IE 311: Operations Research I

FALL 2022

Instructor  Esra Koca (esra.koca@sabanciuniv.edu)

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

Recitation Hours
A1-A5: Friday 14:40 – 15:30

Office Hours
Monday 12:40–13:30 (both in-office and online, Zoom link is posted at SuCourse+)

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

Graduate Teaching Assistants
Arghavan Sharafi (arghavan@sabanciuniv.edu)
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Undergrad. Teaching Assistant
Burcak Kaymaz (burcakkaymaz@sabanciuniv.edu)

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.


**Reference Books**

**Grading**
- Quizzes (15%)
- Midterm 1 (25%) The date will be announced via SuCourse+
- Midterm 2 (25%) The date will be announced via SuCourse+
- Final (35%)
- Labs (6% BONUS)
- Participation (4% BONUS)

**Lecture Style**
- Most of the **Tuesday** lectures will be computer-based labs and there will be implementation tasks.
- The other **Tuesday** lectures will cover theoretical topics. Please see the tentative schedule - the changes will be announced on SuCourse+.
- On **Thursdays**, we will have theoretical lectures.
- Participation and asking questions are always welcome during the lectures.

**Recitation Style**
- 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 Tuesdays**.
– Groups of **three 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 **6% BONUS** in total.

Quizzes
– The quizzes will be given on **Fridays** during the **recitation hours** reserved for the quizzes:
A1-A5: Friday 15:40 - 16:30

– The quizzes will be **in-person** and **closed-book**.
– The content will primarily be based on the lectures and recitations after the previous quiz.
– There will be **6 quizzes** in total, and the **best 5** of them will be considered. Each quiz will have the same weight.
– 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
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<td>(5) 31-Oct</td>
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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+.