IE 311: Operation Research I

Summer 2021

Instructor:	Mahsa Ghandehari (Email: mahsa.ghandehary@sabanciuniv.edu)
Lecture Hours:	Thursday 12:40-14:30, Tuesday 11: 40-14:30, Wednesday: 12:40-14:30.
Office Hours (Instructor):	By appointment.
Recitation Hours:	A1-A3: Thursday: 14:40-16:30, Wednesday: 16:40-18:30
Office Hours (TAs):	By appointment (one week before exam additional office hours will be held)
Graduate Teaching Assistants:	Hüseyin Ender Sarı (sari@sabanciuniv.edu) Nima Moradi (nimamoradi@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 solving** of decision problems with **deterministic parameters** using operations research techniques with a particular emphasis on **solution algorithms and implementation**.
Course Topics:	The following main topics will be covered in this course:

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.
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 Thursdays and Wednesdays, we will have two hours of theoretical lectures (unless otherwise stated). On Tuesdays, we will have one hours of theoretical lectures and two hour of computer-based lectures (unless otherwise stated). Each computer-based lecture will involve some implementation assignments. Students are required to submit their work through Sucourse at the end of the lecture.

Grading:

Quizzes	(30%)	
Midterm	(35%)	July 29th at 14:50
Final	(35%)	
Assignments	(Bonus credit)	

A student is required to attend
- at least 70% of the lectures, and
- at least 70% of the quizzes, and
- the midterm exam, and
- the final exam.

Quizzes:	Students should be prepared to have **a quiz every Thursday at 14:45** except for the first week. The content will primarily be based on the lecture and recitation from the previous weeks. There are scheduled to be 7 quizzes in total. **The best six quizzes** will be taken into consideration in the quiz grade (out of 6+1). Quizzes will be distributed via Sucourse, and recorded via Zoom online meeting platform.
Exams:	There will be only one midterm exam 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
    – Lecture 2a: Modeling Linear Programs
    – Lecture 2b: Modeling Integer Programs

• Final
    – Lecture 3a: Preliminaries for LPs
    – Lecture 3b: Simplex Method for Structured LPs
    – Lecture 3c: Simplex Method for Unstructured LPs
    – 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.

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.

Tentative Schedule:

week	day		Lectures	Recitations	
1	July 1	(Thursday)	Lecture 1, 2a	No recitation session	
2	July 6	(Tuesday)	Lecture 2a	No recitation session	
	July 7	(Wednesday)	Lecture 2a, 2b	Recitation 1	Quiz 0
	July 8	(Thursday)	Lecture 2b	Recitation 2	Quiz 1, 2
3	July 13	(Tuesday)	Lecture 2b	No recitation session	
	July 14	(Wednesday)	Lecture 2b	Recitation 3	
4	July 27	(Tuesday)	Lecture 3a	No recitation session	
	July 28	(Wednesday)	Lecture 3a	Recitation 4	
	July 29	(Thursday)	Lecture 3a, 3b	Midterm	
5	August 3	(Tuesday)	Lecture 3b	No recitation session	
	August 4	(Wednesday)	Lecture 3b	Recitation 5	
	August 5	(Thursday)	Lecture 3c	Recitation 6	Quiz 3, 4
6	August 10	(Tuesday)	Lecture 3c, 3d	No recitation session	
	August 11	(Wednesday)	Lecture 3d	Recitation 7	
	August 12	(Thursday)	Lecture 3d, 3e	Recitation 8	Quiz 5, 6
7	August 17	(Tuesday)	Lecture 3e, 3f	No recitation session	
	August 18	(Wednesday)	Lecture 3f	Recitation 9	
	August 19	(Thursday)	Lecture 3f	Recitation 10	Quiz 7