90-722 Management Science I | Spring 2024

Course Information
Course site: https://canvas.cmu.edu/courses/38727
Lectures: Tuesday/Thursday – 2:00 – 3:20 PM @ HBH 1002
Recitation:
- *Section B3: Friday – 9:30-10:50 AM @ HBH 1006*
- *Section C3: Friday – 3:30-4:50 PM @ HBH 1006*

Instructor Information
Holly Wiberg (she/her/hers)
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Office Hours: [to be announced]

Course TAs: *[to be announced]. Office hours will be posted on Canvas and will start on 1/22.*

Course Description
This course, along with its companions (*90-760 Management Science II*, and an optional elective *94-833 Multicriteria Decision Making & Decision Analysis*) 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. We will develop a practical toolkit for solving real world decision-making problems.

90-722 focuses on optimization models and methods. Optimization models provide a quantitative framework to guide decisions when you want to maximize (or minimize) some outcome, subject to various requirements. This applies to nearly any industry, such as:
- booking patients for surgery to minimize wait times under schedule constraints,
- ordering raw supply quantities to minimize manufacturing cost under demand constraints, or
- allocating ventilators across hospital systems to minimize deaths under transportation constraints.

By the end of the class, you will be able to take real problems such as these, translate them into mathematical formulations, solve them using Excel, and interpret the solutions. This skill will be a significant asset on the job market and in your career.

Note: There are several Management Science-related course tracks at Heinz. They overlap considerably but are tailored for programs based on student career paths and interests. MSPPM, MS3, and PPM-DC students take two minis: Management Science I and II (90-722, 90-760) in spring of Year 1. Students in any track are invited to take 94-833 Multicriteria Decision Making & Decision Analysis as an elective, which covers a different but complementary set of managerial decision tools.

Prerequisites/Corequisites
This course has no formal pre-requisites but assumes knowledge of college pre-calculus (or its equivalent), including summation notation and fluency graphing and interpreting linear and nonlinear functions. The course uses Excel intensively. If you are not comfortable with Excel, you should work through some Excel tutorials before the course begins.

Intended Learning Outcomes (ILOs)
By the end of the Management Science course sequence, students will be able to...
- Model and solve quantitative problems in Excel – working with spreadsheets should feel second nature!
- Identify the right management science technique for your problem. You will become familiar with different problem-solving approaches and their limitations. Even if you aren't the one implementing them day-to-day, you'll know when to call upon the right specialists and consultants when the occasion arises.
- Apply management science techniques as an "end user modeler."
- Take an end-to-end quantitative analytical approach to policy and business problems – from formalizing a problem in mathematical terms to analyzing the model results. In short, you should be able to use the language of mathematical modeling.

In 90-722 specifically, the main "management science" technique that we will employ is optimization. So, by the end of this mini, you will have achieved these ILOs in the context of modeling and solving optimization problems.

Course Materials
Textbook (Required): Cliff T. Ragsdale's **Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics, 8th edition**. You can order the textbook from Cengage. You can also use the 6th or 7th editions, although you will want to watch out for problem number changes.

Software: You will need regular access to Microsoft Excel to complete assignments. If this is an issue, please let me know and we can make necessary arrangements.

Assessments and Grading

Grading consists of four elements: weekly homework, in-class cases (during recitation), two exams, and attendance/participation. You will have weekly homework assignments and three in-class cases that will allow you to apply the current lecture content. These will include a mix of written analysis and hands-on Excel work. There will also be two in-class exams: a midterm and a final exam. Grading is broken down as:

% Grade	Description
45% exams	Midterm (20%) and final exam (25%)
32% homework	Best 4 out of 5 weekly HW assignments (8% each)
15% recitation cases	Two cases (7.5% each)
8% in-class questions	Requires attendance in lecture (with 2 "free passes"). *See course policies below.*

Grades will be assigned as: A+ (≥97), A (≥93, <97), A- (≥90, <93), B+ (≥87, <90), B (≥83, <87), B- (≥80, <83), C+ (≥77, <80), C (≥73, <77), C- (≥70, <73), R (<70). The minimum passing grade for the course is a C- (70%).

Grading philosophy and procedures

My goal is to prepare you to be quantitatively minded decision makers and technical practitioners. The ILOs are designed to reflect these goals, and grading will be geared towards attainment of the ILOs. Homework and exam solutions will be posted with rubrics to explain point attribution. If you believe there is an error in a graded homework, reach out to the TAs within one week of the homework return. You must accompany the request with a clear and specific written explanation of the issue. Please email to me directly to request a regrade of an exam question.

Course Expectations and Policies

Lecture Attendance: I expect all students to attend lectures in-person—and actively participate—but you will have 2 "free pass" absences to be flexible to schedule conflicts; no reason required. Please let me know ahead of time if you expect to miss class, and we will make arrangements for you to catch up on the material. Attendance will be logged through in-class question forms that you'll fill out at the end of each class. These will serve primarily as a pulse check for me to see where you all are at and adjust accordingly. These questions will be graded for completion, not correctness—it is a way for you to stay actively engaged with the course content.

Recitations: Friday recitations will also generally be required in person: they will be used for exams and in-class group case assignments. On the weeks where there is not a case or exam, recitation will not be mandatory, but attendance is strongly encouraged. We have divided the lecture into two recitation sections to provide more opportunities for interaction and deep-dives into content. The recitations will give you an opportunity to do hands-on exercises, work collaboratively, and ask questions. *Note that you must attend your assigned recitation time (either B3 or C3); both sections are at capacity.*

Homework assignments: Homework assignments will be due on Wednesdays (by midnight) via Gradescope and will generally cover the previous week's lecture material. We will not accept late assignments, but the lowest grade across all homework assignments will be automatically dropped. You do not need to submit all five homework assignments – if you do not submit one, it will by default be the dropped assignment.

You can work on assignments individually or in groups of up to 4 students. If you work in a group, you will submit one assignment for your group: one student should upload the assignment to Canvas and include the names of all teammates in the assignment comments and in the assignment writeup itself. You do not need to work with the same group all semester. *Note: There should be minimal interaction across groups concerning homework problems (or in-class cases). 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.*

In-class cases: There will be two cases in recitation which are meant to be low stakes opportunities to put the course material into practice, honing your Excel skills and managerial interpretation of the results. These two recitations will have mandatory in-person attendance.

Exams: Both exams will occur in class. The exams will be closed book, but you will be allowed a "crib sheet": one 8.5 x 11" handwritten sheet – one-sided for the first exam, and two-sided for the second exam. There will be no makeup exams offered, pending extraordinary circumstances. You can bring a standard calculator into the exam.

Unforeseen Circumstances: The past years have shown us new levels of uncertainty; there is a limit to how robust our plans can be! If unusual circumstances arise, health-wise or other, please let me know as soon as possible. I will aim to accommodate your needs (within reason), and we can work together to make a plan that allows you to succeed in this class.

Lecture Recording: We will record the lectures through Zoom and will post them on Canvas within 24 hours of each lecture. Note that the videos are intended solely for your personal educational use; they may not be shared with anyone outside of your course section (including students who enroll in the course in future semesters). Unauthorized sharing of the videos violates the Family Educational Rights and Privacy Act (FERPA). Students may not record lectures.

Special Accommodations and Disability Resources: If you require disability-related accommodations, I encourage you to meet with me early in the semester. If you need an accommodations letter from the Disability Resources office, please contact Catherine Getchell, Director of Disability Resources, 412-268-6121, getchell@cmu.edu. I will work with you to ensure that accommodations are provided as appropriate.

Academic integrity statement
In this course, I will hold you to the high standard of academic integrity expected of all students at CMU. I do this for two reasons. First, it is essential to the learning process that you are the one doing the work. I have structured the assignments in this course to enable you to gain a mastery of the course material. Failing to do the work yourself will result in a lesser understanding of the content, and therefore a less meaningful education for you. Second, it is important that there be a level playing field for all students in this course and in the College so that the rigor and integrity of Heinz's educational program is maintained.

Please review CMU's Academic Integrity policy. Violating the policy in any way (e.g., plagiarism, unauthorized collaboration, cheating, etc.) will result in disciplinary action. Possible sanctions include receiving a failing grade on the assignment or exam, being assigned a failing grade in the course, having a formal notation of disciplinary action placed on your record, suspension, or expulsion from CMU for the most serious cases.

Finally, we are entering a new era of education with the emergence of generative AI tools such as ChatGPT – one that both educators and students are still navigating. In this class, we will adopt the following policy:
-   Generative AI tools can be used to support general learning or ungraded exercises, such as brainstorming or reviewing general principles. If you do use AI tools for these purposes, please let me know! I would be eager to engage with any of you on this to get your perspective on where AI is useful and its opportunities/pitfalls.
-   AI tools ***should not*** be used for any graded assignments, as it cannot be considered a substitute for developing the fundamental skills and expertise represented by the learning objectives of this course. Please note that generative AI tools rely on predictive models to generate content that may appear correct, but has been shown to sometimes be incomplete, inaccurate, taken without attribution from other sources, and/or biased. You are ultimately responsible for the content of the information you submit and may not attempt to pass off any work generated by an AI program as your own.

Inclusivity Statement
I value an inclusive environment, as does the broader CMU community. I strongly believe that a culture that promotes diversity, equity, and inclusion benefits all of us—it creates a better environment to work and study, and it unlocks creativity and innovation to make us better problem-solvers.

With this in mind, I hope to foster a sense of community in this classroom and consider this classroom to be a place where you will be treated with respect. We welcome individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. This is our shared responsibility. If this standard is not being upheld, please feel free to speak with me.

Reporting Resources: Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or witnesses discrimination to speak out for justice and support their colleagues. Anyone can share these experiences anonymously using the Ethics Reporting Hotline (844-587-0793; cmu.ethicspoint.com).

Additionally, the Title IX office is dedicated to promoting gender equity at Carnegie Mellon University, which includes coordinating the University's efforts to prevent and effectively respond to all forms of gender discrimination (including gender identity discrimination) and sexual misconduct impacting community members, including sexual assault, sexual exploitation, sexual harassment, dating and domestic violence, and stalking. The office provides a comprehensive list of reporting options, both within CMU and externally, including a form to report experiences directly to the Title IX office.

Student Wellness Statement
First off, please take care of yourself! School is important, but it's not the only priority – take breaks, find stress relievers, and get rest. Finding balance will help your quality of life and will also make you a better student. You will work your best when you can bring your full self and energy to class.

All of us struggle, and all of us can benefit from help in those times. As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may impact your ability to attend class, concentrate, complete work, take an exam, or participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at: http://www.cmu.edu/counseling/. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:
- CaPS: 412-268-2922
- Re:solve Crisis Network: 888-796-8226
- If the situation is life threatening, call the police: 412-268-2323 (CMU) or 911 (off-campus)

Other resources
Student Academic Success Center (SASC): The SASC offers various programs to support your academic well-being. Consider making an appointment with one of these services if you are interested. A few to highlight:
- Academic coaching – This program provides holistic, one-on-one peer support and group workshops to help students implement habits for success. Academic Coaching assists students with time management, productive learning and study habits, organization, stress management, and other skills.
- Communication support – Communication Support offers free one-on-one communication consulting as well as group workshops to support strong written, oral, and visual communication.
- Language and cross-cultural support – This program supports students seeking help with language and cross-cultural skills for academic and professional success through individual and group sessions.

CMU Food Pantry: If you are worried about affording food or feeling insecure about food, there are resources on campus that can help. Email the CMU Food Pantry Coordinator to schedule an appointment (412-268-8704 (SLICE office); cmu-pantry@andrew.cmu.edu).

Tips for success
This class will move quickly – we have a lot to cover in seven weeks! I strongly encourage you to do the pre-readings assigned before each lecture, since this will make the lecture content much more digestible. Additionally, the most useful part of the class will be hands-on learning through case studies and homework assignments, so please take the time to get "in the weeds" with all exercises, even if you are working in a group for homework or case. This is where you get to apply the class material and see its practical value.

The class will also use Excel extensively. Don't worry too much about Excel mechanics during lectures. I will run through examples to show you what can be done, but recitation and office hours will be better places to work through Excel questions. There is also a *ton* of Excel content online, so Google will be your quickest resource if you run into spreadsheet bugs.

If you feel like you are falling behind at any point, my door is open. I encourage you to stop by office hours discuss assignments, questions from lecture, or anything else (related to school or otherwise!); I look forward to seeing you! You can also set up time to meet 1:1 to discuss specific issues with me. Finally, Heinz has tutoring resources available to support your academic success – I am happy to connect you with a tutor as needed.