THE SIXTH ANNUAL ALAN J. GOLDMAN LECTURE

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Friday, November 12, 2004
110 Maryland Hall
Lecture: 11:00 a.m.
Reception to follow
in 304 Whitehead Hall

THE DANCE OF THE THIRTY-TON TRUCKS:
DEMAND DISPATCHING IN A HIGHLY DYNAMIC ENVIRONMENT

Abstract

The real-time delivery of non-perishable goods with predictable demands and delivery times in real time remains a challenging problem. In the concrete industry, the challenges are dramatically increased because overbooking coupled with a dynamic environment results in more than 90% of orders being modified during the day of delivery. Weather and traffic conditions alter the expected travel time. In addition, multi-truck orders must be completed once they are started. To make matters worse, concrete will harden in the truck in as little as two hours while traffic in the D.C. area can create enormous traffic tie-ups. When a truck arrives at a customer site, the customer may not be ready for the delivery or a storm may negate the ability to use the concrete. In this environment, orders can be cancelled or delayed, and/or the order amount can be modified.

To solve this problem, we create a decision support tool consisting of both planning and execution modules. These modules assist customer service representatives in their determination as to whether to accept or reject an order. Other modules help dispatchers in evaluating thousands of possible delivery alternatives. This talk describes the series of optimization problems that are required to implement this decision support tool. We discuss the implications of imperfect data, and describe some of the implementation tricks that assist us in satisfying the real-time requirements. The foundation for the solution is a time-space network. We use a multitude of alternatives that allow for late start times and/or allow the “stretching” of the inter-arrival times for the delivery of an order. Choosing at most one of the multitude of alternatives for each delivery adds restrictive integrality constraints to the network model. The optimization problem determines whether new orders should be accepted, when drivers should arrive for work, the scheduling of all orders, the real-time assignment of drivers to delivery loads, the dispatching of these drivers to customers and back to plants, and the scheduling of plants. Most of these activities are performed using exact optimization techniques.

(This is joint work with Martin Durbin of the Optimization Solutions Group at Decisive Analytics Corporations in Arlington, Virginia.)

Please see the next page for a short biography of the speaker.
Karla L. Hoffman

Karla Hoffman is a Professor in the Systems Engineering and Operations Research Department in the School of Information Technology and Engineering at George Mason University where she was Chair for five years ending in 2001. She received her B.S. in mathematics from Rutgers University in 1969, and an M.B.A. and a D.Sc. in Operations Research from the George Washington University in 1971 and 1975, respectively. Previously, she worked as a mathematician in the Operations Research Department of the Center for Applied Mathematics at the National Institute of Standards and Technology (NIST) where she served as a senior consultant to a variety of government agencies. In 1984, she was awarded the Applied Research Award of the NIST for her research in solving large combinatorial optimization problems. The same year, she received the Commerce Department Silver Medal Award for meritorious service. In 1989, Dr. Hoffman received the Distinguished Faculty Award of George Mason University. In 2002, she received the Fellows Award of the Institute for Operations Research and the Management Sciences (INFORMS).

Dr. Hoffman was President of INFORMS in 1999 and previously served both as Treasurer and as chair of the Investment Committee of INFORMS. She has also served as Treasurer of the Operations Research Society of America, and has been on the Executive Committee of the Mathematical Programming Society. She has served as chair of various committees for each of these societies.

Dr. Hoffman’s primary area of research is combinatorial optimization. She currently serves as a consultant to the FCC on combinatorial auctions for the allocation of spectrum and is co-director of an FAA project on auction design for the allocation of arrival and landing slots at airports. She consults to a variety of Fortune 500 companies on real-time scheduling and routing problems. Her research focuses on the development of new algorithms and models for the solution of complex industrial problems.