IE 425: Inventory Management and Production Planning

(aka Advanced Inventory Theory)

Spring 2010

Syllabus

Instructors: Prof. Larry Snyder and Zümbül Bulut

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Class Meetings: T Th 2:35–3:50 PM, Mohler 375

Office Hours: Larry: T 1:00–2:00 PM, F 1:30–2:30 PM; Zümbül: W 10:00–11:00 AM, Th 1:00–2:00 PM; and by appointment

Course Description: This course will provide an in-depth study of classical models for inventory management and their extensions. We will study both deterministic and stochastic inventory models, with more emphasis on the latter. Although many of the topics we will cover are of great interest to managers, our focus will be not on practice but on theory.

The goals of this course are to provide students with:

1. a thorough understanding of classical inventory models like the EOQ, newsboy, (r, q), and base-stock models
2. a set of quantitative tools for analyzing the costs of and optimal solutions for various inventory policies
3. an understanding of the relationships among the classical models, and of which is most applicable for a given setting
4. a thorough knowledge of the approaches to multi-echelon inventory systems that have been proposed in the literature
5. a sampling of the more complex models that have been developed using classical models as a basis

Prerequisites: IE 111, 339, or an equivalent probability course, or the consent of the instructors

Reading: The following textbook is required for the course:

- Zipkin, Paul H. *Foundations of Inventory Management.* Boston: McGraw–Hill, 2000.

This book is available at the Lehigh bookstore, or on-line.

You may also wish to consult the following books:

- Axsäter, Sven. *Inventory Control*, 2nd ed. Norwell, MA: Kluwer, 2006.
- Porteus, Evan L. *Foundations of Stochastic Inventory Theory.* Stanford, CA: Stanford University Press, 2002.
- Silver, Edward A., David F. Pike, and Rein Peterson. *Inventory Management and Production Planning and Scheduling*, 3rd ed. Hoboken, NJ: Wiley, 1998.
- Simchi-Levi, David, Xin Chen, and Julien Bramel. *The Logic of Logistics: Theory, Algorithms, and Applications for Logistics Management*, 2nd ed. New York: Springer–Verlag, 2004.

Requirements:

1. Homework assignments

   You will be assigned homework every few weeks. The homework problems will be based on the readings and in-class material. They will challenge you to understand, interpret, and extend the models and solution techniques we discuss in class.

2. Final exam

   You will be given a final exam in take-home format that will test your understanding of the material covered in class. You will have 1 week to complete the exam and may use books, notes, and any other sources, except people (other than us). The exam will be handed out on the last day of class (Thursday, April 29) and will be due one week later.

3. Research project [Ph.D. students only]

   You will be required to complete a research project on a topic of your choosing. You may, for example, develop a new model for some topic in inventory management, perform a computational study, develop a simulation model, extend a model we discussed in class in some novel way, etc.

   During the last week of class, we will hold a mini-conference during which you will present your research. In addition, you will be required to submit a 6-page paper to be distributed as part of a proceedings for our conference. The paper will be due on Tuesday, April 27. You will be required to submit a short proposal for your project several weeks into the semester. This will provide us with an opportunity to give you early feedback before you embark on your project. In addition, you will be expected to meet with Zümbül regularly during the semester to discuss your ongoing work on your project.

4. Class participation

   You are expected to attend class regularly, come to class prepared, participate in the discussions we have in class, and ask questions when you are confused.

Your grade will be calculated as follows:

Item	M.S. Students	Ph.D. Students
Homework assignments	40%	30%
Final exam	35%	25%
Research project	—	25%
Class participation	25%	20%

Homework Policy: The homework assignments are likely to take you a fair amount of time, so get started on them early. *No late homework assignments will be accepted unless you clear them with us ahead of time.*

Cooperation on homework assignments is encouraged. However, each student must turn in a separate write-up. Moreover, when you write up your homework, *you may not look at anything you wrote down while you were working with your classmates.*

You must cite any people or sources that helped you on a particular problem. For example: "Friendly McPal and I worked on this problem together" or "I got help from Smarty McPants and consulted 'EOQ for Dummies' when solving this problem." We also encourage you to come to us for help when you are stuck.

CourseSite: We will use the new CourseSite system (`coursesite.lehigh.edu`) to post readings, homework assignments and their solutions, and other information about the course. Please check there regularly for updates.

Plagiarism Policy: Plagiarism is defined in the Lehigh student handbook as "the unacknowledged appropriation of another's work, words, or ideas in any themes, outlines, papers, reports, or computer programs." This includes "patchwork plagiarism," in which an author essentially quotes another author's work when attempting to paraphrase it. There will be a zero-tolerance approach to plagiarism in this class—plagiarized assignments will receive a grade of 0. For more information about what plagiarism is and what counts as plagiarism, see `www.lehigh.edu/library/guides/PlagiarismStudent.html`.

***Tentative* Course Outline:**

Introduction and Single-Echelon, Deterministic Models

Week of January 18: Introduction, types of inventory models, the EOQ model and extensions.
Reading: Chapters 1–2, Sections 3.1–3.5

Week of January 25: EOQ w/imperfect quality, DEL model.
Reading: Sections 3.6, Chapter 4 (skim)

Multi-Echleon, Deterministic Models

Week of February 1: Independent and serial systems.
Reading: Sections 5.1, 5.3

Week of February 8: Serial systems (cont'd).
Reading: Section 5.3 (cont'd)

Single-Echelon, Stochastic Models

Week of February 15: Policy evaluation.
Reading: Sections 6.1–6.2

Week of February 22: Policy evaluation (cont'd).
Reading: Section 6.2 (cont'd)

Week of March 1: Approximations.
Reading: Section 6.4

Week of March 8: [*Spring Break*]

Week of March 15: Optimization.
Reading: Section 6.5

Week of March 22: Optimization (cont'd).
Reading: Section 6.5 (cont'd)

Multi-Echelon, Stochastic Models

Week of March 29: Independent and serial systems (the Clark-Scarf model).
Reading: Sections 8.1–8.3

Week of April 5: The Clark-Scarf model (cont'd).
Reading: Section 8.3

Policy Optimization

Week of April 12: Introduction, linear order costs.
Reading: Sections 9.1–9.4

Week of April 19: Linear order costs (cont'd), fixed-plus-linear order costs.
Reading: Section 9.4–9.5

Mini-Conference

Week of April 26: 2010 IE 425 Mini-Conference on Inventory Theory.