

IEMS 482: Routing and Scheduling Spring 2006

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Class Time and Location: MW 9:00-10:20 (Tech M228)

COURSE DESCRIPTION

This course will provide an introduction to modeling and solution methods for vehicle routing and scheduling problems. While examples will be drawn mainly from vehicle routing applications, the methods presented are also useful in the analysis of other routing and scheduling problems. The course is encouraged for all students interested in transportation, both in IEMS and civil engineering.

LEARNING OBJECTIVES

1. To introduce students to modeling and formulation techniques for a variety of routing and scheduling problems;
2. To introduce students to methods for the development and assessment of solution approaches for these problems;
3. To expose students to recent research in routing and scheduling problems; and,
4. To engage students in an in-depth research project.

PREREQUISITES

Students are expected to have completed some coursework in mathematical programming, large-scale optimization and logistics [at least one of the following: 450, 454, or 480; or consent of the professor]. In addition, students should be familiar with some high level programming language.

COURSE MATERIALS

Recommended text: Paolo Toth and Daniele Vigo (2002), “The Vehicle Routing Problem”, SIAM Discrete Mathematics and Applications 9.

Available either at Norris or online: www.siam.org has a winter sale price of \$76 until 4/14/06 subject to availability.

Other reference texts include:

1. Ahuja, R. K., T. L. Magnanti and J. B. Orlin (1993); *Network Flows: Theory, Algorithms and Applications*; Prentice Hall.

2. Ball, M.O., Magnanti, T.L., Monma, C.L., Nemhauser, G.L., eds. (1995); *Network Routing. Handbooks on Operations Research and Management Science*; Elsevier.
3. Golden, B. L. and A. A. Assad, eds., (1988); *Vehicle Routing: Methods and Studies*; North Holland.
4. Lawler, E. L., J. K. Lenstra, A. H. G. Rinnooy Kan, and D. B. Shmoys (1985); *The Traveling Salesman Problem: A Guided Tour of Combinatorial Optimization*; John Wiley & Sons, Ltd.
5. Laporte G., Gendreau M., Potvin J-Y, Semet F. (2000); *Classical and modern heuristics for the vehicle routing problem*; International Transactions in Operational Research, Volume 7, Numbers 4-5, pp. 285-300(16).

In addition, related journals include: Operations Research, Management Science, Transportation Science, Transportation Research, IIE Transactions, Interfaces (for applications), Naval Research Logistics.

Online bibliography at <http://www.sintef.no/static/am/opti/projects/top/vrp/bibliography.html>

COURSE ASSESSMENT

The main requirement of this course is a term-long paper in which students will look at a specific routing or scheduling problem (possibly related to their research). As described below, the process of writing this paper will be interactive and will involve input from both the professor and the other students throughout the quarter.

1. Presentations (10% each).
 - First presentation: Overview of proposed problem; review of 3-5 related publications in the literature
 - Second presentation: Describe initial problem formulation and potential solution approaches
 - Final presentation: Summarize the key findings of the project
2. Reports (20% each).
 - Interim report: due on 4/28. The report should include the literature review, a complete description of the problem and a detailed outline of next steps. This outline should include: ideas for problem formulation and solution method, a discussion of the expected results, and the proposed organization for the final report. A discussion with the professor should be scheduled within a week, to review and refine ideas for the final paper.
 - Final paper: due on 6/5. During the 8th week of class, there will be a paper writing tutorial and students will work in groups to improve their papers. Grading will be based on three factors: the amount of imagination exhibited by the student in selecting the problem, the substance of the work itself, and the quality of the paper.
3. Peer reviews (20%). As part of the interactive paper-writing environment, each student will be required to provide feedback on the presentations and papers of other students. The professor will provide a template for the peer reviews.
4. Participation (10%). Students are expected to prepare for and actively participate in class discussions.

Course outline

<i>Week</i>	<i>Date</i>	<i>Topic</i>	<i>T&V chapter</i>	<i>Assignment</i>
1	3/27	Course overview; modeling solution approaches Variations of the VRP	Ch 1: Overview Ch 10: Applications	Develop paper ideas
2	4/3	VRP Heuristics	Ch 5: Heuristics Ch 6: Metaheuristics	Individual meetings with professor: Paper topic
3	4/10	Math programming based methods; lower bounds	Ch 4: Set covering Ch 2: Branch & bound	Work on literature review
4	4/17	Practical issues in VRP's		First presentations: Topic overview, lit review
5	4/24	Integrated routing and scheduling	Ch 7: VRPTW Ch 8: VRPB	Interim reports due: Problem description, lit
6	5/1	Inventory routing problem Periodic routing	Ch 12: IRP	Individual progress meetings with professor
7	5/8	Non-traditional applications		Second presentations: Models, solution methods
8	5/15	Paper writing tutorial		Group writing sessions
9	5/22	No class this week		Work on papers
10	5/31	Final presentations in class 5/31; papers due on 6/5		