IE 220: Introduction to Operations Research
Fall 2007

Syllabus

Instructor: Prof. Larry Snyder

Office: Mohler 321, phone 8-6696

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Class Hours: T-Th 1:10–2:25 PM, Mohler 451

Office Hours: W 9:00–10:00 AM, Th 2:30–4:00 PM, and by appointment. If my door is open, you're welcome to drop by, but I'd appreciate your using scheduled office hours as much as possible.

Teaching Assistant: Tolga Seyhan, `ths207@lehigh.edu`, office hours M 4:00–5:00 PM, F 11:00 AM–12:30 PM, and by appointment. Office and phone number TBA.

Course Description: This course will introduce you to deterministic and stochastic models in operations research. You will learn to formulate, analyze, and solve mathematical models that represent real-world problems. In the first two-thirds of the course, we will discuss *deterministic* models, in which no uncertainty exists. This section of the course will cover linear programming and the simplex algorithm, as well as related analytical topics. It will also introduce other types of mathematical models, including transportation, network, integer, and non-linear models. The remaining third of the course will cover *stochastic* models that handle the randomness inherent in most real systems. Topics will include Markov chains and queuing models.

Textbook: Hillier, F. S. and Lieberman, G. J. *Introduction to Operations Research*, 8th ed., New York: McGraw-Hill, 2005.

Course Scope: We will cover Chapters 1–6, 8–9, 11–12, and 16–17 of the textbook, with additional chapters added as time permits.

Prerequisites: IE 111 or Math 231 (probability and statistics).

Corequisites: You must take IE 122, Software Tools, while you are taking IE 220, unless you have taken it already.

Computers: In this class we will make extensive use of Microsoft Excel and the modeling language AMPL. You will learn both software packages in IE 122. You should download the student version of AMPL from `http://www.ampl.com/DOWNLOADS/index.html`.

Blackboard: Lecture slides, homework assignments and solutions, and other important materials will be posted on Blackboard. Please check there regularly.

Exams: You will have two one-hour in-class exams and a two-hour final exam. The final exam will be cumulative. The exams will be closed-book, closed-notes. **No make-up exams will be given,** and no credit will be given for any missed exam.

Homework: You will have regular homework assignments consisting of problems from the book.

Late Assignments: Homework assignments must be turned in during class on the day the assignment is due. **No credit will be given for any homework assignment turned in late.** If you wish to have a late assignment graded for no credit, we will be happy to oblige. I will drop your lowest homework grade from your average. This means you get one freebie—use it wisely!

Legibility: Homework must be typed or written *neatly* and with problems in the correct order. If we have difficulty reading or following your homework, we will not go to great lengths to decipher it!

Plagiarism Policy: I strongly encourage you to consult with your colleagues when you're working on homework. However, you will not understand the material thoroughly or do well on the exams unless the work that you turn in is ultimately your own. Therefore, you must write up your answers alone, and *without looking at anything you wrote down while working with your group*. This means that if you solved the problem with a friend, you're going to have to go home and solve it all over again, by yourself. If you wrote AMPL code with a friend, you're going to have to re-write it by yourself. **The work you turn in must be your own.**

In your write-up, you must cite everyone with whom you worked or consulted about each problem, as well as any books or other references (other than Hillier and Lieberman and the lecture slides) that you used to solve the problem. For example: "I worked with Friendly McPal on this assignment," or "I got help from Smarty McPants about problem #3," or "I consulted *Linear Programming for Dummies*, Section 4.2, by Dopey McBrain when solving question #2."

Any breach of this policy will be considered an act of plagiarism, and no credit will be given for such assignments. **Repeat offenses will be grounds for failure for the course.**

Re-grade Requests: If you disagree with the grade you received on a homework or exam problem, you may submit a request for that problem to be re-examined. This request must be turned in **in writing no more than 48 hours after you receive the graded assignment.** It must contain a clear explanation, in no more than one paragraph, of why you feel the grade you received is incorrect. Once we re-examine your work and decide whether to change your grade, our decision will be final.

Class Preparation and Participation: You are expected to come to class regularly and to be prepared for each class by reading the relevant sections of the textbook ahead of time. I will post slides on Blackboard in advance so that you may bring them to class if you wish. In addition, you are expected to participate in class discussions and ask questions when you are confused. A portion of your grade will be based on class participation.

Extended Absences: If you believe you will miss two or more consecutive lectures due to illness, family emergencies, etc., please contact me as early as possible so that we can develop a plan for you to make up the missed material. Under no circumstances will I give credit for missed homework or exams unless you have discussed your absence with me in advance.

Grading: Your grade will be calculated as follows:

Homework Assignments:	30%
In-Class Exams:	17.5% each (35% total)
Final Exam:	25%
Class Participation:	10%

Course Objectives: Upon completion of this course, you will be able to:

1. Formulate a real-world problem as a mathematical programming model
2. Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
3. Understand the relationship between a linear program and its dual, including strong duality and complementary slackness
4. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change
5. Solve specialized linear programming problems like the transportation and assignment problems
6. Solve network models like the shortest path, minimum spanning tree, and maximum flow problems
7. Understand the applications of, basic methods for, and challenges in integer programming
8. Solve single- and multiple-variable unconstrained non-linear optimization problems
9. Formulate a model as a Markov chain and find its steady-state probabilities
10. Model a dynamic system as a queuing model and compute important performance measures

If you have a documented learning disability and will be requesting academic accommodation for this class, please contact Dean Cheryl Ashcroft in the office of the Dean of Students, UC 212, at x84152, or by e-mail at caa4@lehigh.edu. She will establish the appropriate accommodations for you.

Tentative Course Schedule

Week of	Topic	Chapter(s)	Notes
Aug. 27	Introduction to Model Building Linear Programming	1, 2 3	
Sep. 3	Linear Programming	3	
Sep. 10	The Simplex Method	4	
Sep. 17	The Simplex Method	4–5	
Sep. 24	Duality, Sensitivity Analysis	6	
Oct. 1	Transportation and Assignment Problems	8	Exam 1
Oct. 8	Network Models	9	Pacing Break (no class T)
Oct. 15	Network Models Integer Programming	9 11	
Oct. 22	Integer Programming Non-Linear Programming	11 12	
Oct. 29	Non-Linear Programming	12	
Nov. 5	Markov Chains	16	Exam 2
Nov. 12	Markov Chains	16	
Nov. 19	Queuing Models	17	Thanksgiving Break (no class Th)
Nov. 26	Queuing Models	17	
Dec. 3	Additional Topics Review		