This syllabus reflects the nature of the course when it was most recently taught. All syllabi are subject to change by the instructor.

Spring, 2010: 90-760A&B
Management Science II: Decision & Risk Modeling

Instructor: Jon Caulkins

Course Objectives:
This course, along with its companion (90-722 Management Science I: Optimization & Multi Criteria Methods) 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.

The course moves quickly; be careful not to fall behind.

Text:


Blackboard:
Course materials will be posted to blackboard (www.cmu.edu/blackboard). You should monitor it for announcements (e.g., changes to assignments).
Recitations:
On most Fridays, I hold a recitation, answering questions and working problems in HbH 1000. On one or more Fridays the TA’s will instead hold recitation in the computer lab to explain how to use Excel and Crystal Ball. Because of the class is so large relative to the computer room, there will be multiple recitations that day and you will be assigned a time slot.

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

The final exam will be Monday May 3rd at 8:30 AM in HbH 1000 & also HbH 1502.

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.

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.
Class Schedule:
T 3/16  Forecasting (Chapter 11, esp. Sections 1-3, 6-7, 10, 15, 16.1, 19 & 21)
R 3/18  Discriminant Analysis (Chapter 10, esp. Cases 10.1 & 10.3)
F 3/19  Recitation
T 3/23  Random Variables & Simulation Part I (Chapter 12 through Section 12.13)
R 3/25  Random Variables & Simulation Part II (Section 12.14)
F 3/26  Crystal Ball recitation in the computer lab (may be different time)
T 3/30  Queuing Theory I (Chapter 13 – can just skim 13.7-13.10, but read 13.11)
R 4/1  Queuing Theory II (Optional: Larson’s “There’s More to a Queue …”)
F 4/2  Recitation
T 4/6  Project Mgmt I (Chapter 14; you can skim 14.8 & 14.10 and skip 14.12)
R 4/8  Project Management II
F 4/9  Recitation
T 4/13  Stochastic Optimization (one or two of 12.14-12.17, TBA)
R 4/15  Mid-Term Exam
F 4/16  Recitation
T 4/20  Decision Anal I: Max EMV & Decision Trees (Chapter 15.1-15.11)
R 4/22  Dec Anal II: Bayes’ Rule, Utility Elicitation & Max EU (15.12 – 15.15)
F 4/23  Recitation
T 4/27  Decision Analysis III: MCDM (Handout, 15.16-15.18, & skim 3.14)
R 4/29  Decision Analysis IV: Risk-Return Frontiers (handout)
F 4/30  Recitation (Review for Exam)

Skills Taught:  (You should learn one concrete professional skill from most every class.)
T 3/16  Do Time Series forecasting with Crystal Ball
R 3/18  Perform Discriminant Analysis with da.xla add-in
T 3/23  Perform Monte Carlo simulation (e.g., for a budget)
R 3/25  Optimize within a MC Simulation (e.g., single period inventory opt)
T 3/30  Apply steady state queueing formulas
R 4/1  No specific skill, but understand subtler ideas about queues
T 4/6  Use LP to create a 2-attribute tradeoff curve (e.g., crashing CPM)
R 4/8  Use simulation to estimate uncertainty in project schedule
T 4/13  From class just understanding; text shows how to optimize simple DES
T 4/20  Use decision trees to max EMV
R 4/22  Elicit a single-attribute utility function and use it to max EU
T 4/27  Use scoring models and AHP to solve MCDM problems
R 4/29  Finish AHP and/or Compute a Risk-Return Frontier