IE 311: Operations Research I

Fall 2023

Instructor Ezgi Karabulut Türkseven (ezgi.turkseven@sabanciuniv.edu)

Lecture Hours
A: Tuesday 09:40–10:30 (FENS G032), Thursday 08:40–10:30 (FENS G032)
B: Tuesday 08:40–09:30 (FENS G032), Thursday 14:40–16:30 (FENS G032)

Recitation Hours
A: Friday 14:40–16:30.
B: Friday 16:40–18:30.

Office Hours
(Professor)
Wednesday 11:00–12:00 (both in-office and online, Zoom link is posted at SuCourse+)

Office Hours
(TAs) TBA
There will be extra office hours before the exams and they will be announced via SuCourse+.

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Catalog Description
Linear and integer programming formulations; convex analysis; algorithmic design and the simplex method; duality and sensitivity; computer implementations.

Objective The objective of this course is to study the modeling and solution of decision problems with deterministic parameters using operations research techniques with a particular emphasis on solution algorithms and implementation.
This course will cover the following main topics:

1. **Introduction to Optimization**: Introduction to decision making, modeling, and operations research. Common concepts in optimization.

2. **Modeling Linear and Integer Programs**:
   - (a) Modeling Linear Programs.
   - (b) Modeling Integer Programs.

3. **Analysis of Linear Programming**:
   - (a) Preliminaries (basic linear algebra and convex analysis).
   - (b) Simplex Method for structured LPs.
   - (c) Simplex Method for unstructured LPs.
   - (d) Duality.
   - (e) Dual Simplex and Revised Simplex Methods.
   - (f) Sensitivity and post-optimality analysis.

**Textbook**


**Reference Books**


**Grading**

- Quizzes (15%)
- Midterm 1 (25%) The date will be announced on SuCourse+
- Midterm 2 (25%) The date will be announced on SuCourse+
- Final (35%)
- Labs (10% BONUS)

**Lecture Style**

*Tuesday* classes will be **theoretical** lectures.

**Recitation Style**

On *Thursdays*, we will mostly have 1 hour of **theoretical** lecture, and 1 hour of **computer-based labs** and there will be implementation tasks.

On *Tuesdays*, **recitation questions** and **short videos** will be posted.

On *Fridays*, the TAs will hold **recitation hours**.

The students must have already watched the posted videos and worked on the recitation questions posted on Tuesday, and come prepared to these sessions with their **computers**.
Labs

– There will be a lab session on most Thursdays.
  – Groups of up to five students will work together on the implementation task assigned. Each group needs to submit their answer (typically a Python file) at the end of the session.
  – Students are allowed to form their own groups.
  – Each group should designate one member as the lead student in every lab session.
  – Each group should bring at least one laptop to the classroom.
  – The lead student is responsible for writing the code with the assistance of other group members and submitting the group’s answer to SuCourse+.
  – The lead student duty should be rotated every week.
  – The group’s answer will be graded on a 0-1 scale. The group will get 1 if the grader is convinced that the group has worked on the assignment (partially correct or completely incorrect answers can still get 1 if there is evidence in this direction).
  – Attending the lab session is not sufficient to get the grade. The grader should be convinced that the student is really participating the group work.
  – The lab grades will be considered as 10% BONUS in total.

Quizzes

– The quizzes will be given on Fridays during the recitation hours towards the end of the class.
  – The quizzes will be in-person, individual work and closed-book.
  – The content will primarily be based on the lectures and recitations after the previous quiz.
  – There will be almost weekly quizzes, and the lowest grade will be dropped.
  – There will be no make-up quiz.

Exams

– There will be two midterm exams and a final, all in-person and closed-book.
  – Each exam will have a computer-based component.
  – A comprehensive make-up exam will be given for students missing any of these exams due to a medical excuse at the end of the semester.
  – Tentative exam topics are as follows:
    • Midterm 1: Lectures 2a - 2b
    • Midterm 2: Lectures 3a - 3d
    • Final: Lectures 2a - 2b, Lectures 3a - 3f

Software: Students will need to model, implement and solve linear and integer programs in lectures, recitations and homework questions. We will use Gurobi solver with Python interface.
A step-by-step installation tutorial is already uploaded to SuCourse+.