NORTH CAROLINA STATE UNIVERSITY

OPERATIONS RESEARCH PROGRAM
SEMINAR SERIES

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4:30PM-5:45PM

In-Person: 2321 Fitts-Woolard Hall

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Title
OR-based Industry Use Cases

Abstract

Mathematical optimization can help business leaders make better decisions in every aspect of their business. The Analytics Center of Excellence at SAS work closely with customers across various industries to solve customized optimization and machine learning problems. This talk will provide an overview of some of the challenging use cases that the team has successfully completed and discuss some technical details about two of them.

Use Case 1:

A subset of students with disabilities in the Boston Public Schools (BPS) system require a designated monitor (supervisor) to ride the school bus with them. Monitors ride several bus routes on a given day. BPS constructs packages of routes for monitors to make their bids at the beginning of each academic year, with a goal of maximizing the number of routes per package to make the packages more attractive to monitors, while securing full coverage of student needs. Each year, BPS manages approximately 3500 routes scheduled for 625 buses and about 1350 students requiring different types of monitors. Building packages manually can take at least one week and can lead to less-than-desirable packages. SAS has been working with BPS since 2018, formulating this complex problem using mathematical programming and Operations Research (OR) techniques. The initial pure Mixed Integer Linear Programming (MILP) approach resulted in a

model with 11 million binary variables and 2.6 million constraints. To improve performance, SAS has since reformulated with an innovative integer multicommodity network flow model approach, obtaining a total run time of 20 minutes. Results provided by SAS have been used as guidance in the BPS packaging process in 2019 and 2021.

Use Case 2:

Most middle mile planning use cases involve vehicle routing where the objective is usually to minimize the distance traveled by the delivery trucks. However, several other business requirements may include time window for pick-ups/drop-offs, classification of trucks (capacity, liftgate, length, etc.), and so on. A customized algorithm will be explained that uses column generation and mixed integer linear programming to improve an initial heuristic solution generated using an open-source software.

Biography

I have been working as an Operations Research Specialist in the Analytics Center of Excellence at SAS Institute for the past few years. I work with customers from a variety of industries to help develop data-driven solutions to optimize their business operations. I have a PhD in Industrial Engineering from North Carolina State University (Go Wolfpack!) with a focus on Operations Research. Aside from classical OR techniques, I have experience in Artificial Intelligence/Machine Learning and Full-Stack Web Development.