NETWORK PROGRAMMING

MATH 8440

Course Description:

A presentation of network flow models and optimization algorithms. Topics include pure, generalized, integer, and constrained network problems, plus special cases of each, including transportation, assignment, shortest-path, transshipment, and multicommodity. **3 credits**

Prerequisites:

Math 4300/8306

Overview of Content and Purpose of the Course:

A theoretical and applied treatment of network flows designed to prepare students for further study in the area or for industry implementation.

Anticipated Audience/Demand:

Graduate students in mathematics, computer science, and engineering.

Major Topics:

1) **Brief Review of Linear Programming**
   a. Primal Simplex
   b. Duality
   c. Optimality Conditions

2) **Transportation Problem**
   a. Model
   b. Applications
   c. Transportation Simplex Method

3) **Assignment**
   a. Model
   b. Applications
   c. Hungarian Algorithm

4) **Minimum Cost Network Flow Problem**
   a. Model
   b. Applications
   c. Network Simplex Method
   d. Out of Kilter Algorithm

5) **Shortest Path Problem**
   a. Model
   b. Applications
   c. Dijkstra's Algorithm

6) Maximum Flow Problem
   a. Model
   b. Applications
   c. Minimum Cuts
   d. Augmenting Path Algorithm
   e. Preflow-Push Algorithm

7) Multicommodity Flow Problem
   a. Model
   b. Applications
   c. Simplex-Based Decomposition Algorithms

8) Network with Side Constraints Problem
   a. Model
   b. Applications
   c. Relaxation methods
   d. Simplex-based decomposition methods

Methods:

This course will be presented by lecture and class discussion.

Student Role:

Students must attend and participate in class and must complete the course requirements.

Textbook:

R. Ahuja, L. Magnanti, and J. Orlin. *Network Flows,* Prentice Hall, 1993.

J. Evans and E. Minieka. *Optimization Algorithms for Networks and Graphs,* Dekker, 1992.

F. Glover, D. Klingman, and N. Phillips. *Network Models in Optimization and Their Applications in Practice,* Wiley: Interscience, 1992.

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