

IE 311: Operations Research I

Fall 2020

Instructor: Burak Kocuk (burak.kocuk@sabanciuniv.edu)

Lecture Hours: A: Tuesday 09:40–10:30, Thursday 14:40–16:30.
B: Tuesday 08:40–09:30, Thursday 08:40–10:30.

Office Hours Tuesday and Thursday 10:40–11:30.
(Instructor):

Recitation Hours: A1–A3: Thursday 16:40–17:30, Friday 10:40–11:30.
B1–B3: Thursday 16:40–17:30, Friday 11:40–12:30.
Each recitation on Friday will be followed by a one-hour office hour.

Office Hours Tuesday 12:40–13:30
(TAs): Wednesday 11:40–14:30.
Additionally, each recitation on Friday will be followed by a one-hour office hour.

Graduate Teaching Assistants: Bahar Okumuşoğlu (okumusoglu@sabanciuniv.edu)
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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**.

Course Topics: 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: Operations Research: Applications and Algorithms, 4th edition. W.L. Winston. Thomson/Brooks/Cole, 2004.

Homer Books Link

Reference Books: Introduction to Operations Research, 9th edition. F.S. Hillier, G.J. Lieberman. McGraw-Hill, 2010.
Operations Research: An Introduction, 7th edition. H.A. Taha. Prentice-Hall, 2003.

Lecture Style: All lectures will be live and delivered via Zoom. Students are required to attend at least 70% of the lectures.
On **Tuesdays**, we will have one hour of theoretical lectures (unless otherwise stated).
On **Thursdays**, we will have one hour of theoretical lectures and one hour of computer-based lectures (unless otherwise stated).
Each computer-based lecture will involve some implementation assignments. Although they will not be graded, students are required to submit their work through Sucourse at the end of the lecture.

Recitation Style: On **Tuesdays**, recitation questions and short videos will be posted.
On **Thursdays at 16:45**, there will be a quiz every week (the topic will be the recitation from the previous week).
On **Fridays**, the TAs will hold online office hours during the recitation hours. The students must have already worked on the recitation questions posted on Tuesday and come prepared to these sessions.

Grading: Quizzes (25%)
 Midterm 1 (22.5%) **November 16th at 19:40**
 Midterm 2 (22.5%) **December 19th at 10:00**
 Final (30%)
 Assignment (Bonus credit)
 A student is required to attend

- at least 70% of the lectures, and
- at least 70% of the quizzes, and
- at least one of the midterm exams, and
- the final exam.

Quizzes: Students should be prepared to have a quiz every Thursday at 16:45. The content will primarily be based on the lecture and recitation from the previous week. There are scheduled to be 10 quizzes in total. Two make-up quizzes will be given for all students (dates to be announced later). The best eight quizzes will be taken into consideration in the quiz grade (out of 10+2). Quizzes will be distributed via Sucourse, and recorded via Zoom online meeting platform.

Exams: There will be two midterm exams and a final. 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. Exam questions will be distributed one-by-one via Sucourse, and recorded via Zoom online meeting platform.

Tentative exam topics are as follows:

- Midterm 1
 - Lecture 2a: Modeling Linear Programs
 - Lecture 2b: Modeling Integer Programs
- Midterm 2
 - Lecture 3a: Preliminaries for LPs
 - Lecture 3b: Simplex Method for Structured LPs
 - Lecture 3c: Simplex Method for Unstructured LPs
- Final
 - Lecture 2: Modeling Linear and Integer Programs
 - Lecture 3d: Duality
 - Lecture 3e: Dual Simplex and Revised Simplex Methods
 - Lecture 3f: Sensitivity and Post-Optimality Analysis

Assessment
Policy:

The students will be informed about the structure and rules of the quizzes and exams via announcements sent through Sucourse. The rules announced will be applied strictly and it is students' responsibility to get familiar with them. There will be multiple versions of each of the questions (with equal difficulty) directed to the students. **If the student submits the answer of another version, s/he will receive 0 from the WHOLE assessment (quiz/exam)** unless s/he has a convincing explanation. Depending on the severity of the academic misconduct, the instructor will report such students to the Disciplinary Committee. Follow-up meetings will be arranged after each assessment regularly. An invitation to such a meeting does not necessarily mean that the student is under suspicion. In these meetings, the instructor may ask to clarify the submitted answer or ask a completely new question from the same topic. The student's grade might change after the follow-up meeting.

Tentative
Weekly
Schedule:

	Lectures		Recitations	
Week	Tuesday	Thursday	Thursday	Friday
05-Oct	Lecture 1	Lecture 2a	no quiz	Recitation 1
12-Oct	Lecture 2a		Quiz 0	Recitation 2
19-Oct	Lecture 2a		Quiz 1	Recitation 3
26-Oct	Lecture 2b	no class	no quiz	no recitation
02-Nov	Lecture 2b		-	Recitation 4
09-Nov	Lecture 2b		Quiz 2, 3	Recitation 5
16-Nov	Lecture 3a		Quiz 4	Recitation 6
23-Nov	Lecture 3a	Lecture 3a-b	Quiz 5	Recitation 7
30-Nov	Lecture 3b		Quiz 6	Recitation 8
07-Dec	Lecture 3c		Quiz 7	Recitation 9
14-Dec	Lecture 3d		Quiz 8	Recitation 10
21-Dec	Lecture 3e		Quiz 9	Recitation 11
28-Dec	Lecture 3f		no quiz	no recitation
04-Jan	Lecture 3f		Quiz 10	Recitation 12

Quiz 0 will not be graded but the attendance is essential to get familiar with the quiz format.

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.