IE 310: Deterministic Models in Optimization

Spring 2023 TR 12:30 - 1:50 PM CT

103 Transportation Building

(Syllabus)

Instructor:	Jugal Garg (jugal@illinois.edu), 216B Transportation Building
TAs:	Eklavya Sharma (eklavya2@illinois.edu) and Vanshika Gupta (vg12@illinois.edu)
Course website:	`canvas.illinois.edu`; `http://jugal.ise.illinois.edu/ie310.html`
Zoom link:	Available on request
Slack link:	`ie310.slack.com`
Office hours:	Friday 3:00 - 4:00 PM CT or by appointment (Jugal; TB 216B) TBD (Eklavya) TBD (Vanshika)

Course Communication

All announcements, assignments, lecture slides, and other materials will be done through the course website on CANVAS.

Course Description

The course will introduce fundamental topics in optimization at the undergraduate level. Some specific topics to be covered are: Formulations, Linear Programming, Simplex Method, Duality, Sensitivity Analysis, Transportation, Assignment Problems, Network Optimization Problems, Integer Programs, Nonlinear Optimization, and Game Theory.

Prerequisites

Mathematical maturity at the level of a junior undergraduate student will be assumed. Prior coursework in Linear Algebra, Calculus and familiarity with Matrices is required.

Textbook (not required)

1. Introduction to Operations Research by Hillier and Lieberman (10th edition)

Course Objectives

Students completing this course will be able to:

1. formulate mathematical models for common operations research applications
2. identify the objectives, constraints, and decision variables for common optimization problems
3. apply common optimization algorithms for a variety of optimization problems (e.g., linear programs, network models, integer programs)

Tentative list of topics

- Linear Programming (Ch. 3, 4, 5, 6, 7)
  - Model formulation
  - Graphical approach
  - Simplex method
  - Variations of the simplex method
  - Sensitivity analysis
- Graphs and Networks (Ch. 8, 9)
  - Transportation problem
  - Assignment problem
  - Minimum spanning tree problem
  - Shortest path problem
  - Max flow problem
- Integer programming (Ch. 11)
  - Uses of binary variables
  - Branch and bound
- Nonlinear programming (Ch. 12)
  - Unconstrained optimization – search methods
  - Constraint optimization – Lagrange multipliers, KKT conditions

Required Work and Grading Policy

- Homework – Weekly assignments (45%)
- 2 Quizzes (5% each)
- 2 Midterm exams (12.5% each)
- Final Exam (20%)

Academic Integrity

We will follow Student Code Part 4 1-401 through 1-406 (`https://studentcode.illinois.edu/article1/part4/1-401/`).