IEOR 250
Introduction to Production Planning and Logistics Models
Fall 2014

Instructor:
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Office Hours:
Tuesday 11:00-12:00
Wednesday 2:00-3:00
or by appointment.

GSI:
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TBD

Course Meetings:
Tuesday 9:30-11:00 3113 Etcheverry
Thursday 9:30-11:00 3113 Etcheverry

Course Description:
We will explore models and quantitative approaches for making a variety of strategic, tactical, and operational decisions related to logistics and production planning, including models focusing on network design, inventory planning and control, distribution planning, and as time permits, vehicle routing, production scheduling, and forecasting. Within these general areas, there are many issues and approaches, and we will only have time to cover a fraction of them, but I will attempt to give you a sense of the "big picture" before we address specific models and concepts. We will cover both relatively simple fundamental models and algorithms, as well as a selection of more advanced models and algorithms that build on this fundamental knowledge. Although we will not formally prove the effectiveness of all of the results and approaches we explore, we will prove some results in detail so that you get a flavor for this type of analysis. This semester, I will also try to focus on Excel and possibly AMPL models to illustrate some of the concepts we discuss. By the end of the course, you will have a broad understanding of the fundamental approaches used in operations management, and will be prepared to both use quantitative tools to understand logistics and production planning issues, and to read advanced literature and take advanced courses in this area.

Text:

There is no textbook for this course. However, the following books, on reserve in the engineering library, might prove useful:

Network and Discrete Location by Daskin (1995: Wiley)

Production and Operations Analysis by Nahmias (2004 plus various other editions: Irwin-McGraw Hill)

Analysis of Inventory Systems by Hadley and Whiten (1963: Prentice-Hall)

Production and Inventory Management by Hax and Candea (1984: Prentice-Hall)

The Logic of Logistics by Simchi-Levi, Chen ,and Bramel (2004:Springer-Verlag)

Scheduling: Theory, Algorithms, and Systems by Pinedo (2001: Prentice Hall)

Logistics of Production and Inventory edited by Graves, Rinnooy Kan, and Zipkin (1993: Elsevier)

Factory Physics by Hopp and Spearman (2000: Irwin- McGraw Hill)

Foundations of Stochastic Inventory Theory by Porteus (2002: Stanford University Press)

Fundamentals of Supply Chain Theory by Snyder and Shen (2011: Wiley)

Lecture Notes

There is a set of lecture notes in this course that I am constantly in the process of revising. The material is (currently) divided into 6 chapters – I will post chapters on the bSpace site before we get to the relevant material. There are typos and errors in the notes, so please let me know about any that you notice, and I'll also look for them as I prepare lectures. If there are enough corrections and additions to make it worthwhile, I will repost edited versions of the notes after we cover the material. The notes will closely track the lectures – depending on your personal learning style, you may prefer to follow along in the class notes (and take additional notes as you need to), or you may prefer to take your own notes entirely and use the lecture notes as a reference.

Assignments and Grading

There will approximately bi-weekly homework assignments. Each homework assignment must be turned in at the start of class on the assignment's due date. Homework assignments will be posted on the course's bSpace site.

There will also be a **midterm**, a **final exam**, and a **course project**.

The project can be completed individually or in groups of two or three. The project report will be due in the final week of class. Please don't wait until the last minute to begin work on the project, and be sure to discuss project ideas with me before starting to work. Although I will allow flexibility in selecting a project, I would prefer if the projects fall in one of the following two categories:

- Implementing and testing an algorithm (either one we cover in class, or a relevant algorithm from the literature).
- Extending a model and analysis from the literature. Select an existing model or algorithm which relates to the material in this class, and extend the model in a logical way. For example, add constraints to a vehicle routing problem or add a random element to a location model.

Final grades will be based on the project (15%), exam grades (35% each), and homework performance (15%).

Course Topics

I will try to get to many of the following topics, roughly in the order they are listed. Each year I try to modify the focus of the course slightly in a (typically futile) attempt to make through all of hte material. Last year, we made it through much of the material, but didn't have an opportunity to cover the scheduling material in as much depth as I would like, so this year I'll try to move a little faster through some of the earlier material in order to cover the scheduling material in more depth. The list of topics is subject to change – please let me know if there is a particular topic that you would especially like to get to.

- Overview of Logistics and Supply Chain Management
- Network Design
  - The Role of Intermediate Nodes in a Distribution Network
  - Location and Flow Models
    - Center Models
    - Covering Models
    - The Plant Location Problem and Extensions
    - Heuristics, Lagrangian Relaxation
- Single Stage Inventory Management
  - Deterministic
    - EOQ and extensions
    - Power-of-Two (Multi-Echelon, Joint Replenishment)
    - Time-varying demand
    - Capacitated Lot Sizing – Florian-Klein
  - Stochastic
    - Forecasting
    - Continuous Review
    - Single Period – the newsvendor
    - Multi-period (with and without fixed costs)
- Inventory in Multi-Echelon Supply Chains

  - Two-stage EOQ Extensions
  - Serial Supply Chains
  - Distribution Systems
  - Guaranteed Service Systems
- Production Planning and Control
  - EOQ extensions
  - Economic Lot Scheduling Problems
  - Production Scheduling
    - Single Machine Models, Algorithms, and Interchange Arguments
    - Parallel Machine Models, Algorithms, and Approximations
    - Jobshop Models and Heuristics
  - Production Planning
    - Aggregate Planning
    - MRP
    - Kanban, Conwip
- Routing Models
  - TSP approximations
  - Heuristics
- Introduction to Forecasting