IE 606 – Large Scale Optimization, Spring 2024

Instructor: Duygu TAŞ KÜTEN

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Office: FENS 1077

Office hours: T 11:40-12:30

Class meeting times and locations: T 10:40-11:30 (FENS 2019), R 13:40-15:30 (FENS G029)

Number of credits: 3 SU credits (10 ECTS credits)

Prerequisite(s): A graduate-level understanding of linear programming concepts.

Course Description: The aim of this course is to provide the students with necessary background for attacking large-scale optimization problems. In particular, strong models and valid inequalities, extended formulations, cutting plane and column generation algorithms, decomposition approaches in deterministic and stochastic optimization will be introduced along with applications in production planning, network design, and logistics.

Course Content: Design of efficient algorithms that exploit the structure of large-scale optimization problems; relaxation; decomposition; sparse systems; simplex with bounded variables; cutting plane methods and heuristic algorithms; effective computation techniques for real life applications.

Learning Outcomes: Upon successful completion of the course, the learner is expected to be able to (i) understand the difficulties of solving large-scale optimization models, (ii) learn decomposition methods to solve large-scale optimization models, and (iii) learn how to derive strong formulations for optimization problems.

Grading: Project: 15%; Midterm-1: 25%; Midterm-2: 25%; Final: 30%; Participation: 5%.

Project: Each student is required to deliver a term project. The first part of the project is to identify a large-scale optimization problem and to write up a short proposal describing the problem, providing a mathematical formulation and plans on how to solve it. In the second part, students are expected to apply and implement one (or a combination) of the techniques they learned in class to solve the problem they proposed using a programming language, and a commercial solver of their choice.

Exams: Closed book and closed notes.

Rules for attendance: Class participation contributes to 5% of the final grade.

Make-up Policy: A single comprehensive make-up exam will be offered after the final exam to those who have missed a midterm or the final exam. A medical report must be e-mailed to me from the Health Center to be eligible for the make-up.

Academic Integrity: Each student in this course is expected to abide by the Sabancı University Academic Integrity Statement (available at http://www.sabanciuniv.edu/en/academic-integrity-statement).

Tentative Outline:

- Introduction and large-scale optimization examples
- Revised simplex and column generation
- Dantzig-Wolfe decomposition
- Lagrangian relaxation and decomposition
- Valid inequalities
- Extended formulations
- Cutting planes
- Benders decomposition
- Two stage stochastic programming
- Heuristics
- Presentations by students on latest advances in large-scale optimization
- Project presentations by students

Disclaimer: The instructor reserves the right, when necessary, to alter the grading policy, change examination dates, and modify the syllabus and course content. Modifications will be announced in class and via SUCourse. Students are responsible for the announced changes.