The 16th Annual Workshop on Supply Chain and Logistics

June 2, 2023

Bilkent University
Department of Industrial Engineering
Ankara, Turkey

Program Schedule

08:40 - 09:00	Registration and breakfast
09:00 - 09:10	Opening remarks
09:10 - 10:10	"Optimization of System Reliability and Maintenance: Past, Present & Future" David W. Coit, Rutgers University/Universite Paris-Saclay
10:10 - 10:30	Coffee break
10:30 - 11:30	"Humanitarian Relief Distribution Problem: An Adjustable Robust Optimization Approach" İhsan Yanıkoğlu, Özyeğin University
11:30 - 11:50	Coffee break
11:50 - 12:20	Practice Session: "A Revenue Management Practice with Dynamic Pricing to Monetize a Highly Volatile Business" Emirhan Buğday, Invent Analytics
12:20 - 13:30	Lunch break
13:30 - 14:30	"Machine Learning-enhanced Column Generation Approach for Public Transport-based Express Shipment with Autonomous Robots" Barış Yıldız, Koç University
14:30 - 14:50	Coffee break
14:50 - 15:50	"Data-Driven Sports Ticket Pricing for Multiple Sales Channels with Heterogeneous Customers" Övünç Yılmaz, University of Colorado Boulder
15:50 - 16:10	Coffee break
16:10 - 17:10	"Disaster Resilient Cities: An OR Approach to Disaster Management" Bahar Yetiş Kara, Bilkent University

Place: Mithat Çoruh Auditorium (EB Building). Please register through the following link: https://www.eventbrite.com/e/16th-annual-workshop-on-supply-chain-and-logistics-tickets-629834370557

Optimization of System Reliability and Maintenance: Past, Present & Future

David W. Coit, Rutgers University/Universite Paris-Saclay

Abstract: It can be argued that all of engineering and all engineering disciplines are practical implementations of some form of an optimization problem. In this talk, we review the most important research advancements and contributions pertaining to optimization of complex system reliability. We discuss how research and research priorities have continually changed in response to the needs of the reliability community, and the availability of needed data and models. Although always changing and advancing, the evolution of research in this field can be loosely and chronologically classified into three eras: the Era of Rigorous Mathematics, the Era of Pragmatism, and the Era of Active Reliability Improvement. Almost from the inception of reliability as a formal engineering discipline accompanied by mathematical principles based on probability theory, there has been the desire to systematically and rigorously optimize to produce a uniquely reliable system design. Research is a continuum of conflicting and competing ideas that respond to changing and advancing ideas and research priorities. The evolution of research ideas and researchers has also naturally changed as perspectives and opinions have also changed in response to the needs, interests, and priorities of the engineering community. Considering complex system reliability optimization, the research has similarly evolved, sometimes slowly and sometimes rapidly, as a continuum of ideas as different researchers make contributions. As we look to the future, system reliability optimization is changing from a static analysis to a dynamic form of analyses responding to trends in data and machine learning; focusing more on degradation models and dependent reliability and degradation; seeking to combine design and maintenance optimization; and developing customized models for subpopulations without assuming homogeneous populations or users.

David W. Coit is a Professor in the Department of Industrial & Systems Engineering at Rutgers University, Piscataway, NJ, USA, and a Research Fellow and Visiting Professor at Universite Paris-Saclay, Paris, France. He has also been a Visiting Professor at Tsinghua University, Beijing, China. His current teaching and research involve system reliability modeling and optimization, and energy systems optimization. He has over 130 published journal papers and over 100 peer-reviewed conference papers (h-index: 61). He is currently an Associate Editor for IEEE Transactions on Reliability and Journal of Risk and Reliability and for 15 years was a Department Editor for

IISE Transactions. His research has been funded by USA National Science Foundation (NSF), U.S. Army, U.S. Navy, industry, and power utilities. His NSF grants included a CAREER grant to develop new reliability optimization algorithms considering uncertainty. He was also the recipient of the P. K. McElroy award, Alain O. Plait award and William A. J. Golomski award for best papers and tutorials at the Reliability and Maintainability Symposium (RAMS). Prof. Coit received a BS degree in mechanical engineering from Cornell University, an MBA from Rensselaer Polytechnic Institute, and MS and PhD in industrial engineering from the University of Pittsburgh, and he is a fellow of IISE.

Humanitarian Relief Distribution Problem: An Adjustable Robust Optimization Approach

İhsan Yanıkoğlu, Özyeğin University

Abstract: Management of humanitarian logistics operations is one of the most critical planning problems to be addressed immediately after a disaster. The response phase covers the first 12 hours after the disaster and is prone to uncertainties because of debris and gridlock traffic influencing the dispatching operations of relief logistics teams in the areas affected. Moreover, the teams have limited time and resources, and they must provide equitable distribution of supplies to affected people. This paper proposes an adjustable robust optimization approach for the associated humanitarian logistics problem. The approach creates routes for relief logistics teams and decides the service times of the visited sites to distribute relief supplies by taking the uncertainty in travel times into account. The associated model allows relief logistics teams to adjust their service decisions according to revealed information during the process. Hence, our solutions are robust for the worst-case realization of travel times but still more flexible and less conservative than those of static robust optimization. We propose novel reformulation techniques to model these adjustable decisions. The resulting models are computationally challenging optimization problems to be solved by exact methods, and hence we propose heuristic algorithms. The state-of-the-art heuristic, which is based on clustering and a dedicated decision rule algorithm, yields near-optimal results for medium-sized instances and is scalable even for large-sized instances. We have also shown the effectiveness of our approach in a case study using a data set obtained from an earthquake that hit the Van province of Turkey in 2011.

İhsan Yanıkoğlu holds a B.Sc. (2007) and an M.Sc. (2009) degree in Industrial Engineering from Bilkent University. He also holds an M.Phil. (2010) and a Ph.D. (2014) degree in Operations Research and Econometrics from Tilburg University. His research interests primarily lie in optimization, particularly in robust, stochastic, and discrete optimization. Over the last 4-5 years, he has devoted his research to developing practical robust optimization methodologies and their applications.

Practice Session: A Revenue Management Practice with Dynamic Pricing to Monetize a Highly Volatile Business

Emirhan Buğday, Invent Analytics

Abstract: This presentation explores a revenue management practice that leverages an approach that involves adjusting prices dynamically in response to changes in demand, availability, and other market conditions, utilizing machine learning. The session will commence with an overview of the application, emphasizing its advantages with examples from the airline cargo industry. Subsequently, the speaker will address the challenges associated with developing a robust and real-time pricing engine to support this practice. The discussion will further delve into the details of how machine learning techniques are used to analyze historical data and predict future demand.

Emirhan Buğday is an Associate Data Science Manager at Invent Analytics. He leads and collaborates in designing and developing cutting-edge, cloud-based machine learning solutions for the retail and airline industries. By utilizing state-of-the-art technologies, he addresses a variety of complex business problems, including demand forecasting, segmentation, assortment optimization, and pricing. He holds Bachelor's and Master's degrees in Industrial Engineering from Bilkent University.

Machine Learning-enhanced Column Generation Approach for Public Transport-based Express Shipment with Autonomous Robots

Barış Yıldız, Koç University

Abstract: Growing urbanization, exploding e-commerce, rising customer expectations, and the importance of the environmental impact of transportation create an urgent need for innovative last-mile delivery solutions. In this work, we explore a new express shipment model that combines the public transport-

based last-mile delivery concept with automated parcel lockers and Autonomous Robots (AR), and study its real-time management. Considering dynamic demand arrivals with short delivery time promises (e.g., two-three hours), we propose a rolling horizon framework and devise a machine learning-enhanced Column Generation (CG) methodology to solve the real-time system management problem with high-quality solutions in a short computation time. The results of our numerical experiments with real-world delivery demand data show the significant potential of the proposed system to reduce vehicle traffic, emissions, and noise. Our results also reveal the efficacy of the learning-based CG methodology that can provide almost the same quality solutions as the classical CG approach with much less computational effort.

Barış Yıldız received his Ph.D. from Bilkent University Industrial Engineering Department in 2016. He holds an M.S. degree in Operations Research from U.S. Naval Postgraduate School and a B.S. degree in Systems Engineering from the Turkish Army Academy. He joined Koc University Industrial Engineering Department in 2016 as a faculty member. His research focuses on network design and management problems in telecommunication and transportation networks that appeared in prestigious journals, including Operations Research, Transportation Science, Transportation Research Part B, C, E, and EJOR. Dr. Yıldız is the recipient of the 2018 INFORMS SOLA Best Dissertation Award and the 2019 Turkish Science Academy BAGEP award. His research has been supported by several national and international grants.

Data-Driven Sports Ticket Pricing for Multiple Sales Channels with Heterogeneous Customers

Övünç Yılmaz, University of Colorado Boulder

Abstract: Sports teams face challenges in maintaining or increasing ticket sales levels. With the growth of analytics, they aim to implement data-driven pricing techniques to improve gate revenues; however, they do not have state-of-the-art demand estimation and price optimization tools that take into account the range of valuations across different seat sections and opponent match-ups. Partnering with a college football team, we develop a data-driven pricing tool which (1) segments customers in two sales channels, using transaction-level data and anonymous customer profiles; (2) explores the decision-making process of different customers within these segments using the Multinomial Logit and Mixed Multinomial Logit frameworks; and (3)

computes optimal or near-optimal prices subject to some business constraints enforced by the team management. In addition, our method takes the sequential arrivals of customers and the capacity constraints of seat categories into account. Our estimation results show that customers differ significantly in their sensitivities to price and distance to the field within each segment, in addition to the differences across segments. We also observe that customers become less likely to choose a seat category as its remaining inventory falls below a certain point. By analyzing different policies, we show that price optimization could increase revenue by as much as 7.6%. In addition, better categorization of games and further refinement of seat category differentiation and related pricing may help further boost this figure up to 11.9%.

Övünç Yılmaz is an assistant professor of Operations at the Leeds School of Business at the University of Colorado Boulder. His area of interest is Revenue Management and Pricing, particularly innovative RM applications in the airline, hotel, and event industries. His research has been published in leading journals such as Management Science, Manufacturing & Service Operations Management, and Journal of Operations Management. Before joining Leeds in 2020, Yilmaz was an assistant professor at the Mendoza College of Business at the University of Notre Dame. He completed his PhD studies at the Moore School of Business, University of South Carolina. He also has an MS degree in Operations Research from the University of North Carolina at Chapel Hill and a BS degree in Industrial Engineering from Koc University.

Disaster Resilient Cities: An OR Approach to Disaster Management
Bahar Yetiş Kara, Bilkent University

Abstract: There have been decades of research in the field of humanitarian logistics, and academics in the field of logistics are becoming more and more interested in it. That being said, we still acquire insight and identify new problems with each disaster. We have observed various distribution logistics applications during Covid-19, e.g., for PCR test sites and vaccination centers. Unfortunately, the recent earthquake in Turkey has led us to re-evaluate the response cycle of disaster management. Close inspection reveals that this response phase actually leads to a variety of new applications of distribution logistics problems. We have conducted many meetings and workshops with municipalities that were very active during the response of the Maraş Earthquakes. Many municipalities aim to have “earthquake resistant cities” with correct action plans and be ready for potential disasters. Based on our

discussions with these municipalities, we have developed an "ideal action plan." We also investigated the potential decision problems and linked these problems with OR literature.

Bahar Yetiş Kara is a Professor in the Department of Industrial Engineering at Bilkent University where she has been a faculty member since 2001. Dr. Kara holds an M.S. and Ph.D. degree from Bilkent University Industrial Engineering Department, and she worked as a Postdoctoral Researcher at McGill University in Canada. Since 2021, she has served as Department Chair at Bilkent University Industrial Engineering Department. Dr. Kara's current research interests include distribution logistics, humanitarian logistics, hub location and hub network design. She is one of the founders and a member of the executive board of the EURO Working Group on Humanitarian Operations (HOpe). She is also a member of the senate and executive board of Bilkent University and of Turkish OR Society. Dr. Kara editored 4 books and authored/co-authored more than 80 journal and conference papers. Since 2001, Dr. Kara has received many research grant fundings from many academic and industrial organizations including The Scientific and Technological Research Council of Turkey (TÜBİTAK), The Inter Academy Panel (IAP), and United Kingdom Research and Innovation. Dr. Kara holds "Best Dissertation Award" given by INFORMS-UPS-SOLA (2001), TUBA-GEBIP (National Young Researchers Career Development Grant) reward (2008), IAP Young Researchers Award (2009), and TÜBİTAK Young Scientist Incentive Award (2010). She is currently working as an associate editor of Transportation Research - Part B, Journal of Operational Research Society, IIE Transactions, and Socio-Economic Planning Sciences.

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