ISyE 6663 - Spring 2026
Nonlinear Optimization

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Prerequisites: Linear Algebra (vectors, matrices, linear independence) and basic knowledge of real analysis and multivariate calculus (sequences, subsequences, accumulation/limit points, gradients and Hessian matrices of multivariate functions). The appendix of the courses main reference (see below) provides a comprehensive overview of these topics.

Course Outcomes: This course covers theory and algorithms for unconstrained and constrained nonlinear optimization problems. Topics to be covered include: 1) theory of convex analysis and Lagrangian duality; 2) optimality conditions for unconstrained and constrained optimization problems; 3) unconstrained optimization algorithms such as gradient methods, Newton method, quasi-Newton methods, conjugate direction conjugate gradient methods; 4) coverage of material as time permits from the following topics: i) penalty and barrier function methods; ii) interior point methods, and; iii) augmented Lagrangian methods. We will also study the complexity analysis of the algorithms in item 3.

Textbook: No textbook required. Lecture notes will be provided to you on Canvas and they are based on the reference:

- A. Ben-Tal and A. Nemirovski: Optimization III: Convex Analysis, Nonlinear Programming The- ory, Standard Nonlinear Programming Algorithms, lecture notes, 2024, https://www2.isye.gatech.edu/ nemirovs/

Homework problems will be taken from the problem sets provided in the lecture notes.

Grading policy: There will be two midterms (25% of the grade each), a final exam (35% of the grade), and four to five homework assignments (15% of the grade), which will only be partially graded. *Your final average score, computed according to the above weights, will be curved only at the end of the course to determine your letter grade for the course. The time allocated by Georgia Tech to the final exam is approximately three hours, but my usual allocated time is about 120 minutes. The final exam will be designed so that the time allocated to it will be sufficient.*

Homework policy: Your hw solutions should be submitted online before the due date and time assigned to them on Canvas. After that, they will NOT be accepted. There will be NO EXCEPTION to this rule unless you have an emergency that must be clearly explained.

Exam dates: 1st midterm (Feb 12th, Thursday); 2nd midterm (Mar 19th); final exam (May 7th, Thursday, 11:20 am - 2:10 pm).

Academic Honesty: It is expected that all students be aware of their responsibilities; this class will strictly adhere to the Georgia Tech Academic Honor Code (www.honor.gatech.edu).

Teaching mode: The teaching mode for the course is Residential, i.e., classes will be given in the classroom unless an emergency or special situation arises.

Re-grade: You can submit a written explanation by email to me for regrade after you check against the solutions and within 1 week after the solutions are provided.

Accommodations for Students with Disabilities If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at $(404)894-2563$ or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email me as soon as possible to set up a time to discuss your learning needs. For Covid19, individuals who fall into higher risk groups, as defined by the Georgia Department of Public Health and the Centers for Disease Control and Prevention, may request an accommodation. Students seeking an academic accommodation should start by contacting the Office of Disability Services.

Laptop, tablet and Cell phone use: Cell phone, tablet and laptop can be used to follow the class, not to become a distraction. They can used for taking notes, refer to notes, taking a photo on the board, etc. Please do not distract the others.

Generative AI In general, use of Generative AI and of any previous semester course materials, such as homework, projects, and any other coursework, are prohibited in this course. Using these materials will be considered a direct violation of academic policy and will be dealt with in accordance with the GT Academic Honor Code. When in doubt regarding what constitutes a violation, do not guess the answer and post on Piazza for clarifications.

Collaboration, Group Work, and Use of Generative AI You are allowed to work in groups on all homework and out-of-class assignments (and you may use my solutions), but any work you turn in must be written in your own hand. In-class tests and exams are to be your own work. All in-class tests and exams will be closed book and notes.

Student-Faculty Expectations Agreement At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.