IE 311: Operations Research I

Spring 2021

Instructor	Esra Koca (esra.koca@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 (Instructor)	Tuesday 11:00–11:30 Thursday 11:00–11:30
Recitation Hours	A: Thursday 16:40–17:30 B: Friday 09:40 – 10:30 C: Friday 10:40 – 11:30 D: Friday 12:40 – 13:30 E: Friday 14:40 – 15:30 F: Friday 17:40 – 18:30
Office Hours (TAs)	Thursday 17:40–18:30 Friday 08:40 - 09:30 Friday 11:40 - 12:30 Friday 13:40 - 14:30 Friday 15:40 - 16:30 Friday 16:40 - 17:30
Graduate Teaching Assistants	Deniz Tuncer (dtuncer@sabanciuniv.edu) Ibrahim Enes Yavas (iyavas@sabanciuniv.edu) Ismail Gokay Dogan (igokay@sabanciuniv.edu) Mosayeb Jalilian (mosayeb.jalilian@sabanciuniv.edu) Nozir Shokirov (shokirovnozir@sabanciuniv.edu) Yasaman Karimian Hadi Ardebili (yasaman@sabanciuniv.edu)
Undergrad. Teaching Assistants	Goksu Ozcan (goksuozcan@sabanciuniv.edu) Irmak Ecem Eris (irmakeris@sabanciuniv.edu) Murat Dalyanci (muratdalyanci@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.**

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 a single hour of **theoretical** lectures (unless otherwise stated).
On **Thursdays**, we will have one hour of **theoretical** lectures. In the second lecture hours, there will be a **quiz**, then we will have **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** and **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%)	**March 27th at 14:00-16:30**
Midterm 2	(22.5%)	**April 24th at 10:00 - 12:30**
Final	(30%)	

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. The content will primarily be based on the lecture and recitation from the previous week.

There are will be 10 quizzes in total. 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

Week	Lectures		Quizzes	Recitations
	Tuesday	Thursday	(Thursday)	(Thursday & Friday)
22-Feb	Lecture 1-2a		No Quiz	Recitation 1
1-Mar	Lecture 2a		Quiz 0	Recitation 2
8-Mar	Lecture 2a		Quiz 1	Recitation 3
15-Mar	Lecture 2b		Quiz 2	Recitation 4
22-Mar	Lecture 2b		Quiz 3	Recitation 5
29-Mar	Lecture 3a		Quiz 4	Recitation 6
5-Apr	Lecture 3a-3b		Quiz 5	Recitation 7
12-Apr	Lecture 3b		Quiz 6	Recitation 8
19-Apr	Lecture 3c		Quiz 7	No Recitation
26-Apr	Lecture 3d		Quiz 8	Recitation 9
3-May	Lecture 3e		Quiz 9	Recitation 10
17-May	Lecture 3f		Quiz 10	Recitation 11
24-May	Lecture 3f		No Quiz	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.