IE 425: Advanced Inventory Theory
Spring 2007

Syllabus

Instructor: Prof. Larry Snyder

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Class Meetings: MW 4:10–5:25 PM, Mohler 451

Office Hours: T 2:00–3:30 PM, W 1:00–2:30 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 and optimal solutions for such policies
3. an understanding of the relationship 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 instructor

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*. Norwell, MA: Kluwer, 2000.
- 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 (35%)

   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. Project (20%)

   The course project will have both a computational and a writing component. I will discuss the project in more detail early in the semester. I will suggest some sample formats (e.g., perform a simulation experiment related to a model we have studied, write a literature review, write a "digested" version of a journal article), but you may also suggest your own if you wish. The project will be due on the final day of class.

   The project is optional for Master's students.

3. Final exam (25%)

   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 me).

4. Class participation (20%)

   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.

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 me ahead of time.*

Cooperation on homework assignments is encouraged; however, each student must turn in a separate write-up. 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." I also encourage you to come to me for help when you are stuck.

Blackboard: I will use the Blackboard system to post readings, homework assignments and their solutions, and other information about the course. Please check there regularly for updates.

Electronic Submission: All written work, including homework assignments, the project, and the final exam, must be submitted electronically using Blackboard. I prefer pdf files, but Microsoft Word files are acceptable as well. There are at least three methods for creating pdf files:

1. Write your document in LaTeX and create a pdf file using `pdflatex`, `dvipdfm`, or another method provided by your LaTeX implementation. If you do not already know how to use LaTeX, I can send you a short overview. I strongly encourage you to learn how to use LaTeX if you do not use it already, since it is a critical skill for researchers in engineering.
2. Write your document in Word and "print" the document to a pdf file using Adobe's pdf print driver, which is available from Adobe's web site or from Lehigh's software download site.
3. Write your document by hand and scan it to create a pdf file. This method is acceptable but not preferred.

To submit your work, find the corresponding entry in the "Assignments" section of Blackboard. Each assignment will have a link that says "View/Complete Assignment: [*assignment*

name]." Click the link to upload one or more files and submit them to me. After I grade your work, you can go to "Course Tools," then click on "My Grades." You will see the grade you received for the assignment. Click on the grade to download your file with my comments marked on it.

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

Week of January 22: EOQ w/imperfect quality and present-value criterion, DEL model and extensions.
Reading: Sections 3.6–3.7, Chapter 4

Multi-Echleon, Deterministic Models

Week of January 29: Independent and serial systems.
Reading: Sections 5.1–5.3

Week of February 5: Tree systems, the JRP, the ELSP.
Reading: Sections 5.4–5.6

Single-Echelon, Stochastic Models

Week of February 12: Fundamentals, world-driven demand.
Reading: Sections 6.1–6.3

Week of February 19: Approximations, optimization.
Reading: Sections 6.4–6.5

Week of February 26: Optimization (cont'd), extensions.
Reading: Sections 6.5–6.7

Week of March 5: SPRING BREAK.

Stochastic Leadtimes

Week of March 12: Independent leadtimes, capacity constraints.
Reading: Sections 7.1–7.3

Week of March 19: Exogenous supply systems, leadtime distributions.
Reading: Sections 7.4–7.5

Multi-Echelon, Stochastic Models

Week of March 19: Independent and serial systems (the Clark-Scarf model).
Reading: Sections 8.1–8.3

Week of April 2: Assembly and distribution systems.
Reading: Sections 8.4–8.6

Week of April 9: Other topics.
Reading: Sections 8.7–8.8

Policy Optimization

Week of April 16: Introduction, linear order costs.
Reading: Sections 9.1–9.4

Week of April 23: Fixed-plus-linear order costs (plus other topics as time permits.)
Reading: Sections 9.5–9.8