IEOR 290L
Logistics Modeling
Fall 1998

Instructor:

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Office Hours:

Tuesday 3:00-5:00
Thursday 11:00-12:00
or by appointment.

Course Meetings:

Mon. 12:30-2:00 Room 4143 Etcheverry Hall
Wed. 12:30-2:00 Room 4143 Etcheverry Hall

Course Description:

This is an advanced course focusing on research, much of it quite recent, in the area of modeling and analysis of manufacturing and logistics systems. Many of the papers and topics we cover will be quite theoretical, and many of the models we consider will be vastly simplified versions of real systems. We will begin by exploring analytical techniques such as worst-case and average case analysis, and then consider the application of these techniques to routing, inventory, scheduling, and integrated distribution models and algorithms.

Text:

The main text for this course is:

The Logic of Logistics by Bramel and Simchi-Levi (1997: Springer)

Some of the coverage of certain topics in the text will be augmented by research papers. A tentative list of these papers is included in the list of topics at the end of this syllabus.

Class Format and Grading

This is a seminar class, so everyone is expected to participate in the teaching of the class. I will give the first series of lectures, and students will give many of the remaining lectures. Topic assignments will be made sometime during the first few weeks of class. Each lecture will consist of presentation and discussion of a specific topic, either from the textbook or from a research paper. Everyone is expected to read the appropriate material ahead of time.

In addition, there will be a course project, due at the end of the semester. The project will consist of a research proposal; you will be responsible for selecting an interesting problem, modeling the problem in a useful way, finding applicable prior research in the literature, and perhaps obtaining some preliminary results. The last few classes will be devoted to oral presentations of each project.

Final grades will be based on the lecture or lectures, and the project.

Course Topics

We will cover many of the topics contained in the textbook in roughly the same order, augmenting the text with appropriate papers. This is a tentative list of topics, many of which will take several classes to cover. Also, let me know if there are other topics which you would like to cover.

- Worst-Case Analysis
  - The Bin-Packing Problem
  - The Travelling Salesman Problem
- Average Case Analysis
  - The Bin-Packing Problem
  - The Travelling Salesman Problem
- Performance Bounds based on Mathematical Programming
- Vehicle Routing Models
  - Capacitated VRP with Equal Demands
  - Capacitated VRP with Unequal Demands

    Fisher, M., and R. Jaikumar. (1981) A Generalized Assignment Heuristic for Vehicle Routing. *Networks* **11**, pp. 109-124.

    Christofides, N., A. Mingozzi, and P. Toth. (1981) State-Space Relaxation Procedures for the Computation of Bounds to Routing Problems. *Networks* **11**, pp. 145-164.
  - VRP with Time Window Constraints

    Solomon, M. (1986) On the Worst-Case Performance of Some Heuristics for the Vehicle Routing and Scheduling Problem with Time Window Constraints. *Networks* **16**, pp. 161-174.
  - Column Generation for the VRP

    Cullen, F., J. Jarvis, and D. Ratliff. (1981) Set Partioning Based Heuristics for Interactive Routing. *Networks* **11**, pp. 125-143.

- Stochastic VRP

  Bertsimas, D. (1992) A Vehicle Routing Problem with Stochastic Demand. *Operations Research* **40** pp. 574-585.

- Vehicle Dispatching and Allocation

  Farvolden, J., and W. Powell. (1994) Subgradient Methods for the Service Nework Design Problem. *Transportation Science* **28**, pp. 256-272

- Deterministic Inventory Models

  - Constand Demand

    Elmaghraby, S. (1978) The Economic Lot Scheduling Problem (ELSP): Review and Extensions. *Management Science* **24** pp. 587-598

  - Time-Varying Demand

    Florian, M, and M. Klein. (1971) Deterministic Production Planning with Concave Costs and Capacity Constraints. *Management Science* **18** pp. 12-20.

    Baker, K.R., P. Dixon, M.J. Magazine, and E.A. Silver (1978) An Algorithm for the Dynamic Lot-Sizing Problem With Time-Varying Production Capacity Constraints. *Management Science* **24** pp.1710-1720.

- Integrated Logistics Models

  Jackson, P.L., W.L. Maxwell, and J.A. Muckstadt. (1985) The Joint Replenishment Problem with Powers of Two Restrictions. *IIE Transactions* **17**, pp. 25-32

  Anily, S., and A. Federgruen (1990) One Warehouse Multiple Retailer Systems with Vehicle Routing Costs. *Management Science* **36**, pp 92-114.

  Dror, M., and M. Ball. (1987) Inventory/Routing: Reduction from an Annual to a Short-Lived Problem. *Naval Research Logistics* **34** pp. 891-905.

- Facility Location/Allocation Models

  Pirkul, H. and V. Jayaraman. (1996) Production, Transportation, and Distribution Planning in a Multi-Commodity Tri-Echelon System. *Transportation Science* **30**, pp. 291-301.

  Geoffrion, A .M. (1972) Generalized Benders Decomposition. *Journal of Optimization Theory and Applications* **10** pp. 237-260.

  Geoffrion, A.M. and G. Graves (1974) Multicommodity Distribution System Design by Benders Decomposition. *Management Science* **20** pp. 822-844.

- Production Scheduling Models

Adams, J., E. Balas and D. Zawack (1988). The Shifting Bottleneck Procedure for Job Shop Scheduling. *Management Science* **34**, 391-401.

Hoogeveen, J.A. and A.P.A. Vestgens. (1996) Optimal on-Line Algorithms for Single Machine Scheduling. *Proceedings of the Fifth Conference on Integer Programming and Combinatorial Optimization* pp.404-414.

Kaminsky, P. and D. Simchi-Levi. (1997) Probabilistic Analysis and Practical Algorithms for the Flow Shop Weighted Completion Time Problem. To appear in *Operations Research*.