Spring, 2015: 90-722D Management Science I: Optimization and Multi Criteria Methods

Class Time and Location:
TR 3:00PM – 4:20PM HBH 1002
F 9:00AM – 10:20AM HBH 1002

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Syllabus is from Jon Caulkins

Course Objectives:
This course, along with its companion (90760 - Management Science II) survey a variety of management science methods that can be applied to public and non-profit sector problems. Management Science I is not a prerequisite for Management Science II; you can take either one or both and in any order. These courses have four objectives, listed in order from least to most important.

First, you should become as comfortable working with spreadsheets as you already should be with word processors. By the end of the course, firing up Excel to model and solve a simple quantitative problem should be second nature. The ability to do so will be a significant asset for you on the job market and in your career.

Second, you should learn about a variety of techniques, what they are capable of, and what their limitations are so that you can intelligently call upon management science specialists and consultants when the occasion arises in your professional life.
Third, you should acquire sufficient proficiency with a subset of these techniques that you can use them as an “end user modeler” for analyses of problems you are likely to encounter.

Fourth, you should learn how to approach, abstract, and analyze messy problems from a quantitative, analytical perspective. In short, you should be able to use the language and perspective of mathematical modeling.


Other books you might want to consult: Frederick S. Hillier and Gerald J. Lieberman’s *Introduction to Stochastic Models in Operations Research*.

Blackboard:
Course materials will be posted to blackboard ([www.cmu.edu/blackboard](http://www.cmu.edu/blackboard)). You should monitor it for announcements (e.g., changes to assignments).

Recitations:  
*The TAs will lead the recitations. They will use the class time to focus on working through problems, and use of Excel and the solver.*

Grading:  
Course grades will be based on: homework (25%), midterm exam (20%), class participation (15%), and the final exam (40%).

*Credit for class participation can be earned by engaging fully in the classroom according to one’s own learning style. Attendance is necessary to earn class participation credit. One can earn full participation credit by asking good questions, or by listening attentively and taking good notes. Students will lose credit for being a distraction to others, by reading newspapers or materials unrelated to class, or excessive sleeping.*

*We will start the semester allowing laptops to be used for taking notes. If use of laptops is becoming a distraction, and students are using them to read materials unrelated to class, laptops will no longer be allowed to be open during class.*

The homework grade will be based on the best 5 of 6 assignments. One is dropped to allow for illness, job interviews, etc.

Homework can be hand-written. (Typing formulas can be time consuming, but is of course acceptable.) HW must be neat though! TA’s cannot give points to things they cannot read. The HW assignments are to be turned in by 5:00 PM on a Monday. Late assignments will not be accepted and will receive a 0.
HW should be submitted in hard copy, not through the digital drop box. The TA’s will have a physical box in HbH Room ___ where you can submit it.

The HW can be done individually or in groups of two or three. If you work in a group: (1) you should submit one HW for the group and everyone in the group will receive the same grade on that HW; (2) you must identify all members of the group, and (3) more will be expected of group HW in terms of clarity of presentation and exposition, absence of arithmetic errors, quality of writing, etc.

Within a group you may collaborate in any way you choose, although it is a bad idea to let others do the work for you because they won’t be able to help you during tests. There should be no interaction across groups concerning homework problems. You are encouraged to discuss the readings, concepts, and other problems that are not assigned as homework, including ones that parallel the homework assignment, but you should not collaborate in any way on the problems assigned as homework. It is never permissible for a person from another group to see your homework, drafts, calculations, spreadsheets, or other computer work. Likewise, you should avoid seeing the homework of any other group, and if it is offered, you should refuse or leave the room immediately.

If there is a substantial error in grading of a homework, you may ask the TA’s for a re-grade. Please do not worry about minor issues. Each individual homework problem counts for a modest portion of the course grade. In contrast, see me if you have any concerns about the grading of an exam problem.

The exams clearly dominate your course grade, and exams in this course are hard. They demand synthesis, integration, and higher-level conceptual understanding of the material than in weekly assignments, which are designed to reinforce the week-by-week learning.

Taping or Recording Classroom Activities
No student may record or tape any classroom activity without my express written consent. If a student believes that he/she is disabled and needs to record or tape classroom activities, he/she should contact the Office of Disability Resources to request an appropriate accommodation. The university is taping the lectures, and they will be made available on blackboard.

Study Tips:
It is imperative that you read the assigned material before coming to class. Each week will cover a well-defined chunk of material and will be the basis for a homework assignment that is due the following week. Homework is due on Monday to ensure that you have time to read the new chapter before Tuesday’s class. It would be better to submit an incomplete homework than to not finish the reading before class
The key to learning mathematics is repeated exposure. It is hard to grasp new concepts from one or two exposures, no matter how intense. It is usually more fruitful to work on the material repeatedly, in small chunks and via different formats (reading the text, listening to lecture, doing HW, etc.).

Likewise, it is important to use active learning. Typically mathematical material will “make sense” when you read or hear it, but it is only when you try to use it that you find out whether you’ve actually learned the material. So challenge yourself to work problems, explain concepts to friends or family members, and think about how you would apply the material outside the classroom, in professional or personal life.

Course Schedule:

Week 1, January 12: Chapter 1 and 2, Introduction to Optimization and Linear Programming

Week 2, January 19: Chapter 3, Modeling and Solving LP Problems in a Spreadsheet

Week 3, January 26: Chapter 4, Sensitivity Analysis and the Simplex Method

Week 4, February 2: Chapter 5, Network Modeling

Week 5, February 9: Chapter 6, Integer Linear Programming

Week 6, February 16: Chapter 7, Goal Programming and Evolutionary Optimization

Week 7, February 23: Chapter 10, Data Mining

Final Exam week, March 2: