Spring, 2017: 90-722A, B, & C
Management Science I: Optimization

Lecture Section A:  Tuesday, Thursday 10:30 – 11:50 AM in HbH 1202
Lecture Section B:  Tuesday, Thursday 1:30 – 2:50 PM in HbH 1204
Lecture Section C:  Tuesday, Thursday 3:00 – 4:20 PM in HbH 1204
Recitation:  Friday 9:00 – 10:20 in HbH A301

All three sections will cover the same material but may have their own exams and be graded on separate curves, so please attend your assigned section. If you have a compelling reason for needing to switch see me ASAP and we’ll try to find someone who wants to switch sections in the opposite direction.

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Course Secretary:  Adrienne McCorkle  
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Office Hours:  Thursdays 12:00 – 1:20 PM, Fridays 11:30 AM – 3 PM, and by apt.

TA’s:  Momin Abrar Ghalib  mghalib@andrew.cmu.edu;  Krishna Dalal  kddalal@andrew.cmu.edu;  Thomas Goldring  tgoldrin@andrew.cmu.edu;  Yutian Guo  yuitiang@andrew.cmu.edu;  Samantha Levinson  sglevins@andrew.cmu.edu;  Joseph Marren  jjmarren@andrew.cmu.edu;  Mallory Nobles  mnobles@andrew.cmu.edu;

Note: TA’s work specific hours. Outside those hours, they are just students like you, with their own deadlines and classes to worry about. Do not expect TA’s to be “on duty” whenever and wherever you see them.

Course Objectives:

This course, along with its companions (90-760 Management Science II: Decision and Risk Modeling, 94-833 Decision Analysis and Multi-Criteria Decision Making, and 95-760 Decision Making Under Uncertainty) are introductory courses in analytics and management science that survey a variety of hands-on quantitative and modeling methods useful to decision makers and analysts.

Normally Heinz PPM, HCPM, MBTM, and MEIM students take 90-722 & 90-760, whereas MISM students take 95-760 which pulls examples from the information systems context. Both tracks feed into 94-833, although students with a strong quantitative background can take 94-833 in the first year; none of the other courses are actually a prerequisite for 94-833.

These courses have four objectives.

First, you should become as comfortable working with spreadsheets, spreadsheet tools, and various add-ins as you already should be with word processors. By the end of
the course, firing up Excel to model and solve a quantitative problem should be second nature. This skill will be a significant asset 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.

Third, you should acquire sufficient proficiency with some of the techniques that you can use them as an “end user modeler”.

Fourth, you should learn how to approach, abstract, and analyze problems from a quantitative, analytical perspective. In short, you should be able to use the language and perspective of mathematical modeling. In most lectures we will work through a small “case” to help you connect the methods to a problem that is richer than the typical end of chapter problem.

The course moves quickly; be careful not to fall behind. Unless I explicitly say otherwise, always read the assigned readings – including cases – before the class in which they are discussed; failing to do so is the most common reason for failing the course.

Text:

Required: Chapters 3, 6, and 7 from Cliff T. Ragsdale’s Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Management Science, 6th edition, which you can order from Cengage for something like $16.99 per chapter or rent through Amazon.

I used to assign the entire text (~$250), but many students did not buy it. This caused substantial disruption as people juggled different editions and many did not obtain copies that came with the software. I have given up on our all being able to use the specialized software; we will work in “straight” Excel.

To save you money, I have written my own versions of topics Ragsdale covers in other chapters. My chapters have a very odd numbering scheme (e.g., Chapters 1A and 1B, 2A and 2B, etc.). That is so they (mostly) interleave in sequence with Ragsdale’s chapters. My chapters are a work in progress so please give me feedback on typos, poorly worded passages, etc.

Many other textbooks cover similar topics. If you have trouble understanding Ragsdale’s or my presentation, I encourage you to check out another of these introductory management science textbooks (many available through the engineering library in Wean Hall): Dimitris Bertsimas and Robert Freund Data, Models, and Decisions, Christian Albright et al. Data Analysis and Decision Making with Microsoft Excel, Anderson et al. Introduction to Management Science, Wayne L. Winston’s Operations Research: Applications and Algorithms; Lawrence L. Lapin's Quantitative Methods for Business Decisions; Thomas M. Cook and Robert A. Russell's Management Science, Frederick S. Hillier and Gerald J. Lieberman's Introduction to Stochastic Models in Operations Research. Andrew W. Shogan's Management Science is particularly good for goal programming and integer programming.

If you enjoy the course and want to learn more I recommend the (easy to read) professional magazines Analytics (http://www.analytics-magazine.com/) and OR/MS Today (http://www.informs.org/ORMS-Today/) and also the academic journal Interfaces
which specializes in describing successful applications in diverse settings (http://www.interfaces.smeal.psu.edu/).

It is good to complement an equation-oriented treatment of decision making with books about human limitations of decision making. Examples include Daniel Ariely’s *Predictably Irrational: The Hidden Forces that Shape Our Decisions*; Richard Thaler and Cass Sunstein’s *Nudge: Improving Decisions about Health, Wealth and Happiness* (on libertarian paternalism); Daniel Kahneman and Amos Tversky, *Choice, Values, Frames*; Ralph Keeney, *Value-Focused Thinking: A Path to Creative Decisionmaking*; Peter Miller, *The Smart Swarm: How Understanding Flocks, Schools, and Colonies Can Make Us Better at Communicating, Decision Making, and Getting Things Done*; Daniel Kahneman’s, *Thinking, Fast and Slow*, Davenport, Harris, & Morrison *Analytics at Work*.

**Blackboard:**
Course materials will be posted to blackboard (www.cmu.edu/blackboard). You should monitor it for announcements (e.g., changes to assignments). I will also maintain and monitor electronic discussions forums on blackboard. Last year’s class largely ignored them, but in earlier years they were used extensively as a supplement to office hours and class discussion.

**Recitations:**
I conduct Friday recitations myself in HbH A301 unless I am out of town. Some weeks we will work a case, but beyond that I’d like you to drive the content with your questions. It’s a good time to ask about how the methods play out in real world applications, new trends in the field of analytics, etc., but usually we spend most of the time working end of chapter problems. Ideally you’ll email me ahead of time requesting that I work a particular problem so I can have it prepared, but I can work most problems on the fly.

**Grading:**
Course grades will be based on: homework (15%), class & recitation participation (not just attendance) (15%), midterm on February 14th (30%), and the final on March 7th (40%).

I will drop one (the lowest) homework grade to allow for illness, job interviews, etc. I will not drop more than one even if you are lucky enough to have lots of job interviews.

I do not give make up exams. If you miss an exam you can take a 0 or an incomplete in the course and fill in the score from next year’s exam.

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. Late assignments will not be accepted and will receive a 0.

HW should be submitted in hard copy, not through the digital drop box. Location TBA.
The HW can be done individually if you prefer, but I suggest working in groups of two or three (max). If you work in a group you should submit one HW for the group and everyone in the group will receive the same grade on that HW.

Within a group you may collaborate in any way you choose, although it is a very bad idea to divvy up the problems because you won’t be able to do that during tests. There should be minimal interaction across groups concerning homework problems. You are encouraged to discuss the readings, concepts, and problems that are not assigned as homework, including ones that parallel the homework assignment, but you should not collaborate on the problems assigned as homework. In particular, obtaining a copy of another group’s work, either their answers or a spreadsheet they used, is cheating and will be subject to sanction up to failure in the course and reporting of the incident to the Dean.

Needless to say searching online for solutions to a homework problem is cheating and can get you expelled. (There were problems with that two years ago and students claimed not to realize it was dishonest. You are hereby officially forewarned.)

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

Exams dominate your course grade. 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.

Academic Integrity:
Cheating will be punished, typically by failure in and dismissal from the course as well as reporting the infraction to the relevant academic action bodies for consideration of further sanctions.

Taping or Recording Classroom Activities
One section’s lectures will be videoed, with a link to the recordings posted to blackboard.

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; failing to read ahead is the most common reason people fail the course. Each week will cover a well-defined chunk of material that will be the basis for a homework assignment that is due the following week. It would be better to submit an incomplete homework than to not finish the next week’s reading before class.
The key to learning math is repeated exposure. It is hard to grasp new concepts from one or two exposures, no matter how intense. It is 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, 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.

Last, lecture is a terrible time to try to learn Excel mechanics. I will demonstrate things in Excel to give you a big picture understanding of what can be done. However, your primary resources for learning Excel will be the textbook and online aids. If you Google or search on YouTube you’ll find lots of Excel guides. This is graduate school, so by now you should be an “independent learner” who can look up such tutorials on your own.

(Do not expect TA’s to debug your spreadsheets. They may be able to help explain Excel techniques during office hours if there are no other students with conceptual or mathematical questions. But, the textbook and online tutorials are your primary source for Excel help.)

Class Schedule:
Provided as a separate document.