

IE 511-Spring 2022 Integer Programming

TR 9:30-10:50 am
Classroom: 1131 Siebel Center

Instructor: **Rasoul Etesami**
Office: 143 CSL Bldg. (*etesami1@illinois.edu*)
Office Hours, 3 pm-4:00 pm Thursdays, 143-CSL.

TA: TBD

Suggested Textbooks: *Integer Programming* by Laurence A. Wolsey
Integer and Combinatorial Optimization by Nemhauser and Wolsey
Theory of Linear and Integer Programming by Schrijver

NOTE: The classes will be in-person (except the first week, which will be online via Zoom). Lecture notes will be posted weekly in the Canvas. However, please feel free to take notes during the lectures as more details may be discussed in the class.

Canvas Link: <https://canvas.illinois.edu/courses/18128>

Course Description: The course will cover key topics in integer optimization including theory, algorithms and applications at the graduate level. Some specific topics to be covered are: Modeling and Formulations, Polyhedral Theory, Complexity, Lagrangian Relaxation and Duality, Dynamic Programming, Branch & Bound, and Cutting Plane Algorithms.

TENTATIVE COURSE OUTLINE:

Topics	Lectures
Introduction to IP, Formulation, and LP Basics	Weeks 1-2
Polyhedra Theory	Weeks 3-4
Computational Complexity	Week 5
Theory of Valid and Strong Valid Inequalities	Weeks 6-7
Lagrangian Duality, Relaxation, Branch&Bound	Weeks 8-9
Network Basics and Problems on Graphs	Weeks 10-11
Applications, Dynamic Programming, Analysis of Heuristics	Weeks 12-13
Matchings	Week 14
Matroids and Lattice Theory (if time permits)	Week 15

Mathematical maturity at the level of a beginning graduate student will be assumed. Familiarity with reading and writing mathematical proofs and basic knowledge in Linear Algebra are required. Prior coursework in Linear Programming, Linear Algebra and Graph Theory will be helpful.

Assignments and Exams:

- There will be 5 homework assignments, which will be posted approximately every-other-week. Homework assignments and their solutions will be posted in Canvas.
- You should upload your homework solutions in Canvas before the due date. **NO** late homework will be accepted.
- No collaboration or other solution sources are allowed on the problems assigned for homework or exams. It is important to explain your solutions clearly as it may affect your grades.
- There will be *one* in-class midterm exam. **TENTATIVE DATE: March 22.**
- There will be one one final exam. By mid April, the exact date and whether it is in-class or take-home will be determined.

Course Grade Composition:

Item	% of grade
Homework Problem Sets	60%
Midterm Exam	20%
Final Exam	20%