

MATH 4428
Mathematical Modeling
Spring 2018 – Section 1

Class: MWF 12:20 – 1:10 pm, Vincent Hall 2

Instructor: Kaitlin Hill, Vincent Hall 8, hillk@umn.edu

Office hours: M 2:00 – 3:00, W 1:30 – 2:30, Th 2:30 – 3:30, or by appointment

Website: math.umn.edu/~hillk/math-4428.html

Course Prerequisites: MATH 2243, 2373, or 2573 (linear algebra and differential equations)

Textbook: *Mathematical Modeling*, by Mark Meerschaert, 4th ed.

Available at sciencedirect.com.ezp2.lib.umn.edu/science/book/9780123869128

Selected supplemental readings

Objectives

During this course, students will develop their skill in analyzing optimization, dynamical, and probabilistic models. These skills include:

- Translating a real-world problem into a mathematical model
- Determining a solution or possible solutions to the mathematical model
- Relating mathematical findings back to the real-world application
- Assessing the quality of the model and determining ways to improve the model
- Working with a team to analyze, interpret, and communicate the solution to a problem using optimization, dynamical systems, or probabilistic techniques

Course Grade Components

30% - Homework

15% - Midterm project

25% - Final project

30% - Midterm exams

Homework

Homework will be assigned each Friday, due the next Friday. Each homework assignment will be based on the content covered the week it is assigned. Late homework will not be accepted. The lowest homework grade will be dropped.

Exams

There will be three in-class, non-cumulative exams. The exams will cover the material in each section of the course and will be closed-book. They will be designed to assess your understanding of conceptual and computational aspects of the course. The three midterms are *tentatively* scheduled for:

Midterm 1: February 19 (Monday)

Midterm 2: April 2 (Monday)

Midterm 3: May 10 (Thursday)

Projects

There will be three project opportunities during the semester, for each major component of the course. While the exams are designed to assess your understanding of broad course topics, the projects are meant to assess your ability to apply the skills learned in a less structured setting. You will form teams of 3-4 students each, who will work together throughout the semester.

Each team of students will be responsible for completing a project in two out of the three topic areas.

Project timeline:

- 1/31 Deadline for forming teams
- 2/14, 16 Midterm project presentations: optimization teams
- 3/28, 30 Midterm project presentations: dynamical systems teams
- 4/6 Final project proposals (must be on a topic area not previously investigated)
- 5/2, 4 Final project presentations

Your team will choose a topic from a list provided and give a 15-minute presentation on the model, model analysis, model simulation and solution, and an interpretation of your results. A list of topics and detailed presentation guidelines will be provided.

Your presentation will be evaluated by the class and instructor for a group grade, and each person in the group will complete a peer review for the project. Your individual grade will reflect a combination of the group and individual feedback. To help ensure success for everyone, teams should set expectations in the first team meeting, assign roles and duties, and hold each other accountable for performance before the presentation is imminent.

Computer Software

Some homework assignments will have a computational component, which will be supplemented by example code to help with the programming. Course projects will also have a computational component. You are welcome to use any program, though MATLAB is recommended. Students who have CSELabs accounts may download MATLAB for free at https://www.cs.umn.edu/download_software/matlab.

If you do not have a CSELabs account, fill out this form: <https://www.cs.umn.edu/account-management>. This will automatically create a CSELabs account for CSE students. For non-CSE students, you will be asked to verify the course, and CSE IT will open the account for you.

Academic Honesty

Collaboration on homework is encouraged. However, homework must be written in your own words, and any figures and code submitted must be your own work. Academic dishonesty will be handled according to university policy, and a grade of F or N will be awarded for the course.

Further statements on the academic honesty policy, as well as disability accommodations and other course policies, can be found under **General University Course Policies**, below.

General University Course Policies

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please

see: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: <http://policy.umn.edu/education/studentresp>.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, the student may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/education/instructorresp>.

The Office for Community Standards has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <https://communitystandards.umn.edu/avoid-violations/avoiding-scholastic-...> If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: <http://policy.umn.edu/education/makeupwork>.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate

shared norms and standards of the academic community. For additional information, please see: <http://policy.umn.edu/education/studentresp>.

Grading and Transcripts

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

A	4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
A-	3.667
B+	3.333
B	3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
B-	2.667
C+	2.333
C	2.000 - Represents achievement that meets the course requirements in every respect
C-	1.667
D+	1.333
D	1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S	Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to: <http://policy.umn.edu/education/gradingtranscripts>.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents

Policy: <http://regents.umn.edu/sites/regents.umn.edu/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents

Policy: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations

The University of Minnesota views disability as an important aspect of diversity, and is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you have, or think you have, a disability in any area such as, mental health, attention, learning, chronic health, sensory, or physical, please contact the DRC office on your campus (UM Twin Cities - [612.626.1333](tel:612.626.1333)) to arrange a confidential discussion regarding equitable access and reasonable accommodations.
- Students with short-term disabilities, such as a broken arm, **can** often work with instructors to **minimize** classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above.
- If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact your instructor early in the semester to review how the accommodations will be applied in the course.

- If you are registered with the DRC and have questions or concerns about your accommodations please contact your (access consultant/disability specialist).

Additional information is available on the DRC website, <https://diversity.umn.edu/disability/>, or e-mail drc@umn.edu with questions.

Mental Health and Stress Management

As a student, you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

Academic Freedom and Responsibility

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom and conduct relevant research. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.* When conducting research, pertinent institutional approvals must be obtained and the research must be consistent with University policies.

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

** Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*