ISYE 6662: Discrete Optimization

(Spring 2027)

Instructor: Oktay Günlük (ogunluk3@gatech.edu)

Lectures: Tuesdays and Thursdays: 2:00 pm – 3:15 pm, TBD

Office Hours: TBD

Grad TA: TBD

TA Office hours: TBD

Credit Hours: 3

Course Description

This course is intended to introduce doctoral students, particularly those in the ISyE IE and OR tracks, to the theoretical fundamentals, modeling techniques and algorithmic methodologies of integer linear programming. The algebraic and geometric properties of polyhedral formulations of mixed-integer programming problems are studied. Key topics include: formulations, relaxations, polyhedral theory, cutting planes, column generation, decomposition and enumeration.

Prerequisites

- Linear algebra at the advanced undergraduate level. You should be familiar with concepts such as matrix rank, determinants, linear independence, Gaussian elimination, etc., and should be comfortable doing basic proofs with them.
- Linear optimization at the doctoral level (ISyE 6661 or equivalent). You should be familiar with convexity, modeling with LP's, the simplex algorithm, LP duality, etc.

Course Objectives and Learning Outcomes

The main objective of the course is to develop a deep understanding of integer optimization problems and algorithms. The goal is to show students how to model with IP's (and what can and cannot be modeled with IP, to some extent), as well as to identify what makes a particular IP "easy" or "difficult", and the appropriate solution methodologies in each case.

Class Participation and Attendance

Students are strongly encouraged to attend lectures and actively participate by asking for clarifications and answering questions.

Homework Assignments

Homework assignments will be posted on Canvas and are due at **9PM on Mondays**.

- They should be submitted through **Gradescope**.

- Late submissions are not accepted.
- If you found that your graders made a grading mistake, clearly describe your request for regrade on **Gradescope**. Regrade request must be submitted **within one week after the grades are posted**. Any regrade request may require us to regrade your entire homework, not just the grading mistake.
- You may discuss solution approaches to homework problems with other students,
  - This may **not** involve taking notes.
  - You must write up solutions on your own independently, and clearly acknowledge anyone with whom you discussed the problem.

Assessments and Grades

Course grade will be based on homework assignments, two midterms and one final exam. The final exam will be cumulative, covering all topics studied during the semester.

Homework	10%	Bi-weekly
Midterm 1	30%	TBD
Midterm 2	30%	TBD
Final Exam	30%	TBD
Total	100%	

The course grade will be calculated using the percentages above. The natural cut-offs of 90, 80, 70 and 60 will be used for letter grades A, B, C and D. Letter grades can be increased using a curve.

Reading materials

Textbook: *Integer Programming* by Conforti, Cornuéjols and Zambelli.
`https://www.amazon.com/Integer-Programming-Graduate-Texts-Mathematics/dp/3319110071`

Lecture slides: We will also treat this document, which is available on Canvas, as a textbook.

Additional resources: If you would like to read additional material related to this course, material from most lectures can be found in

- Optimization over Integers, Bertsimas and Weismantel.
- Integer and Combinatorial Optimization, Nemhauser and Wolsey.
- Integer Programming, Wolsey.
- 6662 Lecture notes from 2019 (available on Canvas)
- 6661 Lecture notes from 2025 (available on Canvas)

Course Websites

The Canvas site will contain all of the information that you need in this course, including staff information and office hours, lecture notes, homework assignments and solutions, exam preparation material, course announcements. Make sure that you are enrolled on the course Canvas site and that you **check the site regularly** for updates, announcements, and new material. We will use Gradescope for homeworks and exam grades.

- **Canvas**: TBD
- **Gradescope**: TBD

We will use Ed Discussions as a place to ask and answer questions about the course content and the homework, which can also be accessed via Canvas. Please post your questions and feel free to answer other students' questions there. Participation in the form of asking or answering questions is strongly encouraged.

- **Ed Discussions:** TBD

If you email the course staff to ask questions regarding course content and homework, we will redirect you to Discussions site.

Course Policy

- Your work on the written homework and exams should be your own.
- Buying, selling, or reposting course materials on external websites will be considered an academic integrity violation.
- ODS students needing special accommodations must notify me within the first three weeks of the semester through AIM. (see USG handbook)
- All course participants (Instructors and Students) are expected and required to abide by the Georgia Tech Honor Code. For information on Georgia Tech's Academic Honor Code, please visit
  - `http://www.catalog.gatech.edu/policies/honor-code/` or
  - `http://www.catalog.gatech.edu/rules/18/`.
- 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. Please observe what I expect of you and what you expect of me listed in the Student-Faculty Expectations developed jointly by the SGA and faculty:
  - `https://catalog.gatech.edu/rules/21`