“Distributionally Robust Facility Location Problem Under Decision-Dependent Stochastic Demand”

Abstract: While the traditional facility location problem considers exogenous demand, in some applications, locations of facilities could affect the willingness of customers to use certain types of services, e.g., carsharing, and therefore they also affect realizations of random demand. Moreover, a decision maker may not know the exact distribution of such endogenous demand and how it is affected by location choices. In this study, we consider a distributionally robust facility location problem, in which we interpret the moments of stochastic demand as functions of facility-location decisions. We reformulate a two-stage decision-dependent distributionally robust optimization model as a monolithic formulation, and then derive exact mixed-integer linear programming reformulation as well as valid inequalities when the means and variances of demand are piecewise linear functions of location solutions. We conduct extensive computational studies, in which we compare our model with a decision-dependent deterministic model, as well as stochastic programming and distributionally robust models without the decision-dependence assumption. The results show superior performance of our approach with remarkable improvement in profit and quality of service under various settings, in addition to computational speed-ups given by formulation enhancements. These results draw attention to the need of considering the impact of location decisions on customer demand within this strategic-level planning problem. In addition to this study, in this talk, we present the application of distributionally robust optimization to the resource distribution problem with capacity, inventory and distribution considerations, under spatiotemporal uncertainties of disease spread with a case study over COVID-19 test kit and vaccine distribution problem, in comparison to deterministic and stochastic approaches, and current practices.

Biography: Beste Basciftci is currently an Assistant Professor at the Dept. of Business Analytics at the Tippie College of Business at the University of Iowa. She obtained her PhD in Operations Research from H. Milton Stewart School of Industrial and Systems Engineering at Georgia Institute of Technology, with a minor in Statistics. She received her bachelor’s degrees in Industrial Engineering and Computer Engineering from Bogazici University with High Honors. She also holds a master’s degree in Industrial Engineering from Bogazici University. She is broadly interested in data-driven decision-making problems under uncertainty. Methodologically, her research focuses on developing mixed-integer, stochastic programming and distributionally robust optimization approaches to operations research related problems, specifically for applications in energy systems, supply chains, smart city operations, predictive asset management and mobility. Her research also involves developing and integrating statistical modeling and business analytics approaches to optimization framework. She is honored to receive prestigious awards with her research, including the INFORMS ENRE (Energy, Natural Resources and the Environment Section) Best Student Paper Award, ISE Transactions Best Paper Award in Focus Issue of Operations Engineering & Analytics, and Georgia Tech ISyE Alice and John Jarvis Research Award.