco Campi, Bernardo Pagnoncelli

We consider a naive portfolio optimization model with a single chance constraint and review an established sampling approach that can be used to identify feasible solutions. To improve solution quality while maintaining feasibility, we propose and compare two constraint removal procedures: one greedy and the other randomized. We present detailed computational results and discuss how and why these results may be generalizable to other chance constraint models.

2 - A Branch-and-price Algorithm for Multistage Stochastic Unit Commitment

Ali Koc, Postdoctoral Researcher, IBM TJ Watson Research Center, Yorktown Heights, NY, 10598, United States of America, akoc@us.ibm.com, Jayant Kalagnanam

Grid operators typically solve a unit commitment problem to minimize total start-up and fuel cost of generating units over a planning horizon, making sure that total generation amount in each time period exceeds the demand. Multistage stochastic programming approach is sometimes preferred when some of the problem parameters, such as the demand, are uncertain. We present a branch-and-price algorithm for a multistage stochastic unit commitment problem, and display some computational results.

3 - Computational Experience with Confidence Intervals on the Optimality Gap

David Woodruff, Professor, University of California Davis, Davis, CA, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

Recently Mak, Morton and Wood proposed a method of computing bounds on the optimality gap along with confidence intervals. In this talk, we describe our computational experience computing confidence intervals on a variety of problems, many of which are mixed integer. Somewhat surprising to us was the large number of samples needed to achieve intervals that are what we consider to be reasonably narrow.

4 - Bundling and Solution Quality Estimation for Stochastic Programming: Implementation and Results

Jean-Paul Watson, Sandia National Laboratories, jwatson@sandia.gov, David Woodruff

We discuss two largely ignored, but critical in practice, issues arising when solving large-scale stochastic mixed-integer programs: scenario bundling and solution quality estimation. We describe our open-source implementations of bundling and techniques for obtaining confidence bounds on solution quality, including multiple replication and sequential sampling procedures. Experimental results on stochastic wind farm network design and unit commitment problems are reported.

■ SC34

C - Room 7, Level 3

Approximate Dynamic Programming in Transportation

Sponsor: Computing Society
Sponsored Session

Chair: Hugo Simao, Reserch Staff, CASTLE Lab - Princeton University, 112 Sherrerd Hall, Princeton, NJ, 08540, United States of America, hpsimao@princeton.edu

1 - Approximate Dynamic Programming for Empty Container Repositioning Problem

Ning Shi, Dr., Sun Yat-sen University, No. 135 Xin Gang Xi Road, Haizhu Distinct, Guangzhou, China, shning@mail.sysu.edu.cn

In this work, we study an empty container repositioning problem in a cyclic route where the ports face uncertain demands. We formulate this problem as a stochastic dynamic programming problem, but this encounters the classic curse of dimensionality. To overcome this problem, we propose an approximate dynamic programming algorithm which is based on an optimal policy for a simple special case. We conduct numerical experiments to illustrate the efficiency of this algorithm.

2 - Stochastic Programming Models for Certain Air Traffic Flow Management Problems

Charles N. Glover, Research Assistant, University of Maryland, 3117 A.V. Williams, College Park, MD, 20742, United States of America, cnglover@math.umd.edu, Michael Ball

Convective weather is a major contributor to air traffic delays. There is much uncertainty associated with weather predictions, so stochastic models are necessary to assign ground delay and route adjustments to flights. We describe a two-stage stochastic integer program for this problem. We show that under certain conditions the LP-Relaxation yields integer optimal solutions. This model is then used to develop and compare heuristics, which seek solutions that are both equitable and efficient.

3 - Approximate Dynamic Programming in the Strategic Planning of a Fleet of Business Jets

Hugo Simao, Reserch Staff, CASTLE Lab - Princeton University, 112 Sherrerd Hall, Princeton, NJ, 08540, United States of America, hpsimao@princeton.edu, Warren Powell

A fleet of executive jets of varied sizes serves a global business market. Though demand is segmented by specific-size jets, operational constraints require aircraft substitution. Approximate dynamic programming is used to help plan aircraft disposal/acquisition over a multi-year horizon. We will show how the ADP model performs comparatively with a near-optimal approach on a simplified, reduced scope problem. We will then show how the ADP approach scales to larger, more realistic problems.

4 - Learning in Approximate Dynamic Programming for Managing a Multi-Attribute Driver

Martijn Mes, Assistant Professor, University of Twente, School of Management and Governance, Department OMPL, Enschede, 7500AE, Netherlands, m.r.k.mes@utwente.nl

A well known problem in Approximate Dynamic Programming (ADP) is the exploration versus exploitation trade-off, and more specifically how to cope with the downstream bias in the sampling decisions. To overcome this, we propose a way to estimate the value function limits and to use these limiting values in our sampling decisions. We demonstrate how this approach can efficiently be used to improve the rate of convergence of an ADP algorithm for managing a single multi-attribute driver.

■ SC35

C - Room 8A, Level 3

Large Scale Dynamic Stochastic Games

Sponsor: Applied Probability
Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Co-Chair: Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, 380 Panama Mall, Stanford, CA, United States of America, ramesh.johari@stanford.edu

1 - Phase Transition in Mean-field Games: An Application to Synchronization of Coupled Oscillators

Prashant Mehta, Assistant Professor, University of Illinois, 1206 W. Green Street, Urbana, IL, 61801, United States of America, mehtapg@illinois.edu

This talk is concerned with phase transition in non-cooperative dynamic games with a large number of nonlinear oscillators. A variant of the Kuramoto model is used in a novel game-theoretic setting. The main conclusion is that the synchronization of the coupled oscillators can be interpreted as a solution of a non-cooperative dynamic game. Using approximate dynamic programming techniques, the classical Kuramoto control law is shown to be an approximation of the game-theoretic solution.

2 - Mean Field Stochastic Dynamic Games with Egoistic, Altruistic and Massive Agents

Peter Caines, Professor, McGill University, Dept ECE, 3480 University Street, Montreal, QC, H3A 2A7, Canada, peterc@cim.mcgill.ca, Roland Malhame, MinYi Huang

This work analyses Mean Field LQG problems with cost coupling. In the altruistic-egoistic stochastic dynamic LQG games under study, the cost of each agent is a convex combination of its own cost and the social cost. Decentralized equilibrium strategies for all agents are generated using techniques based upon the Mean Field (Nash Certainty Equivalence) (MF(NCE)) methodology. The Social Optimality Theorem for purely altruistic populations is presented along with the theory of Massive agents.

3 - Mean Field Equilibrium in Dynamic Stochastic Games with Complementarities

Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, 380 Panama Mall, Stanford, CA, United States of America, ramesh.johari@stanford.edu, Sachin Adlakha

We study mean field equilibrium for stochastic games with complementarities, such as dynamic games with network effects. We find necessary conditions for the existence of a mean field equilibrium in such games. Furthermore, we show that there exist a "largest" and "smallest" equilibrium among all those where the equilibrium strategy used by a player is nondecreasing. We also show that natural best response dynamics converge to each of these equilibria.

4 - Dynamic Oligopoly Models in Concentrated Industries

Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Dynamic oligopoly models are used to study strategic dynamic interactions in many industries. Their applicability is limited, however, by the curse of dimensionality involved in the equilibrium computation. In this talk we discuss several new approaches that alleviate this difficulty. Our focus is on industries in which there are few large dominant firms and many small firms; this is a commonly observed market structure. The methods greatly increase the applicability of this class of models.

■ SC36

C - Room 8B, Level 3

Case Competition I - INFORMed's Annual Case Competition is an Opportunity for INFORMS Members to Showcase Their Efforts in the Classroom

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - PriceMax

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne

Angela Morella is the CFO of PriceMax. Tasked to find a way to better forecast 2010 earnings per share, Morella sets out to find a good forecast of gross domestic product, which she believes is related to sales. Morella asks her analyst, to find such a forecast. Using forecasts from the Survey of Professional Forecasters, and data on realized GDP change, Gabriel evaluates the 2000-2009 forecasts of six professional panelists.

2 - Flexible Capacity Planning for Real Estate Development

Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Current practices in real estate development challenge planners and designers to build the most appropriate capacity against a fixed demand forecast. Planners and designers therefore focus much of their attention on producing the most "accurate" demand forecasts and decide on a cost-minimal capacity design that meets these forecasts. Communication of uncertainty in forecasts is all too often a second thought or even ignored.

■ SC37

C - Room 8C, Level 3

Resource Allocation in Stochastic Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com

1 - Performance Bounds for Large Scale Queueing Systems

David Goldberg, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, dag3141@mit.edu, David Gamarnik

We resolve several questions related to a certain heavy traffic scaling regime (Halfin-Whitt) for parallel server queues, used recently in the modeling of call centers. We derive the asymptotics of the steady-state queue length, and bound the large deviations behavior of the limiting steady-state queue length. Our proof technique involves bounding the multiserver queue between two simpler systems, which exhibit an interesting duality and may be useful in many related settings.

2 - Improved Approximations for the Erlang Loss Model

Mayank Sharma, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, mxsharma@us.ibm.com, Mark Squillante, Yingdong Lu, Jonatha Anselmi

We propose two new methods for loss probability calculation in stochastic loss networks. The first is a refined slice method which is exact in a certain scaling regime and is therefore ideally suited to the asymptotic analysis of large loss networks. The latter borrows from volume computation methods for convex polytopes to provide approximations for the loss probability in an unscaled network with error bounds as a function of the computational costs.

3 - An Integrated Model for Capacity Planning and Dynamic Control in Call Center Networks with General SLAs

Santiago Balseiro, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Assaf Zeevi, Awi Federgruen

We address the following problems that arise in the management of call center operating under certain Service Level Agreements (SLAs): (1) setting the capacity levels of the agent pools; (2) constructing a routing scheme for arriving customers; and (3) devising a dynamic priority rule for customers waiting at each pool. We develop a mathematical programming approach to simultaneously solve the above integrated planning problem and discuss some of its salient features.

4 - On Approximations for Multiple Multidimensional Stochastic Knapsacks

Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Yingdong Lu

We consider a generalization of the classical knapsack problem in which the items and knapsacks have multiple dimensions, the per-dimensional size of each item is stochastic, and the per-dimensional size of every knapsack is fixed. Using detailed probabilistic analysis and results, we improve upon the recent results of Dean, Goemans and Vondrak for the single one-dimensional stochastic knapsack problem, and we provide new results for the multiple multidimensional stochastic knapsack problem.

■ SC38

C - Room 9A, Level 3

Global Optimization & MINLP with Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu

1 - Robust Optimization Models for Support Vector Machine with Input Uncertainty

Hongsheng Xu, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, xuhongsh@ufl.edu, Neng Fan

We consider support vector machines (SVMs) with uncertainties of the training data sets. The types of uncertainties include interval, ellipsoidal and ball uncertainty for points. These problems are considered with linear and nonlinear SVMs. We proposed robust optimization models for these SVMs with uncertainties. The Lagrange multipliers are used to solve nonlinear models and integer program approaches with decomposition methods are used for robust models of transductive SVMs.

2 - Using Conditional Value-at-risk in the Shortest Path Problem to Find Robust Paths Under Arc Failures

Juliana Bright, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, juliana.bright@okstate.edu, Baski Balasundaram

Finding a shortest path in a network is a classical problem. In practice, arcs may fail — for instance, during natural disasters. We use Conditional Value-at-Risk (CVaR) to find a path that is robust under probabilistic arc failures. CVaR, a quantitative risk measure, is roughly the mean excess loss associated with a decision. This talk discusses ways to model losses and presents a MILP model to find a shortest path below a CVaR threshold. Preliminary computational results are also presented.

3 - Multi-way Clustering and Biclustering by the Ratio Cut and Normalized Cut in Graphs

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu, Panos Pardalos

We consider the multi-way clustering problem based on graph partitioning models by the Ratio cut and Normalized cut. We formulate the problem using new quadratic and quadratically constrained models. Spectral relaxations, new semidefinite programming relaxations and linearization techniques are used to solve these problems. It has been shown that our proposed methods can obtain improved solutions.

4 - Network Analysis and Optimization in Epileptic Brain State Transition Study and Seizure Prediction

Jicong Zhang, PhD Candidate, University of Florida, 303 Weil Hall, ISE Department, Gainesville, FL, 32611, United States of America, jicong@ufl.edu, Panos Pardalos

Epilepsy is a chronic neurological disorder affecting 50 millions. An epileptic seizure can be predicted if there exists a preictal state which is a transitional state between interictal and ictal states. Studies show that consistent patterns are observable before seizure onsets in EEG. Based on constructed brain networks using nonlinear dynamics and dependency functions, network analysis and optimization can be applied to brain state transition study and seizure prediction with good effect.

■ SC39

C - Room 9B, Level 3

Optimization Society Prizes

Cluster: Optimization/Prizes
Sponsored Session

Chair: Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sahinidis@cmu.edu

1 - Hooked on Integer Programming
George L. Nemhauser, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States of America, george.nemhauser@isye.gatech.edu

Integer programming is addictive. I got hooked more than forty years ago and I'm still an addict. There are many fun challenges and no indication that the rate of progress has diminished. In this talk I'll tell a little of my story and conclude with what I think are current opportunities.

2 - Analysis of First Order Methods for Large Scale Optimization
Zhi-Quan Luo, Professor, University of Minnesota, Dept Electrical and Computer Engineering, 200 Union Street SE, Minneapolis, MN, 55455, United States of America, luozq@ece.umn.edu

In this talk, we review the joint work with Paul Tseng on the first order methods for large scale smooth/nonsmooth optimization, and their impact to contemporary applications such as compressed sensing and image processing.

3 - Probability Inequalities for Sums of Random Matrices and Chance Constrained Optimization
Anthony Man-Cho So, Assistant Professor, The Chinese University of Hong Kong, Dept of Sys Engr & Engr Mgmt, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

Chance constrained optimization has found applications in many areas—such as finance, control and signal processing—and is the subject of much research recently. In this talk, we will first discuss some recent advances in the study of probability inequalities for sums of random matrices. Then, we will demonstrate how these results can be used to construct safe tractable approximations of a variety of chance constrained optimization problems.

4 - Fast Multiple Splitting Algorithms for Convex Optimization
Shiqian Ma, Columbia University, 500 W. 120th Street, Mudd Blvd, Room 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb

We present two different classes of general K-splitting algorithms for solving convex optimization problems. We prove that the number of iterations needed by the first class of algorithms to obtain an $epsilon$-optimal solution is $O(1/epsilon)$. The algorithms in the second class are accelerated versions of those in the first class, where the complexity result is improved to $O(1/sqrt{epsilon})$ while the computational effort required at each iteration is almost unchanged.

■ SC40

C - Room 9C, Level 3

CEIR and Beyond

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, tomlin@yahoo-inc.com

1 - One LP Code a Minute
John Forrest, IBM Research (Retd.), john.forrest@fastercoin.com

A short, content free, look back at LP codes which I have used, abused and written. Some attempt may be made to put the more successful codes in the context of the available computer architectures, but more emphasis will be on the codes which nobody else has heard of and which I have tried to forget. For example, hands up all those who have heard of Alligator?

2 - From LP/90/94 to UMPIRE
John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, tomlin@yahoo-inc.com

This talk outlines the features of CEIR LP/90/94 that survived into the UMPIRE Mathematical Programming System, describes some that did not, and summarizes the new features that were introduced in this code.

3 - IBM's Optimization Subroutine Library - History and Innovations
David Jensen, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, davjen@us.ibm.com

John Forrest was the principle author of IBM's Optimization Subroutine Library. It represented a significant departure from previous offerings for mathematical optimization. In this talk we will discuss the some of the innovations that made the product successful, focusing on the many contributions that John made to its design and implementation.

4 - Some OSL History
J.P. Fasano, IBM Research Watson, 1101 Kitchawan Road, Yorktown Heights, United States of America, jpfasano@us.ibm.com

This talk will provide some anecdotal stories and history on the early days of OSL development.

■ SC41

C - Room 10A, Level 3

Computational Economics for Integrated Assessment

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Todd Munson, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, tmunson@mcs.anl.gov

1 - Sensitivity of Global Carbon Emissions to Uncertain Trade Elasticities
Todd Munson, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, tmunson@mcs.anl.gov, Joshua Elliott, Sam Kortum, Fernando Perez Cervantes, David Wiesbach

In this talk we study a global computable general equilibrium model with carbon taxes and border tax adjustments for Annex B regions to understand the mitigation effects of such policies. Carbon contents for the border tax adjustments are computed endogenous to the model by applying a carbon conservation principle. Analysis of the results from these sensitivity studies are presented using matrices representing bilateral carbon emission flows.

2 - Distributional Impacts of Greenhouse Gas Mitigation Policies
Joshua Elliott, University of Chicago, Chicago, IL, United States of America, jelliott@ci.uchicago.edu, Don Fullerton, Todd Munson

We study the distributional impacts of greenhouse gas mitigation policies using the CIM-EARTH economic model. We develop general purpose tools that use survey consumption and panel income data to construct household consumers along demographic dimensions including lifetime wealth and region. We report on early results for the US and comment on efforts to expand models to other countries.

3 - The Role Agriculture and Forestry in Greenhouse Gas Mitigation Policy
Alla Golub, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, golub@purdue.edu, Thomas Hertel, Steven Rose, Brent Sohngen, Benjamin Henderson

While agriculture and forestry, including associated land use change, account for about 30% of current global GHG emissions, they have the potential to play a much larger role in mitigation in the next few decades. This paper integrates the analysis of land use related non-CO2 emissions and carbon forest sequestration with more conventional analyses of CO2 emissions from fossil fuel combustion to provide a comprehensive assessment of the role of land in global GHG emissions and mitigation.

4 - Dynamic Stochastic General Equilibrium Analysis of Climate Change Policies and Discounting
Kenneth Judd, Hoover Institution, Hoover Institution, Stanford, CA, 94305, United States of America, kennethjudd@mac.com, Thomas Lontzek

We formulate dynamic stochastic general equilibrium extensions of Nordhaus' models of climate change and economic performance. We use multidimensional dynamic programming methods to study dynamically optimal policy responses. We use conventional risk analysis from finance to highlight the importance of the covariance and persistence of damages to economic output and find that these considerations substantially lower the hurdle required to justify significant mitigation policies.

■ SC42

C - Room 10B, Level 3

Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu

1 - A Decomposition Algorithm for General Stochastic Mixed-integer Programs
Suvrajeet Sen, Professor, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, sen.22@osu.edu, Yunwei Qi

We present a new decomposition algorithm for stochastic mixed-integer programs with general integers, as well as continuous variables. The method draws upon the new cutting plane tree algorithm, which also ensures finite convergence of the decomposition method.

2 - Ellipsoid Method for Sample Average Approximation
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We propose an approach to obtain a profoundly reduced sample for sample average approximation method. For each scenario, there is a polyhedron of the second stage problem and the very polyhedron can be characterized by its maximum volume inscribe ellipsoid. We use the numerical parameter of ellipsoid to differentiate the sampled scenarios in order to reduce the variance of recourse function. We present a two phrase method for large scale stochastic programming with numerical results.

3 - Chance-constrained Models and Benders-based Cutting Plane Algorithms for Insuring Critical Paths
Siqian Shen, PhD Candidate, Department of ISE, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, siqian.shen@gmail.com, Shabbir Ahmed, J. Cole Smith

We study a chance-constrained model arising in the protection of vital arcs in a critical path network, in which the probability of on-time completion is sufficiently large. We approximate the problem by using a two-stage mixed-integer program via SAA, and employ RLT to make it amenable to solution via Benders decomposition. We demonstrate the computational efficacy by testing a set of instances, and illustrate some management insights.

■ SC43

C - Room 1, Level 2- Mezzanine

Optimization in Radiotherapy

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

1 - Motion Management with Phase-Adapted 4D-Optimization
Omid Nohadani, Assistant Professor, Purdue University, 315 N. Grant Street, Bldg. E40-149, West Lafayette, IN, 47906, United States of America, nohadani@purdue.edu, Joao Seco, Thomas Bortfeld

Cancer treatment with ionizing radiation is often compromised by organ motion, particularly in lung cases. We present a spatiotemporal optimization method, which takes into account all phases of breathing. Monte Carlo dose calculations are employed to warrant for highest accuracy. We compare the performance of the proposed 4D-method with gating techniques on clinical lung cases and report significant improvements. These phase-adapted 4D-plans are intrinsically robust against irregular breathing.

2 - Efficiently Optimizing CVaR for IMRT with Sequential Sampling
Benjamin Armbruster, Northwestern University, 2145 Sheridan Road (Tech Bldg), Evanston, IL, 60208-3119, United States of America, armbruster@northwestern.edu, James Luedtke

We provide an overview of CVaR in radiation treatment planning and examine the unique challenges of the large QP that results. We combine a cutting-plane approach and a sequential sampling scheme, and we analyze its convergence by drawing an analogy to nonlinear stochastic programs.

3 - Semi-infinite Linear Programming for Sector Duration Optimization in Gamma Knife Perfexion
Hamid Ghaffari, PhD Candidate, University of Toronto, 5 King's Collage Road, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Dionne Aleman, Mark Ruschin, David Jaffray

We introduce a new approach to sector duration optimization (SDO) to find the optimal shot shapes in a Gamma Knife Perfexion treatment. The goal is to minimize overdosing of healthy tissue while delivering a high radiation dose to the target. A semi-infinite linear programming (SILP) approach is used to significantly reduce the size, and therefore the computational time, of SDO. We present the numerical results of clinical experiments using SILP for both radiotherapy and radiosurgery treatments.

■ SC44

C - Room 2, Level 2- Mezzanine

Healthcare Applications of Optimization Techniques

Sponsor: Health Applications
Sponsored Session

Chair: Lisa Maillart, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, maillart@pitt.edu

1 - Should We Screen if Breast Cancer Can Regress?
Shengfan Zhang, North Carolina State University, 3008 Kings Ct Apt H, Raleigh, NC, 27606, United States of America, szhang5@ncsu.edu, Julie Ivy

In decision modeling, breast cancer is often assumed to be a progressive disease. However some studies suggest that breast cancer may regress without treatment. In such cases, screening diagnosis may not be advantageous. We build a partially observable Markov model to explore the impact of the transition from In Situ cancer to cancer-free on breast cancer mortality and treatment. Our objective is to quantify how large the regression rate has to be in order to impact screening policy.

2 - A Stochastic Control Framework for Spatiotemporal Optimization in Radiotherapy
Archis Ghate, Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, archis@u.washington.edu, Minsun Kim, Mark Phillips

Progress in functional imaging is enabling radiotherapy planners to monitor a patient's biological response over weeks of treatment. We propose a stochastic control-based treatment-planning framework where states represent biological conditions, and beam intensities are the controls. Approximate control schemes are compared for efficiency. Numerical simulations on head and neck test cases show a 64-98% improvement in treatment efficacy compared to conventional static-deterministic methods.

3 - Multi-range Robust Optimization with Application to R&D Project Selection
Ruken Duzgun, PhD Student, Lehigh University, 200 W. Packer Ave., Bethlehem, PA, 18015, United States of America, rud207@lehigh.edu, Aurelie Thiele

We consider a robust optimization approach to R&D project selection when investments are done in stages and cash flows are uncertain. To model the outcome of each phase, such as a drug trial, we introduce multiple ranges for the cash flows (e.g., high and low) at each time period and a parameter limiting the number of times the cash flows fall in the low range. We develop a tractable robust counterpart and present theoretical insights as well as numerical results.

4 - A Large Scale Dynamic Programming Approach to Placing Expedited Livers
Zeynep Erkin, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, zee2@pitt.edu, Lisa Maillart, Mark S. Roberts

When the standard match process does not result in timely allocation, livers are offered to a transplant center instead of a specific patient(s). The center then decides which, if any, of its patients should receive the organ. We model and analyze this sensitive resource allocation problem as a large-scale, average reward MDP. We estimate the MDP parameters using clinical data and implement ADP techniques to solve for the optimal policy that we compare with heuristic policies via simulation.

■ SC45

C - Room 6, Level 2- Mezzanine

Applications of Operations Research Models and Methods in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, bgolden@rhsmith.umd.edu

Co-Chair: Edward Wasil, American University, Kogod School of Business, Washington, DC, United States of America, ewasil@american.edu

1 - Threshold-based Heuristics for the Single-day Surgery Scheduling Problem

William Herring, Doctoral Candidate, University of Maryland, Mathematics Building, College Park, MD, 20742, United States of America, wherring@math.umd.edu, Jeffrey Herrmann

Scheduling elective surgeries is a dynamic, sequential decision-making process that must balance the costs of deferring waiting cases and blocking higher-priority cases. The single-day scheduling problem combines surgical block schedules, block release policies, and waiting lists. This talk presents a stochastic dynamic programming approach, an optimal algorithm for a special case, heuristics for the general case, and computational results that demonstrate the heuristics' effectiveness.

2 - A Data Driven Approach for Optimizing Kidney Allocation

Inbal Yahav, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, iyahav@rhsmith.umd.edu

In America, over 90,000 candidates currently wait for kidney transplantation, which increases annually by about 20,000. Current policy poorly matches donors with recipients. We present a policy combining an IP-based learning phase with a data mining phase, which outperforms current policy with respect to better matches and fewer organ rejections.

3 - The Effects of the Residency Teaching Model on the Efficiency of the Emergency Department

David Anderson, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, danderson@rhsmith.umd.edu, Bruce Golden, Katie Johnson, Joseph Lim, Jay Kellegrew, John Silberholz, Emily Sze, Ekta Taneja, Edward Tao

The effects of the residency teaching model on emergency room efficiency have been debated in the literature. We built a simulation model based on collected and historical database data from the University of Maryland Medical Center Emergency Department. We found that increased resident presence in the Emergency Department increased throughput for both critical and non critical patients.

4 - Factorial Design Quantifies Effects of Hand Hygiene and Nurse-to-Patient Ratio on MRSA Acquisition

Sean Barnes, University of Maryland, College Park, MD, United States of America, seanlbarnes@gmail.com, Bruce Golden, Edward Wasil, Anthony Harris, Jon Furuno

Optimal methods to control MRSA patient-to-patient transmission in the ICU setting are still unknown. We applied a 2k factorial design on the output of a stochastic, agent-based model to compare the effects of hand hygiene compliance and nurse-to-patient ratio on the transmission of MRSA in a 20-bed ICU. The results suggest that increasing the nurse-to-patient ratio is more effective at levels below ~60% compliance; however, improving compliance becomes the better strategy at higher levels.

■ SC46

C - Room 7, Level 2- Mezzanine

Panel Discussion: OR in Engineering Schools

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu

1 - Panel Discussion: OR in Engineering Schools

Panelists: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu, David Morton, Engineering Foundation Professor, The University of Texas at Austin, 1 University Station, C2200, Austin TX 78712-0292, United States of America, morton@mail.utexas.edu, Patrick Jaillet, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge MA, United States of America, jaillet@mit.edu, Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem PA 18015, United States of America, larry.snyder@lehigh.edu, Margaret Brandeau, Professor, Management Science and Engineering, Stanford University, 380 Panama Way, Mail Code: 4026, Stanford CA 94305, United States of America, brandeau@stanford.edu

Panelists will present their perspectives on the state and health of operations research in engineering schools. Key issues include: where OR is taught in the curriculum, whether OR courses are required, enrollment trends, and how to increase the visibility of OR within engineering.

■ SC47

C - Room 8, Level 2- Mezzanine

Analysis of Next-Generation Sequencing Data

Cluster: Computational Biology and Bioinformatics
Invited Session

Chair: Alex Zelikovsky, Professor, Georgia State University, 34 Peachtree Street, Suite 1450, Atlanta, GA, 30303, United States of America, alexz@cs.gsu.edu

1 - Error Correction of Next-generation Sequencing Data

Dumitru Brinza, Staff Scientist, Bioinformatics, Life Technologies, 850 Lincoln Center Dr. M/S 408-2, Foster City, CA, 94404, United States of America, Dumitru.Brinza@lifetech.com

Ultra-high throughput next-generation sequencing technologies generate data with ~1-3% error rate, that makes usage of the data challenging. We present a spectral alignment error correction method implemented in SOLiD(TM) Accuracy Enhancement Tool (SAET). The method takes advantage of high coverage (>20x) provided by next-gen data and corrects miss-calls based on evidence from multiple reads of the same DNA region. On average SAET reduces the error rate by 5-10 times.

2 - Estimation of Alternative Splicing Isoform Frequencies From RNA-Seq Data

Ion Mandoiu, Associate Professor, University of Connecticut, CSE Department, 371 Fairfield Way, Unit 2155, Storrs, CT, 06269-2155, United States of America, ion@engr.uconn.edu, Serghei Mangul, Alex Zelikovsky, Marius Nicolae

We present a novel expectation-maximization algorithm for inferring alternative splicing isoform frequencies from high-throughput transcriptome sequencing (RNA-Seq) data. Our algorithm exploits largely ignored disambiguation information provided by the distribution of insert sizes generated during library preparation, and takes advantage of base quality scores, strand and read pairing information if available. Empirical experiments show significant accuracy improvements over existing methods.

3 - Bioinformatics Pipeline for Fosmid Based Molecular Haplotype Sequencing

Jorge Duitama, University of Connecticut, 371 Fairfield Way, Unit 2155, Storrs, CT, 06269, United States of America, jduitama@engr.uconn.edu, Gayle McEwen, Margret Hoehe, Thomas Huebsch, Eun-Kyung Suk, Sabrina Schulz

The process of grouping alleles of heterozygous variants coming from the same chromosome copy of an individual is called haplotyping. We developed a new bioinformatics pipeline for next generation sequencing (NGS) of fosmid pools to assemble separately the two chromosome copies in particular regions. The pipeline includes an algorithm for fosmids detection from coverage patterns in mapped reads, a fosmid specific alleles calling module and an algorithm for single individual haplotyping.

4 - HCV Quasispecies Reconstruction From 454 Reads

Alex Zelikovsky, Professor, Georgia State University, 34 Peachtree Street, Suite 1450, Atlanta, GA, 30303, United States of America, alexz@cs.gsu.edu, Irina Astrovskaya, Serghei Mangul

When reconstructing viral quasispecies, the main obstacle is that only a reference RNA is known and the challenge is to find "real" quasispecies sequences which are usually very close to each other. Even the number of quasispecies is not yet known and there is no any established model of clustering them. We report our analysis of 454 Lifescience reads using maximum likelihood model resolved with expectation maximization and several novel optimization models.

■ SC48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - JMP Division, SAS - Dynamic Visualization with JMP
Mia Stephens, JMP Division - SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, mia.stephens@jmp.com

JMP is data analysis and visualization software from the SAS Institute. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP provides a complete array of statistical procedures, from basic to advanced, and produces integrated and dynamic visual output. We will demonstrate popular JMP tools for data visualization, including Tabulate, Graph BuilderÆ, Bubble Plots, the data filter, and new mapping tools.

2 - Innovative Scheduling - Practical Solutions to Real-World Logistics Problems
Ravindra K. Ahuja, Innovative Scheduling Inc., 2153 SE Hawthorne Rd., Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

In this tutorial, we will share with the audience our experiences of building successful solutions to complex real-world operations research problems. We will describe several business problems, their modeling, algorithmic development, and packaging into decision support systems. We will explain the difficulties encountered, how we addressed them, and the lessons we learnt. We will also describe our approach for building optimization-based decision support systems in the rapid development mode.

■ SC49

C -Room 10, Level 2- Mezzanine

Global Sourcing and Boundaries of the Firm

Sponsor: Information Systems
Sponsored Session

Chair: Anjana Susarla, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

1 - How Organizational Practices Influence Service Performance
Jiban Khuntia, University of Maryland, College Park, MD, United States of America, jiban@umd.edu, Sunil Mithas, Anjali Kaushik, Jonathan Whitaker

This research focuses on the organizational practices of BPO service provider firms, and develops a conceptual model to link organizational practices with service performance outcomes. The model identifies three organizational practices that influence service performance: quality practice, customer relationship practice, and compensation practice. The results provide evidence that the three organizational practices lead to higher service performance outcomes.

2 - The Impact of Quality on Service Satisfaction in Outsourcing Relationships
Deepa Mani, Indian School of Business, ISB, Gachibowli, Hyderabad, India, deepa_mani@isb.edu, Nishta Langer

The reach and impact of outsourcing has expanded in the modern organization to include a variety of strategic business objectives. Yet, evidence suggests that many firms remain unprepared for the transformation that strategic outsourcing brings, resulting in significant dissatisfaction with their outsourcing engagements. In this study, we use data on 200 strategic outsourcing relationships to examine the drivers of service satisfaction. In particular, we focus on the dimensions of service quality in explaining variance in service satisfaction. Our results have important implications for theory and the management of outsourcing relationships.

3 - Knowledge Intensive IT Services: An Empirical Examination
Ramanath Subramanyam, Asst. Professor, University of Illinois, 1206 S. 6th St., 350 Wohlers Hall, Champaign, IL, 61822, United States of America, rsubrama@illinois.edu, Anjana Susarla

Increasingly, firms rely on external firms for access to critical knowledge. This paper focuses on the key challenge in designing contractual agreements that can protect competitive knowledge, whilst simultaneously providing incentives for inter-organizational learning and frictionless knowledge exchange. We integrate explanations from theories of incomplete contracts and knowledge-based research to investigate contract design characteristics.

■ SC50

C -Room 11, Level 2- Mezzanine

Internet-Based Information Intermediaries

Sponsor: Information Systems
Sponsored Session

Chair: Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 137 Nelson Ave, Saratoga Springs, NY, 12866, United States of America, kuruzj@rpi.edu

Co-Chair: Animesh Animesh, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, Canada, animesh.animesh@mcgill.ca

1 - Investigating the Accuracy of On-line Reputation Systems
Sarah Rice, University of Connecticut, 2100 Hillside Road, Storrs, United States of America, Sarah.Rice@business.uconn.edu

We address the accuracy of on-line reputation systems by specifically asking what influences an individual's choice to leave honest feedback, and how might the decision to leave no feedback be interpreted. We conduct an exploratory survey specifically designed to gain insights as to why on-line market participants may or may not contribute their private information to an on-line reputation system.

2 - A Disaggregate Level Analysis of User Contribution in an Online Community
Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West #589, Montreal, QC, H3A1G5, Canada, jui.ramaprasad@mcgill.ca, Rishika Ramkumar

Consumers are increasingly receiving information from and contributing to online communities. In this study, we conduct a systematic empirical examination of the factors that drive online contribution. We find that opinions of a user's local network influence contribution more than those of the overall network. Also, active users and users with a longer relationship with the online community are more likely to contribute. We discuss the implications of the results for both theory and practice.

3 - An Empirical Analysis of the Adoption of Facebook on Campus
Oliver Yao, Associate Professor, Lehigh University, 621 Taylor St., Bethlehem, PA, 18015, United States of America, yuy3@lehigh.edu, Xue Bai

Using campus and Facebook data for 94 universities in the U.S., we examine the effect of offline environmental factors on the adoption of online social networks. We find that Facebook are used in a greater extent when the campus has a greater number of offline social communities, such as student clubs and organizations, and fraternities and sonorities; when the campus size is larger; and when the campus is located in a region with lower average temperatures and greater levels of precipitation.

4 - Online Pricing and Distribution Strategies: A Case Study of Air Travel
Nelson Granados, Assistant Professor of Information Systems, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, John Mooney

We discuss contemporary practices in the design of Internet-based marketing and sales in the air travel industry, with particular focus on merchandising, ala carte pricing, and ancillary fees. We examine the demand-side impacts of these practices. Based on these impacts, we offer some prescriptive guidelines for online air travel distribution strategies, including the Internet-based technological innovations that will enable them.

■ SC51

C -Room 12, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Microsoft - Presenting Microsoft Solver Foundation 3.0
Nathan Brixius, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, Senior Engineering Lead

Microsoft Technical Computing's Solver Foundation is a .Net runtime for mathematical programming, modeling, and optimization. The latest release broadens the range of models that can be created, solved, and analyzed using Solver Foundation Services (SFS) and OML to include linear and mixed-integer nonlinear problems. A demo and technology roadmap will be presented.

2 - AnyLogic - AnyLogic in Brief
Andrei Borshchev, General Director, AnyLogic NA-XJ Technologies, 9 Ramsey Road, Lebanon, NJ, 08833, United States of America, andrei@xjtek.com

AnyLogic is the one tool that recognizes the value of different approaches. With AnyLogic you can build models in multiple techniques or even combine them to create hybrid models that are truer to your system than those created with single-purpose tools. This workshop provides background, demos, and an overview of the tool, as well as an insight into future features.

■ SC52

C -Room 13, Level 2- Mezzanine

Container Security and Detection Systems

Sponsor: Military Applications
Sponsored Session

Chair: Ana Lisbeth Concho, Research Assistant, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, aconcho@stevens.edu

1 - Container Inspection Strategies Optimization via Heuristics Considering Budget and Space Constraints
Ana Lisbeth Concho, Research Assistant, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, aconcho@stevens.edu, Jose Ramirez-Marquez

A new approach for developing optimal shipping container inspection strategies at Port-of-Entry is proposed to maximize the detection-rate of suspicious containers and minimize the average inspection time while considering budget and space constraints. An evolutionary algorithm is used for simulating multiple inspection strategies and obtaining the corresponding Pareto set.

2 - Nuclear Shielding in Port of Entry Inspection
Tsvetan Asamov, Rutgers Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States of America, asamov@rci.rutgers.edu, Jolie Cizewski, Elsayed Elsayed, Curtis McGinity

We present a physically consistent model for the detection of shielded nuclear materials in the Port-of-Entry inspection problem. We assume a Beta distribution for the probability density of both the nuclear source mass and shielding thickness. Our numerical results suggest that the radiation sensor readings for containers with nuclear materials may violate the widely held normality assumption. Additionally, we illustrate the necessity for real-time threshold optimization of radiation detectors.

3 - Maritime Simulation Model of Mobile Detection Systems
Daniel Faissol, Postdoctoral Researcher, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, 94511, United States of America, faissol1@llnl.gov, Thomas Edmunds, Richard Wheeler

We have developed the Maritime Simulation Model (MSM) to evaluate the efficacy of a given detection architecture aimed at detecting a radioactive material being transported on a small boat. The use of simulation allows us to capture the interdependencies between the radiation detection model and the patrol operations model, as well as the complex geometry of the patrolled region. In this talk, we demonstrate MSM and present results and analysis.

■ SC53

C -Room 14, Level 2- Mezzanine

Networks and Inference

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: Sujay Sanghavi, Assistant Professor, ECE, UT Austin, 1 University Station, ENS 425, Austin, TX, 78712, United States of America, sanghavi@mail.utexas.edu

1 - Manipulation Robustness of Collaborative Filtering
Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Xiang Yan

A collaborative filtering system recommends to users products that similar users like. Collaborative filtering systems infuence purchase decisions, and hence have become targets of manipulation by unscrupulous vendors. We demonstrate that while nearest neighbor algorithms, which are widely used in commercial systems, are highly susceptible to manipulation, a new class of algorithms we propose are robust in the sense that, on average, frequent users experience vanishing distortion.

2 - A Token-based Approach for Distributed Computation
Venkatesh Saligrama, Professor, Boston University, Boston, MA, United States of America, srv@bu.edu, Murat Alanyali

We consider distributed algorithms for data aggregation based on neighboring pairwise computations on a graph. We endow each node with a state that can either be active(transmit) or inactive. The idea is to control the message transmission by modulating the states. This framework admits different schemes such as Gossip and Coalescing random walks (CRW). We study per-node message and time complexities of different algorithms as a function of the network size.

3 - Network Codes for Distributed Storage and Interference Alignment
Alex Dimakis, Assistant Professor, University of Southern California, 532 EEB, 3740 McClintock Ave., Los Angeles, CA, 90089-2560, United States of America, dimakis@usc.edu

Distributed storage schemes for data centers and peer-to-peer networks often use traditional erasure codes to introduce redundancy for robustness. Following recent developments, we will show that interference alignment is fundamental for distributed storage repair problems and demonstrate equivalence of interference alignment to a rank minimization problem subject to full-rank constraints.

4 - Dirty Statistical Models
Sujay Sanghavi, Assistant Professor, ECE, UT Austin, 1 University Station, ENS 425, Austin, TX, 78712, United States of America, sanghavi@mail.utexas.edu

Several techniques in high-dimensional statistics decompose the data into a "truth" from a clean structural model, and noise; e.g. Compressed Sensing (sparsity), PCA (low-rank) etc. Real data, however, may not fit into any one such clean model. We introduce dirty models: instead of decomposing the data, we decompose the model itself - jointly using several clean models. This results in much more flexible and robust algorithms; we show this for multi-task learning, PCA and graphical models.

■ SC54

C -Room 15, Level 2- Mezzanine

Technology Choice in Semiconductor Manufacturing

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Richard Roth, Director of MIT Materials Systems Laboratory, Massachusetts Institute of Technology, 292 Main Street, Cambridge, United States of America, rroth@MIT.EDU

1 - Supply Chain and Timing Issues in the Transition to a 450mm Wafer Standard
Charles Fine, Professor, Massachusetts Institute of Technology, Cambridge, MA, United States of America, charley@mit.edu, Richard Roth

The transition to a 450mm wafer standard for the semiconductor industry offers an opportunity for long term improvements in throughput and costs. However, there are strategic questions about both the timing of the transition and the roles of various players within the supply chain. This work addresses the impact of timing decisions including introduction rate and rate of technology on the chipmakers, equipment suppliers and raw wafer producers.

2 - Economics of the Transition to 450mm Wafers in the Semiconductor Industry
Richard Roth, Director of MIT Materials Systems Laboratory, Massachusetts Institute of Technology, 292 Main Street, Cambridge, United States of America, rroth@MIT.EDU, Charles Fine

The semiconductor industry is considering using 450mm wafers to improve area throughput and reduce processing costs. However, several drawbacks exist including the large upfront investments and long learning horizon which may mean that it will take several years before the wafer size transition can pay for itself. This work explores the conditions under which there are sufficient long term cost savings to offset the early investments and cost penalties.

3 - Learning as a Driver Technology Choice Decisions in Semiconductor Manufacturing
Thomas Rand-Nash, Doctoral Candidate, Massachusetts Institute of Technology Materials Systems Laboratory, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, trand@mit.edu

This work explores process technology decision making in the presence of learning effects in semiconductor manufacturing, and hopes to characterize the conditions under which learning-related production cost effects impact technology choice decision making. Relevant factors considered include learning rates, production volume as a function of demand, market structure, and budget constraints.

4 - The Impact of Offshoring on the Innovation Trajectories of Firms versus Individuals

Erica Fuchs, PhD, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15217, United States of America, erhf@andrew.cmu.edu, Chia-Hsuan Yang

After the burst of the telecom bubble in March 2000, the majority of U.S. optoelectronic component firms moved manufacturing offshore. This research explores (1) whether due to the different offshore production economics, the firms who move manufacturing offshore stop or slow U.S.-based R&D activities in particular technologies and (2) whether inventors originally within these offshoring firms, leave, and continue to innovate in the pre-offshoring technologies at different institutions.

■ SC55

C -Room 16, Level 2- Mezzanine

Innovation Processes

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Laura Kornish, Associate Professor, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80309, United States of America, kornish@colorado.edu

1 - The Impact of Device Choice on Outcomes in Hip Replacement Surgery

Kamalini Ramdas, London Business School, Regent's Park, London, NW14SA, United Kingdom, kramdas@london.edu, Khaled Saleh, Steven Stern, Haiyan Liu

It is well known in healthcare that a surgeon's experience in terms of number of surgeries performed is an important predictor of surgical outcomes. Unlike previous research in this area, we examine how experience with specific devices used in surgery affects surgical outcomes, using a data set consisting of all hip replacement surgeries conducted at the University of Virginia hospital in 2006-2008.

2 - Empirical Evidence for the Role of the Domain Name Itself in Website Performance

Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Karl Ulrich

This paper provides the first large-scale empirical evidence linking specific properties of internet domain names to the realized demand for their associated websites. We find that the websites with the highest demand have names that are short, include dictionary words, avoid punctuation symbols, and use numerals. The use of phonemes associated with disgust is negatively associated with performance for most websites, but positively associated with performance for adult sites.

3 - Idea Generation and Concept Selection

Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy-en-Josas, France, sommers@hec.fr, Stylianos Kavadias

Idea or concept generation and selection is an essential, but relatively poorly understood part of the new product design process. In this work, we consider how group interactions affect the information dissemination during the idea generation process, and how the idea generation process and organizational choices affect the concepts ultimately selected for further development.

4 - Opportunity Spaces in Innovation: Empirical Analysis of Large Samples of Ideas

Laura Kornish, Associate Professor, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80309, United States of America, kornish@colorado.edu, Karl Ulrich

Identifying a large number of ideas with parallel search is a common approach to innovation. One potential weakness of parallel search is repetition. We analyze repetition in five data sets comprising 1,368 opportunities and address three questions: (1) When a large number of efforts to generate ideas are conducted in parallel, how likely are the resulting ideas to be redundant? (2) How large are the opportunity spaces? (3) Are unique ideas more valuable than those that are similar to others?

■ SC56

C - Room 1, Level 1

Advances in Ranking and Selection

Sponsor: Simulation Society
Sponsored Session

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

1 - Selection of a Good Enough Subset with Descriptive Complexity Preference

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews, Urbana, IL, United States of America, enluzhou@illinois.edu, Shen Yan, Chun-Hung Chen

Simple designs are usually more preferable than complex designs in the real world if their performances are within a good enough range. In this paper, we propose a simulation-based approach to identify m simplest good enough designs among K (K>m) total designs using an optimal simulation budget allocation scheme. The numerical results show that our approach finds the simplest good enough designs efficiently, and outperforms some other approaches on all the test problems.

2 - Decision Analytic Ranking and Selection Algorithms

Jason Merrick, Associate Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States of America, jrmerric@vcu.edu, Toni Sorrell

Ranking and selection problems can be cast as simple influence diagrams and solved with sampling-based algorithms designed for them. Alternatively, methods such as OCBA, 0-1, LL, and the knowledge gradient can be used. We perform an empirical comparison of these methods to investigate whether influence diagram algorithms are competitive for ranking and selection problems or ranking and selection methods should be adapted to solve influence diagrams.

3 - An Empirical Analysis of Transient Mean Ranking and Selection

Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, Douglas.Morrice@mccombs.utexas.edu, Chun-Hung Chen

In this presentation, we empirically analyze the performance of the transient mean Ranking and Selection algorithm. Based on this analysis, we consider ways in which to improve performance of the algorithm.

■ SC57

C - Room 2, Level 1

Operations-Finance Interface

Cluster: Risk Management
Invited Session

Chair: Fehmi Tanrisever, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, f.tanrisever@tue.nl

1 - An Integrated Approach to Commodity Risk Management

Fehmi Tanrisever, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, f.tanrisever@tue.nl

We examine the operating and financial hedging decisions of a value maximizing firm, under imperfect capital markets. Motivated by the flour milling industry, we consider a firm who buys a certain commodity and converts it into a final product. We show that, the cost of financial distress may lead the firms to choose more conservative strategies via under-producing. We discuss how commodity markets can be used to mitigate this problem to generate more wealth for the shareholders.

2 - Operational Hedging Strategies to Overcome Financial Constraints for Clean Technology Startups

Sinan Erzurumlu, Assistant Professor, Babson College, Tomasso 123, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Fehmi Tanrisever, Nitin Joglekar

The clean technology sector has been hit by the recent credit squeeze because many clean technology startups rely on project financing from limited financial resources to fund their capital outlays. Startups can overcome the financing problem by reducing the potential risks of their technologies. Our goal is to develop a framework that conceptualizes the associated risks and biases associated with clean technology industry and discuss the role of operational hedging to manage any shortcomings.

3 - An Analysis of Joint Manufacturer-Bank Loans to Finance the Supply Chain

Jianer Zhou, Assistant Professor, Boston College, 140 Commonwealth Ave., Fulton 454C, Chestnut Hill, MA, 02467, United States of America, jianer.zhou@bc.edu, Harry Groenevelt

We consider a supply chain involving 3 parties: retailer, manufacturer and bank. To sell her products through a retailer whose ability to finance inventory is limited, the manufacturer partners with a bank to offer a loan program to the retailer. We formulate the interaction between the manufacturer and the retailer as a Stackelberg game. Our paper provides insights into the motivation of the manufacturer to offer a collaborative loan program if the financial market is incomplete.

4 - Risk Propagation in a Supply Chain
Alejandro Serrano, Zaragoza Logistics Center, Edificio Nayade 5, Bari 55 - PLAZA, Zaragoza, 50197, Spain, aserrano@zlc.edu.es, Santiago Kraiselburd, Rogelio Oliva

We study how risk, measured by the variability of payments from customers, propagates upstream in a supply chain, when firms have limited access to external funds, and unilaterally exceed trade credit agreements. We model a chain with three players, where the downstream player faces random demand. Using numerical Markov chains, we study the impact of firms' target leverage, demand variability, and agency costs on risk propagation.

■ SC58

C - Room 3, Level 1

Quantitative Methods for Credit Risk

Cluster: Quantitative Finance
Invited Session

Chair: Rafael Mendoza-Arriaga, Assistant Professor, McCombs School of Business, University of Texas at Austin, IROM, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

1 - Default Clustering and Valuation of Collateralized Debt Obligations
Xianhua Peng, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China, xp2102@caa.columbia.edu, Steven Kou

The recent financial crisis has witnessed the powerful impact of default clustering (i.e., one default event tends to trigger more default events in the future and cross-sectionally), especially on the market of collateralized debt obligations (CDOs). We propose a model for CDO pricing based on cumulative default intensities that can incorporate default clustering. The result of calibration to the market data when default correlation was substantially high shows that the model is promising.

2 - First Passage Time(s) of Two-dimensional Brownian Motion
Haowen Zhong, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, hz2193@columbia.edu, Steven Kou

We deal with the first passage time problem of 2-dim drifted Brownian Motion. Via a PDE approach we solve for the Laplace transform of the first passage time(s) of an 2-dim drifted BM. We then perform a numerical inversion for the required pdf. Our approach not only is computational and practical convenient, but also provides useful insights leading to n-dim case.

3 - Optimal Importance Sampling for Dynamic Portfolio Credit Risk
Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu, Alex Shkolnik

Dynamic intensity-based point process models, in which a firm default is governed by a stochastic intensity process, are widely used to model portfolio credit risk. In the context of these models, this paper develops, analyzes and evaluates an importance sampling scheme for estimating the probability of large portfolio losses. The scheme is widely applicable, and is shown to be asymptotically optimal. Numerical experiments illustrate the performance of the algorithm.

4 - A Class of Multivariate Lifetime Distributions Associated with Multi-dimensional Subordinators
Yunpeng Sun, Northwestern University, 2145 Sheridan Rd. C210, Evanston, IL, United States of America, ypengsun@iems.northwestern.edu, Rafael Mendoza-Arriaga, Vadim Linetsky

We construct a class of multivariate lifetime distributions associated with multi-dimensional Levy subordinators. The distributions in this class are parameterized by an n-dimensional Levy measure, a non-negative drift vector, and a set of univariate marginals. This class of lifetime distributions can be simulated with the computational effort linear in the number of lifetimes. Applications to multi-name credit risk modeling will be presented.

■ SC59

H - Salon A, 4th Floor

Doing Good with Good OR Student Competition

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

Co-Chair: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

1 - Strategic Planning of Radiation Therapists: An IP Approach with Duration and Experience Constraints
Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com, Martin Puterman, Mike Darud

Radiation therapists work in many tasks to provide treatment at the British Columbia Cancer Agency. Experience and duration constraints are important considerations when creating a two year staff plan. We developed a multi-period assignment model with side constraints and goal programming that balances conflicting objectives. The application is used to enable better use of this limited cancer care resource.

2 - Decision Model for Sustainable Water, Sanitation, & Household Energy in Developing Communities
Justin Henriques, PhD Candidate, University of Virginia, 151 Engineers Way, P.O. Box 400747, Charlottesville, VA, 22904, United States of America, jjh9a@virginia.edu, Garrick Louis

The lack of access to basic needs in developing countries leads to death, disease, and environmental degradation. This research creates decision support models for the systematic selection and implementation design of sustainable technologies for distributed water, sanitation, and household energy systems. The author applies these models in countries including Haiti, Indonesia, and Kenya. He also operates a non-profit organization that implements the research as community development projects.

3 - Improving the Educational Outcomes of Future Surgeons
Jonathan Turner, PhD Candidate, Northwestern University, Evanston, IL, United States of America, JonathanTurner@u.northwestern.edu, Heron Rodriguez, Mark Daskin, Debra DaRosa

Our analytical models and simulation have influenced Northwestern Memorial Hospital to increase the length of surgical resident rotations from one to two months. The software we designed will also evenly distribute operating room experiences across residents. These changes will increase resident-patient continuity of care, the educational experience of future physicians, patient satisfaction and patient safety.

■ SC60

H - Salon B, 4th Floor

Benefit-Risk Assessment and Communication in Pharmaceuticals

Sponsor: Decision Analysis
Sponsored Session

Chair: Jim Felli, Research Fellow, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

1 - Benefit-Risk: A Story in Pictures
Jim Felli, Research Fellow, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

Stories constitute the single most powerful weapon in a leader's arsenal. — Howard Gardner, Harvard University.

2 - Approaching Benefit/ Risk Analysis From a Decision Analytic Perspective
Marilyn Metcalf, Director, Quant & Dec Sciences, GSK, PO Box 13398, Five Moore Drive, Research Triangle Park, NC, 27709-3398, United States of America, marilyn.a.metcalf@gsk.com

Benefit/risk analyses have many features of decision analyses. We will review framing and tools familiar to decision analytic practitioners that can be helpful in many benefit/risk trade-offs. In addition, we will discuss communications approaches in collecting information, building models, and articulating results that are helpful in both arenas.

3 - Decision Analytic Models to Aid Informed Regulatory Decisions About Medicinal Products
Lawrence Phillips, London School of Economics & Political Science, Department of Management, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.com, Barbara Fasolo

All drug regulators convert 10 gigabytes of data about a new medicinal product into a 'yes-no' approval decision through a process of discussion and debate that does not use quantitative models. Research at the European Medicines Agency shows how modelling improves the transparency and quality of the regulatory decision-making process, and facilitates communication about the balance of benefits and risks.

4 - Progress Toward More Systematic Benefit-Risk Assessment in Pharmaceuticals

Rebecca Noel, Research Scientist, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, United States of America, noel_rebecca_a@lilly.com

Assessing the benefit-risk (B-R) balance of medicines is a prominent challenge facing pharmaceutical manufacturers and regulators. While B-R assessments are the core of decision-making, the current process relies primarily on expert judgment. This session highlights efforts and approaches to develop and apply a more structured and systematic approach to B-R assessment for pharmaceutical regulatory decision-making.

■ SC63

H - Room 404, 4th Floor

Value of Information (VoI): From Theory to Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Laure Canis, US Army Corps of Engineers, 70 Pacific Street, Cambridge, MA, United States of America, laure.canis@polytechnique.org

1 - Value of Information and the Accuracy of Discrete Approximations

Arjun Ramakrishnan, Student, University of Texas at Austin, 1100 E32nd st Apt 106, Austin, TX, 78722, United States of America, arjunr@mail.utexas.edu, Eric Bickel

Value of information is one of the key features of decision analysis. My work deals with providing a consistent and functional methodology to determine VOI on proposed well tests in the presence of uncertainties. This method shows that VOI analysis by discretizing continuous probability distributions and using conventional decision trees can be accurate if the correct discretization is chosen. We also compare different discrete approximations.

2 - General Bounds on Value of Information in Two-act Linear Loss Decisions

Jeff Keisler, University of Massachusetts, Boston, MA, United States of America, Jeff.Keisler@umb.edu, Laure Canis

We consider the two act linear loss problem (TALL) when action alternative's payoff has known mean and standard deviation. We derive an analytic upper bound for the Expected Value of Perfect Information on this payoff, as the product of standard deviation and a function of the absolute ratio of the mean to the standard deviation, and extend the result to the case where the distribution is known to be symmetric. We also derive lower bounds. We compare with results for the normal distribution.

3 - Value for Information for Prioritizing Nano-related Research

Igor Linkov, US Army Corps of Engineers, Cambridge, MA, United States of America, igor.linkov@usace.army.mil, Laure Canis

We first present a decision model for selecting the optimal manufacturing process for Single Wall Carbon Nanotubes (SWCNT) from the point of view of different stakeholders. We then perform a Value of Information Analysis on health related and manufacturing criteria to establish when performing further research is worth the costs.

4 - The Value of Information for Some Stopping Problems

Debarun Bhattacharjya, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com, Lea Deleris

In stopping problems such as the search for an apartment or employee, the decision maker receives a sequence of candidates and decides whether to choose the current candidate, thereby stopping the search, or whether to continue the search. We investigate properties of the value of information in several variations of the stopping problem, and discuss how a model that ignores sequential decisions can potentially severely under-estimate the value of information.

■ SC68

H - Room 415, 4th Floor

Managing Distribution Channels Under Competition

Sponsor: eBusiness
Sponsored Session

Chair: Yunzeng Wang, Professor of Finance and Management Science, University of California, Riverside, 900 University Avenue, Riverside, CA, 92521, United States of America, yunzeng.wang@ucr.edu

1 - Site-to-store or Store-to-site? Application of One-way Transshipment in Dual-channel Retailing

Chao Liang, PhD Candidate, The Unversity of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX, 75080, United States of America, cxl071000@utdallas.edu, Suresh Sethi, Jun Hang

Although more than 80% of retailers now sell products through multiple channels, it is not clear how a retailer should integrate effectively a physical channel with an online channel. We compare two standard integration strategies site-to-store and store-to-site. We first consider the case in which the physical channel consists of one retail store, and then the multiple-retail-store case. Finally, we develop a simple heuristic to identify an effective strategy for the multiple-retail-store case.

2 - Private Labels vs. National Brands: Information Asymmetry and New Product Introduction

Arcan Nalca, Assistant Professor, Queen's University, 143 Union Street, Goodes Hall 226, Kingston, Ontario, K7L 3N6, Canada, arcan.nalca@business.queensu.ca, Tamer Boyaci, Saibal Ray

Retailers introduce private labels (PL) to gain profits directly from the PL and also use it as a strategic weapon against national brand (NB) manufacturers. Today, retailers also focus on design and innovation of PLs by improving the existing products through their ability to learn from customers. In this paper, we investigate the PL introduction and positioning decisions of a retailer and its effects on the NB manufacturer in an asymmetric information environment.

3 - The Effect of List Price on Channel Performance in a Revenue-sharing Contract

Jun Ru, University at Buffalo, The State University of New York, School of Management, Buffalo, NY, 14260, United States of America, jun.ru@utdallas.edu, Yunzeng Wang, Xiangpei Hu

Credited for creating innovative contracts for managing business with suppliers, Amazon.com offers a contract called Advantage Program. A key parameter is the product list price that Amazon.com allows a supplier to choose. It then sets the retail price at or below supplier's list price for selling the product to the market. We show that supplier's list price acting as a constraint on retailer's retail price plays a major role in determining firms' decision and performance in equilibrium.

■ SC69

H - Salon F, 6th Floor

Roundtable Session I - Upcoming Topics in Railroad Operations Research

Sponsor: Railrway Applications
Sponsored Session

Chair: Carl VanDyke, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, United States of America, Carl.VanDyke@oliverwyman.com

Co-Chair: David Hunt, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

1 - Current Trends and Future Topics Rail Research: A Survey and Forecast

Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

In this presentation, I will survey the intensity of recent rail research in various areas. I will present indicators of trends for rail research, and prognosticate on hot research topics for the upcoming decade.

2 - Use Operations Research Models to Improve Railroad Operations

Clark Cheng, Director Operations Research, Norfolk Southern Corp, 1200 Peachtree St NE, Box 117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

As an OR practitioner in the rail industry, I have witnessed the industry has embraced OR models in tactical and strategic decision making although there is still a long way to go. In this presentation, I will review what and how OR models have been used in a wide range of applications, e.g., car scheduling, fleet sizing, crew planning, vehicle routing, capacity planning, maintenance scheduling, service design, demand forecasting, etc. Also, I will discuss some upcoming topics in railroad.

3 - The Impacts of Positive Train Control (PTC) and Implications for Further Research

Carl VanDyke, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, United States of America, Carl.VanDyke@oliverwyman.com, David Lehlbach, Rod Case, David Hunt

The Federal Railroad Administration has mandated that railroads implement PTC systems by 2015. The railways are implementing PTC as "overlay" systems, which are used in conjunction with existing control systems. This talk will examine various open questions related to PTC, and where further research is required on the design and performance of PTC. Topics such as braking algorithms, line capacity impact assessment, and the role of precision dispatching will be explored.

■ SC70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Irregular Operations in Aviation

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Jon Petersen, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30309, United States of America, Petersen@gatech.edu

1 - Airline Recovery via Benders and Lagrangian

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road Room M239, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Seokcheol Chang, Milind Sohoni

Airline recovery is to find a modified schedule of flights, passenger itineraries, and aircraft in anticipation of a disruption (crew recovery is usually a follow-up process). We use an integer programming model, which is solved by a combination of Benders and Lagrangian. Instead of traditional dual prices, Lagrangian multipliers are used to form Benders cuts.

2 - A Solution Procedure for Airline Integrated Recovery

Jon Petersen, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30309, United States of America, Petersen@gatech.edu, Gustaf Solveling, Sergey Shebalov, Ellis Johnson, John-Paul Clarke

While the airline industry has benefited from advancements made in analytical OR methods, most applications stem from the frictionless environment of the planning stage. However the operational stage may be rife with schedule perturbations. The recovery process seeks to repair the flight schedule, aircraft rotations, crew schedules, and passenger itineraries in a tractable manner. Using math programming we solve the integrated problem and present promising computational results.

3 - Improving Passenger Service by Extending Disruption Management with Flight Planning

Bo Vaaben, Senior Consultant, Jeppesen, Koebmagergade 53 - 3th, Copenhagen, 1150, Denmark, Bo.Vaaben@jeppesen.com, Lavanya Marla, Cynthia Barnhart

When managing disruptions most airlines recover their operation by applying a combination of delays, swaps and cancellations. This paper presents how these traditional recovery techniques can be extended with altering flight plans. This is based on a network model and solved as a multi-commodity flow problem. The model allows an airline to find the right trade-off between fuel-burn and passenger service. Real life results from a medium sized carrier are presented.

4 - Restructuring of Terminal Areas During Thusingstorms using Convective Weather Forecasts

Diana Michalek, Massachusetts Institute of Technology, Operations Research Center, 77 Mass Ave, Bldg E40-130, Cambridge, MA, 02139-4307, United States of America, dianam@mit.edu, Hamsa Balakrishnan

The relaxation of the current rigid airspace structure, especially during stormy weather and in bottlenecked airport terminal areas, has the potential to increase airspace capacity and thereby decrease aircraft delay. We propose integer programming models for dynamic airspace configuration in the terminal area, taking into account both scheduled airspace demand and convective weather forecasts. We evaluate and discuss model results for realistic weather and demand scenarios.

■ SC71

H - Salon H, 6th Floor

Panel Discussion: Genesis of Data Envelopment Analysis

Cluster: In Honor of Bill Cooper
Invited Session

Moderator: Lawrance Seiford, Professor, University of Michigan, Ann Arbor, MI, United States of America, seiford@umich.edu

1 - Genesis of Data Envelopment Analysis

Panelists: Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Arie Y. Lewin, Duke University, The Fuqua School of Business, Durham NC, United States of America, ayl3@duke.edu, William Cooper, University of Texas, Austin TX, United States of America, cooperw@mail.utexas.edu, Eduardo Rhodes

This session focuses on the objectives that led to the development of the DEA method for efficiency evaluation. Panelists will assess success in achieving those objectives over the past 30 years and challenges that lie ahead.

■ SC72

H - Salon J, 6th Floor

Transportation Pricing and Financing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu

1 - Roadway Pricing Strategies for Rural Freeways

Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu, Promothes Saha, Ruoyu Liu

The primary goal of roadway tolling in rural areas is revenue generation rather than elimination of congestion externalities, and thus urban pricing models are not directly applicable. We present a model for finding socially-optimal prices accounting for the benefits obtained from toll revenue and the effects of diversion (including pavement deterioration and local economic activity.

2 - Private Involvement in Financing Public Projects

Zitao Zhang, Northwestern University, 2145 Sheridan Rd. Rm A316, Evanston, IL, 60201, United States of America, zitao-zhang@northwestern.edu, Pablo Durango-Cohen

This paper has taken the initial effort to understand potential complexities that could rise in the public-private collaboration of transportation investment. By adopting concepts from macroeconomic theory and public finance, we provide a prescriptive framework to illustrate tax variations under different circumstances and emphasize the importance of cost structure, timing of decision-making, and funding adequacy.

3 - Optimal Regulation on Private-sector Transportation Investment

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, Jasmy Methipara, Yijing Lu, Andrea Robitallie

This paper develops a methodology for analyzing optimal regulatory policies on private-sector transportation investment. Our method combines the strengths of mathematical programming models in representing optimizing behavior and the advantages of agent-based techniques in simulating dynamic interactions on dissimilar time scales in large complex systems. Among all regulatory strategies examined for the test scenarios, profit/revenue sharing is shown to be the most effective policy in terms of welfare-maximization and equitable benefit distribution.

■ SC73

H - Salon K, 6th Floor

Vehicle Routing II: Stochastic and Dynamic Logistics Applications

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Alan Erera, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, alan.erera@isye.gatech.edu

1 - A Stochastic Programming Formulation for the Consistent Vehicle Routing Problem with Stochastic Customers: Some New Results
Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca, Ola Jabali, Walter Rei, Tom Van Woensel, Ton de Kok

The Consistent Vehicle Routing Problem corresponds to a situation encountered by express mail delivery companies who wish to provide their regular commercial customers with consistent service, in the sense that they would like to visit them every day around the same time, if they need service. We have proposed to model this problem as variant of the Vehicle Routing Problem with Stochastic Customers. We report and analyze recent computational results on a set of small to medium-size instances.

2 - Dynamic Stochastic Traveling Salesman Problem: Value of Real-time Traffic Information
Tae Su Cheong, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, taesu.qlink@gmail.com, Chelsea White III

After each stop, we assume that the vehicle chooses the next stop that has not yet been visited, based on current traffic conditions. Travel time along each arc in the network is modeled as a random variable, and the congestion status of the network evolves as a Markov chain. We present an efficient algorithm for dynamicaly determining a tour that minimizes the expected total travel time and give examples that indicate the value of traffic congestion information.

3 - SimuRial: A Reliability-based Algorithm to Solve the VRP with Stochastic Demands
Javier Faulin Fajardo, Professor, Public University of Navarre, Campus Arrosadia, Pamplona, 31006, Spain, javier.faulin@unavarra.es, Scott Grasman, Angel Juan, Alejandro Garcia del Valle

The VRP with Stochastic Demand (VRPSD) is a NP-hard problem in which demand is not revealed until the distribution vehicle visit the customer. That situation can cause infeasibilities which should be avoided. Our approach SimuRial is focused on reducing the probability of occurrence of such undesirable situations called route failures using Reliability concepts and Monte Carlo simulation. Some new generic instances are generated and some promising results are obtained.

4 - Robust Empty Repositioning in Large Scale Freight Consolidation Networks
Antonio Carbajal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, acarbajal@gatech.edu, Alan Erera, Martin Savelsbergh

Large scale consolidation networks require cost effective repositioning plans to correct empty-container imbalances among terminals. We present techniques to develop robust repositioning plans to hedge against uncertainty in the supply and demand of containers. We address modeling issues and solution techniques and present computational results on test instances.

■ SC74

H - Room 602, 6th Floor

Online Adaptive Routing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Song Gao, University of Massachusetts-Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, United States of America, songgao@ecs.umass.edu

1 - Hierarchical Time-dependent Shortest Path Algorithm for Dynamic Traffic Assignment Models
Yang Gao, University of Arizona, Tucson, Tucson, AZ, United States of America, gabegao@email.arizona.edu, Yi-Chang Chiu

To improve the efficiency and accuracy of time-dependent shortest path algorithms, when applied to fine-grained, large-scale dynamic traffic network modeling, we propose an algorithm that utilizes network structure and dynamic traffic information, and combines both heuristic and exact optimization approaches. Numerical results demonstrate the improved computational efficiency and high solution quality of the proposed algorithm.

2 - Optimal Paths in Dynamic Networks with Dependent Random Link Travel Times
He Huang, University of Massachusetts-Amherst, Amherst, MA, United States of America, he@engin.umass.edu, Song Gao

We find paths with minimum expected disutility in a stochastic time-dependent network where all link travel times at all times are jointly distributed random variables. A comparison is made with similar problems that do not consider the stochastic dependencies, through theoretical results in small networks and computational results in large networks. The impact of stochastic dependencies on optimal path generation is shown to be related to the level of correlation and risk attitudes.

3 - A Prospect Theory Model for Strategic Route Choice with Stated Preference Data
Song Gao, University of Massachusetts-Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, United States of America, songgao@ecs.umass.edu, Mike Razo

Most route choice studies with real-time information account for detours a traveler takes in response to received information, but not strategic choice behavior, where a traveler plans ahead for information to be received later. We develop a strategic route choice model that incorporates Cumulative Prospect Theory to account for risk. The model is estimated on stated preference data from interactive maps, and offers insights into risk-taking and strategic choice behavior in a simple network.

Sunday, 4:30pm - 6:00pm

■ SD01

C - Ballroom D1, Level 4

Optimization and Equilibrium Modeling for Energy Markets - I

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Engineering, College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - An Optimization Model for Biogas Production From Wastewater
Chalida u-Tapao, PhD Student, University of Maryland, College Park, MD, United States of America, cutapao@umd.edu, Steve Gabriel, Mark Ramirez, Christopher Peot

We present a new optimization model that considers both operational and investement decisions for an advanced wastewater treatment plant. These decisions involve converting wastewater into biosolids (fertilizer), methane gas, and electricity for internal or external purposes. We consider objective function to minimize carbon emissions, energy usage as well as maximize net profit.

2 - Options to Hedge Against Producer Risks in Electricity Markets
Salvador Pineda, PhD Student, University Castilla - La Mancha, Campus Universitario s/n, Ciudad Real, 13071, Spain, Salvador.Pineda@uclm.es, Antonio J. Conejo

In electricity markets power producers face both price risk and production availability risk. Forward contracts are well-known financial instruments to hedge the risk related to price volatility, but not the risk pertaining to unexpected unit failures. Using a multi-stage stochastic programming model, this presentation analyzes the advantages of hedging with options, compared to forward contracts, for a risk-averse producer if pool prices and unit availability are uncertain.

3 - Unit Commitment Benefits of LMP-based Market Coupling: A Stylized Model for Insight
Benjamin Hobbs, Professor/Sr. Research Associate, The Johns Hopkins University DoGEE/University of Cambridge EPRG, 313 Ames Hall, 3400 No. Charles St., Baltimore, MD, United States of America, bhobbs@jhu.edu, Harry van der Weijde

Stochastic unit commitment models are used to estimate the benefits of locational marginal pricing that arise from better coordination of day-ahead commitment decisions and real-time balancing markets in adjacent power markets subject to wind volatility. This model is applied to a stylised system. We conclude that both types of benefits are highly sensitive to load and generator characteristics, and that the benefits of coordinated balancing are larger than those of coordinated unit commitment.

4 - An Approach to Solve Discretely-constrained Linear MCPs
Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Engineering, College Park, MD, 20742, United States of America, sgabriel@umd.edu, Antonio J. Conejo, Sauleh Siddiqui, Carlos Ruiz Mora

In this presentation we provide a new method to solve discretely-constrained linear MCPs. We provide both theoretical as well as numerical results with applications in energy markets.

■ SD02

C - Ballroom D2, Level 4

Dynamic Optimization in Energy

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Canan Uckun, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu

1 - Managing Supply Surplus in an Electricity System
Owen Wu, Assistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States of America, owenwu@umich.edu

Contingency planning is crucial for electricity systems with high penetration of wind power. Under excessive energy supply surplus situations, jointly optimizing the operations of energy storages, conventional power plants, and wind power generators is paramount to the reliability and efficiency of the system. For a basic system, we characterize the strategies that minimize the expected system cost under supply surplus situations.

2 - Dynamic Scheduling of Demand Response Events for the Smart Grid
Jason Black, Researcher, GE Global Research, 1 Research Circle, K14A64, Niskayuna, NY, 12309, United States of America, blackj@ge.com, Rajesh Tyagi

Electric Utilities currently utilize simple approaches for dispatching demand response. These approaches do not optimize either the number of participating customers or the duration of their responses according to the physical or economic conditions on the power system. We present a methodology to optimally schedule customers for DR events. Our approach determines the best number of participants, as well as the timing for their participation in the event based on prevailing conditions.

3 - Dynamic Electricity Pricing for Smart Homes
Canan Uckun, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu, Dan Adelman

The Smart Home promises to make the power grid a more responsive and interactive platform by using a smart meter instead of a traditional one. As well as enabling consumers to control their energy consumption, smart meters give retailers the ability to do real-time pricing. We model the retailers' real-time pricing problem and consumers' responses as dynamic programs. Since the retailers have millions of consumers, the problem gets very large in size. We solve it by using an ADP approach.

■ SD03

C - Ballroom D3, Level 4

Joint Session ENRE/ Optimization: Optimization and Risk Management in Oil and Gas Exploration and Production

Sponsor: Energy, Natural Resources and the Environment/ Optimization
Sponsored Session

Chair: Leon Lasdon, Professor, IROM Department, McCombs Business School, University of Texas, Austin, TX, 78712, United States of America, leon.lasdon@mccombs.utexas.edu

1 - CR Models for Optimal Waterflooding of Oil Fields
Leon Lasdon, Professor, IROM Department, McCombs Business School, University of Texas, Austin, TX, 78712, United States of America, lasdon@mail.utexas.edu, Anh Nguyen, Larry Lake

We describe multiperiod "capacitance-resistance" models which identify the strength and dynamics of interconnections between water injection wells and oil production wells. A GAMS implementation is used to solve parameter identification and optimal injection problems as large NLP's. Examples are presented using real data from several oil fields.

2 - Using Optimization to Evaluate Major Subsurface Risks in Natural Gas Development Projects
Amin Ettehad, PhD Student, University of Texas, Austin, TX, 78712, United States of America, amin_ettehad@mail.utexas.edu, Larry Lake, Christopher Jablonowski

Optimization of oil and gas fields requires integrated quantitative models to systematically and simultaneously account for the technical and economic aspects of hydrocarbon recovery. In this paper, the authors extend their previous work on an integrated gas storage model to the case of gas production. The focus is on screening economics, scenario analysis, and uncertainty analysis.

3 - Portfolio Approach to Competitive Bidding for Offshore Petroleum Leases
W. Brian Lambert, PhD Student, Colorado School of Mines, Golden, CO, 80401, United States of America, wlambert@mymail.mines.edu, Michael Walls

During a competitive bidding process, exploration and development firms must decide how much to bid for blocks of uncertain petroleum reserves offshore. We compare a portfolio approach to selecting bids that minimize portfolio variance, subject to a minimum expected return, with that of a block-by-block approach to selecting bids that maximizes the expected return of each block. We find alternative bidding strategies with lower risk-return profiles than achieved by the single-block approach.

■ SD04

C - Ballroom D4, Level 4

Energy Infrastructure Planning Models

Cluster: Clean Energy
Invited Session

Chair: Thomas Edmunds, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, United States of America, Edmunds2@llnl.gov

1 - Transmission Network Expansion Planning with Simulation Optimization
Russell Bent, Los Alamos National Laboratory, Los Alamos National Laboratory, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Alan Berscheid, G. Loren Toole

The transmission expansion problem considers how to upgrade electric power. The problem is complex, non-linear, and non-convex. The power grid is evolving (e.g. adding renewable generation) and the adaptation of traditional approximations to the real, complex is no longer easy. This necessitates new optimization techniques. We describe a local search variation of Limited Discrepancy Search that encapsulates the complexity of power flows in a black box to address the complexity directly.

2 - Comparing the p-Median and Flow-refueling Models for Locating Alternative-fuel Stations
Michael Kuby, Professor, Arizona State University, School of Geographical Sciences, and Urban Planning, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu, Christopher Upchurch

Two popular models for optimizing station infrastructure are the node-based p-median model and the path-based flow-refueling model. We analyze how well stations located by each model perform on the other's objective. Stations located for flow-refueling do better at minimizing distance to demand nodes than stations located by the p-median model do at maximizing flows refueled, especially for long-distance trips. Locations for the flow-refueling model also tend to be more stable as p increases.

3 - Approximate Dynamic Programming for a Stochastic Multiscale Energy Policy Model
Warren Powell, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu

We are interested in optimizing energy investments over a multidecade horizon under uncertainty, without the errors introduced by averaging energy from wind and solar over time. Using approximate dynamic programming, we model intermittent energy in hourly increments in the presence of hydroelectric storage, while making yearly investment decisions over 20 years. We show that the results are near-optimal on a deterministic dataset, and produce robust solutions under uncertainty.

■ SD05

C - Ballroom D5, Level 4

Sports and Entertainment

Contributed Session

Chair: Bumsoo Kim, Doctoral Student, George Washington University, 2201 G Street NW, Fungar Hall 415, Washington, DC, 20052, United States of America, bk4498@gwu.edu

1 - Expect Return on Bets for Parlay versus Multiple Spread and Moneyline Bets

Henry Amato, Professor of Managerial Sciences, University of Nevada Reno, 1664 N. Virginia St, Mail Stop 028, Reno, NV, 89557, United States of America, hna@unr.edu, Sheri Faircloth

This paper considers the rationality of betting parlays as oppose to wagering on multiple single games against the spread or moneyline. In general, we find that a bettor who can pick with at least a break-even probability on several games has a higher expected return on investment by placing parlay wagers than multiple single game wagers. This paper shows how to determine the number of teams to play in a parlay based on win probabilities which will give the highest return on investment.

2 - Fantasy Football: An Integer Optimization Model and Forecasting Technique

Andy Sun, Massachusetts Instititute of Technology, Operations Research Center, 50 Memorial Drive, Cambridge, MA, United States of America, sunx@mit.edu, Dimitris Bertsimas, Adrian Becker

Fantasy Football is a weekly online game in which participants earn fantasy points based on the real life performance of NFL players. Despite its vast popularity and intensive analysis by experts, no known method provides a comprehensive strategy for the entire season. With this motivation, we develop a prediction model for player fantasy performance, and mixed IP formulations for drafting and weekly lineup management. We present simulation results comparing our methods to expert ranking.

3 - Optimization for an Effective Team Formation in Professional Sports

Emrah Zarifoglu, Operations Research Scientist, Gravitant, Inc., 3491 Lake Austin Blvd. Apt C, Austin, TX, 78703, United States of America, zarifemrah@gmail.com, Ilyas Iyoob

College and professional sports leagues are increasingly using Operations Research for improvement on the field as well as off the field. Optimizing player selection is a good example of off the field optimization. Each franchise would like to maximize their team's success by selecting the right players while satisfying budget constraints and rules of the league. We propose rules of thumb for a franchise to achieve its goal optimally by effective player selection.

4 - Optimal Relegation in Sports

Martin Puterman, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Martin.Puterman@sauder.ubc.ca, Qingchen Wang

Many sports including soccer,golf and international hockey use relegation rules to allocate teams or players to different divisions, tours or leagues based on relative abilities or accomplishments. We use simulation to compare the efficacy of different relegation rules with respect to a range of objectives. Our approach includes a latent model for ability or skill and a random mechanism based on skill to determine performance.

5 - Effectiveness of Product Placement in POP Contents: Analysis of Korean Commercial Programming

Bumsoo Kim, Doctoral Student, George Washington University, 2201 G Street NW, Fungar Hall 415, Washington, DC, 20052, United States of America, bk4498@gwu.edu, Joohwan Seo

This study investigates the 'Korean Pop Wave' phenomenon in recent years and study the effectivenss of product placement in Pop contents. We look at the abnormal increase in inbound tourists from East Asian countries to Korea and propose a Regime Switching State-Space model to analyze the intangible Pop Wave effects. Study shows that product placement is a powerful marketing strategy and highlights the importance of understanding the economic drivers and consequences of product placement.

■ SD06

C - Ballroom E, Level 4

Tutorial: Optimal Control of Queueing Networks

Cluster: Tutorials
Invited Session

Chair: Michael Veatch, Gordon College, Department of Mathematics, 255 Grapevine Road, Wenham, MA, 01923, United States of America, Mike.Veatch@gordon.edu

1 - Optimal Control of Queueing Networks

Michael Veatch, Gordon College, Department of Mathematics, 255 Grapevine Road, Wenham, MA, 01923, United States of America, Mike.Veatch@gordon.edu

This talk addresses Markov decision process formulations of queueing network control problems. Manufacturing and service system models are used to illustrate some formulation approaches that facilitate computation. Software developed by the author to solve small examples is described. The structure of optimal policies is addressed through connections with fluid models and by reviewing some monotone control results.

■ SD07

C - Ballroom F & G, Level 4

Joint Session JFIG/ WORMS: Panel Discussion: Balancing Work and Life

Sponsor: Junior Faculty Interest Group/ Women in OR/MS
Sponsored Session

Moderator: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

Moderator: Sadan Kulturel-Konak, Associate Professor of Management Information Systems, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Panel Discussion: Balancing Work and Life

Panelists: Sadan Kulturel-Konak, Associate Professor of Management Information Systems, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu, Ariela Sofer, George Mason University, Fairfax VA, United States of America, asofer@gmu.edu, Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst MA 01003, United States of America, nagurney@gbfin.umass.edu, Martin Wortman, Professor, Texas A&M University, College Station TX, United States of America, wortman@tamu.edu, Lawrance Seiford, Professor, University of Michigan, Ann Arbor MI, United States of America, seiford@umich.edu, Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa AL, United States of America, bkeskin@cba.ua.edu, Cynthia Barnhart, Associate Dean for Academic Affairs, School of Engineering, Massachusetts Institute of Technology, Room 1-206, 77 Massachusetts Avenue, Cambridge MA 02139, United States of America, cbarnhar@mit.edu

All of us must allocate 24 hours a day to the activities of life. How well we balance work responsibilities with personal activities we truly enjoy directly affects our quality of life. It also helps manage stress. Are you satisfied with your balance of time between work and life? If you answered "no," you are not alone. Achieving balance with work and life is an ongoing process of juggling responsibilities at work and the personal needs. In this interactive panel discussion, the successful panelists will share their experiences and secrets in managing this balance. After the panel discussion, the floor will be open to questions.

■ SD08

C - Room 11A, Level 4

Facility Network Design Models

Sponsor: Location Analysis
Sponsored Session

Chair: Robert Aboolian, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, United States of America, raboolia@csusm.edu

1 - Hydrogen Production Facility Network Design From Stochastic Green Energy Supply Source

Jorge E. Barnett Lawton, MIT-Zaragoza International Logistics Program, Calle de Bari 55, Portal 5, PLAZA, Zaragoza, 50197, Spain, jbarnett@zlc.edu.es, Mozart Menezes, Jarrod Goentzel

We analyze the profit maximization problem for an integrated firm generating electricity from wind and producing hydrogen through electrolysis, operating on a single node of a transmission network under nodal pricing. We present the firm's optimal actions for any given market scenario, and formulate the firm's capacity optimization problem. We then address the hydrogen production location/capacity problem.

2 - The Gravity Multiple Server Location Problem

Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Tammy Drezner

We propose models for locating facilities serve a set of demand points. The number of facilities is unknown. There is a given number of servers to be distributed among the facilities. Each facility acts as an M/M/k queuing system. In one model we assume that customers do not consider the waiting time at the facility in their facility selection. In a second model we assume that customers know the expected waiting time at the facility and consider it in their facility selection.

3 - Efficient Algorithms for Reliable Supply Network Design

Tingting Cui, University of California-Berkeley, Berkeley, CA, United States of America, tingting@ieor.berkeley.edu, Z. Max Shen, Robert Aboolian

Under the risk of random facility failure, the reliable supply network design problems study proactive strategies for the system structure, as well as the consequent customer assignment/reassignment issues. We present efficient algorithms that are based on linear reformulation of the original nonlinear MIP for lower bounds, neighborhood search procedures to improve the upper bounds, and cutting plane processes to confine the search space.

4 - A Multi-stage Stochastic Supply Chain Network Design Problem with Financial Decisions and Risk

Stefan Nickel, Karlsruhe Institute of Technology (KIT), Institute for Operations Research, Karlsruhe, Germany, stefan.nickel@kit.edu, Francisco Saldanha-da-Gama, Hans-Peter Ziegler

We consider a multi-period supply network design problem. The decisions to be made involve the location of facilities, the flow of commodities and the amount of money spent in alternative investments. Costumer demands and interest rates are assumed to be uncertain and are described by discrete scenarios. The problem is formulated as a multi-stage stochastic mixed-integer linear-programming problem. All variables in all periods interact because of the considered service level and downside risk.

5 - Preventive Healthcare Facility Network Design with Congestion

Robert Aboolian, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, United States of America, raboolia@csusm.edu, Vedat Verter, Oded Berman

The efficiency of a preventive care program depends on participation of its clients. We address the design of a network of preventive care facilities facing uncertain participation. The problem is to find the number, locations and capacities of the facilities to maximize the overall participation. Accessibility, a main factor in client participation, is measured by the sum of travel time to facility and the waiting and service time at that facility. We present an exact approach for this problem.

■ SD09

C - Room 11B, Level 4

Healthcare Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Mor Armony, Stern School of Business, New York University, New York, NY, United States of America, marmony@stern.nyu.edu

1 - The Impact of Cross-border Patient Movement on the Delivery of Healthcare Services

Dimitrios Andritsos, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dandrits@anderson.ucla.edu, Christopher Tang

Motivated from recent legislative discussions in the European Union, which are intended to provide European patients with "free choice" to decide on the country they receive treatment, we analyze a Stackelberg game that captures the interactions among patients, providers, and healthcare funders. We examine the impact of such "free choice" on the performance of healthcare systems of different countries in equilibrium and use publicly available data to compare with the findings of our model.

2 - Burn Unit Triage in a Catastrophic Scenario

Carri Chan, Columbia University, 3022 Broadway, Uris Hall, Room 410, New York, NY, 10027, United States of America, cwchan@columbia.edu, Linda Green

The U.S. has mandated that regions develop plans for burn victims of mass casualty events. Hospitals without specialized burn units will initially care for patients until they can be transferred to available burn beds. We describe a series of transfer policies developed for NYC using varying assumptions about availability of patients' medical histories. We show how knowledge of co-morbidities impacts optimal triage decisions and the expected number of survivors.

3 - Improving Access to Diagnosis in Developing Countries: Access vs. Accuracy and Network Externality

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Milind Sohoni

Several novel, point-of-care diagnostic devices are being rolled out in developing countries that can eliminate long diagnostic delays. Allocation of limited supply of these devices is based on thumb rules such as clinic size and disease burden. We develop an optimization model to study the impact of network externality on the allocation decision - allocation to one clinic changes the delays at clinics that don't receive the allocation - and apply it to infant HIV diagnosis network in Uganda.

4 - "Nursevendor Problem": Personnel Staffing in the Presence of Endogenous Absenteeism

Sergei Savin, The Wharton School, University of Pennsylvania, Philadelphia, PA, United States of America, savin@wharton.upenn.edu, Linda Green, Nicos Savva

The problem of determining nurse staffing levels in a hospital environment is a complex task due to variable patient census levels and service capacity caused by nurse absenteeism. In this paper, we combine an empirical investigation of the factors affecting nurse absenteeism rates with an analytical treatment of nurse staffing decisions using a novel variant of the newsvendor model.

■ SD10

C - Room 12A, Level 4

Large-scale Queueing Systems with Applications to Call Centers

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Itai Gurvich, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - Wait-time Predictors for Service Systems with Time-varying Demand and Capacity

Rouba Ibrahim, University of Montreal, Montreal, Canada, rei2101@columbia.edu, Ward Whitt

We develop new improved real-time delay predictors for many-server service systems with a time-varying arrival rate, a time-varying number of servers and customer abandonment. These delay predictors may be used to make delay announcements. We use computer simulation to show that the proposed predictors outperform previous predictors.

2 - Hazard Rate Scaling of the Abandonment Distribution for the GI/M/n + GI Queue in Heavy Traffic

Tolga Tezcan, Assistant Professor, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, Tolga.Tezcan@simon.rochester.edu, Josh Reed

We obtain a heavy traffic limit for the GI/M/n+GI queue which includes the entire patience time distribution. Our main approach is to scale the hazard rate function of the patience time distribution in such a way such that our resulting diffusion approximation contains the entire hazard rate function. We then show through numerical studies that for various key performance measures, our approximations outperform those commonly used in practice.

3 - An Overflow System with Many Servers: Approximations and Implications to Call Center Outsourcing

Ohad Perry, CWI, Science Park 123, Amsterdam, 1098 XG, Netherlands, ohad.perry@cwi.nl, Itai Gurvich

Motivated by call-center outsourcing problems, we consider a network with multiple call centers overflowing some of their calls to a central call center. Relying on a separation of time scales, we establish heavy-traffic approximations and prove an asymptotic independence result which facilitates, in turn, simplified expressions for the customer waiting-time distribution. The asymptotic independence is shown to be useful in solving some call-center optimization problems.

4 - On the Accuracy of Fluid Models for Capacity Sizing in Queueing Systems with Impatient Customers

Achal Bassamboo, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa

We study the optimal capacity sizing problem for M/M/N+G systems. We use fluid models to characterize near-optimal prescriptions. These prescriptions depend intricately on the entire abandonment distribution and can lead to an operating regime with traffic intensity greater than 1. We demonstrate that in this case, the prescription is optimal up to O(1). That is, as the customer arrival rate increases, the optimality gap does not grow.

■ SD11

C - Room 12B, Level 4

Managing Supply Chain Disruption Risk

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gregory DeCroix, Associate Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, gdecroix@bus.wisc.edu

1 - Sourcing for Supplier Effort and Competition

Cuihong Li, University of Connecticut, School of Business, Storrs, CT, United States of America, cuihong.li@business.uconn.edu

We study a buyer's sourcing strategy in terms of the supply base design and contracting mechanism, considering suppliers' cost-reduction effort and supplier competition. In the supply base design, the buyer determines the number of suppliers (one or two) in the supply base, and the capacity to be invested in each supplier. In the contracting mechanism design, the buyer chooses the time of price and capacity decisions, either before or after suppliers' effort investment.

2 - Production Planning Under Power Uncertainty

Cagri Latifoglu, Doctoral Candidate, Lehigh University, ISE Department, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States of America, cal206@lehigh.edu, Lawrence V. Snyder, Pietro Belotti

We consider production planning under electricity supply uncertainty where the uncertainty is caused by participation in an Interruptible Load Contract (ILC) offered by the electricity retailer. An ILC is a mechanism that allows the electricity retailer to mitigate some of the risk that arises from fluctuations in the demand and supply of electricity. We have developed a robust optimization model for production planning that renders the industrial company less vulnerable to power interruptions.

3 - Using a Dual-sourcing Option in the Presence of Asymmetric Information About Supplier Reliability

Zhibin Yang, University of Oregon, zyang@lcbmail.uoregon.edu, Goker Aydin, Volodymyr Babich, Damian Beil

We study a manufacturer's use of dual-sourcing option to manage supply disruption risk under asymmetric information about supplier reliability. The manufacturer faces a tradeoff between benefit of supplier competition and benefit of diversification. Asymmetric information pushes the manufacturer away from diversification, because it increases the benefit of supplier competition. However, the dual-sourcing option may be more valuable for the manufacturer under asymmetric information.

4 - Managing Supply Disruptions in Assemble-to-order Systems

Gregory DeCroix, Associate Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, gdecroix@bus.wisc.edu, Zigeng Liu

We study the management of inventories in an ATO system with multiple components and finished products. Since the optimal policy for ATO systems (even without disruptions) is unknown, we explore several alternate policies of varying complexity. We develop methods for computing or approximating key performance metrics, and compare performance across policies. We also explore the implications of supply disruptions on decisions such as supplier selection and the use of component commonality.

■ SD12

C - Room 13A, Level 4

Network Design Applications in Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Halit Uster, Associate Professor, Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843, United States of America, uster@tamu.edu

1 - Green Supply Chains for Remote Locations

Yue Geng, Northwestern University, 2145 Sheridan Road, Room C223, Evanston, IL, United States of America, yue-geng@northwestern.edu, Diego Klabjan

Logistics to remote locations post challenges including highly seasonal variability, limited options resulting in high transportation costs, and low carbon footprint requirements. Using optimization and analytics, we show how to design a cost and environmentally effective logistics network and estimate future feasibility.

2 - Strategic Design of a Hydrogen Supply Chain

Rosemary Berger, Research Affiliate, Massachusetts Institute of Technology Center for Transportation and Logistics, 77 Massachusetts Avenue, E40-276, Cambridge, MA, 02139, United States of America, rosemary.berger@verizon.net, Jarrod Goentzel, Mozart Menezes

Realizing the vision of the hydrogen economy requires the capability to produce large quantities of hydrogen at competitive cost with minimal carbon emissions. This work describes a decision support model that optimizes a hydrogen supply chain, determining where to produce and how to distribute, with a focus on renewable energy sources and multiple distribution options. Insights into centralized versus decentralized production strategies are discussed, and a case study of Spain is presented.

3 - Integrated Multi-product Network Design Models with Lead Time and Safety Stock Considerations

Reha Uzsoy, Clifton A. Anderson Distinguished Professor, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, ruzsoy@ncsu.edu, Karthik Sourirajan, Leyla Ozsen

We wish to locate distribution centers to support a number of retailers. The replenishment lead time at a distribution center (DC), serving a set of demand points, is a function of the total flow of all products through the DC. The safety stock levels at each DC are determined for individual products and consider risk pooling across the demand points served by that DC. We propose heuristics to obtain approximate solutions and evaluate their performance.

4 - Design and Analysis of Relay Networks in TL and LTL Transportation

Halit Uster, Associate Professor, Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843, United States of America, uster@tamu.edu, Panitan Kewcharoenwong

We consider the optimum design of a relay network with applications in Less-than-Truckload (LTL) and and Truckload (TL) transportation. The locations of relays and routing of commodities are determined in such a way that driver tour length, circuity, and load imbalance are controlled while the total design cost is minimized. We present an accelerated Bender decomposition approach for model solution and extensive numerical results on the impact of using relay networks.

■ SD13

C - Room 13B, Level 4

Market Influence on Supply Chain Performance

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Annabelle Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Annabelle.Feng@mccombs.utexas.edu

1 - Optimal Pricing and Bundling of Vertically Differentiated Information Goods

Xiajun Pan, Assistant Professor, University of Missouri at Kansas City, 5110 Cherry St., Kansas City, MO, 64110, United States of America, panxia@umkc.edu, Dorothee Honhon

We study how to choose the optimal bundling strategy for a retailer offering vertically differentiated information goods. We characterize conditions under which pure bundling and mixed bundling strategies are optimal respectively. We provide efficient methods to identify which individual components to offer, whether or not to offer a bundle containing all the components and how to price the offered individual components and the bundle in order to maximize the retailer's profit.

2 - Using Free Gift Cards to Avoid Salvaging in the Newsvendor Problem

Jing Zhou, Assistant Professor, University of North Carolina Charlotte, 9201 University City Blvd., Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, SungJune Park, Moutaz Khouja

Cachon and Swinney (2009) study the effect of strategic consumers on retailers' inventory and pricing policy and on their profits in a newsvendor setting. We extend their model by allowing the retailers to salvage leftover products by giving free gift cards to consumers who purchase the product at the regular price. We derive the optimal ordering and gift card policy and the conditions under which offering gift cards is more beneficial than not offering gift cards for the retailers.

3 - Innovation and Complementarity: Economic Incentives and Market Outcomes

Zhixi Wan, HEC Paris, 1, rue de la Liberation, Jouy en Josas, 78351, France, WAN@hec.fr, Daniel Levinthal, Brian Wu

We develop a model to explain the failure of incumbent firms faced radical technical change. We focus on the effect of the incumbent's complementary asset (e.g., good production management) on its choice between an old technology trajectory that can better leverage the complementary asset and a new trajectory that more likely fits market taste. We find that in equilibrium the incumbent may forego the new technology and invest more than the entrant but win competition less likely.

4 - Contracting and Coordination Under Asymmetric Production Cost Information

Annabelle Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Annabelle.Feng@mccombs.utexas.edu, Xianghua Gan, Metin Cakanyildirim, Suresh Sethi

We analyze a supply chain consisting of a supplier and a retailer. The supplier's unit production cost, which characterizes his type, is only privately known to him. The retailer offers a menu of contracts, each of which consists of two parameters: the ordering quantity and the supplier's share of the channel profit. We show that the optimal contract depends critically on a surrogate measure — the size of the outside market that the supplier may serve if not trading with the retailer.

■ SD14

C - Room 14, Level 4

Supply Chain Management I

Contributed Session

Chair: Zhenying Zhao, Supply Chain Architect, Intel, 2126 E. Aloe Pl, Chandler, AZ, United States of America, zhenying.zhao@intel.com

1 - Design of Traceability Systems for Product Recall

Hongyan Dai, Hong Kong University of Science and Technology, IELM Department, Hong Kong, Hong Kong - PRC, daihy@ust.hk, Mitchell M. Tseng, Paul Zipkin

A product recall is enormously expensive, both financially and reputationally. Inability to trace back defect sources results in excessive recalls and unclear liabilities. We propose a rigorous model to link design parameters of traceability systems to supply chain performance and investigate the impacts of pricing strategies on liability allocation and incentives to improve traceability. Our larger goal is to provide a systematic method to better manage product recalls with new technologies.

2 - Should Design Action be Outsourced with Production Action? The Effect of Commitment

Pei-Cheng Liao, Associate Professor, National Taiwan University, Department of Accounting, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, pcliao@ntu.edu.tw, Suresh Radhakrishnan

We examine outsourcing decision and show that the client's inability to pre-commit 'not to intervene and help the vendor out,' could result in more tasks being outsourced. We provide a rationale for the puzzle that even though the vendor's responsibilities increase, the client's unit price for the vendor does not increase correspondingly. We highlight the importance of taking the agency problem arising from such commitment problems into account to provide the 'right' incentives to the vendors.

3 - Global Sourching with Foreign Tax Credit Planning

Joice Hu, Purdue University, 403. State Street, W. Lafayette, IN, United States of America, hu23@purdue.edu, Vernon Hsu

Most countries employ he worldwide tax system in which a multinational firm's global incomes are subject to its home country's tax. Under this system, foreign tax credits generated from a subsidiary located in a high-tax regime can be use to offset the tax liability generated from another subsidiary located in a low-tax regime. Our paper characterizes the interdependence between the global firm's two subsidiaries at both international tax and supply chain operations level.

4 - Achieving Low Cost Supply Chain (LCSC) with Optimization-based Planning

Zhenying Zhao, Supply Chain Architect, Intel, 2126 E. Aloe Pl, Chandler, AZ, United States of America, zhenying.zhao@intel.com, Shamin Shirodkar

In this paper, we introduce an integrated optimization-based solver for Intel supply chain planning. We discuss the solver architecture including a unique Production Planning Model (PPM), data-driven constraint generation, Object Relational Mapping (ORM), and pattern-based design, as well as various performance enhancement techniques to handle large-scale MIP modelThe solver has reduced the planning cycle time from weeks to one day and brings down inventory dramatically.

■ SD15

C - Room 15, Level 4

Behavioral OM and Neighboring Fields: Decision Theory, Leadership and Economics

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Christoph Loch, INSEAD, Constance de Blvd, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - Economic and Environmental Assessment of Remanufacturing Strategies for Cell Phone Service Providers

Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd., Charlottesville, 22903, United States of America, Ovchinnikova@darden.virginia.edu, Vered Doctori-Blass, Gal Raz

We look at remanufacturing from the perspective of a wireless service provider and through a combination of an analytical model and a behavioral study, analyze the economic and environmental impacts of introducing a remanufactured version of a high-end product into a product line that otherwise consists of new high- and low-end products. We find that although remanufacturing is in most cases profitable, it is not necessarily environmentally beneficial.

2 - Demand Censoring and Newsvendor Decisions: Research Results and Pedagogical Case

David Drake, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, david.drake@insead.edu, Nils Rudi

In an experimental newsvendor setting, we manipulate demand feedback (i.e., censored and uncensored demand feedback conditions) to study three phenomena: level and adjustment behavior - average quantity and the variability of order quantities; and observation bias - the impact of the degree of demand feedback on order quantities. We summarize results, and report on a case developed from this work that has been used to teach 3,000 MBAs and executives the newsvendor model and related challenges.

3 - Mental Balancing of Tradeoffs

Sanjiv Erat, University of California San Diego, San Diego, CA, United States of America, serat@ucsd.edu

The current article proposes that people, when faced with a tradeoff, employ mental balancing heuristic wherein they attempt to equate and thus minimize the "imbalance" between tradeoff costs/benefits. Four experiments offer evidence consistent with the proposed heuristic. The implications of the heuristic to operational decision-making is discussed.

4 - The Core Functions of Leadership
Christoph Loch, INSEAD, Constance de Blvd, Fontainebleau, France, Christoph.LOCH@insead.edu, G. Mohammad Ahmad

The core functions of leadership are to help the group coordinate actions and resolve conflicts. In experiments we examine followers' demand for leadership and their benefits from it. Demand for leadership as well as the group's benefit increase the more difficult the coordination and conflict resolution problems become.

■ SD16

C - Room 16A, Level 4

Capital Projects Supply Chain Research

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Scott J. Mason, Fluor Endowed Chair and Professor, Clemson University, 124 Freeman Hall, Clemson, SC, 29634, United States of America, mason@clemson.edu

1 - Capital Projects Supply Chain: An Introduction
Scott J. Mason, Fluor Endowed Chair and Professor, Clemson University, 124 Freeman Hall, Clemson, SC, 29634, United States of America, mason@clemson.edu, Bill Ferrell

Capital projects are large construction endeavors involving the design, engineering, procurement, and construction of entities like power plants, refineries, and semiconductor wafer fabs. These projects have unique features that make efficient execution very difficult. We provide an overview of research in IE/OR/supply chain that we believe can produce value add in this domain by reducing costs associated with inventory levels, damage, and waste as well as shortening overall project duration.

2 - Capital Project Supply Chains: Execution and Innovation
Daryl Johnson, Marketing Director, Fluor Supply Chain Solutions, Fluor Corporation, 1 Fluor Daniel Drive, Sugar Land, TX, 77478, United States of America, daryl.johnson@fluor.com, Jim Scotti, Larry Jackson

Fluor Corporation is a Fortune 500 company providing comprehensive capabilities and world-class expertise in engineering, procurement, construction, commissioning, operations, maintenance and project management for many of the world's most challenging, complex projects. The presentation will include unique elements, success stories, and lessons learned related to global execution of capital projects.

3 - Improving Capital Project Values using Risk Mitigating Lead Time Options
Erik Hertzler, Intel, Chandler, AZ, 85226, United States of America, Erik.F.Hertzler@Intel.com, Felix Cheng, Karl Kempf, John Fowler

Confronted with uncertainty in demand, long durations in supply and large costs, it is crucial to mitigate financial risk. Decreasing lead times enables use of forecasts that are inherently more accurate. Lead Time Option contracts are useful when mutually agreeable option costs are negotiated. We are solving this problem using historical demand forecast error and servicing costs based upon lead time to create an efficient frontier for option cost vs. lead time reduction.

4 - Equipment Procurement Strategy with Reservation and Forecast Revision: A Heuristic Approach
Chen Peng, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Feryal Erhun, Karl Kempf, Erik Hertzler

In a business environment with volatile market demand, high penalties for unmet demand, long capacity delivery leadtimes, and rigid capital procurement contracts, firms in capital-intensive semiconductor industry often over-purchase capital equipment; an inefficiency that amounts to losses of hundreds of millions of dollars per annum. We propose a dual-mode equipment procurement model to reduce this inefficiency.

■ SD17

C - Room 16B, Level 4

Non-financial Applications of Options: The Business of Making Risky Decisions

Cluster: Practice of OR/MS
Invited Session

Chair: Scott Mathews, Technical Fellow, The Boeing Company, P.O. Box 3707 MC 42-54, Seattle, WA, 98124-2207, United States of America, Scott.H.Mathews@boeing.com

1 - Performance Options: Risk-averse and -Seeking Decision-making Capability for Strategic Performance
Scott Mathews, Technical Fellow, The Boeing Company, P.O. Box 3707 MC 42-54, Seattle, WA, 98124-2207, United States of America, Scott.H.Mathews@boeing.com

The Performance Option Algorithm provides risk-averse and risk-seeking decision-making capability for strategic, non-financial options dealing with performance. Performance is a measure of capability, such as speed, range and time. An option is an opportunity to make an initial resource commitment that may or may not have a long-term beneficial payoff, such as an investment in new technology to improve the performance, or capability, characteristics of a new product or service.

2 - Performance Options: An Options-based Decision Framework for Valuing Non-financial Returns
Jacomo Corbo, University of Pennsylvania-The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman, Philadelphia, PA, 19104, United States of America, jacomo@wharton.upenn.edu, Scott Mathews

The application of real options is typically restricted to strategic management problems about investment and investment modes—in short, to financial domains. Here, we present results on a real options calculation in a non-financial setting, namely Formula One (F1) pit stop strategy. We show how to calibrate the calculation against empirical data, discuss fidelity, and compare results against machine learning approaches.

3 - Equivalence of the Utility Indifference Price and Linear Price of an Option in an Incomplete Market
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

In an incomplete market, the market maker may value an investment project, as well as an option on this investment, by the utility indifference price. Under what conditions does the indifference price of the option in this case equal the linear price? We derive the utility functions, and lattice structures of the investment, that enable this result. The new lattice generalizes the traditional uS/dS upward and downward movements and allows for negative asset values.

■ SD18

C - Room 17A, Level 4

Optimization in Health Care

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Robert R. Meyer, Professor Emeritus, University of Wisconsin, Madison, WI, 53706, United States of America, rrm@cs.wisc.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Radiation Treatment Planning: Beam Angle Selection
Robert R. Meyer, Professor Emeritus, University of Wisconsin, Madison, WI, 53706, United States of America, rrm@cs.wisc.edu, Leyuan Shi, Hao Howard Zhang, Weiwei Chen, Warren D'Souza

An important element of radiation treatment planning (RTP) for cancer therapy is the selection of 5-9 angles (out of 360 possible angles in relation to the patient) for the radiation beam. Using single-beam data extracted from plans employing equally-spaced beams, we have developed a Nested Partitions approach for this combinatorial optimization problem.

2 - Cluster-based Linear Program for Solving Large-scale Radiation Treatment Planning Problem

Hao Howard Zhang, University of Maryland, 6812 Mapleleaf Ct, Apt 101, Baltimore, MD, 21209, United States of America, hzhan001@umaryland.edu, Warren D'Souza, Leyuan Shi, Robert R. Meyer

We present a computer-cluster-based linear programming (LP) method for intensity-modulated radiation therapy (IMRT) dose optimization. High-resolution data obtained from accurate Monte-Carlo dose calculation can be utilized as input. Large LPs, which have to be decomposed to be solvable on a single PC, can be solved efficiently via our approach. Results are presented for challenging clinical test cases and contrasted with conventional IMRT and intensity-modulated arc therapy (IMAT) plans.

3 - Time-varying Intensity Modulated Radiation Therapy Optimization with Changing Tumor Geometry

Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Ronald Rardin, Mark Langer

Although radiation therapy is typically planned as a single overall treatment, it is delivered over several weeks in 30-40 sessions or "fractions," and both cumulative and per-fraction dose constraints apply. The extended time also invites improvement by periodic re-optimization using updated imaging of tumor geometry. We present an efficient rolling-horizon approach to computing plans meeting all these requirements,and demonstrate its effectiveness on realistic cases simulating practice.

■ SD19

C - Room 17B, Level 4

Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Sunil Kumar, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States of America, skumar@stanford.edu

1 - Markdown Management: Pricing as a Signaling Device

Ramandeep Randhawa, University of Southern California, 3670 Trousdale Pkwy, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu, Gad Allon, Achal Bassamboo

We study the classical revenue management scenario of a monopolist retailer selling to customers over a finite horizon. The retailer possesses information about the aggregate demand, whereas customers have private information on their valuations and are strategic. We study how the profit maximizing retailer strategically uses price as a signaling device.

2 - A Simple New Scheme for High-dimensional Dynamic Allocation

Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu, Florin Ciocan, Yiwei Chen

We present 'hedged re-optimization' — a simple generic approach to a swathe of high dimensional dynamic allocation problems. We demonstrate it's practiality and establish surprising uniform performance guarantees.

3 - Reoptimization Heuristics with Bounded Revenue Loss

Stefanus Jasin, Stanford University, 1030 El Monte Ave #215, Mountain View, CA, 94040, United States of America, stf48198@stanford.edu, Sunil Kumar

Many heuristics in Revenue Management involves repeated resolves of a deterministic Linear Program. We study the effectiveness of reoptimization approaches in a model where demand arrives according to Poisson processes. We provide a class of heuristics whose expected loss does not scale with the size of the problem, validating its use in networks with moderate capacities and demands. We also discuss extension incorporating customer choice and unknown parameters.

4 - Revenue Management for a Web Publisher using Advertising Networks

Sami Najafi-Asadolahi, London Business School, London, United Kingdom, snajafi.PhD2005@london.edu, Kristin Fridgeirsdottir

We consider a web publisher facing uncertain demand from advertisers requesting space through an ad network, and an uncertain supply of impressions from viewers. Formulating the problem as a novel queuing system, we show that the optimal CPM price can increase in the number of ads rotated in a slot. We also show that in a competitive setting, more web traffic may not mean more revenue.

■ SD20

C - Room 18A, Level 4

Applications of Pricing Optimization

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Robert Phillips, Professor, Columbia University, Uris 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu

1 - Optimal Pricing with Adverse Selection

Robert Phillips, Professor, Columbia University, Uris 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu, Robin Raffard

We model adverse selection in consumer lending as differential price sensitivity between "goods" and "bads" in a population. We characterize optimal pricing policies with adverse selection, compare the results to commonly used "risk-based pricing" approaches, and estimate the magnitude of the effects on both risk and profitability using real world data.

2 - An Efficient Formulation for the Choice Based Linear Program

Guillermo Gallego, Columbia University, New York, NY, United States of America, gmg2@columbia.edu

We present a formulation of the deterministic choice based linear program that reduces the number of variables from an exponential number to just one per origin-destination fare. The formulation works for general attraction models where the attractiveness of the no-purchase alternative depends on the products in the consideration set that are not offered. The model allows for multiple market segments and encompasses both the independent and the multinomial demand models.

3 - Self Storage Revenue Management

Garrett Van Ryzin, Columbia University, New York, NY, United States of America, gjv1@columbia.edu

We provide an overview of an industry project applying pricing optimization to a self storage business. We discuss the unique challenges in demand estimation and optimization encountered in the industry and provide an overview of the system that was developed.

4 - Revenue Management of Consumer Options for Sporting Events

Fikret Gocmen, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, fcg2110@columbia.edu, Robert Phillips, Guillermo Gallego, Santiago Balseiro

In elimination tournaments there is uncertainty about which teams will advance to the final game. Thus, we consider consumer options that are contingent on a team reaching the event, i.e. the bearer is guaranteed a ticket in the final game only if her team advances to that stage. We formulate the problem of pricing such options using a discrete choice revenue management model, and show that options increase both the organizer's profit and the total consumers' surplus.

■ SD21

C - Room 18B, Level 4

Modeling Healthcare Systems

Sponsor: Service Science
Sponsored Session

Chair: Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com

1 - System of Systems and Service Systems as Complimentary Approaches for Healthcare Problems

Po-Ching DeLaurentis, Regenstrief Institute, Inc., 410 W. 10th St., Indianapolis, IN, 46202, United States of America, pcdelaur@iupui.edu, Dan DeLaurentis, Matt Burton, Brad Doebbeling

This talk considers key features of a system of systems and service systems in the context of healthcare service. We propose an integration of system of systems and service systems approaches yielding benefits in terms of both correct and complete representation of healthcare services and applicability of associated modeling tools for solving problems. We will show an initial mapping and an example of this integration in the context of an information intensive healthcare delivery system.

2 - A Multi-agent Supply and Demand Model of Health Providers and Patients

Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com

Motivated by Vancouver's Downtown Eastside - a small geographic area with many health agencies providing mental health and addictions services - we propose a multi-agent model containing both competitive and cooperative elements. We use the model to find mechanisms that encourage system optimality and policies that enhance cooperative action.

■ SD22

C - Room 18C, Level 4

Organizing Service Development & Service Curriculum

Sponsor: Service Science
Sponsored Session

Chair: William Millhiser, Assistant Professor, Zicklin School of Business, Baruch College, The City University of New York, 55 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu

1 - An Interactive Game to Learn Sustainability Engineering

Rodolfo Fernandez, The University of Texas at El Paso, 500 W. University Av., El Paso, TX, United States of America, refernandez@miners.utep.edu, Ricardo Meraz, Olivia Moreno, Heidi Taboada

In the present talk, a novel sustainability engineering game will be presented. The game was developed by undergraduate students as part of their final project in a newly developed Sustainability Engineering course. The main objective of the game is to provide an interactive way of teaching different sustainability concepts such as life cycle analysis, ethical consumerism and design for the environment.

2 - Implementing Sustainability Engineering Principles Into the Undergraduate Engineering Curricula

Abril Vazquez, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, apvasquez@miners.utep.edu, Jose Espiritu

In the present talk, an overview of the curricula developed to teach a new Sustainability Engineering class will be presented. The course was team-taught by faculty from the Industrial, Manufacturing and Systems Engineering Department and the Mechanical Engineering Department. It was offered during the Spring 2010 semester as a technical elective course open to undergraduate students enrolled in the College of Engineering at The University of Texas at El Paso.

3 - Curriculum Development: Switching From Production to Service Operations Management

William Millhiser, Assistant Professor, Zicklin School of Business, Baruch College, The City University of New York, 55 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu

We recently converted a core class from "Production & Operations Management" to "Service Operations Management." Why is this important at the largest AACSB-accredited business school? What aspects of services were included in the new syllabus? What was the outcome of the textbook selection process? How did we find consensus among instructors who deliver 28 sections to 2000 BBA students annually? In answering these questions, this will be an interactive session drawing upon audience experiences.

4 - How to Organize New Service Development?

Thomas Meiren, Head of New Service Development, Fraunhofer IAO, Nobelstr. 12, Stuttgart, 70569, Germany, Thomas.Meiren@iao.fraunhofer.de, Adrienne Schäfer, Lars Witel, Bo Edvardsson

New services are playing an increasingly important role in companies and often they are crucial for their future survival. In parallel, this raises the question about appropriate structures and processes for the successful development of new services. The presentation discusses current strategies and different organizational options for New Service Development and includes selected case studies as well as the results of an empirical study among 791 European companies.

■ SD23

C - Room 18D, Level 4

Panel Discussion: Introduction to Service Science Research Institutes

Sponsor: Service Science
Sponsored Session

Moderator: Grace Lin, WRO & Columbia University, 9 Garey Drive, Chappaqua, NY, 10514, United States of America, gracelin.ny@gmail.com

1 - Panel Discussion: Introduction to Service Science Research Institutes

Panelists: Christoph Heitz, Professor, Zurich University of Applied Sciences, Rosenstrasse 3, Winterhur, 8401, Switzerland, heit@zhaw.ch, Roland T. Rust, Distinguished University Professor and David Bruce Smith Chair in Marketing, Robert H. Smith School of Business, 3451 Van Munching Hall, University of Maryland, College Park MD 20742-1815, United States of America, rrust@rhsmith.umd.edu, Krishna Singh, SRII President & IBM Service Science Research Programs, IBM ALmaden Research Center, San Jose CA 95120, United States of America, KrisSingh@us.ibm.com

Representatives from selected Service Science related Institutes will discuss their visions, missions, and their views (or definitions) of Service Science. They will discuss their R & D activities, projects, and success stories.

■ SD24

C - Room 19A, Level 4

Joint Session SPPSN/ MIF: Statistical Issues in Public Policy

Sponsor: Public Programs, Service and Needs/ Minority Issues
Sponsored Session

Chair: Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Dr., 444 Groseclose, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

1 - Statistical Evaluation of Land Use Change via Ethanol

Dexin Luo, Geogia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, dexin.luo@gatech.edu, Kobi Abayomi

Dependence in compositional data - sum constrained or 'simplexed' data models - cannot be asserted via linear correlation. We introduce methodology for distance from independence in compositional data using replicates and the empirical copula. We illustrate competition among the constituents of US corn yield vis a vis Ethanol production.

2 - Statistical Evaluation of Wealth Inequality

Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Dr., 444 Groseclose, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

We amend Theil's Index - a popular measure for distributional apportioning - to correct the mis-specification of between and across group inequality. We introduce tests of equi-inequality, under the correction. We illustrate the methodology on Health and Retirement Survey (HRS) data.

3 - Statistical Methodology for the Millennium Development Goals Index

Gonzalo Pizarro, United Nations Development Programme, Manhattan, NY, United States of America, gonzalo.pizarro@undp.org, Kobi Abayomi

The Millennium Development Goals (MDG) Index is a linear combination of disparate multivariate data designed to measure nation-wide progress toward the United Nations' 2015 development targets. We illustrate a Bayesian methodology for creating the index.

■ SD25

C - Room 19B, Level 4

Strategic Interactions in Disaster Relief Operations

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Justin Yates, Assistant Professor, Texas A&M University, 237D Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu

Co-Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Structuring Public Private Partnerships in Transportation Infrastructure
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu, Qingbin Cui

The public private partnership for transportation infrastructure is established through contractual agreements, long term maintenance contracts, and long term leases to essentially outsource some traditional government functions to private partners in order to finance the transportation infrastructure, downsize government, and control spending. We propose a convex optimization method by affine controllers to mathematically solve the multi-stage model.

2 - Key Dynamics for Sustainable Partnerships in Haitian Disaster Recovery
John Coles, johnbcoles@gmail.com, Jun Zhuang, Justin Yates

On January 12th 2010, a 7.0 magnitude earthquake struck close to Port-au-Prince, Haiti. A flexible cost-benefit ratio was implemented to assist agencies' in assessing partnership efficacy using the costs and benefits discussed in interviews with agency representatives working in Haiti. Guidelines for partnership selection were developed using the first-hand information to assist responding agencies in identification of the key factors that can make partnerships more effective.

3 - Structuring Dynamic Public Response to Multiple Biological Terrorist Attacks
Richard John, Associate Professor, University of Southern California, Department of Psychology & CREATE, SGM 621, MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff

We utilize an immersive video scenario simulation methodology to explore reactions of various stakeholder groups to multiple terrorist attacks using weaponized anthrax in the Seattle, Washington area. As the attack unfolds respondents are faced with various decision dilemmas over time; their responses reveal viable options, uncertainties, information needs, risk attitude, and value trade-offs. We structure stake-holder specific decision models to predict public response to biological disasters.

4 - Network Infrastructure Vulnerability Mitigation
Alan Murray, Professor, Arizona State University, Geographical Sciences and Urban Planning, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

Critical network infrastructure management is an important and challenging task as system components may fail or be damaged due to natural disasters, human error or sabotage. Because continued, uninterrupted performance of network infrastructure is essential, this paper develops an optimization model for selecting network components to protect/harden in order to maximize system performance if one or more other (unprotected) components are damaged or destroyed.

5 - Behavioral Rates of Return Following Terrorist Attacks
Fynnwin Prager, USC CREATE, 3710 McClintock Avenue, RTH 314, Los Angeles, United States of America, fprager@usc.edu, William J Burns, Colin MacKenzie

We look at the rate of return in public behavior following the shocks of hazardous events such as terrorist attacks. We observe behavioral change following various incident types and through various data sets. We find that the rate of return to previous behavior in these cases follows similar paths as those derived from mathematical and focus group based studies. Our results have important implications for modeling the behavioral and economic impacts of catastrophic events.

■ SD26

C - Room 4A, Level 3

Data Mining for Business Intelligence

Sponsor: Data Mining
Sponsored Session

Chair: Hyunjung Helen Shin, Professor, Ajou University, San 5 Wonchun-dong Yeoungtong-gu, Suwon, 443-749, Korea, Republic of, shin@ajou.ac.kr

1 - A Hybrid Customer Score for Response Modeling using Support Vector Regression with Pattern Selection
Dongil Kim, PhD Student, Seoul National University, 599 Gwanakno, Seoul, Korea, Republic of, dikim01@snu.ac.kr, Sungzoon Cho

Response models identifying respondents for upcoming marketing promotions usually employ classification models to predict the response probability of each customer. However, the purchase amount of each customer is also crucial. In this paper, we propose a hybrid customer score employing both the response probability and the purchase amount. Support vector regression was used to predict the purchase amount. In addition, a pattern selection method was used to reduce the training time complexity.

2 - Exceptional Utility Detection in Managed Print Services
John Handley, Xerox Corporation, John.Handley@xerox.com

We present a data mining application for a managed print service to determine whether customers are receiving value. The system reads monthly black/white and color print counts and prices from thousands of printers in many accounts, fits a Cobb-Douglas utility model to ratios of BW to color print volumes and prices per print using robust statistical procedures, and uses estimated parameters of the model to detect cases of exceptional economic utility, an imbalance in price and printing behavior.

3 - Stock Price Prediction using Hierarchical Network Structure
Kanghee Park, PhD Student, Ajou University, San 5, Woncheon-dong Yeongtong-gu, Paldal 822, Suwon, Korea, Republic of, can17@ajou.ac.kr, Hyoung Ro Lee, Hyunjung Helen Shin

Stock price prediction using the conventional time series techniques often falls, sensitively reacting to irregular and external interventions propagated from global economical issues. To cope with this, we propose to employ a network structure for time series prediction. The network can include many time series indices within a unified framework and represent the relationship between two indices with various forms of connections such as simple, causal, and hierarchical links.

4 - The Impact of the Frequency and Sentiment of News on Stock Price
Sunghoon Park, PhD Student, Seoul National University, Seoul, Korea, Republic of, shpark82@snu.ac.kr, Jeong Geun Yeom, Sungzoon Cho

Mass media delivers tons of information to the public, which have critical influences on the decisions of investors. We analyze the influence of the frequency and sentiment of news articles on stock prices. Most of time, frequent exposure in the media leads to an upward trend of stock price. However, it was found that the stock prices highly fluctuates or decreases when there's an increase of negative news articles on certain issue.

■ SD27

C - Room 4B, Level 3

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Sigrun Andradottir, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, sa@gatech.edu

1 - On the Rate of Convergence to Stationarity of the M/M/N Queue in the Halfin-Whitt Regime
David Goldberg, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, dag3141@mit.edu, David Gamarnik

We study the rate of convergence to stationarity of the M/M/n queue in the Halfin-Whitt regime. We prove that a phase transition occurs when the excess parameter B reaches 1.86. For B less than 1.86, the rate of convergence is quadratic in B; above 1.86 it is the solution to an explicit equation. We also bound the prefactor governing the rate of convergence uniformly over n, and derive a rule-of-thumb for the time it takes an overloaded (underloaded) queueing system to return to steady-state.

2 - Rare-event Simulation for Many-server Queues
Henry Lam, PhD Candidate, Harvard University, Department of Statistics, Cambridge, MA, United States of America, khhlam@gmail.com, Jose Blanchet

We develop rare-event simulation methodology for the analysis of loss events in a many-server loss system, focusing on the steady-state loss probability (i.e. fraction of lost customers over arrivals) and the behavior of the whole system leading to loss events. The algorithm, which can be shown to be asymptotically optimal, requires working with a full measure-valued process descriptor, the first of such kind in the rare-event simulation context under the setting of many-server queues.

3 - A Strongly Polynomial Algorithm for Controlled Queues
Alexander Zadorojniy, PhD Student, School of Electrical Engineering, Tel-Aviv University, Tel-Aviv 69978, Israel, Tel-Aviv, Israel, alexander.zadorojniy@gmail.com, Adam Shwartz, Guy Even

We consider the problem of computing optimal policies of finite-state finite-action Markov decision processes (MDPs). A reduction to a continuum of constrained MDPs (CMDPs) is presented such that the optimal policies for these CMDPs constitute a path in a graph defined over the deterministic policies. We present an algorithm based on this new approach that finds this path, and thus an optimal policy. We prove that the length of this path is polynomial if the MDP satisfies a coupling property.

4 - Refined Square-root Staffing for Call Centers with Impatient Customers
Bo Zhang, Georgia Institute of Technology, Atlanta, GA, United States of America, Johan van Leeuwaarden, Bert Zwart

We consider a useful model of call centers, i.e. the Erlang A model. To minimize the staffing level subject to different service-level constraints, we propose refined square-root staffing (SRS) rules, which preserve the insightfulness and computational scalability of the celebrated SRS principle and yet achieve a stronger form of optimality. The refinements are derived by developing corrected diffusion approximations and then using them to explicitly characterize the error of conventional SRS.

■ SD28

C - Room 4C, Level 3

Nanomanufacturing & Nanoinformatics II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu

1 - A Statistical Approach to Modeling the Potential Data in Nanoquantification
Xinwei Deng, Visiting Assistant Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Ave., Madison, WI, 53706, United States of America, xdeng@cs.wisc.edu, Peter Qian, Xudong Wang

Quantifying the potential from nanomaterials under AFM scanning is challenged by its small scale and complicated surface topography. A physical model is difficult to fully capture the complicated relations between potential and topography. In this work, we propose a statistical approach to modeling such relations. It provides the flexibility to explore the significant factors and identify a parsimonious model, which gives a better prediction performance and meaningful physical interpretation.

2 - Hierarchical Modeling of Weight Kinetics of Silica Nanowire Growth Under Different Temperatures
Li Wang, University of Southern California, 3715 McClintock Avenue, GER 236, Los Angeles, CA, 90089, United States of America, wang40@usc.edu, Qiang Huang, Li Zhu, Tirthankar Dasgupta

To understand the weight kinetics of silica nanowire growth under different temperatures, we postulate a physics-driven bayesian hierarchical model. The model is able to utilize growth temperature information to improve characterization of the weight kinetics. Model parameters are obtained by Monte Carlo Markov Chain(MCMC) simulation, using experimental observations as input. The modeling of observed initial weight loss is also discussed.

3 - The Constrained Random Effect Models for Nanoparticle Synthesis
Jye Chyi Lu, Georgia Institute of Technology, Atlanta, GA, jclu@isye.gatech.edu, Andres Hernandez, Martha Grover, Hin Kyeol Woo

This research formulates the likelihood for mean nanoparticle sizes, where some of them are not available due to engineering constraints. Since the data are collected from computer experiments, random effects are included in the logistics and normal regressions for modeling spatial dependence of data.

4 - Nonparametric Bayesian Modeling of Hazard Rate with Change-point for Nanoelectronic Devices
Tao Yuan, Assistant Professor, Ohio University, Stocker Center 279, Athens, OH, 45701, United States of America, yuan@ohio.edu, Chia-han Yang, Way Kuo, Yue Kuo

This study proposes a model for hazard rate with a change-point using nonparametric Bayesian method. The decreasing hazard rate in the infant mortality period is modeled by a stochastic jump process. Simulation algorithm based on Gibbs sampling is developed for posterior inference. The proposed approach is applied to analyze the experimental failure times of two nanoelectronic devices and compared with other parametric and nonparametric methods.

■ SD29

C - Room 5A, Level 3

Technometrics Invited Papers

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Steinberg, Department of Statistics and Operations Research, School of Mathematical Sciences, Tel Aviv University, Tel Aviv 69978, dms@post.tau.ac.il

Co-Chair: Hugh Chipman, hugh.chipman@acadiau.ca

1 - Reliability Growth Management Metrics and Statistical Methods for Discrete-use Systems
J. Brian Hall, Division Chief, Aviation, Missiles, and C4ISR, U.S. Army Test and Evaluation Command, 4120 Susquehanna Avenue, TEAE-REA, Dr. J. Brian Hall, APG, MD, 21005, United States of America, jbrianhall@msn.com, Paul Ellner, Ali Mosleh

Reliability growth management metrics and statistical procedures are presented for discrete-use systems. These metrics serve as concomitant measures of programmatic risk and system maturity that may be utilized to assess the progress of ongoing reliability growth efforts, or lack thereof. A methodology overview is given, as well as an application to a ground-to-air missile program. Extensions to reliability growth planning for discrete-use systems is also covered.

2 - Discussion on Reliability Growth Management Metrics and Statistical Methods for Discrete-use Systems

Christine Anderson-Cook, Donald Gaver, Art Fries, Nozer Singpurwalla, Alyson Wilson

We will have a discussion on Brian Hall's presentation.

3 - Discussion of Paper by Hall, Ellner, and Mosleh
Donald Gaver, Distinguished Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, DGaver@nps.edu, Patricia Jacobs

This interesting paper provides an approach to reliability growth problems that has novel features, such as that of using a random parameter, or "mixture" model to describe the introduction of "failure modes" into a system, and the effects of removal efforts. It is provocative and and stimulating by suggesting, perhaps implicitly, that many further efforts in this important area are needed.

■ SD30

C - Room 5B, Level 3

Joint Session QSR/ Service Science: SPC Applied to Service Industry

Sponsor: Quality, Statistics and Reliability/ Service Science
Sponsored Session

Chair: Fugee Tsung, Professor and Head, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong - PRC, season@ust.hk

1 - Service System Monitoring via Detection of Cycle Time Changes
Nan Chen, Research Assistant, University of Wisconsin Madison, 1513 University Ave, Madison, WI, 53705, United States of America, nchen3@wisc.edu, Shiyu Zhou

The cycle time in service systems usually refers to the time required for a customer to traverse through the system in a designed routine. It is well known as an important performance measure of service systems regarding their responsiveness and capacity. In this presentation, I will introduce a control chart designed for detecting cycle time changes with the ability to adjust according to arrival patterns. Successful applications can result in faster response and better resource allocations.

2 - Statistical Process Control for Multistage Processes with Binary Data
Yanfen Shang, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, shangyf@ust.hk, Changliang Zou, Fugee Tsung

This paper proposes a binary state space model (BSSM) for modeling multistage processes with binomial (binary) data and develops corresponding monitoring and diagnosis schemes by utilizing a hierarchical likelihood approach and directional information based on the BSSM. Our simulation results show that the proposed schemes consistently outperform the existing chi-square scheme in monitoring and diagnosing for binomial multistage processes.

3 - Multivariate Categorical Charting Techniques via Log-linear Models
Jian Li, Hong Kong University of Science and Technology, Rm 5551, Dept of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, jianli@ust.hk, Fugee Tsung, Changliang Zou

The statistical process control for multivariate categorical processes is addressed. We employ the log-linear model for sufficiently characterizing the relationship among the categorical variables and propose a novel Phase II control chart. This chart incorporates the monitoring of multivariate binomial or multivariate multinomial processes into a unified framework, and it is easy to implement and efficient to detect various shifts. Numerical simulations demonstrate its effectiveness.

4 - SPC Application in Web Traffic Stability Monitoring
Jing Zhong, Applied Researcher, Microsoft Corp., 555 110th Ave. NE, Bellevue, WA, 98004, United States of America, zhongjing81@gmail.com

The continuing growth of internet has brought extremely high volume web search data, as well as challenges to traffic stability monitoring. The early detection and diagnosis of out-of-control status is critical for online service quality assurance. However the high dimension and correlation among the metrics that commonly adopted in online practice has limited the efficiency of fast root cause diagnosis. This work will show a real life application of SPC in the web search industry.

■ SD31

C - Room 5C, Level 3

Detection and Characterization of Complex Patterns in Health Informatics

Sponsor: Data Mining
Sponsored Session

Chair: Artur Dubrawski, Carnegie Mellon University, 5000 Forbes Avenue, NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - Discovering Complex Anomalous Clusters using Disjunctive Anomaly Detection Algorithm
Maheshkumar Sabhnani, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sabhnani@cs.cmu.edu, Artur Dubrawski, Jeff Schneider

Disjunctive Anomaly Detection algorithm (DAD) is designed to identify complex anomalous clusters in multidimensional categorical data. It is unique in its ability to detect clusters which can be characterized using conjunctive-disjunctive statements. It can also discern separate overlapping effects caused by distinct processes that simultaneously affect the same subsets of data. DAD is shown to outperform alternative state-of-the art methods for microarray analysis and syndromic surveillance.

2 - Visualizing Complex Relationships to Support Transition of Disease Classification
Ryan McDermitt, Partner, Nyka Consulting, 4898 Tarry Glen Dr, Suwance, GA, 30024, United States of America, ryan.mcdermitt@nykaconsulting.com, Krista Yager

The US health care industry is under federal mandate to transition from ICD-9 to ICD-10 (International Classification of Disease for Medical Diagnosis and Procedures (ICD-9<20,000 codes: ICD-10>140,000 codes.) The logic to develop ICD-10 codes is independent with no foundational overlap shared with ICD-9 (ICD-10 codes have an intelligent alpha-numeric naming convention.) The relationships while difficult to map and understand has successfully been defined and visualized into clusters.

3 - Fast Generalized Subset Scan for Anomalous Pattern Detection
Edward McFowland III, Carnegie Mellon University, Pittsburgh, PA, United States of America, emcfowla@andrew.cmu.edu, Skyler Speakman, Daniel Neill

Fast Generalized Subset Scan (FGSS) is a novel method for detecting anomalous patterns in general datasets. We frame the pattern detection problem as a search over subsets of records and attributes, and exploit a novel property of the nonparametric scan statistic allowing for efficient optimization over subsets. Our empirical results show the utility of FGSS across multiple domains, including detection of patterns in Emergency Department visits, container shipments, and network intrusion data.

4 - Scalable Detection of Anomalous Patterns with Connectivity Constraints
Skyler Speakman, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States of America, sspeakma@andrew.cmu.edu, Daniel Neill

We present GraphScan, a method for detecting arbitrary-shaped connected clusters in graph or network data. For spatial event detection, graph nodes represent locations and edges represent adjacency between neighboring locations. GraphScan enables efficient, exact computation of the most anomalous subgraph for graphs of up to 100 nodes. We evaluate GraphScan using simulated disease outbreaks injected into real-world hospital data, and show substantial improvements in run time and detection power.

■ SD32

C - Room 6A, Level 3

Computing With GPUs

Sponsor: Computing Society
Sponsored Session

Chair: Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sahinidis@cmu.edu

1 - Solving Large-scale Dense SOCP on Heterogeneous Computing Platform
Yuriy Zinchenko, University of Calgary, Calgary, Canada, yzinchen@ucalgary.ca

To minimize negative impact of uncertainties in optimal radiotherapy planning for cancer treatment, a convex robust counterpart of a conventional model has been proposed. The robust model is a large-scale dense SOCP. However, presently, such an approach is clinically infeasible due to excessive computational demands associated with solving the resulting problem. We investigate the use of heterogeneous platforms, namely GP-GPU, to speed up linear algebra operations required by IPM solver.

2 - Optimizing Codes for OpenCL and NVIDIA Fermi
Anne C. Elster, NTNU, 7517 Stoncliff CIR, (Address for sabbatic leave 2010/11), Norway, elster@idi.ntnu.no

Modern GPUs are now massive floating-point stream processors that offer energy efficient compute power. With the recent development of tools such as CUDA and OpenCL, it has become much easier to fully utilize the computational power these system offer. This presentation will highlight some of the experiences the author's research group has had with recent GPUs, including looking at using GPUs to compress data in order to lower latency between disk and memory and between CPU memory and GPUs.

3 - GPU Computing with Kaczmarz's and Other Iterative Algorithms for Linear Systems

Joseph Elble, University of Illinois at Urbana Champaign, 932 Waterview Way Apt D, Champaign, IL, 61822, United States of America, joseph.elble@gmail.com, Panagiotis Vouzis, Nick Sahinidis

The GPU is used to solve large linear systems derived from partial differential equations. The PDEs studied are common to many fields, e.g. fluid dynamics and structural mechanics. The paper presents comparisons between GPU and CPU implementations of several well-known iterative methods. The results demonstrate that our GPU implementation outperforms CPU implementations of these algorithms, as well as previously studied parallel implementations on Linux clusters and shared memory systems.

4 - A GPU Implementation of BLAST

Panagiotis Vouzis, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States of America, pvouzis@cmu.edu, Nick Sahinidis

We present results with a GPU implementation of the widely used bioinformatics software BLAST. The algorithm relies on the approximate solution of dynamic programs to identify similarities in protein sequence. We present an implementation using CUDA on an NVIDIA GPU.

■ SD33

C - Room 6B, Level 3

Computational and Systems Biology

Sponsor: Computing Society
Sponsored Session

Chair: Teresa Przytycka, NCBI / NLM / NIH, 8600 Rockville Pike, Bethesda, MD, 20894, United States of America, przytyck@ncbi.nlm.nih.gov

1 - A Tensor Higher-order GSVD for Comparison of Global DNA Expression From Multiple Organisms

Sri Priya Ponnapalli, University of Texas at Austin, Department Electrical and Computer Engr., Austin, TX, United States of America, sripriyaponnapalli@gmail.com, Michael A. Saunders, Orly Alter

The increase in high-dimensional datasets recording multiple aspects of a single phenomenon is accompanied by a need for mathematical frameworks that can compare multiple large-scale matrices of different numbers of rows. The only such framework to date, the GSVD, is limited to two matrices. We define a tensor GSVD that under certain conditions extends all the properties of the GSVD to more than two matrices, and illustrate it with a comparison of DNA microarray data from multiple organisms.

2 - Tuning and Controlling Gene Expression Noise in Synthetic Gene Networks

Rhys M Adams, Graduate Research Assistant, University of Texas, 1515 Holcombe Blvd, Houston, TX, 77030, United States of America, rhysm.adams@gmail.com, Gàbor Balàzsi, James Collins, Kevin Murphy

We have developed and studied a set of synthetic gene regulatory networks using members of the TetR family of transcription factors. With these gene regulatory networks we are able to control mean gene expression and noise (or variation) levels as well as their sensitivities to environmental perturbations. By controlling these "demographics" of gene expression, investigators will be able to study what aspects of gene expression affect cell population fitness in a precise manner.

3 - Informativity-guided Analysis of Genomic Data

Maga Rowicka, Assistant Professor, University of Texas Medical Branch, 301 University Blvd, Galveston, TX, 77554, United States of America, merowick@UTMB.EDU, Jang Yi

A bottleneck in systems biology today is data analysis, especially extracting biologically meaningful information (BMI). We present an approach for determining the amount of BMI contained in a set of genes arising from a genomic experiment. Quantifying BMI of such a set allows optimization of the data analysis toward obtaining most biologically meaningful results. We demonstrate how our approach can be used to improve analysis of various genomic datasets.

4 - Connecting Genotype to Phenotype

Teresa Przytycka, NCBI / NLM / NIH, 8600 Rockville Pike, Bethesda, MD, 20894, United States of America, przytyck@ncbi.nlm.nih.gov, Yoo-ah Kim, Stefan Wuchty

In complex diseases different genotypic perturbations lead to the same disease by dys-regulating same cellular pathways. I will discuss our computational method, that utilizes graph-theoretical apporaches and optimization techniques to identify such dys-regulated pathways.

■ SD34

C - Room 7, Level 3

ICS Leading Edge Tutorial

Sponsor: Computing Society
Sponsored Session

Chair: Robert Dell, Professor and Chairman, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA, 93943, United States of America, Dell@nps.edu

1 - A Nested Benders Decomposition Algorithm for Protecting Critical Infrastructure

Matthew Carlyle, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd. Gl-211, Monterey, CA, 93943, United States of America, mcarlyle@nps.edu, Gerald Brown, David Alderson, Kevin Wood

We present three-stage optimization models for determining vulnerabilities in critical infrastructure systems and designing or redesigning such systems to reduce their susceptibility to deliberate, optimal attacks. We then present a nested Benders decomposition algorithm for solving these models, and show results for problem instances that represent real infrastructure systems at functionally and computationally reasonable levels of detail.

■ SD35

C - Room 8A, Level 3

Stochastic Models in Operations Research

Sponsor: Applied Probability
Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Optimal Size-based Task Assignment for Multi-server Queues in the Quality-driven Regime

Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, bozhang@gatech.edu, Bert Zwart

We consider the M/G/N queue in a certain many-server asymptotic regime, namely the Quality-Driven regime. We propose a size-based task assignment policy, under which the steady-state probability that there are more jobs than servers in the system is shown to coincide with the corresponding probability in an infinite-server queue on a logarithmic scale. This suggests that in this regime separating large and small jobs properly can protect system performance against job size variability.

2 - Characterization of Stationary Distributions of Reflected Diffusions in Polyhedral Domains

Weining Kang, Assistant Professor, University of Maryland, Baltimore County, Department of Mathematics and Statistics, Baltimore, MD, United States of America, wkang@umbc.edu, Kavita Ramanan

In this talk we consider a class of reflected diffusions in polyhedral domains defined via an extended Skorokhod problem. Reflected diffusions in this class are shown to be solutions to a submartingale problem. Necessary and sufficient conditions for a probability measure to be the stationary distribution for the class of reflected diffusions are established. Illustrative examples of diffusion limits of stochastic networks are provided.

3 - Portfolio Rebalancing Error with Mean Reversion and Jumps

Xingbo Xu, Columbia University, S. W. Mudd Building, Rm 313A, 500 West 120th Street, New York, NY, 10027, United States of America, xx2126@columbia.edu, Paul Glasserman

We analyze the limiting distribution of the difference between discretely and continuously rebalanced portfolios as the rebalancing frequency increases when the underlying asset dynamics have mean reversion or jumps. In the first case, the asymptotic error is normal; mean reversion has no effect on the limiting variance but appears in the covariance between the error and the continuous portfolio. With jumps, the asymptotic error is never normal but the limiting variance has a simple form.

4 - Monte Carlo Techniques for Reflected Fluid Networks

Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu, Xinyun Chen

We will discuss some techniques that can be used to estimate, with a controlled error, expectations via simulation of reflected fluid networks in the positive quadrant. Our discussion also includes steady-state simulation.

■ SD36

C - Room 8B, Level 3

Case Competition II - INFORMed's Annual Case Competition is an Opportunity for INFORMS Members to Showcase Their Efforts in the Classroom

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - A Leader Home Improvement Retailer Commitment to Disaster Response
Monica Villarreal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, monica_cvg@yahoo.com, Paul Kerl, Matt Drake, Ozlem Ergun, Gonca Karakus, Pinar Keskinocak, Julie Swann

The Home Depot (THD) is motivated to be a strong first responder to both natural and man-made disasters. If THD is going to attain its highest priority of preparing customers for the event and providing adequate supply levels for the post-event cleanup and repair operations, the company must have a detailed operational plan for stocking the stores and bringing them back on-line as soon as possible after the disaster.

2 - KEY Electronics - Sourcing and Warehouse Analysis
Tim Kraft, Stanford University, 920 South California Avenue, Palo Alto, CA, 94306, United States of America, tkraft@stanford.edu, Yenho Thomas Chung, Feryal Erhun

Based in Oklahoma City, OK, KEY Electronics is a consumer electronics retailer with over 1,500 stores throughout the United States and Mexico. KEY has a limited retail presence in Mexico, which it would like to expand from 30 stores in 2009 to 70 by year-end 2012. As part of its Mexico growth strategy, KEY must 1) improve its current sourcing of products for Mexico and 2) determine how to revamp its existing warehouse operations.

■ SD37

C - Room 8C, Level 3

Stochastic Models for Market Microstructure

Sponsor: Applied Probability
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, NY, United States of America, c.maglaras@gsb.columbia.edu

Co-Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Information Aggregation in Smooth Markets
Krishnamurthy Iyer, Stanford University, 19A Comstock Circle Apt 101, Stanford, CA, United States of America, kriyer@stanford.edu, Ramesh Johari, Ciamac Moallemi

We consider a market model with finitely many informed rational risk-averse traders interacting with a market maker. We identify a basic asymptotic smoothness condition on the price in the market that ensures information aggregation under a portfolio convergence assumption. The condition requires that, eventually, per unit price of infinitesimal purchases or sales be the same. Notably, we show that, under mild conditions, market makers based on market scoring rules satisfy asymptotic smoothness.

2 - Price Volatility as a Limit of Queuing Systems
Sasha Stoikov, Cornell University, 55 Broad Street, New York, NY, United States of America, sfs33@cornell.edu, Josh Reed, Marco Avellaneda

We present a stochastic model for the bid and ask quotes of a traded asset. We describe methods for computing the probability p(x,y) that the next price move is up, conditional on the bid (x) and ask sizes (y). We then define the efficient price to be a weighted average of the bid and the ask prices, where p(x,y) is the weight applied on the ask price. The instantaneous volatility of this efficient price may be interpreted as as a microstructure-adjusted volatility.

3 - A Multiclass Queueing Model of Limit Order Book Dynamics
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Costis Maglaras

We model the limit order book as system of two, coupled multiclass queues. Specifically, each side of the book is modeled as a single server, multiclass queue operating under a strict priority rule defined by the prices associated with each limit order. We describe the transient dynamics of this system, and formulate and solve the optimal execution problem for a block of shares over a short time horizon. We derive the market impact function associated with our microstructure model.

■ SD38

C - Room 9A, Level 3

Novel Global Optimization Methods

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Zelda Zabinsky, Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, zelda@u.washington.edu

1 - Solving Nonlinear Integer Programs with Nonconvex Quadratic Constraints
Youdong Lin, Lindo Systems, Inc., 1415 N Dayton St, Chicago, IL, 60642, United States of America, ylin@lindo.com, Linus Schrage

We describe a software implementation for finding global optima to nonlinear programs that contain integer variables as well as one or more constraints that contain nonconvex quadratic terms. We discuss and analyze the effectiveness of various methods for constructing convex relaxations and for doing branching.

2 - Probabilistic Branch and Bound for Global Optimization of Noisy Functions
Wei Wang, PhD Candidate, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, wangwei@uw.edu, Zelda Zabinsky, Archis Ghate

We introduce a probabilistic branch-and-bound (PBnB) scheme for global optimization of noisy functions. We use statistical analysis to guide the branching and pruning scheme, which also prescribes the number of sample points and associated replications for estimating the true function values. The scheme terminates with a probability bound on the optimality gap. Numerical results are presented.

3 - Global Optimization of Truss Structure Design
John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu, Tallys Yunes, Tallys Yunes

We solve truss structure design problems with discrete bar sizes without introducing integer variables. We use a global optimization method that relies on constraint programming as well logic cuts and linear quasi-relaxations to accelerate the search. The solution is implemented in a general solver, SIMPL, that solves a wide range of global optimization problems by integrating techniques. It solves the truss problems 2 to 7 times faster than commercial MILP solvers.

4 - Interacting Multi-Criteria Annealing Algorithm
Onur Mete, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, mete@u.washington.edu, Zelda Zabinsky

We develop an Interacting Multi-Criteria Annealing (IMCA) algorithm that generates a population of candidate points according to Pattern Hit-and-Run Markov chain. The candidate points interact through selection rules representing multiple criteria. The IMCA algorithm converges to a subset of Pareto optimal solutions. We present analytical and numerical results of our algorithm for multi-criteria optimization.

■ SD39

C - Room 9B, Level 3

Advances in Combinatorial Optimization and Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrea Lodi, DEIS, University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, andrea.lodi@unibo.it

Co-Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it

1 - Solving Optimization Problems at Google
Emilie Danna, Software Engineer, Google, 1600 Amphitheatre Pkwy, Mountain View, CA, 94043, United States of America, edanna@google.com, Mihai Amarandei-Stavila, Bruno De Backer, Vincent Furnon, Laurent Perron, Emmanuel Guéré

Google operations offer many opportunities to apply optimization. In this talk, we describe the optimization problem underlying several of Google's operations and we examine how it is solved with integer programming, constraint programming and local search.

2 - Integer-free Polytopes of Maximal Gomory-Chvatal Rank
Sebastian Pokutta, Technische Universität Darmstadt, Dolivo Str. 15, Darmstadt, Germany, pokutta@mathematik.tu-darmstadt.de, Andreas S. Schulz

It is an open problem to characterize polytopes of maximal Gomory-Chvatal rank, even if we restrict ourselves to polytopes in the 0/1-cube. In fact, tight bounds on the rank of a polytope contained in the 0/1-cube are unknown. We consider the important special case of polytopes contained in the 0/1-cube that contain no integer points. For this class, we provide a complete characterization of polytopes with maximal rank.

3 - Lifted Inequalities for 0-1 Mixed-integer Bilinear Covering Sets
Kwanghun Chung, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, khchung@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

Lifting, a technique for generating strong valid inequalities in integer programming, has recently been extended to nonlinear programming. In this talk, we present large families of facet-defining inequalities for 0-1 mixed-integer bilinear covering sets via sequence-independent lifting techniques. We also relate the polyhedral structure of the bilinear set to that of the single-node flow set and show that our facets generalize lifted flow cover inequalities from the IP literature.

4 - Interdiction Branching
Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Andrea Lodi, Stefano Smriglio, Fabrizio Rossi

We introduce "interdiction branching," a branching method that exploits the bilevel nature of disjunction selection. The method is designed to overcome the difficulties in solving problems for which branching on variables is inherently weak by computing a set of variables of which at least one must be nonzero in any improving solution. We present computational results that show the effectiveness of this method on well-known combinatorial problems.

■ SD40

C - Room 9C, Level 3

Panel Discusssion: Forrest-fest | COIN-OR 10th Retrospective

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Moderator: Robin Lougee, Program Manager, COIN-OR, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, rlougee@us.ibm.com

1 - Panel Discussion: Self-documenting Code and Other 'Tricks' of the Trade
Panelists: Robin Lougee, Program Manager, COIN-OR, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, rlougee@us.ibm.com, John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara CA 95054, United States of America, tomlin@yahoo-inc.com, John Forrest, IBM Research (Retd.), john.forrest@fastercoin.com

COIN-OR's success in its first decade is due in large part to the software contributions of John Forrest, particularly CLP and CBC. In this panel, John and others will share their perspectives on optimization software development - what we've learned and where we need to go. (Submit questions at info@coin-or.org)

■ SD41

C - Room 10A, Level 3

Efficient Methods for Sparse or Low-rank Optimization

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

1 - Fast First-order Alternating Direction Multiplier Methods for Compressed Sensing and Related Problems
Donald Goldfarb, Professor, Columbia University, 500 W. 120th Street, Mudd Building, Room 313, New York, NY, 10027, United States of America, goldfarb@columbia.edu, Shiqian Ma

We present both Gauss-Seidel-like and Jacobi-like first-order alternating direction multiplier (augmented Lagrangian) methods for solving convex optimization problems that require O(1/sqrt(epsilon)) iterations to compute an epsilon-optimal solution. We apply these methods to various problems whose solutions are known to either be sparse or low rank or both.

2 - Existence of Sparse Solutions in Random Quadratic Optimization Problems
Jiming Peng, University of Illinois at Urbana-Champaign, 117 Transportation Building MC-238, Urbana-Champaign, United States of America, pengj@illinois.edu

In recent years, the sparse solutions for certain classes of optimization problems have attracted much attention in numerous disciplines. In this talk, we report some results on sparse solutions for nonconvex quadratic optimization problems with random data, these include the sparse solutions for the so-called standard quadrtaic optimization problem and sparse solutions for the well-known Markowitz's mean variance model.

3 - Penalty Decomposition (PD) Methods for Rank Minimization
Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

We first establish that a class of rank minimization problems have closed form solutions. We then propose PD methods for rank minimization problems in which each subproblem is solved by a BCD method. We show that any limit point of the sequence generated by our method when applied to the rank constrained minimization problem is a stationary point of a nonlinear reformulation of the problem. Finally, we apply the methods to matrix completion and nearest low-rank correlation matrix problems.

■ SD42

C - Room 10B, Level 3

Joint Session OPT/ MIF: Stochastic Programming - Applications

Sponsor: Optimization/Stochastic Programming/ Minority Issues Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

1 - A Stochastic Programming Approach for Reducing Energy Consumption in Data Centers
Julian A. Gallego Arrubla, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Young Myoung Ko, Lewis Ntaimo, Natarajan Gautam, Ronny Polansky

Data centers consume a phenomenal amount of energy which can be significantly reduced by appropriately allocating resources using technologies such as virtualization, voltage scaling and powering off servers. For this we formulate and solve a large-scale stochastic integer program that incorporates inherent variability and uncertainty especially in terms of workload experienced by the system. Numerical results based on real traces indicate a significant energy saving.

2 - Efficient Nested Solutions of the Bipartite Stochastic Network Interdiction Problem
Mike Nehme, The University of Texas at Austin, 2412 W 12th Street, Austin, TX, 78703, United States of America, mikenehme@yahoo.com, David Morton

We describe a stochastic network interdiction model for deploying radiation detectors at border checkpoints to detect smugglers of nuclear material. The model is stochastic because the smuggler's origin-destination pair is known only through a probability distribution when the detectors are installed. While the problem is strongly NP-hard, we describe a family of instances which may be solved in polynomial time, and show that the solutions to this family are nested.

3 - Optimizing Natural Gas Supply and Energy Trading for an Electricity Generation Company
Jose Prina, Assistant Professor, Pontificia Universidad Catolica de Chile, Department of Industrial and Syst. Eng., Avda. Vicuna Mackenna 4860, Macul, Santiago, Chile, jprina@ing.puc.cl, Oran Kittithreerapronchai, Sujin Kim, Panida Jirutitijaroen

We consider an electric power company that owns thermal plants and participates in a deregulated market. Different types of contracts for natural gas procurement are available, including access to the spot market. The company also manages natural gas storage capacity. A stochastic programming model that allows to optimize fuel and electricity transactions is presented. This model considers electricity contracts, spot market trading, and natural gas storage management.

4 - Stochastic Online Scheduling of Multi-step Sequential Medical Procedures in Nuclear Medicine

Eduardo Perez, Postdoctoral Research Associate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, eduardopr@neo.tamu.edu, Lewis Ntaimo, Cesar Malave

Nuclear medicine (NM) procedures use radioisotopes for diagnosis and treatment of patients. These multi-step procedures have to be performed under strict time constraints. The need to provide high levels of patient service in NM lead to scheduling issues such as dealing with uncertainty in patient arrivals. We present a stochastic online framework that uses a stochastic integer programming model for patient scheduling in NM. A computational study based on an actual NM clinic will be presented.

■ SD43

C - Room 1, Level 2- Mezzanine

Scheduling Healthcare Workforce

Sponsor: Health Applications
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Midterm Scheduling of Physicians with Flexible Shifts using Branch-and-price

Jens Brunner, TUM School of Management, Arcisstr. 21, München, 80333, Germany, Jens.Brunner@wi.tum.de

We present a new methodology to solve the flexible shift scheduling problem of physicians when hospital administrators can exploit flexible shifts to cover demand. The objective is to minimize the total assignment cost subject to individual and general labor contracts. The resulting model constructs shifts implicitly. To find high quality rosters, we develop a branch-and-price algorithm. Computational results demonstrate the efficiency of the algorithm for several planning horizons.

2 - Nurse Scheduling in an Operating Suite

Gino Lim, Associate Professor PhD, University of Houston, E211, Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, Arezou Mobasher

We introduce two IP models for assigning nurses to different surgery cases in an operating suite. A nurse assignment model was developed to allocate the required number of nurses with appropriate specialties to all surgery cases with different procedure complexities for a daily nurse schedule. In addition, a nurse lunch model was developed to establish lunch schedules for working nurses without interfering the on-going surgery cases. Numerical experiments show the effectiveness of these models.

3 - Removing Barriers to Resident-patient Continuity of Care

Jonathan Turner, PhD Candidate, Northwestern University, Evanston, IL, United States of America, JonathanTurner@u.northwestern.edu, Debra DaRosa, Mark Daskin, Sanjay Mehrotra, Heron Rodriguez, Paul Speicher

Our data show that continuity of care (CoC) between surgical residents and patients is very low. Our analytical model and our simulation show that keeping it low are 1) long time periods between diagnosis, surgery and follow-up 2) that residents don't attend clinic appointments often enough to see patients at these stages and 3) that the residents spending time operating are not the ones spending time seeing patients. The analysis and simulation also show how several strategies can improve CoC.

4 - Distributional Robust New Vendor Models for Nurse Demand Estimation

Ashley Davis, PhD Candidate, Northwestern University, IEMS, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ashleydavis2012@u.northwestern.edu, Mark Daskin, Sanjay Mehrotra

Facing uncertain patient volumes, hospitals must maintain nurse-to-patient ratios to offer safe patient care. Using a distributional-robust newsvendor model we analyze data from the general surgery and intensive care units of hospitals in Chicago, IL and Augusta, GA. Benefits of using the model are discussed.

■ SD44

C - Room 2, Level 2- Mezzanine

Healthcare Operations

Sponsor: Health Applications
Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

1 - Using Simulation to Improve the Educational Impact in a Surgical Suite

Todd R. Huschka, Mayo Clinic, 200 1st AVE SW, Rochester, MN, 55905, United States of America, Huschka.Todd@mayo.edu, Brian T. Denton, Erica Weikert, Jonathan Woodall, Celia Wang

Balancing the needs of the patient and the surgeon together with the desire to provide educational opportunities for in room providers is a high priority within an academic medical center. Using simulation modeling we explore how various changes to the instructor/student relationship may impact a surgical suite. We present results that provide insight into staffing decisions.

2 - Design and Optimization of a Hospital Inpatient Bed Management System

Jonathan Helm, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, United States of America, jhelm@umich.edu, Mark Van Oyen

Although a hospital represents a complex network of subsystems that must all work together to serve dynamically changing patient needs, these subsystems are often managed independently, causing congestion and bottlenecks in patient flow that impact cost, quality and access. We present a framework for coordinating and optimizing hospital admissions based on the stochastic process that governs bed occupancy by unit and patient type to maximize throughput subject to quality and access constraints.

3 - Surgical Yield Management: Predictive Models for Case Screening

John Osborn, Operations Manager, Mayo Clinic, 200 1st Street SW, Mary Brigh 2-810, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

Surgeon productivity is critical to a viable surgical practice. Elective case volume is driven by consultations in an outpatient setting, but not all patients are surgical candidates, thus careful planning is necessary to maximize the yield of a given consultative day. This paper presents screening models, based on yield management principles, to maximize elective case yield.

4 - Operations Research in Primary Care

Hari Balasubramanian, Assistant Professor, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

We look at different operational aspects of managing a primary care practice, from panel management and case-mix considerations to capacity planning and the design of flexible teams. The presentation will also foreground the broader context of primary care in the United States.

■ SD45

C - Room 6, Level 2- Mezzanine

Optimization in Medicine

Sponsor: Health Applications
Sponsored Session

Chair: Brian T. Denton, North Carolina State University, Campus Box 7906, 111 Lampe Drive, Raleigh, NC, 27695-7906, United States of America, bdenton@ncsu.edu

1 - Alleviating the Impact of an Epidemic

Cecilia Zenteno, Columbia University, 500 W 120th St., New York, NY, United States of America, cecizl@gmail.com, Daniel Bienstock

Consider a finite resource (such as manpower) that can be used to alleviate the impact of an ongoing epidemic. Each day, one can decide how of the resource to allocate; however, there is uncertainty as to the future course of the epidemic. We consider robust versions of the classical SEIR model, and algorithms for intelligently rationing the resource. Joint work with Daniel Bienstock.

2 - Optimal Design of Multiple Medication Guidelines for Type 2 Diabetes Patients

Jennifer Mason, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian T. Denton, Steven Smith, Nilay Shah

Patients with type 2 diabetes are often prescribed many medications to manage their risk for cardiovascular events. We present an MDP model to determine the optimal sequence and timing of blood pressure and cholesterol medications with an objective of primary and secondary event prevention. We consider multiple criteria including expected quality-adjusted life years and expected discounted costs of care. We compare our results to outcomes for implementing current US and international guidelines.

3 - Multi-objective Recipient Prioritization Optimization in Liver Transplantation

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu, Wen-Hsin Feng, Dadi Xing

Since cadaveric liver is scarce and life-saving resource for end-stage liver disease patients, it is critical to design schemes to prioritize the patients for receiving liver transplants under the consideration of several conflicting system outcomes. Through a simulation model, we embed an extended ranking and selection procedure in a genetic algorithm for the resultant multi-objective stochastic optimization problem and we construct a Pareto front for optimal prioritization schemes.

4 - HIV Treatment in Resource-limited Environments: An Approximate Dynamic Programming Approach

Theologos Bountourelis, Post-Doctoral Associate, University Of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, bountourelis@gmail.com, Ronald Braithwaite, Andrew J. Schaefer, Mark S. Roberts, Rob Koppenhaver

In the past 20 years, HIV has globally claimed over 20 million lives with the sub-Saharan Africa area impacted the most. It is estimated that millions of patients are currently in need of treatment with fewer than 8% having access to it. Under such resource constraints, the question of efficient treatment allocation becomes relevant. We implement ideas drawn from the area of Approximate Dynamic Programming (ADP) to design treatment allocation policies that improve population survival rates.

■ SD46

C - Room 7, Level 2- Mezzanine

Undergraduate Research Showcase I

Cluster: Undergraduate Operations Research Prize
Invited Session

Chair: Joel Sokol, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jsokol@isye.gatech.edu

1 - Global Humanitarian Supply Chain Improvements for the World Food Programme (WFP)

James Wade, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, j.wade@gatech.edu, Ozlem Ergun, Lawrence Li, Julie Swann, Santiago Aviles, Elhadj Bah, Manuel Jimenez, Alvaro Morales

Most of the current literature in humanitarian logistics focuses on disaster relief and emergency response in non-food supply chains. Humanitarian relief and logistics, however, may extend for years after the initial event and the literature is limited in this area. In this paper we attempt to provide a novel example in humanitarian logistics by describing a collaborative project between Georgia Tech and the World Food Programme (WFP) to improve WFP's sustained humanitarian supply chain operations. To make these improvements our team developed a mathematical model to evaluate the effects of strategic changes to the global supply chain, such as prepositioning, and an inventory management tool to standardize and facilitate inventory-ordering decisions.

2 - Lake to Puddle: A System Dynamics Approach to Social, Economic, and Environmental Consequences of Water Use in Udaipur, India

Ashka Dave, Washington University, St. Louis, MO, United States of America, ashkadave@gmail.com

In Udaipur water shortages are evident as lakes in the city dry to puddles every summer. The shortage results from the convergence of social, economic, and environmental factors and is detrimental due to the economic importance of lake tourism for residents. A system dynamics model was constructed in order to study: (1) interdependency of domestic, industrial, and tourist water use on the supply of water (2) areas for policy and interventions to alleviate water shortages, and (3) areas of future research. Collecting additional data will help test suggested interventions, which include reducing distribution losses, reducing demand, and treating polluted water.

3 - Robust Power Generation Planning Under Demand Uncertainty

Phoebe Zhimei Lai, University of California - Berkeley, Berkeley, CA, United States of America, phoebe.lai@berkeley.edu, Aurelie Thiele

We present a robust optimization approach to the power generation problem faced by an electric company in presence of demand uncertainty, where the random demand at each time period is modeled as an uncertain parameter belonging to a known range. We develop a novel modeling technique, based on demand aggregation, to successfully utilize the robust optimization methodology for this problem structure, i.e., right-hand-side uncertainty. Our computational study suggests that, in order to achieve the highest possible cost improvements, the width of the range forecast should be chosen to capture the shape of the demand distribution. Numerical experiments are very encouraging.

4 - Reasoning by Constraint Satisfaction

Rasit Cesur, Sakarya University, Turkey, rasitcesur@gmail.com

Human beings can be produced by a system that has a single function to work on different specialized data. How we find guilty in a crime case? We need evidences. Without evidences (information) there is no way to clarify the case. Constraints have to be satisfied to achieve goal in a CSP. The information has to be gained for finding guilty or solving any problem. Because of this similarity, our thinking mechanism can be handled as a CSP. In this study, spell checking problem is handled to understand our thinking modal regarding sensory motor stage described by Piaget.

■ SD47

C - Room 8, Level 2- Mezzanine

Joint Session Computational Biology/ HAS: Biological Applications

Cluster: Computational Biology and Bioinformatics/ Health Applications
Invited Session

Chair: Allen Holder, Rose-Hulman Institute of Technology, 5500 Wabash, Terre Haute, IN, United States of America, holder@rose-hulman.edu

1 - Accelerating ILP Solutions for Multi-state Phylogenetics Through Generalized Buneman Pruning

Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu, Navodit Misra, R. Ravi, Guy Blelloch

Integer linear programming has proven a powerful tool for maximum parsimony phylogeny construction, but efficient solutions have depended on a solution-space pruning construct called the Buneman graph that is defined only for binary genetic data. Here we describe a generalization of Buneman theory to arbitrary numbers of states and present applications of the resulting ILP methods to various previously infeasible data types, such as amino acid sequences and copy number variations.

2 - Use of a New Dihedral Angle Measure in Modeling Protein Complexes

Jim Smith, Professor, University of Massachusetts, 160 Govenors Drive, Amherst, MA, 01003, United States of America, jmsmith@ecs.umass.edu, Corina Rusu

Our main objective in this research is to better understand the protein structure of a large protein complex of the Type III secretion system (T3SS). This Type III secretion is comprised of more than twenty unique proteins and is one of the most complex protein secretion apparatuses known. In particular, we will study the T3SS for {Yersina pestis} (plague).

3 - Contact Geometry of Protein Folds

Yosi Shibberu, Associate Professor Mathematics, Rose-Hulman Institute of Technolgy, 5500 Wabash Ave, Terre Haute, IN, 47803, United States of America, shibberu@rose-hulman.edu, Allen Holder

We review the problem of aligning the 3D structures of protein molecules and introduce a new geometric description of the problem using n-dimensional Euclidean geometry. The new geometric description has both geometric and graph theoretic elements which we describe.

4 - Ordering Genotypes to Decompose the Pure Parsimony Problem

Allen Holder, Rose-Hulman Institute of Technology, 5500 Wabash, Terre Haute, IN, United States of America, holder@rose-hulman.edu

We show that the problem of haplotyping by pure parsimony, which is known to be APX-hard, decomposes into smaller problems upon ordering the genotypes. The ordering induces a lattice like structure that allows a polynomial bound on the problem. The bound is sharp, and we identify a sub-class of problems that is solvable in polynomial time.

■ SD48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AMPL Optimization LLC - New and Forthcoming Developments in the AMPL Modeling Language and System

Robert Fourer, AMPL Optimization, 900 Sierra Place SE, Albuquerque, NM, 87108, United States of America, 4er@ampl.com, David M. Gay

We describe recent and ongoing projects to extend and enhance AMPL to facilitate both formulation and implementation of optimization models. Extensions to AMPL's language will allow for more natural description of discrete models and stochastic data. New solver interfaces will make nontraditional solvers more accessible for practical modeling. A new callable interface to the AMPL system will facilitate business deployment.

2 - Ziena Optimization, Inc. - New Developments in the KNITRO 7.0 Optimization Solver

Richard Waltz, Ziena Optimization, Inc., 1801 Maple Avenue, Evanston, IL, 60201, United States of America, waltz@ziena.com

This software demonstration will highlight areas of improvement in the new version 7.0 release of the KNITRO optimization solver. Benchmark results will be presented showing significant performance gains for large-scale models. The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and applications.

■ SD49

C -Room 10, Level 2- Mezzanine

Designing and Managing Systems Development Processes

Sponsor: Information Systems
Sponsored Session

Chair: Jungpil Hahn, Assistant Professor of Management, Purdue University, 100 S. Grant St., RAWL 4042, West Lafayette, IN, 47907, United States of America, jphahn@purdue.edu

1 - Coordination in Enterprise Architecting: Preliminary Findings

J. Alberto Espinosa, Associate Professor of Information Technology, American University, 4400 Massachusetts Ave., N.W., Washington, DC, 20016, United States of America, alberto@american.edu, Wai Fong Boh, Frank Armour

Enterprise architecture (EA) models the desired relationships between business processes and technology. Managing the EA can be daunting because of the complex interdependencies among business, technology and the people involved. This has received little attention and our study fills this gap. We provide preliminary evidence from a Grounded Theory study of 30 practitioner interviews.

2 - Fuzzy Methodologies: Recognizing Context in IS Project Management

Kelly Slaughter, Manager, Grant Thornton, 1717 Main, Dallas, TX, 75201, United States of America, kelly.slaughter@gt.com, Jennifer McClung, Nancy Murr, Blake Sellers

IS projects are frequently managed through invariant methodologies tailored to the project's idiosyncratic context though managerial improvisation. An interdisciplinary analysis of a two year IS implementation suggests introducing structured variations in these methodologies to accommodate knowledge related contingencies of organizational learning, spillover, IT worker experience, and user roles.

3 - Requirements Engineering and Logics of Innovation: Exploration and Exploitation in IS Development

Sean Hansen, Assistant Professor, Rochester Institute of Technology, Saunders College of Business, 105 Lomb Memorial Drive, Rochester, NY, 14623-5608, United States of America, swh4@case.edu, Michel Avital, Kalle Lyytinen

The exploration of new opportunities and the exploitation of existing competencies represent competing logics of innovation within organizations. Through its essential role in generating a design space between existing problems and design solutions, requirements engineering (RE) represents a domain where exploration and exploitation need to be integrated. Through a field study of IT professionals, we analyze the degree to which prevailing RE practice incorporates these logics of innovation.

4 - Knowledge Overlaps in Information System Development

Jungpil Hahn, Assistant Professor of Management, Purdue University, 100 S. Grant St., RAWL 4042, West Lafayette, IN, 47907, United States of America, jphahn@purdue.edu, Gwanhoo Lee

Information systems development (ISD) is a search process by which the ISD team seeks to find an optimal system configuration that produces the best results. Naturally, knowledge overlaps between business and IS play an important role in the ISD process. Using an NK fitness landscapes model, we investigate how knowledge overlaps influence ISD performance for varying levels of interdependencies among design choices, and for different distributions of within- and between-unit interdependencies.

■ SD50

C -Room 11, Level 2- Mezzanine

Trading Agents

Sponsor: Information Systems
Sponsored Session

Chair: Wolfgang Ketter, Assistant Professor, Erasmus University, Rotterdam School of Management, Department of Decision and Information Science, Rotterdam, Netherlands, wketter@rsm.nl

1 - Preference Modeling in a Competitive Agent-based Energy Market

Yixin Lu, PhD Candidate, Rotterdam School of Management, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, ylu@rsm.nl, Wolfgang Ketter, John Collins, Eric van Heck, Manuela Veloso, Prashant Reddy

TAC Energy is a competition that models future retail energy markets to facilitate research in economic decision-making in Smart Grids. It challenges research teams to design agents which would act as energy retail brokers, purchasing power from distributed sources and regional energy exchanges, and selling power to consumers and exchanges. To develop profitable portfolios, such broker agents must estimate and reason about different customers' preferences in an effective and efficient way.

2 - TacTex09: a Champion Bidding Agent for Ad Auctions

Peter Stone, Associate Professor, The University of Texas at Austin, 1 University Station C0500, Austin, TX, 78712, United States of America, pstone@cs.utexas.edu, Doran Chakraborty, David Pardoe

In the Trading Agent Competition Ad Auctions Game, agents compete to sell products by bidding to have their ads shown in a search engine's sponsored search results. We report on the winning agent from the first (2009) competition, TacTex. TacTex estimates the full game state from limited information, uses these estimates to make predictions, and then optimizes its actions (daily bids, ads, and spending limits) with respect to these predictions.

3 - Agent-based Test Bed Study of Participant Behavior in Integrated Financial and Real Energy Markets

Abhishek Somani, Economics PhD Candidate, Iowa State University, 260 Heady Hall, Iowa State University, Ames, IA, 50011, United States of America, somaniabhishek@yahoo.com, Leigh Tesfatsion

Financial and real markets are intricately connected in restructured electric power systems. Participant behaviors in these integrated markets are not well understood and, additionally, not easily studied using conventional analytical models. This talk will discuss the potential use of agent-based test beds for conducting such studies.

4 - Agent-based Simulation of Private Customer Reactions to Variable Electricity Pricing

Carsten Block, Karlsruhe Institute of Technology, Karlsruhe, Germany, carsten.block@kit.edu, John Collins, Sebastian Gottwalt, Wolfgang Ketter

Demand Side Management is important for future Smart Grids. We present a model that simulates energy consumption of households when customers face varying energy prices. Software agents simulate private customer electricity consumption in a smart home. Customer preferences and the price for electricity determine the use of appliances. The simulation shows results on the impact of time-based demand-response tariffs. Different pricing schemes for private electricity customers are tested.

■ SD51

C -Room 12, Level 2- Mezzanine

ICS Prize Winners

Sponsor: Computing Society
Sponsored Session

Chair: Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu

1 - ICS Prize Winners

The winners of the 2010 ICS Prize and the 2009 ICS Student Paper Award present their award-winning work.

2 - On the Nullstellensatz Method for Combinatorial Optimization

Susan Margulies, Pfeiffer-VIGRE Post-doctoral Instructor, Rice University, 6100 Main St. MS #134, Houston, TX, 77005, United States of America, susan.margulies@rice.edu, Shmuel Onn, Jon Lee, P.N. Malkin, Jesus A. De Loera

Unlike linear models, systems of multivariate polynomial equations over the complex numbers or finite fields can be compactly used to model combinatorial problems. In this way, a problem is feasible (e.g. a graph is 3-colorable, Hamiltonian, etc.) if and only if a given system of polynomial equations has a solution. In the work of M. Laurent, J. Lasserre and P. Parrilo, Y.Nesterov, and others, continuous optimization problems which are modeled by zero-dimensional radical ideals have been shown to have a finite sequence of semidefinite programs that converge to an optimal solution. For yes/no combinatorial decision problems (e.g., is a graph G 3-colorable?), we observed that Hilbert's Nullstellensatz gives a sequence of {\em linear algebra} problems that eventually determines feasibility. This has advantages as linear algebra is quite stable on computation and sparsity is well-understood. In this talk, we present theoretical and experimental results on these sequences of large-scale, sparse, linear algebra relaxations to the combinatorial optimization problem. We show that the size of the smallest Nullstellensatz linear algebra system certifying that there is no stable set of size larger than the stability number of the graph grows as the stability number of the graph. We additionally describe ideas for optimizing the method, such as utilizing alternative forms of the Nullstellensatz, adding carefully-constructed polynomials to the system, branching and exploiting symmetry. Finally, in the case of 3-colorability, we use this method to successfully solve graph problem instances having thousands of nodes and tens of thousands of edges.

3 - A New Stochastic Derivative Estimator for Discontinuous Payoff Functions with Application to Financial Derivatives

Yongqiang Wang, University of Maryland, College Park, 3182 AVW, College Park, MD, United States of America, yqwang@umd.edu, Michael Fu, Steven Marcus

The paper describes a new unbiased stochastic derivative estimator for a class of discontinuous payoff functions that arise in many options pricing settings from finance. The method generalizes two other well-known methods (infinitesimal perturbation analysis and the likelihood ratio method) and can be applied to functions of more general forms containing indicator functions. In addition, the new estimator can be computed from a single sample path or simulation, whereas existing estimators in the literature require additional simulations.

■ SD52

C -Room 13, Level 2- Mezzanine

Logistics Challenges and Supply Chain Innovation

Sponsor: Military Applications
Sponsored Session

Chair: Thomas Turner, Principal Operations Research Analyst, Concurrent Technologies Corporation, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com

1 - Using Simulation to Support Maintenance and Rotation Planning for the Marine Corps Armor Fleet

Thomas Turner, Principal Operations Research Analyst, Concurrent Technologies Corporation, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com, Alan Moses

The Marine Corps program manager for tank systems has made total life cycle management (TLCM) decisions based on subject matter expert opinion and business rules. This talk outlines a desktop decision support system designed to use a previously developed TLCM discrete event simulation to generate a wide range of output and present that output in a way that allows the decision maker to conduct "what-if" analysis of various stock rotation or maintenance policies.

2 - Effect of Variable Improvement Factor on Optimal Preventive Maintenance and Replacement Schedules

Kamran Moghaddam, Post-Doctoral Research Associate, University of Louisville, Department of Industrial Engineering, Louisville, KY, 40292, United States of America, ksmogh01@louisville.edu, John Usher

We develop a new mathematical formulation to determine optimal preventive maintenance and replacement schedule of a system. We model the cases of minimizing total cost and maximizing the system reliability. We present a new mathematical function to model the improvement factor based on the ratio of maintenance and repair costs, and show how it outperforms fixed improvement factor models by analyzing the effectiveness of in terms of cost and reliability of the system.

3 - Flowcasting: A BreakThrough in Supply Chain Integration

Sylvain Landry, Professor, HEC Montréal, 3000 Cote-Sainte-Catherine, Montreal, Qc, H3T2A7, Canada, sylvain.landry@hec.ca, Jacques Roy, Martin Beaulieu

Since the bullwhip effect was demonstrated by Forrester, many attempts have been made to fight it. It occurs when each link in a supply chain acts independently and is unconnected to consumer demand at the point of sale. A revolutionary method called flowcasting uses a single forecast at the store level to replenish the entire supply chain through DRP/MRP planning to manage the flow instead of forecasting demand at each level. This presentation will describe this approach and its impact.

4 - A Center for Innovation in Logistics Systems

Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

A comprehensive analytical architecture to enable US Army Logistics Transformation is presented, incorporating an "engine for innovation" to accelerate and sustain continual improvement. Strategic management challenges are addressed, including management information and decision support systems, human capital investment needs, organizational design and strategic alignment for a learning organization.

■ SD53

C -Room 14, Level 2- Mezzanine

Telecommunications

Contributed Session

Chair: Carlos Oliveira, Bloomberg LP, 731 Lexington Avenue, New York, NY, United States of America, coliveira@gmail.com

1 - From Herding Sheep to Herding Cats: Balancing Compliance and Innovation in the Internet Age

Chintan Vaishnav, Massachusetts Institute of Technology, 32 Vassar Street, Room 32-G806, Cambridge, MA, 02139, United States of America, chintanv@mit.edu

This research analyzes how a telecommunications regulator can balance compliance with innovation as the Internet disrupts traditional communications technologies. We have developed a system-level dynamic feedback model of regulation, competition, and innovation in telecommunications. We propose a combination of two policy levers-Limiting Significant Market Power (SMP) Accumulation and Building Broad-based Consensus around Regulatory Issues-that most effectively achieve the desired balance.

2 - The Impact of Vertical Market Entry of Network Operators in the Wireless Telecom Industry

Xiahua Wei, University of California, San Diego, Department of Economics, La Jolla, CA, 92092-0534, United States of America, xiwei@ucsd.edu

Mobile virtual network operators (MVNOs) purchase airtime from mobile network operators (MNOs) and resell the service, as they do not have spectrum license or necessary network infrastructure. This study seeks to understand the impact of this vertical relationship on incumbent MNOs' performance. I first construct a model to explain why MNOs sell to MVNOs rather than acquiring them in a vertical integration. I further investigate empirically whether MNOs benefit from such a strategic partnership.

3 - Forecasting New Technologies in Telecommunications: Past Experience and Future Directions

Lawrence Vanston, President, Technology Futures, Inc., 13740 Research Blvd, Bldg C-1, Austin, TX, 78750, United States of America, lvanston@tfi.com

Forecasting new technologies requires judgment, knowledge and modeling skills in a world where success is relative and delayed. For 25 years, telecom has provided a rich forecasting environment with seismic transitions in broadband, wireless, fiber optics, the Internet, etc. The future is as promising. In this presentation I draw lessons from past forecasts, provide ideas about the future and explain how modeling skills from operations research apply to the fuzzy world of forecasting the future.

4 - The Deterministic Wireless Local Area Design Problem
Jason Kratz, Graduate Student, Southern Methodist University, 6425 N. Ownby Drive, Dallas, TX, United States of America, jkratz@smu.edu

We have designed an algorithm that uses partitioning and global optimization techniques to place Access Points (APs) for a Wireless Local Area Network Design Problem with known locations of Mobile Devices (such as Desktop Computers). This algorithm does not require a set of fixed potential AP locations. We have also conducted an empirical analysis comparing our algorithms with other metaheuristic algorithms.

5 - Optimization Models for Center Based Multicasting Routing
Carlos Oliveira, Bloomberg LP, 731 Lexington Avenue, New York, NY, United States of America, coliveira@gmail.com

In multicast routing, data is transferred from one or more sources to a set of destinations. A popular strategy for maintaining multicast routing trees is to use a center node that serves as a hub for the network. In this talk, we present optimization models for this problem. We describe algorithms and discuss computational results from the the proposed approaches.

■ SD54

C -Room 15, Level 2- Mezzanine

Panel Discussion: Meet the Editors and Ask Them Questions

Sponsor: Technology Management/New Product Development
Sponsored Session

Moderator: Leonardo Santiago, Federal University of Minas Gerais, Department of Production Engineering, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br

1 - Panel Discussion: Meet the Editors and Ask Them Questions
Panelists:Leonardo Santiago, Federal University of Minas Gerais, Department of Production Engineering, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, Atlanta 30308, United States of America, cheryl.gaimon@mgt.gatech.edu, Daniel Levinthal, Reginald H. Jones Professor of Corporate Management, Wharton School, University of Pennsylvania, Philadelphia PA, United States of America, dlev@wharton.upenn.edu, Rajiv Sabherwal, University of Missouri Curators Professor, University of Missouri at St. Louis, sabherwal@umsl.edu, Morgan Swink, Professor and Eli Broad Legacy Fellow, Michigan State University, swink@bus.msu.edu, Kamalini Ramdas,London Business School, Regent's Park, London NW14SA, United Kingdom, kramdas@london.edu, Stylianos Kavadias,Associate Professor, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, United States of America, Stylianos.Kavadias@mgt.gatech.edu

(i) Prof Kamalini Ramdas, Department of Entrepreneurship and Innovation of Management Science; (ii) Prof Cheryl Gaimon, Department of Management of Technology of Production and Operations Management; (iii) Prof. Dan Levinthal, Organizational Science; (iv) Prof Rajiv Sabherwal, IEEE Transactions of Engineering Management; (v) Prof Morgan Swink, Journal of Operations Management; (vi) Prof Stylianos Kavadias, Department of NPD, R&D, and Project Management of Production and Operations Management

■ SD55

C -Room 16, Level 2- Mezzanine

New Product Development

Contributed Session

Chair: Katrina Appell, PhD Candidate, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48103, United States of America, appell@umich.edu

1 - An Integrated Approach to Supply Chain Configuration by Matching with PD Decisions
Bimal Nepal, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, nepal@tamu.edu, Femi Famuyiwa, Leslie Monplaisir

Supply chain configuration decisions are directly influenced by the decisions made at early stages of the product development (PD) process. This paper presents an integrated approach to supply chain configuration at early stages of the product development by matching the SC design with product architecture type. A multi-objective optimization is presented by considering total supply chain costs and computability factors for supplier selection at each node of the SC.

2 - Global Procurement Decision-making Model for New Product Components
Masatake Saito, Boston University, 133 Park St. #805, Brookline, MA, 02446, United States of America, msaito@tamacc.chuo-u.ac.jp

Global procurement decision makers have to select the best component out of many possible alternatives. The selection of a supplier is based not only on quality, cost and delivery but also on suppliers' value, risk and logistics cost, etc. This decision type could be applied to new model which combined an improved AHP method and a multi-objective problem under some constraints. In this paper, we propose a decision-making model and a framework for a decision support system.

3 - Lean Product Development: An Analysis of Two Deployments
Katrina Appell, PhD Candidate, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48103, United States of America, appell@umich.edu

Lean product development has been well documented, although techniques for successful transformation from traditional environments to lean product development have not been. The research objective is to better understand the methodology by which lean product development is appropriately deployed in traditional product development environments. This will be explored with a comparative study of two deployments comparing an enterprise-wide approach with a project level focused approach.

■ SD56

C - Room 1, Level 1

Simulation Optimization Techniques

Sponsor: Simulation Society
Sponsored Session

Chair: JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn

1 - Optimization Methods for VaR Constrained Portfolio Selection Problems
Xiaoling Sun, Professor, Fudan University, 670 Guoshun Road, Shanghai, China, xls@fudan.edu.cn, Xueting Cui, Xiaojin Zheng, Duan Li

In this talk, we discuss the sample model of VaR constrained mean-variance portfolio selection problem. We propose several convex relaxations based on semidefinite programming and second-order cone programming for the mixed-integer quadratic programming reformulation problem. Branch-and-bound method based on SDP and SOCP relaxations is discussed. Computational results with Monte-Carlo sampling and historic data are also presented.

2 - A Kriging Based Tradeoff Between Exploration and Exploitation
Jeff Hong, Hong Kong University of Science and Technology, Dept of Industrial Engineering and Logis, Hong Kong - PRC, hongl@ust.hk, Lihua Sun

Random search algorithms are often used to solve black box optimization problems. Sampling distributions used in these algorithms need to balance the efforts for exploration (global search) and exploitation (local search). In this paper, we propose a kriging based approach that uses a Gaussian process to construct a sampling distribution in each iteration of the optimization algorithm, and demonstrate the advantages of our approach.

3 - Model-based Evolutionary Optimization
Michael Fu, Professor, University of Maryland-College Park, 4305 Van Munching Hall, College Park, MD, 20742, United States of America, mfu@umd.edu, Steven Marcus, Yongqiang Wang

We propose a new framework for global optimization by building a connection between global optimization problems and evolutionary games, based on which we develop a Model-based Evolutionary Optimization (MEO) algorithm. MEO gives a new insight into the mechanism of model updating in model-based global optimization algorithms. Based on MEO, a novel Population Model-based Evolutionary Optimization algorithm is proposed, which better captures the multimodal property of global optimization problems.

4 - Contamination Control in Food Supply Chain
JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn, Feng Chun Wang, Rong Zeng Cao, Yifan Xu, Yingjie Hu

In this paper, we study a contamination control problem in food supply chain. We formulate the problem as a dynamic programming problem and then study the structure of the optimal control which turns out to be very similar to the hedging-point type of policy. Under the environment in which there is uncertainty associated with contamination control, the problem becomes a stochastic dynamic programming problem, for which we propose a simulation based method.

■ SD57

C - Room 2, Level 1

Advances in Modeling and Optimization of Risk

Cluster: Risk Management
Invited Session

Chair: Paul Krokhmal, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu

1 - Deviation Measures: Theory and Applications

Michael Zabarankin, Associate professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, Michael.Zabarankin@stevens.edu

The talk surveys recent progress in the theory and application of general measures of deviation.

2 - Risk Management Techniques for Fixed Charge Network Flow Problems with Uncertain Arc Disruptions

Vladimir Boginski, University of Florida, Shalimar, FL, United States of America, boginski@reef.ufl.edu, Artyom Nahapetyan, Alexey Sorokin

We consider fixed charge network flow problems with uncertain network topology, that is, each arc in a network has a probability of failure. CVaR risk measures are used for restricting potential losses of flow due to uncertain arc disruptions. We demonstrate that efficient heuristics for finding good quality solutions (within less than 5% from optimality on becnchmark instances) can be utilized, and present computational results for large and dense networks.

3 - Serial Chain Merger Evaluation Model and Application to Mortgage Banking

Dash Wu, Assisstant Professor, Reykjavik University and University of Toronto, Nauthólsvìk, Venus, 2, Iceland, 1 Spadina Crescent Room 205,Toronto, ON, toronto, Canada, DWu@rotman.utoronto.ca, John Birge

Mortgage banking operations can be viewed from the supply chain perspective. This paper describes a series-chain-merger DEA model to assess potential gains from the merger of different chain operations. We show that in our framework the merger of different chains with many sub-chains is efficient within the DEA paradigm if and only if the mergers of sub-chain members are all efficient. A case study is conducted.

■ SD58

C - Room 3, Level 1

Recent Development in Quantitative Finance

Cluster: Quantitative Finance
Invited Session

Chair: Xin Guo, Associate Professor, University of California Berkeley, IEOR, Berkeley, CA, 94720, United States of America, xinguo@ieor.berkeley.edu

1 - Sequential Importance Sampling And Resampling for Portfolio Credit Risk

Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu, Dmitry Smelov

We formulate and evaluate a sequential Monte Carlo method for estimating rare-event probabilities in dynamic, intensity-based point process models of portfolio credit risk. The method uses a resampling scheme to track the zero-variance importance measure associated with the event of interest. Numerical results illustrate the performance of the method, and highlight its advantages over other simulation schemes recently developed for estimating portfolio credit risk.

2 - Dynamic Bertrand Oligopoly

Andrew Ledvina, Princeton, Sherrerd Hall, Princeton University, Princeton, NJ, 08544, United States of America, aledvina@princeton.edu, Ronnie Sircar

We study continuous time Bertrand oligopolies in which a small number of firms producing similar goods compete with one another by setting prices. We first analyze a static version of the game, and then we analyze the dynamic game which results in a nonzero-sum stochastic differential game. We characterize certain qualitative features of the game using an asymptotic approximation in the limit of small competition. The equilibrium of the game is further studied using numerical solutions.

3 - Optimal Contracting Under Incomplete Information

Agostino Capponi, California Institute of Technology, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, agcappo@gmail.com, Jaksa Cvitanic

We extend the classical contracting theory in continuous time by assuming that the outcome process controlled by the agent can only be observed with noise. Thus, both agent and principal have to filter the observations when deciding on the optimal contract. Unlike in the classical case, the optimal effort and fee paid to the agent depend on the contracting time horizon. Their relationship, while still linear, is now influenced by time horizon, riskiness of the project and intensity of noise.

4 - Blind Portfolio Auctions via Intermediaries

Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Michael Padilla

A large volume of assets are sold by institutional investors to execution service providers through blind portfolio auctions. The associated uncertainty creates inefficiencies. We propose a mechanism that makes use of a trusted intermediary to improve efficiency, and demonstrate significant increases in seller revenue, equivalent agent payoff, and total equivalent social welfare.

■ SD59

H - Salon A, 4th Floor

Doing Good with Good OR Student Competition

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

Co-Chair: James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

1 - Strategic Planning for Disaster Recovery with Stochastic Last Mile Distribution

Carleton Coffrin, PhD Student, Brown University, 115 Waterman Street, Box 1910, Province, RI, 02906, United States of America, cjc@cs.brown.edu, Pascal Van Hentenryyck, Russell Bent

We consider the single commodity allocation problem (SCAP) for disaster recovery. SCAPs are stochastic optimization problems that combine resource allocation and warehouse routing. This work formalizes the specification of SCAPs and presents a multi-stage hybrid-optimization algorithm that utilizes the strengths of mixed integer programming, constraint programming, and large neighborhood search.

2 - Prostate Cancer Screening: What is the Societal Benefit?

Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, North Carolina State University, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu, Brian T. Denton, Hari Balasubramanian, Brant Inman, Nilay Shah

Prostate cancer is the most common solid tumor that affects American men. PSA is a biomarker used for early detection of prostate cancer. However, due to the imperfect nature of the test, PSA screening is controversial. We present an optimization model for PSA based screening. Using our model we estimate the total societal benefit for PSA based screening in the U.S. Our study sheds light on the debate about whether and how to conduct prostate cancer screening.

3 - Increasing Food Delivery Through Port Simulation and Overland Transportation Route Optimization

Jordan Stone, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, United States of America, jordanstone@gatech.edu, Rene Alvarenga, Dani Slaton

The World Food Programme (WFP) provides year-round aid to food-deficient countries. We developed a shipment scheduling and routing tool to improve WFP land transportation operations in Eastern Africa. Using this tool, WFP can expect a decrease in shipment lead times and costs and increase their efforts to combat worldwide hunger.

■ SD60

H - Salon B, 4th Floor

Decision Analysis Practice Awards Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Enginee, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

1 - Decision Analysis Practice Awards Finalists
Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Enginee, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

The DAS Practice Award is given annually to the best application of decision analysis, as judged by a panel of decision analysis academics and practitioners. In this session the finalists will present their work. The winner will be announced during the Decision Analysis Society Awards on Monday.

2 - The Implementation of Decision Analysis at Chevron: 20 Years of Building a DA Culture
Frank Koch, Decision Analysis Practice Leader, Chevron Project Resources Co., 1400 Smith Street, Houston, TX, 77002, United States of America, FGKO@chevron.com, Larry Neal, Brian Putt

Decision analysis has been integrated into Chevron's major capital project development process since the mid-1990's. DA is required for all capital investments greater than $50 million. Currently Chevron has over 50 major projects underway with a total capital investment over $150 billion (Chevron's share). Since 2000 over 12,000 employees have been introduced to DA as part of our capital stewardship strategy, including decision makers from CEO down to project managers. During the past few years Chevron has created a functional organization to manage our decision analysts' careers. Chevron has also developed proprietary decision analysis software based on the best practices of our most experienced analysts. Through our use of decision analysis, our leadership has a clearer understanding of the range of potential outcomes of their decisions and greater alignment on commitment to action.

3 - AISoy 1, A Robot that Perceives, Feels and Makes Decisions
David Rios Insua, Royal Academy of Sciences, Madrid, Spain, david.rios@urjc.es, Diego Garcìa, José M. Vidal, Carlos Pallardó, Ra˙l Moreno

AISoy 1 is a new social emotional robot on sale from AISoy Robotics. It may be described as a robot that perceives, feels and makes decisions. We shall describe its architecture, placing emphasis on how decision analytic and Bayesian methods support AISoy 1 actvities when processing information received through its sensors, forecasting the evolution of its environment, adapting its emotional state and choosing the actions to be made.

4 - Neuroscience Trials Australia Uses Decision Analysis to Select Acute Stroke Imaging Software Platform for Extending the Time for Thrombolysis in Emergency Neurological Deficits (EXTEND) Clinical Trial
Leonid Churilov, National Stroke Research Institute, The University of Melbourne, Melbourne, Australia, leonid.churilov@gmail.com, Yoshinari Nagakane, Daniel Liu, Soren Christensen, Henry Ma, Stephen M. Davis, Geoffrey Donnan

Patients with evidence of potentially salvageable brain tissue post onset of ischaemic stroke are likely to be most therapeutically responsive to treatment with tissue Plasminogen Activator (tPA). A complex combination of Magnetic Resonance Imaging (MRI) scans could be used to identify this salvageable tissue and a variety of software platforms for its rapid identification are now available. In this presentation we discuss how multi-attribute rating procedures followed by sensitivity analyses were successfully used to select the most appropriate imaging software platform for a multi-centre acute stroke clinical trial aimed at increasing the number of patients eligible for stroke treatment.

■ SD63

H - Room 404, 4th Floor

Decision Analysis to Decision Influence

Sponsor: Decision Analysis
Sponsored Session

Chair: Prakash P. Shenoy, Distinguished Professor, Kansas University Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7601, United States of America, pshenoy@ku.edu

1 - On Solving Hybrid Influence Diagrams Containing Deterministic Variables
Prakash P. Shenoy, Distinguished Professor, Kansas University Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7601, United States of America, pshenoy@ku.edu, Yijing Li

We describe a framework and an algorithm for solving hybrid influence diagrams containing deterministic variables. Hybrid influence diagrams are influence diagrams with a mix of discrete, continuous, and deterministic chance variables. A continuous chance variable is said to be deterministic if its conditional distributions have zero variances.

2 - The Doctor and the Statistician: Practical Use Value of Information for Fast Track Cancer Treatment
Stuart Harris, Director Pharmaceutical DA Consulting, Decision Frameworks, L.P., Washington, DC, United States of America, StuartHarris@DecisionFrameworks.com

In this real world example, an oncology physician sees compelling results in an underpowered Phase I study and wants to accelerate development. But the bio-statistician feels it would be foolish. This presentation introduces a practical framing and VOI work-flow to evaluate early, less powered, trial designs to mitigate risk or kill poor compounds early. A fast track for cancer treatment case example illustrates the approach and introduces an easy to understand management summary report.

3 - Effectively Communicating Analytic Methods for Non Analyst Decision Makers: A Case Study
Jay Andersen, Decision Sciences, Eli Lilly and Co., Indianapolis, IN, United States of America, jsa@lilly.com

At times, the analytic methods of the portfolio advisor do not produce the desired result. What seems straightforward to the advisor appears puzzling to the decision maker and leads to less clarity, not more. This discussion will focus on taking the decision maker's perspective, and will examine four case studies: one that was effective, two that were not, and one that is in progress.

■ SD68

H - Room 415, 4th Floor

New Technology Management

Sponsor: eBusiness
Sponsored Session

Chair: Byung Cho Kim, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu

1 - Simultaneous or Sequential Launch of New IT
Byung Cho Kim, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Hemant Bhargava, Daewon Sun

This paper examines product introduction strategies of new IT. We investigate whether simultaneous or sequential launch is better for a manufacturer of new IT under monopoly. Inspired by Apple's introduction of iPod Touch, a lower-quality version of iPhone, we aim at understanding the incentive of a monopolist to provide a full-quality version first then a reduced-quality version later. We examine how uncertain third parties' application development affects Apple's product launch strategy.

2 - Efficient Structures for Innovative Social Networks
Amitabh Sinha, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, amitabh@umich.edu, William Lovejoy

What lines of communication in an organization are most productive in the ideation phase of innovation? We investigate this with a recombination and selection model of knowledge transfer operating through a social network. We find that ideation is accelerated when agents churn through a large set of conversational partners, which begets short path lengths and eliminates information bottlenecks. The idealized core-periphery graphs emerge as an important family on the time-cost efficient frontier.

3 - Condition Monitoring of Enterprise Systems Enhanced by Wireless Communication and Cloud Computing
Radu Babiceanu, Assistant Professor, University of Arkansas at Little Rock, Little Rock, AR, 72204, United States of America, rfbabiceanu@ualr.edu

The importance of condition monitoring and fault diagnosis is growing continuously due to the increase in criticality for reliability and safety requirements for large-scale industrial systems. This work presents a systems engineering approach for the integration of several relatively new technologies, such as RFID, Wireless Sensor Networks, and Cloud Computing with the objective of delivering accurate real-time status information, as well as providing system lifetime prediction capabilities.

4 - Applying the IS Success Model and Flow Theory to Explain Consumer Behavior in e-Brokerage Services
David Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@central.uh.edu

In this study, we test constructs from IS and psychology in an integrated theoretical framework. Specifically, we examine how system characteristics affect the cognitive states of flow experience, which in turn determines customer satisfaction and intention to use. We empirically test the framework with responses from online investors. Our empirical results clarify the important antecedents and consequence of consumer behavior in e-brokerage services.

■ SD69

H - Salon F, 6th Floor

Panel Discussion: Roundtable Session II - On the Collaborative Railroad Research

Sponsor: Railway Applications
Sponsored Session

Moderator: Chris Barkan, Professor, University of Illinois at Urbana-Champaign, 205 N Mathews RM1203, Urbana, IL, 61801, United States of America, cbarkan@illinois.edu

Moderator: Teodor Gabriel Crainic, CIRRELT, 2920, Chemin de la Tour, Montreal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca

1 - Panel Discussion: On the Collaborative Railroad Research
Panelists: Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, 6308 Kristen Dr., Fort Worth, TX, 76131, United States of America, homarjun.agrahari@bnsf.com, Chris Barkan, Professor, University of Illinois at Urbana-Champaign, 205 N Mathews RM1203, Urbana IL 61801, United States of America, cbarkan@illinois.edu, Dharma Acharya, AVP - Operations Research, CSX, 500 Water St. J250, Jacksonville FL 32202, United States of America, Dharma_Acharya@CSX.com, Pooja Dewan, BNSF Railway Company, Ft. Worth TX, United States of America, Teodor Gabriel Crainic, UQAM, C.P. 6128, succursale Centre-ville, Montreal, Canada John Gray, Association of American Railroads, United States of America

Different railway companies end up solving same problems in isolation in the absence of a collaborative research environment. Individual research not only costs more but it also takes more time for breakthroughs since research findings are not shared at all or shared too late. In the round table, experts from academia, industry and government will share their views on various research collaboration and IP rights sharing settings, and their pros and cons. The session will conclude with a panel discussion on future directions and the role RAS/INFORMS/Government can play in facilitating such research collaborations.

■ SD70

H - Salon G, 6th Floor

Aviation Environmental Impact Mitigation

Sponsor: Aviation Applications
Sponsored Session

Chair: Karen Marais, Assistant Professor, Purdue University, 701 West Stadium Ave, W Lafayette, IN, 47907, United States of America, kmarais@purdue.edu

1 - Scheduling of Runway Operations for Reduced Environmental Impact
Gustaf Solveling, Graduate Research Assistant, Georgia Institute of Technology, 765 Ferst Dr NW, GA Tech ISyE, Atlanta, GA, United States of America, gustaf.solveling@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

In this study, we derive several insights about the value of environmental optimization for runway scheduling. More specifically, using actual flight data we compare environmentally optimal schedules with first-come-first-serve based policies and fuel-optimal schedules. We determine that while significant savings in environmental costs can be achieved through environmentally optimal schedules, these savings are not much different than those obtained through fuel-optimal schedules.

2 - Estimation of Aircraft Taxi-out Fuel Burn Through Analysis of Flight Data Recorder Information
Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Ave., 33-328, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Harshad Khadilkar, Tom Reynolds

Aircraft taxi processes result in fuel burn, emissions and surface delays. The objective of this work is to estimate aircraft taxi-out fuel burn, given its trajectory on the ground. A fuel burn model is developed through regression analysis of archived Flight Data Recorder information from over 2000 flights of 9 different aircraft types. The statistical significance of several factors such as taxi time, stops, and turns is studied, and the results for different classes of aircraft are compared.

3 - Environmental Feasibility of Alternative Jet Fuels
James Hileman, Principal Research Engineer, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 33-115, Cambridge, MA, 02139, United States of America, hileman@mit.edu, Russell Stratton, Matthew Pearlson, Christoph Wollersheim

This study assessed the feasibility of reducing GHG emissions from the aviation industry through the use of alternative fuels. The focus was on the life cycle greenhouse gas emissions from the production of jet fuels from conventional fossil sources, terrestrial biomass, and renewable oils. This information was supplemented with economic, land and water impacts to understand the potential limits on alternative fuel production. The briefing will present insights gained from these examinations.

4 - Operational Strategies to Mitigate the Environmental Impact of Aviation
Karen Marais, Assistant Professor, Purdue University, 701 West Stadium Ave, W Lafayette, IN, 47907, United States of America, kmarais@purdue.edu, Tom Reynolds, John Hansman, Delri Muller, Payuna Uday, Jonathan Lovegren

Changing aircraft operational procedures can be used to mitigate aviation's environmental impacts in shorter time frames with existing aircraft types. This work compares the relative benefit of these improvements to identify priorities for implementation. The research includes a list of the most promising environmental impact reduction measures, together with a quantitative assessment of their environmental impact reduction potential and barriers to implementation.

■ SD71

H - Salon H, 6th Floor

Statistical Methods in DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu

1 - Nonparametric Estimation and Statistical Tests of Components of Productivity Change
Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Ram Natarajan, Srinivasan Parthasarathy

We describe how productivity change and technical change can be measured using Data Envelopment Analysis (DEA) and provide statistical justification for two commonly used tests, the Student's T-test and the sign test to evaluate whether productivity and technical change has occurred. We also examine the performance of the test statistics developed in this paper through extensive Monte Carlo simulations. We show that test statistics derived from the computationally simple, one-shot metrics perform better than those derived from estimators that are based on computationally more intensive, bootstrap procedures. This finding holds in the presence of noise, is robust to small sample sizes, as well as when the production correspondence involves multiple inputs.

2 - Multiple Variable Proportionality in Data Envelopment Analysis
Wade D. Cook, York University, Toronto, ON, Canada, wcook@schulich.yorku.ca, Joe Zhu

Data envelopment analysis (DEA) provides an optimization methodology for deriving an efficiency score for each member of a set of peer decision making units. Under the original DEA model of Charnes, Cooper and Rhodes (1978) it was assumed that there are constant returns to scale (CRS). This idea was later extended by Banker, Charnes and Cooper (1984) to the more general case that allowed for variable returns to scale (VRS). In both of these structures, it is assumed that the returns to scale (RTS) classification, consistent with the classical definition, applies

to the entire (input, output) bundle. In many settings it can be the case that the output bundle can be separated into distinct subgroups or business units wherein an RTS-type behavior may be different for one subgroup than for another. We refer to such situations as involving multiple variable proportionality (MVP). Examples of MVP occur when there are different product groupings in a manufacturing facility, different wards in hospitals, and so on. Identification of such differential behavior can provide management with important insights regarding the most productive proportionality size (MPPS) in each of those components. In the current paper we introduce DEA-based tools that address those situations where MVP exists.

3 - How to Test the Effects of Operational Conditions and Practices on Productive Performance?

Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

Johnson and Kuosmanen (2009) developed a new method for the joint estimation of nonparametric DEA-style production frontiers and the effects of contextual variables, which is root-n consistent and asymptotically efficient. This paper explores the practical aspects of statistical inferences: computation of standard errors, significance tests, and confidence intervals. We show how total inefficiency can be decomposed to the components explained by the context and the unexplained inefficiency.

■ SD72

H - Salon J, 6th Floor

Network Reliabilty and Travel Behavior Under Uncertainty

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

1 - A Lagrangian Substitution Based Approach for Finding the Most Reliable Path with Strong Spatial Correlation

Tao Xing, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, tao.xing@utah.edu, Xuesong Zhou

This talk presents a lower bound-based approach for finding the most reliable path with possible strong spatial correlations. A Lagrangian substitution method is implemented with heuristic updating technique to reformulate the non-additive and non-convex problem and to reduce the gap between the close-to-optimal solution and the lower bound.Furthermore, we propose a stochastic sampling-based solution algorithm to incorporate the weak or strong spatial correlation among link travel times.

2 - Understanding the Impact of Network Supple Changes to Departure Time and Route Choice Through a Dynamic Traffic Assignment Approach

Shuo Wang, University of Arizona-Tucson, Tucson, AZ, United States of America, wangshuo@email.arizona.edu, Mark Hickman, Yi-Chang Chiu

This talk presents a departure and route choice model and algorithm for integrated corridor management due to short-term or long-term network supply changes. By adapting departure and route choice, commuters aim to minimize their generalized cost - travel time, schedule delay and departure time difference - in the adaptation process in the dynamic user equilibrium framework.

3 - Modeling Within-day Activity Schedule Adjustment Decisions Considering Time-varying Network Conditions

Yunemi Jang, University of Arizona-Tucson, Tucson, AZ, United States of America, yunemi@email.arizona.edu, Yi-Chang Chiu

In this talk, we present a utility maximization activity schedule adjustment decision problem formulation, which captures the internal decision dynamics between activity scheduling problem and time-varying network conditions. A solution algorithm is proposed to ensure solution consistency when considering time-varying travel cost. Numerical cases are demonstrated through the integration of the DTA model DynusT.

4 - A Rule-based Model of Route Choice Under Uncertainty: Do Travelers Choose to be Reliably Congested?

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

We model travelers' route choices under network supply-demand uncertainty with a positive rule-based approach. Individual decision-making processes with regard to route search and route choice are modeled with a consistent set of empirically derived if-then rules. Results show that the impacts of supply- and demand-side uncertainties on travel time variability are not additive. While many travelers search for alternative routes under network uncertainty, much fewer travelers actually change routes. Findings also suggest that travelers' behavioral rules lead to reduction in travel time variability, but not always reduction in absolute travel time - it appears that they end up with a reliably-congested travel experience.

■ SD73

H - Salon K, 6th Floor

Vehicle Routing III: Other Talks on Vehicle Routing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca

1 - Unfeasible Solutions Management in Vehicle Routing Problems with Hard Time Windows

Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca, Teodor Gabriel Crainic, Thibaut Vidal, Christian Prins

Recent heuristics for the vehicle routing problem with time windows often rely on unfeasible solutions to enhance exploration of the search space. Through this talk, several relaxations and penalty frameworks as soft time-windows, allowable return in time, or flexible travel times will be analyzed. Emphasis is put on efficient local search design through theoretical and empirical analyses.

2 - Evaluating Operating Costs in Routing Problems with Fixed Appointment Times

Ashlea Bennett, Assistant Professor, University of Arkansas at Fayetteville, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ashlea@uark.edu, Behrooz Kamali, Alan Erera

In fixed appointment time routing problems, each customer must be assigned an appointment time belonging to an allowable menu of equally-spaced times. They have application in businesses that must visit their customers at fixed times when the customer is required to be present. We evaluate the costs of offering fixed appointment times, which can improve customer service at the cost of reduced route flexibility, and develop heuristics for scheduling customers at fixed appointment times.

3 - Strategic Information Collection in System-optimum Assignment and Network Routing Problems

Natalia Ruiz, The University of Texas-Austin, Austin, TX, United States of America, natiruizjuri@gmail.com

We introduce a new approach to utilizing real time information in problems involving vehicle routing on networks with stochastic arc costs. The proposed method account for the capability of vehicles to collect information as they travel, which is used to refine routing decisions online. The system expected cost becomes a result of the combination of routing costs and information impacts, in virtue of which optimal solutions may differ from, and improve upon, those derived from traditional models.

4 - The Capacitated Vehicle Routing Problem with Backhauls on Trees

Roshan Kumar, The University of Texas at Austin, 1616 Guadalupe Street, Austin, TX, 78701, United States of America, roshan@austin.utexas.edu, Travis Waller, Avinash Unnikrishnan

A special case of the Capacitated Vehicle Routing Problem (CVRP), where the network is constrained to have a tree structure, is studied here (TCVRP). We explore a variant of the TCVRP, where the nodes are divided in to two subsets - linehaul and backhaul nodes. Linehaul nodes are nodes that require delivery from the depot; and backhaul nodes have supply that needs to be picked up and transported to the depot. Also, linehaul nodes have to be serviced before backhaul nodes in any vehicle tour. We derive conditions for a lower bound on the problem and explore various properties of the problem. We formulate the problem as an Integer Program and also present an approximation algorithm which gives a feasible solution to the problem. Finally, we conduct numerical experiments to evaluate the efficiency of the proposed algorithm.

■ SD74

H - Room 602, 6th Floor

Data Fusion and Route Choice in Real Time Stochastic Networks

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Alain Kornhauser, Princeton University, 229 Sherrerd Hall (ORFE Building), Princeton, NJ, United States of America, alaink@princeton.edu

1 - Data-driven Aggregation for Path Travel Time Distribution

Ke Wan, Princeton University, 228 Sherrerd Hall (ORFE Building)., Princeton, NJ, United States of America, kwan@princeton.edu

Data driven scenario analysis and scenario-wise parameter estimation via lasso is the main methodology for path travel time distribution estimation. The scenario is explored according to available link-based observations. Within each scenario, the dependence structure between link travel times is modeled as a lagged Gaussian copula. The L1-constrain-minimization (Lasso) method is used for parameter estimation. The scheme is presented and properties of large data set are shown.

2 - Travel Time Derivatives: Market Analysis and Pricing

Ke Wan, Princeton University, 228 Sherrerd Hall (ORFE Building)., Princeton, NJ, United States of America, kwan@princeton.edu

In this paper, the travel time derivative is introduced as a new hedging tool against transportation related risk, a promising tool to achieve portfolio risk diversification, a new form of dynamic road toll to change travelers' behavior. The potential market participants are analyzed, main products are designed and models for underlying travel time process and pricing methods are introduced.

3 - Travel Time Reliability Evaluation Based on Fuzzy Logic

Xiongfei Zhang, PhD candidate, Tsinghua University,Beijing, China, 1241 Engineering Hall, 1415 Engineering Dr, Madison, WI, 53706, United States of America, xzhang223@wisc.edu, Rachel He, Min Liu, Bin Ran, Qixin Shi

This paper makes an effort to evaluate travel time reliability incorporating as many characteristics of travel time distribution as possible based on fuzzy logic. The basic rules are: (1) the larger the variance is, the more unreliable the travel time is; (2) the larger the distribution skews to the left, the more unreliable the travel time is; (3) the larger the travel times of unlucky travelers are, the more unreliable the travel time is. The proposed methodology is tested with field data.