

ORI 397-19645 – Nonlinear Optimization

General Information

Instructor: Raghu Bollapragada

- Office: ETC 5.118
- Email: raghu.bollapragada@utexas.edu

Course Description: Optimization is an important tool in decision science. A wide variety of decision making problems arising in engineering applications are modeled as *nonlinear optimization* problems (NLPs). The goal of this course is to introduce basic theoretical principles underlying nonlinear optimization problems and the numerical methods that are available to solve them. We focus on algorithms and theory for smooth unconstrained, and constrained optimization problems.

Learning Objectives: By the end of the course, students will learn about the most common numerical optimization algorithms for solving smooth unconstrained and constrained optimization problems. They will understand the theoretical foundation and convergence properties of these methods, and in programming assignments they will learn how to implement the methods.

Topics Covered:

- Fundamentals of unconstrained optimization
- Line search and trust region methods
- Newton and quasi-Newton methods
- Conjugate gradient method
- Theory of Constrained Optimization
- Active set methods for quadratic programming
- Penalty methods
- Sequential quadratic programming
- Interior-point methods

Prerequisites: Multivariable Calculus, Linear Algebra and basic programming skills in Matlab or Python. No prior knowledge of optimization is assumed.

Text (optional): Numerical Optimization, 2nd Edition, by J.Nocedal and S.Wright, Springer Verlag, 2006. Most of the topics covered in the course will be based on this book.

Grading Policy: In this course, there will be several homework assignments, one in-semester exam and one final exam. The weightings are as follows:

Homework Assignments	40%
In-Semester Exam (in class)	30%
Final Exam	30%

Homework assignments are due at the beginning of class on designated days. On these assignments, you are allowed to discuss the problems with your classmates. However, you *must* write your own solution. Late assignments will not be accepted.

Exam Policy: You are required to take the exam at the scheduled time. Make-up exams will not be given without a valid medical excuse.

Honor Code: I expect everyone to abide by the UT Honor Code, which states: The core values of the University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. All suspected violations of the Honor Code will be referred to the Administration for adjudication. The assignments in this course are all to be completed individually. Stealing ideas or copying text from a classmate, the internet, or other external resources will be treated as a violation of the Honor Code. Plagiarism is a serious offense and is cause for dismissal from the University.

Additional Information

- **Email Communication:** For this class, email will be used as an official form of communication for notifying you of new homework assignments and other class updates. The University of Texas email policy can be found at: <http://www.utexas.edu/cio/policies/university-electronic-mail-student-notification-policy>.
- **Students with Disabilities:** The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.
- **Course Evaluation:** Near the end of the course you will have an opportunity to anonymously evaluate the course and instructor using the standard College of Engineering evaluation form.
- **Class Web Site and Privacy:** For this class, web-based, password-protected class sites will be available via the *Canvas* system. The syllabus, handouts, assignments and other resources are types of information that may be available within this site. Site activities could include exchanging e-mail, engaging in class discussions and chats, and exchanging files. In addition, a class e-mail roster will be a component of the site. Students who do not want their names included in this electronic class roster must restrict their directory information in the Office of the Registrar, Main Building, Room 1. For information on restricting directory information see: <http://registrar.utexas.edu/students/records/restrictmyinfo>.
- **Behavior Concerns Advice Line (BCAL):** If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual's behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance

Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit <http://www.utexas.edu/safety/bcal>.

- **Religious Holy Days:** By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.