

Spring, 2021: 90-722 A&B

Management Science I: Optimization

All sessions are virtual.

Section A: Tuesday, Thursday 8:30 – 9:50 AM

Section B: Tuesday, Thursday 1:30 – 2:50 PM

Primary Recitation (for both sections): Friday 10:10 – 11:30 AM

Optional problem-solving recitations for students in

Western Hemisphere, Europe, & Africa: Monday & Wednesday 11:45 – 1:15 PM

Asia & Oceania: Monday 9:30 – 11 PM Pittsburgh time

Instructor: Jon Caulkins, caulkins@andrew.cmu.edu

Office Hours:

“Closed door” 15-minute private meetings by appointment: Wednesday 10 AM – 11:30 AM and outside that time as needed.

“Open door” drop-in hours (no waiting room/privacy): Fridays 12:30 – 2 PM. You can ask almost anything during these Friday office hours, including just shooting the breeze about careers, COVID, etc. (just not politics please). Of course specific substantive questions are welcome, and those can also be asked during the optional, problem-solving recitations.

Wednesday by-appointment meetings are to address matters like academic accommodations. Friday open-door hours are to talk about anything under the sun. The problem solving recitations are a good time to ask questions about concepts, textbook problems, and the like, as are TA office hours.

TA's:

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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.

COVID & Remote format

This is a large class, so under COVID rules it has to be remote. That forces a host of changes, and I'm sure there will be kinks to work out. Please be patient, and also be professional in your approach to those challenges. What I mean by that is to recognize that the stresses of distance education are real, but they are no more daunting than the challenges

you'll confront and surmount throughout your careers. So, I will expect of you, and you should expect of yourselves and your classmates (and of me), professionalism at all times. (E.g., I expect you to have your video turned on during Zoom sessions, unless there is a compelling reason not to.)

Normally this course has two 80-minute lectures per week, but long lectures delivered to 80+ students per section via Zoom do not work well. Also, usually most of the course grade hinges on two in-person, pencil-and-paper tests, but the Eberly Center urges that during COVID it's good to have more, smaller-stakes assessments.

So this year I'm going to try to deliver most of the straight-up lecturing via pre-recorded asynchronous videos you're required to watch before class; they are like required readings. Class in the conventional sense will be shortened correspondingly, to keep the workload the same, with the tail end of the 80 minutes spent working in small groups on small, low-stakes assessments that will be turned in at the end of that class time. Those assessments will let me reduce the weight placed on exams. (We'll also have three shorter tests rather than two longer exams, and there will still be regular, weekly homework assignments.)

Details will vary depending on the week, but I'll aim for something like a 30-40 minute video and 40-50 minutes of "class", leaving 30-40 minutes for completing those "in-class" assignments.

During "class" we will sometimes use breakout rooms in the traditional sense of creating space for 5-10 minute discussions (to promote active learning). Mechanically the end-of-class assignment-completing sessions will also occur via Zoom's breakout room functionality, but I'll try to call them "assignment working groups" (AWG's) to distinguish them from the usual in-class break out discussion rooms. When your AWG has submitted your assignment, you're free to exit Zoom.

I have also been told that it's hard for you to meet each other and make friends, with Zoom classes and few serendipitous hallways conversations. So for at least the first few weeks, the AWG's will be randomly assigned and different each day (same as break-out rooms). We can assess at that point whether you'd like that to continue, or if you'd prefer to switch to stable AWG's for the rest of the mini.

Note: Homework can be done individually or in groups of up to four students. Those groups are self-organized and are distinct from the AWG's.

You'll also be divided into discussion groups for (required) Canvas discussion posts. Details below. Those will be stable communities of 20-25 people sharing ideas under the supervision of a TA. (If you all had to read posts from all 200 or so other students, that would be overwhelming.)

I'm sure that structure sounds complicated, but it's an effort to: (1) Avoid a pure lecture class, (2) Spread out the course grade rather than making it all hinge on two exams, and (3) Create opportunities to interact in smaller groupings.

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 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 covers similar material but 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 their 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 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 management science techniques, what they are capable of, and what their limitations are so that you can intelligently call upon specialists and consultants when the occasion arises.

Third, you should acquire sufficient proficiency with some of those 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 of mathematical modeling. In the course, we will work through small “cases” 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 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: Cliff T. Ragsdale’s *Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics*, 8th edition, which you can order from Cengage. You can get by with the 6th or 7th editions, although the text does evolve and problem numbering changes, so be careful about that.

Canvas:

Canvas will be used extensively for distributing course materials, posting videos, conducting discussions (some graded), submitting homework and exams, etc. You should monitor it daily.

Piazza:

This term we will use Piazza for class discussion other than the graded discussion posts (explained below). The system is designed to get you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza.

Find our class page at: <https://piazza.com/cmu/spring2021/90722/home>
The passcode is 752956109

Recitations:

There will be tests during Friday recitations on February 19th, March 5th, and March 12th. They are required of all students in all time zones, and no make-up tests will be given. If you miss the test, you will receive a zero.

The remaining three Friday recitations will be devoted to case discussions. They are recommended but not graded or required.

I will also hold three optional problem-solving recitations each week. One, on Monday evenings Pittsburgh time, is exclusively for students in Asia & Oceania. The other two are on Monday & Wednesday 11:45 AM – 1:15 PM. They are intended for students in the rest of the world, but are open to everyone. During those sessions I will field general questions and will work a few end of chapter problems, typically at a slower pace than material is covered in class.

Grading:

Course grades are based on:

Daily assignment working group (AWG) submissions: $13 \times 2 = 26\%$

Weekly homework: $5 \times 4 = 20\%$

Three tests (February 19th, March 5th, March 12th): $3 \times 15 = 45\%$

Three graded posts to Canvas discussion boards: $3 \times 3 = 9\%$.

Daily Working Group Assignments:

During the final 30 or so minutes of each Tuesday & Thursday class you will be divided into breakout rooms to work together in a small group to complete an assignment that is to be submitted at the end of class time via Canvas' Gradescope (one submission per group). These will test whether you have completed the required readings and video watching before class, and let you practice skills demonstrated in the class. Grading rubric:

- 2 points if all work completed correctly and with well-written, thoughtful answers
- 1.5 points if complete and mostly correct, or answers that are reasonable but not excellent
- 1 point if complete but there are significant errors or weak exposition
- 0.5 points for assignments that are only partially completed or lackluster
- 0 points for missing or pro forma answers

I suggest that in each AWG, someone volunteer to be scribe. That person can share their screen and type in the group's answers, but feel free to use other collaborative technologies (e.g., Google docs). The submission, though, will be via Canvas Gradescope.

Homework:

I drop one (the lowest) homework grade to allow for all manner of special circumstances including illness, death in the family, job interviews, etc. You do not need to tell me about

those circumstances; one will be dropped regardless. I will not drop more than one except under truly extraordinary circumstances; usually if someone misses two or more weeks it is better to take an incomplete and finish the class next year.

Homework can be typed or hand-written, but must be neat. 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 through Canvas' Gradescope.

HW can be done individually, but I suggest working in groups of two to four (max). Groups should submit one HW, and everyone in the group will receive the same grade. You do not need to work with the same people all semester, and groups can have members from different sections.

There should be minimal interaction across groups concerning homework problems. You may discuss the readings, concepts, and problems that are *not* assigned, but you should not collaborate on the assigned homework problems in any way. Obtaining or providing 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 for possible expulsion from the College.

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, come directly to me if you have any concerns about the grading of an exam problem.

Note: Because of the vagaries of schedules, and break days, HW #3 is longer than the other four homeworks, so be sure to start it early.

Tests:

I do not give make up tests. If you miss a test you can take a 0 on it or take an incomplete in the course and fill in the score from next year's test.

Tests will start at the beginning of recitation time, typically will be 35-40 minutes long, and are to be submitted via Gradescope. Late submissions will be penalized; plan accordingly. You must keep your Zoom video on, audio off, and have no one else in the room with you during the test.

Exams from prior years are posted on Canvas, but tests this year will be quite different in structure and format.

Some answers – particularly algebraic formulations – are easier to hand write than to type, so be sure that you have the ability to take a picture or scan something you've handwritten and embed it within your exam sheet for submission.

Graded discussion posts:

Three times during the mini you will be required to post to a Canvas discussion board, and comment on the posts of your peers. For this, the class will be divided into 7-10 discussion groups of 20-25 students each. Details of due dates and format have been posted to Canvas.

Academic Integrity:

Cheating will be punished, typically by failure in 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 classes will be recorded, with a link posted to Canvas.

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:

Watch the assigned videos and read the assigned material *before* coming to class; failing to do so 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.

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.

(Do not expect TA's to debug your spreadsheets. They may be able to help explain Excel techniques 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 & required readings: Provided as a separate document.