

# IE 412: Quantitative Models in Supply Chain Management

## Spring 2008

### Syllabus

**Instructor:** Prof. Larry Snyder

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

**Office Hours:** M 2–3:30 PM, T 11–12 PM, and by appointment

**Course Description:** The purpose of this course is to study quantitative models for current topics in supply chain management (SCM). Our primary focus will be on the *theory* of supply chain management, but we will also discuss case studies that describe how these theories are put into *practice*.

The goals of this course are to provide students with:

1. a thorough understanding of problems faced by supply chain managers
2. a set of quantitative tools for addressing these problems
3. an overview of the current topics in academic research on supply chain management to serve as a basis for students' own research in the field

**Prerequisites:** IE 316 (optimization) and 339 (stochastic models), or the consent of the instructor. Although not a formal prerequisite, some previous exposure to basic inventory models (EOQ, newsboy,  $(Q, R)$ , etc.) from a previous course on inventory, production, or logistics will be very helpful—undergraduate-level coverage is fine.

**Readings:** There is no required textbook for this course; the primary “text” will be my lecture notes, which I will post on Blackboard periodically. You may also wish to consult the following books for reference throughout the course:

- Chopra, S. and P. Meindl, 2003, *Supply Chain Management: Strategy, Planning, and Operation*, 2nd ed., Upper Saddle River, NJ: Prentice-Hall.
- Simchi-Levi, D., P. Kaminski, and E. Simchi-Levi, 2003, *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies*, 2nd ed., New York: McGraw-Hill Irwin.
- Silver, E.A., D.F. Pike, and R. Peterson, 1998, *Inventory Management and Production Planning and Scheduling*, 3rd ed., Hoboken, NJ: Wiley.

- Nahmias, S., 2005, *Production and Operations Analysis*, 5th ed., New York: McGraw-Hill Irwin.
- Tayur, S., R. Ganeshan, and M. Magazine (eds.), 1999, *Quantitative Models for Supply Chain Management*, International Series in Operations Research and Management Science, Boston: Kluwer.
- Simchi-Levi, D., X. Chen, and J. Bramel, 2004, *The Logic of Logistics: Theory, Algorithms, and Applications for Logistics and Supply Chain Management*, New York: Springer.

In addition, you will be assigned journal articles that are relevant to the topics we discuss in class, and you will be required to write a short summary of the article; see below.

### 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. The exam will be handed out on the last day of class and will be due one week later. You may use books, notes, and any other sources, except people (other than me).

#### 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 SCM, 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 Monday, April 21. You will be required to submit an abstract for your presentation and paper mid-way through the semester. The abstract will provide an opportunity for you to discuss your intended research project with me before embarking on the project.

#### 4. Journal article write-ups

You will be required to write a short (roughly 1/2-page) summary of each assigned article. Your write-up should include a summary of what problem the paper is trying to solve, how the authors solve the problem, what insights are gained from the paper, and how the paper fits into the overall literature. In short, what contributions does the paper make to the literature?

You may also find it helpful to include your own personal thoughts about the paper—for example, that the solution technique might be applicable to a problem in your own

research, or that you find the assumptions bogus, or that you think a particular extension would be interesting to pursue.

The idea here is to develop a library of abstracts, in your own words, of some seminal papers in SCM, which you will find valuable in your future classes or research on the topic. Write-ups are due during the class period in which we discuss the paper. I will give you one or two class periods' notice before each write-up is due.

5. 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	35%	25%
Final exam	35%	25%
Research project	—	30%
Journal article write-ups	15%	10%
Class participation	15%	10%

**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: “Smarty McPants and I worked on this problem together” or “I got help from Smarty McPants and consulted ‘Risk Pooling 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 lecture notes, 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, journal article write-ups, the project, and the final exam, must be submitted electronically using Blackboard. The file you submit must be in pdf format. There are at least three methods for creating pdf files:

1. Write your document in  $\text{\LaTeX}$  and create a pdf file using `pdflatex`, `dvipdfm`, or another method provided by your  $\text{\LaTeX}$  implementation. If you do not already know how to use  $\text{\LaTeX}$ , I can send you a short overview. I strongly encourage you to learn how to use  $\text{\LaTeX}$  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 work 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](http://www.lehigh.edu/library/guides/PlagiarismStudent.html).

**Accommodations for Students with Disabilities:** If you have a disability for which you are or may be requesting accommodations, please contact both me and the Office of Academic Support Services, University Center 212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.

**Tentative Course Outline:** The following is a **very tentative** outline of the course. I may add, subtract, or rearrange topics as the semester progresses.

Week of	Section	Topics Covered
Jan 14	Introduction	Overview of SCM; review of inventory models
Jan 21	Risk Pooling	The risk-pooling effect; postponement
Jan 28	The Bullwhip Effect	The beer game; causes of the bullwhip effect
Feb 4		Quantifying the bullwhip effect
Feb 11	Distribution Strategies	Transshipments
Feb 18	Strategic Planning	The uncapacitated fixed-charge location problem (UFLP)
Feb 25		The Geoffrion and Graves model; the location model with risk pooling (LMRP)
Mar 3		SPRING BREAK
Mar 10		Strategic safety stock placement
Mar 17	Supply Uncertainty	Inventory models with disruptions and yield uncertainty
Mar 24		The risk-diversification effect; the reverse bullwhip effect
Mar 31		Location models with disruptions
Apr 7	Coordination	Contracting
Apr 14		Auctions
Apr 21	MINI-CONFERENCE	