COURSE SYLLABUS

Instructor: Huijing Du (AVH 304; `hdu5@unl.edu`)

Office Hours: TBA

Text: *Linear and Nonlinear Optimization*, by Igor Griva, Stephen G. Nash, and Ariela Sofer, 2nd Edition, SIAM.

Prerequisite Policy: MATH 314/814 and MATH 310 or MATH 325.

Course Description: Mathematical theory of unconstrained and constrained optimization for nonlinear multivariate functions, particularly iterative methods, such as quasi-Newton methods, least squares optimization, and convex programming. Computer implementation of these methods.

Motivation: Nonlinear optimization is a generalization of the material in the multivariable calculus course dealing with finding and analyzing critical points, solving global extremum problems, and constrained optimization using the Lagrange multiplier rule. The machinery of linear algebra makes it easier to state nonlinear optimization problems and discuss the mathematical theory. Most nonlinear problems are too complicated to solve by hand, so numerical methods for optimization are an important component of any study of the subject. Nonlinear optimization problems can be broadly classified as unconstrained and constrained optimization, with similar theory but very different methods. We will explore tools that have been developed to handle this beautiful and very useful subject.

ACE Outcome 3: Use mathematical, computational, statistical, or formal reasoning (including reasoning based on principles of logic) to solve problems, draw inferences, and determine reasonableness. Your instructor will provide examples, you will discuss them in class, and you will practice with numerous homework problems. The exams will test how well youve mastered the material. The final exam will be the primary means of assessing your achievement of ACE Outcome 3.

Contacting me: The best way to contact with me is by email, `hdu5@unl.edu`. Please put [MATH 433] at the beginning of the title and make sure to include your whole name in your email. Using your official UNL email to contact me is strongly recommended. You are welcome to stop by during my office hours. If you want to meet at another time, please email me in advance, and we will try to schedule a time to meet.

Reading: You are expected to read the appropriate sections of the text BEFORE coming to the class meeting in which the topic is scheduled.

Homework: Assignments will be given during the semester. You may discuss the problems with me or your classmates, but you should write up all solutions individually. You should clearly organize your solutions. A sloppy, convoluted work may (shall) be penalized even if formally correct. **No late homeworks will be accepted.** Only part of the homework will be graded. The lowest score will be dropped.

Computer Labs: This course contains a gentle introduction to scientific computing with Matlab. Matlab is one of the most widely-used programming languages in science, mathematics, and engineering, and can be a very strong asset to future scientific work. **No previous programming experience is assumed.** Student are assumed to be able to have basic computer skills, such as using a mouse, keyboard, etc., and be able to download and install programs and navigate websites. Basic programming in Matlab will be taught in class on designated days. Programming assignments and/or projects will be announced in class.

Project: We learn the various optimization methods and their applications in this class. You can image there are tons of topics in analysis and applications we didn't include in class. You can talk with your classmates/friends and read newspapers about a topic relating optimization. The project may consist of problem background information, your idea of how to solve this problem, a prototype model proposed by you or a model from reference, data collection, parameter exploration, numerical exploration, and/or discussion about challenges and/or future directions. This can be an individual work or a group work of two or three students. At the end of the semester You will introduce your work to the class.

Exams: We will have 2 midterm exams and a final exam. Make-up exams will only be given with written

evidence of an official university excused absence. If you know in advance you will be unable to take an exam due to a university excused absence, please notify the instructor (preferably by email) as early as possible. No shows or failure to notify the instructor in advance will yield a score of zero. Your final score will replace your lowest **non-zero** midterm score, assuming it is higher.

Final Exam Policy: Students are expected to arrange their personal and work schedule to allow them to take the final exam at the scheduled time. No student will be permitted to take the final exam early. The final exam for this course is **10:00 a.m. to 12:00 p.m. Thursday, May 7 (Same Class Room)**.

Grading: Homework 20%, Computer Labs 5%, Project 20%, Semester Exams 30% (15% each), Final Exam 25%. Below is the *maximum* percentage required to get a particular letter grade. That is, I may lower these percentages, but I will not raise them.

Percentage	94	90	87	84	80	77	74	70	67	64	60	57
Letter Grade	A+	A	A–	B+	B	B–	C+	C	C–	D+	D	D–

Grade Questions: Any questions regarding grading/scoring of homework, exams, or projects must be made **within two class days** from when they were handed back, or no change in grade will be made. Because of privacy rights, **I cannot discuss grades over email or telephone**. Please do not email or call me asking about your grade. I will not be able to give you any information. Of course, I am happy to discuss grades in my office.

Attendance: Daily attendance for class lectures is expected and is **extremely important**. While attendance is not recorded, **missing even one class will put you behind**. Note that there is a strong correlation between class absences and poor grades. You are responsible for all material and announcements in class regardless of whether or not you attended. **You are also responsible for making arrangements with another classmate to find out what you missed. You should not ask me to go over material you missed (due to tardiness or absences) during office hours or over email.** Turn off your cellphones and other electronics.

ADA Language: Students with disabilities are encouraged to contact the instructor for confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Departmental Grading Appeals Policy: The Department of Mathematics does not tolerate discrimination or harassment on the basis of race, gender, religion, or sexual orientation. If you believe you have been subject to such discrimination or harassment, in this or any other math course, please contact the department. If, for this or any other reason, you believe your grade was assigned incorrectly or capriciously, then appeals may be made to (in order) the instructor, the vice chair, the Department grading appeals committee, the College of Arts and Sciences grading appeals committee, and the University grading appeals committee.

Course Evaluations: The Department of Mathematics course evaluation form will be available during the last two weeks of class. Evaluations are anonymous and instructors do not see the responses until after final grades have been submitted. Evaluations are important the department uses them to improve instruction. Please complete the evaluation and take the time to do so thoughtfully.

Statement of Academic Integrity: Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty.

Special Dates:

January 24, 2020 (Friday):	last day to withdraw from this course and not have it appear on your transcript.
March 6, 2020 (Friday):	last day to change your grade option to or from Pass/No Pass.
April 3, 2020 (Friday):	last day to drop this course and receive a grade of W. (No permission required.) After this date you cannot drop.