ISyE 3133 Engineering Optimization
Spring 2026 Syllabus

1 General Information

Instructors: Prof. Mohit Singh (Lecturer)
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Prerequisites: Math 2602 or 2603 (C or better), CS 2316 or CS 1322, ISyE 2027, or equivalent.

These are REAL prerequisites!

Reading Material:

- (Text Book) Winston and Venkataramanan, Introduction to Mathematical Programming (ISBN-10: 0534359647 / ISBN-13: 978-0534359645)
  We will cover all or parts of the first 9 chapters and possibly some material from Chapters 10, 12, 13 and 14. The book is out of print, but the campus bookstore (in Tech square) may have some copies for you to buy. You can also buy or rent a used copy and the book may also be on the web. The same material is in Chapters 1-9 of *Operations Research: Algorithms and Applications by Winston*. It is a larger and more expensive book, but covers many topics of relevance to IE.
- The majority of course content will be provided through lectures, studios, and slides.

2 Expectations from the course

Course Description and Objectives:

At the end of the course you should be able to

1. "See" and formulate underlying deterministic mathematical programs in various practical systems,
2. Know what standard techniques are out there to solve them,
3. Code these mathematical programs and use software to solve these models,
4. Be able to interpret the results of a model and present the insights, and
5. Know the limitations of different solution methodologies.

How to approach this course: The most important thing you can learn from this course is not the memorization of any specific bit of material. Try to solve as many problems as you can. We will provide some and more are easily available in the textbook. Also, if you have any difficulty, discuss with us in office hours or with your friends when allowed. Finally, there is also Piazza where you can post your queries.

Tentative Course Outline:

Module 1 – Intro to Optimization and Formulating LPs and IPs:

- Operations Research and Optimization.
- Types of mathematical programs: Linear, Integer, Nonlinear, Mixed Integer Nonlinear.
- Formulating mathematical programs: Examples and applications in Linear, Integer modeling.

Module 2 – LP and IP Properties and Solution Methods:

- Linear Programming: Graphical solutions to linear programs, Geometry of linear programming, Simplex method, Degeneracy and cycling, Two-Phase Simplex, and Duality.
- Integer Programming: Enumeration, Linear Programming relaxation, Solution Strategies: Branch and Bound, Cutting Planes.

Module 3 – Special Formulations:

- Network Programming: Shortest Path Problem, Minimum Spanning Tree, Assignment Problem, Maximum Flow Problem, Transportation Problems.
- Models with Piecewise Linear Objective Functions
- Formulations and specialized methods for Traveling Salesperson Problem, Job Scheduling, and Integer Knapsack problem, etc.

3 Course Policies

Grading: Your course grade will be based upon my assessment of your understanding of the material covered throughout the semester. The weights used for grade assignment will be . Grades will be assigned as follows:

1. Attendance in Studio: 5%
2. Participation in Studio and Lectures: 5%
3. Programming Assignments (will require using Python and Gurobi): 5%
4. Quizzes: 20%
5. Midterm 1: 15%
6. Midterm 2: 15%
7. Final exam: 35%

After computing your course grade based on the above formula and evaluating your class participation, I will award your final letter grade, based on the traditional ten-point scale.

Programming Assignments: 5% of the course grade depends on 2 programming assignments. These will be group assignments, for groups of up to 3. See Canvas for deadlines.

Quizzes: 20% of the course grade depends on quizzes.

- There will be around 10 quizzes (see Canvas for schedule).
- Most quizzes will be taken during assigned studio section.

- Your lowest quiz scores are dropped.
- We do not offer any makeups or extensions on the quizzes. Quizzes must be taken in a student's assigned quiz section.

Exams:

1. There will be two in-class midterm exams (15% each of course grade), plus a final exam (35% of course grade).
2. See above for dates.
3. The exams will be closed book.
4. In general, there will be no makeup exams given. If you must miss an exam for any Institute-approved reason, please let me know as far in advance as possible. Travel arrangements are not sufficient reason to warrant a make-up exam or an incomplete grade.

Review and Re-grade request:

- Deadline: Submit a re-grade request on Gradescope within three days of release of grades.
- Please remember that we want you to receive every point you deserve. You can ask for a regrade every time you feel it is appropriate. Ideally, regrades should be requested when the reasons for such regrades are obvious (the marks you got on different questions do not add up to the total you received, etc.). Be aware that if the person who graded misunderstood your answer during the first grading, it was probably not clear. Explaining what you meant afterwards will not earn you any points.
- Regrade requests will not take place on the spot nor will it be considered face-to-face. The instructors keep the prerogative of performing a complete regrade of the assignment when you request the regrade of any of its parts (which can result in a overall lower score).

Attendance

Attendance is mandatory and will be checked with an ungraded short quiz or roll call. You are allowed up to three non-excused absences without questions asked.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct. Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not Applicable

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

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.

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.

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**.

Extensions, late assignments, and re-scheduled/missed exams

Late homework will be not be accepted.