Center for Supply Chain Research

The Probabilistic Traveling Salesman Problem with Deadlines

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Abstract

Abstract: In recent years, there has been tremendous growth in time-definite delivery services for truckload, less-than-truckload (LTL), and small package delivery companies. The most common example of these services would be the next-day and second-day package delivery featured by United Parcel Service (UPS) and FedEx. Because of limited enabling technology and high cost, many high-volume delivery companies employ a pre-planned route, or a priori route, which specifies an ordering of all possible customers that a particular driver may need to visit. The driver then skips those customers on the route who do not receive a delivery. Despite the common usage of a priori routes, the consideration of time constraints in a priori route construction is strikingly absent in the academic literature. We take the first steps in this direction by introducing the probabilistic traveling salesman problem with deadlines (PTSPD). The PTSPD is an extension of the well-known probabilistic traveling salesman problem (PTSP) which finds a minimum expected cost a priori tour through a set of customers N = {i |1, ..., n} with probabilities P = {p_i | 1,..., n} of requiring service on any given day. In the PTSPD, associated with each customer i will now be a deadline l_i. One of the challenges in modeling the PTSPD is defining what it means to violate a deadline in a stochastic environment. We present a series of models representing different ways in which time-deadline violations can be measured and addressed in a stochastic environment. The first two are recourse models, while the third is a chance-constrained approach. Special cases that simplify the models will also be presented, along with a discussion of recent developments in solving PTSPs.

Biography

Biographical Sketch: Ann Melissa Campbell is an Assistant Professor in the Department of Management Sciences at the Tippie College of Business, University of Iowa. She holds BAs in Economics and Computational and Applied Mathematics from Rice University and a PhD in Industrial and Systems Engineering from Georgia Institute of Technology. Dr. Campbell's current research interests are in logistics applications, such as inventory routing problems, hub location and transportation network design, probabilistic routing, and routing and pricing problems emerging from e-commerce.

Center for Supply Chain Research

The center is an inter-disciplinary initiative by faculty from Economics, Computer Science, Industrial Engineering, Operations Management, Mathematics, and Transportation with common interests in the design, operations, logistics and economics of supply chains.

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- To enhance the national and international visibility of supply chain research at the University of Minnesota.
- To enhance industry outreach and educational programs through short courses, degree certificates, and industry-based projects.

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