

CMSE 382 - Optimization Methods in Data Science: Syllabus

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Spring 2026

Class: MWF 3:30PM-4:40PM in EGR 2243 **Credit hours:** 4

Course Information

Instructor:	Dr. Elizabeth Munch • muncheli@msu.edu
Office:	Engineering Bldg, Rm 2503
TA:	Omeiza Olumoye • olumoyeo@msu.edu
Office Hours:	See the Office hours section of the Where and how to get help page
D2L:	Link to D2L

Course Description

This course focuses on optimization theory, algorithms and their applications in big data analysis. After this course, students should be able to understand the mathematical background for different optimization methods (convergence analysis and the motivation of the algorithms), numerically implement optimization algorithms to solve optimization problems, and apply optimization algorithms to solve real applications.

The topics to be covered include:

- Mathematical preliminaries (linear algebra and calculus)
- Optimality conditions for unconstrained optimization
- Least squares
- Gradient method
- Newton's methods
- Convex optimization
- Optimization over a convex set
- Optimality condition for linearly constrained problems
- KKT conditions
- Basic linear programming
- Duality

Recommended Background

It is expected that you have already taken CMSE 202 and CMSE 381. In this course, linear algebra, matrix computation, and analysis will be heavily involved. You will be using Python for programming. All Python needed to complete assignments will be taught in this class, but you are expected to have used Python before.

Instruction Modality

The class is in-person. The teaching modality is *partially flipped classroom*. This means that the class instruction will be a blend of traditional lectures with flipped learning where the students will be expected to watch some pre-recorded videos (posted on D2L and linked from this webpage) before coming to class. As much as possible, in-class time will be used to work in groups to solve worksheet problems and gain a deeper understanding of the material.

Websites

- The [D2L course website](#) has your grades kept as up to date as possible.
- Course content will be posted on [the website you are currently on](#).
- The [tentative course schedule](#) is posted on this website and updated regularly. It contains specific assignments and due dates.

Textbook

Introduction to Nonlinear Optimization by Amir Beck. Available **for free** through MSU library online access. More information is on the [course website textbook page](#).

Generative AI Use

The use of GenAI is allowed on homework problems with proper citation (see [Homework](#) below), but is forbidden on quizzes and exams. See [MSU's Campus-Wide Guidelines for Generative AI](#) for more information on the university's GenAI guidelines.

Grading

Your final grade will be based on the following percentages:

- 40% Homework (*lowest one will be dropped*)
- 10% In-class worksheets (*Total of about 30 worksheets. Graded based on effort and no grade given if not in attendance, but must show effort comparable to the pace of the majority of the class to avoid point deductions. I will drop the lowest 5*)
- 10% Quizzes (*total 6, and the lowest one will be dropped*)
- 40% Midterm Exams (*3 exams*)

Attendance is required to receive credit for all in-class assignments (in-class worksheets, quizzes, and midterms).

Anticipated grading scale

If x is your final percentage:

Grade	Range
4.0	$90 \leq x$
3.5	$85 \leq x < 90$
3.0	$80 \leq x < 85$
2.5	$75 \leq x < 80$
2.0	$70 \leq x < 75$
1.5	$65 \leq x < 70$
1.0	$60 \leq x < 65$
0.0	$0 \leq x < 60$

These numbers may be adjusted lower, but will not be adjusted higher.

Homework

There will be five to six homework sets given which will be turned in for a grade.

- Homeworks are due on the days marked in the schedule at 11:59pm.
 - Homeworks submitted before midnight the following day will still be graded with a 5% penalty.
 - Homeworks submitted before midnight two days after will still be graded with a 10% penalty.
 - After 11:59pm 2 days after, no credit will be given, but an assignment may be excused if there is an emergency.

For example, if homework is due on Friday, those turned in before 11:59pm on Saturday have a 5% penalty; those turned in before 11:59pm Sunday will have a 10% penalty; and no homework will be accepted after that. Please see the [Missed Work Policy](#) section below for information on automatically dropped grades.

I encourage students to work together, discuss the problems, and teach each other while studying together. My collaboration policy is as follows:

- I **do** assume you will talk to each other to work on things.
- I **do** assume you will look up definitions while you are working on things.
- If you do use these resources, you must include an acknowledgement section in your homework mentioning the people and resources you used.

Example: I worked with Person A and Person B while completing this assignment. I also used Wikipedia to understand the iterative hard-thresholding method. I used chatGPT to get further clarification; here are the prompts I used.

- You are not allowed to directly copy each other's work or copy from the internet.

Homework must be submitted on Crowdmark, either as screenshots, a pdf, or as a full jupyter notebook, depending on the specific assignment's instructions. The system allows you to upload multiple versions, but only the most recent submission will be graded. If your homework cannot be clearly read, either due to poor handwriting, poor scan quality, or incorrect file format, you may receive a 0 for the assignment. An account will be created for you the first an assessment is distributed or returned, and you will receive an email for this.

Quizzes

Roughly every other week, there will be a short in class quiz. The quiz will cover the lessons taught since the day of the previous quiz (including the lesson on the day of the previous quiz), up to and including the lesson on the day before the quiz. Quizzes will be collected and graded using Crowdmark. It will be at the end of class and will last for about fifteen minutes. You are allowed to use a cheat sheet (see [Cheat Sheet](#) policy below), but you are not allowed to use calculators or computers, or work with others. You must be in attendance to receive credit for quizzes. Note that no makeups will be given; see the [Missed Work Policy](#) below.

Classwork

In-class worksheet will be assigned. This will be due at the end of class and graded on completion. You are encouraged to talk with others, use your notes, GenAI (citing the prompts used) and use Python. You must be present to complete and turn in the classwork unless the instructor gives you permission to complete the worksheet remotely; see the [Missed Work Policy](#) below for dropped quizzes and classwork. A makeup may be given in case of an excused absence.

Exams

There will be three non-cumulative midterms given. You are allowed to use a cheat sheet (see policy below), but you are not allowed to use calculators or computers, or work with others. See the [schedule](#) for dates. **There is no final for the course.**

Cheat Sheet

On each quiz and exam, you are permitted to use a cheat sheet consisting of one $8.5'' \times 11''$ sheet of paper. For quizzes, you may write on only one side of the paper. For exams, you may use both sides of the paper. You are allowed to write whatever you like within the allotted space. You may consult any resource when creating your cheat sheet including AI tools. Each student must prepare their own cheat sheet; you are not allowed to work with others. Cheat sheets must be handwritten, and will be turned in with the quiz or exam. Failure to follow the cheat sheet rules will result in a 10% grade deduction.

Religious Observance Policy

Students may request to have extensions, a quiz excused, or alternative exam arrangements if an assignment falls on a day of cultural significance (including, but not limited to, religious and cultural holidays). It is important to request an absence in advance per [the university policy](#). An excused quiz will not count toward the number of dropped quizzes.

I made an effort to not have exams scheduled on major holidays, but if you anticipate needing to miss an exam due to an observed holiday, please let me know at least two weeks before to schedule an alternative exam time.

Missed Work Policy

At the end of the semester, five in-class worksheets, one homework, and one quiz will be dropped. In case of emergency, additional homework assignments or quizzes may be excused. This will be determined on a case-by-case basis. Please contact me as soon as possible if you will be missing an assignment, quiz, or exam.

Students with an issue (i.e. medical, bereavement) needing to miss an exam need to get in touch with me as soon as possible, preferably before the exam is administered. A time to make up the exam will be organized with the student.

If you are feeling sick, please email me **before** the class period to request an excused absence. You must include in your email your plan to make up missed work. Unexcused early departure from class will count as an absence and the corresponding in-class assignment will receive a score of 0.

Course Grade

Required Materials

You will need to ensure that you have a laptop to bring to class. We will often be coding examples of topics, so be sure to bring it with you. In the case that you do not have access to a laptop to bring to class every day, please consult the [MSU laptop requirement policy](#) and speak to me as soon as possible so we can figure out alternative accommodations.

Attendance Policy

Students are expected to attend all class meetings and are responsible for all of the material covered in class and in the homework. Note that credit for the in-class assignments will not be given unless the student is present and participating for the majority of class.

Accommodations for Students with Disabilities

Michigan State University is committed to providing equal opportunity for participation in all programs, services, and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued an Accommodation Letter. Please present this form to me at the start of the term or at least two weeks prior to the accommodation date (test, project, etc). Requests received after this date will be honored whenever possible.

Academic Integrity

Michigan State University affirms the principle that all individuals associated with the academic community have a responsibility for establishing, maintaining, and fostering an understanding and appreciation for academic integrity. Academic integrity is the foundation of university success. Learning how to express original ideas, cite sources, work independently, and report results accurately and honestly are skills that carry students beyond their academic career.

Types of academic misconduct include plagiarism, falsification/fabrication—inventing or altering information, tampering, cheating, sharing work by giving or attempting to give unauthorized materials or aid to another student. See [MSU's academic integrity page for more details](#).

We ask that students adhere to the Spartan Code of Honor academic pledge, as written by the Associated Students of Michigan State University (ASMSU):

"As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth

more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do."

Grief Absence Policy

Michigan State University is committed to ensuring that the bereavement process of a student who loses a family member during a semester does not put the student at an academic disadvantage in their classes. If you require a grief absence, you must request grief absence by following the university's policy which is found [here](#).

Student Health and Well-being

- Emergency - call 911
- [Care and Intervention Team](#) (for referring students/others who are exhibiting concerning behavior, including being consistently absent, lack of self-care, etc.)
- [Campus Health Services](#)
- Mental health support: [CAPS](#), 517-355-8270