

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 (Instructor) 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)
Burak Ispartali (burak.ispartali@sabanciuniv.edu)

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**.

Course Topics	<p>This course will cover the following main topics:</p> <ol style="list-style-type: none"> 1. Introduction to Optimization: Introduction to decision making, modeling, and operations research. Common concepts in optimization. 2. Modeling Linear and Integer Programs: <ol style="list-style-type: none"> (a) Modeling Linear Programs. (b) Modeling Integer Programs. 3. Analysis of Linear Programming: <ol style="list-style-type: none"> (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	<p>Operations Research: Applications and Algorithms, 4th edition. W.L. Winston. Thomson/Brooks/Cole, 2004.</p> <p>Homer Books Link</p>																		
Reference Books	<p>Introduction to Operations Research, 9th edition. F.S. Hillier, G.J. Lieberman. McGraw-Hill, 2010.</p> <p>Operations Research: An Introduction, 7th edition. H.A. Taha. Prentice-Hall, 2003.</p>																		
Grading	<table> <tr> <td>Quizzes</td> <td>(15%)</td> <td></td> </tr> <tr> <td>Midterm 1</td> <td>(25%)</td> <td>The date will be announced via SuCourse+</td> </tr> <tr> <td>Midterm 2</td> <td>(25%)</td> <td>The date will be announced via SuCourse+</td> </tr> <tr> <td>Final</td> <td>(35%)</td> <td></td> </tr> <tr> <td>Labs</td> <td>(6% BONUS)</td> <td></td> </tr> <tr> <td>Participation</td> <td>(4% BONUS)</td> <td></td> </tr> </table>	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)	
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	<p>–Most of the Tuesday lectures will be computer-based labs and there will be implementation tasks.</p> <p>–The other Tuesday lectures will cover theoretical topics. Please see the tentative schedule - the changes will be announced on SuCourse+.</p> <p>–On Thursdays, we will have theoretical lectures.</p> <p>–Participation and asking questions are always welcome during the lectures.</p>																		
Recitation Style	<p>–On Tuesdays, recitation questions and short videos will be posted.</p> <p>–On Fridays, the TAs will hold recitation hours.</p> <p>–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.</p>																		

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

**Tentative
Weekly
Schedule**

Week	Lectures		Recitations (Friday)	
	Tuesday	Thursday	Quiz	Recitation
(1) 3-Oct	Lecture 1	Lecture 2a	–	Recitation 0
(2) 10-Oct	Lab 0	Lecture 2a	–	Recitation 1
(3) 17-Oct	Lab 1	Lecture 2a	–	Recitation 2
(4) 24-Oct	Lab 2	–	–	–
(5) 31-Oct	Lecture 2a	Lecture 2b	Quiz 1	Recitation 3
(6) 7-Nov	Lecture 2b	–	Quiz 2	Recitation 4
(7) 14-Nov	Lab 3	Lecture 2b	Quiz 3	Recitation 5
(8) 21-Nov	Lab 4	Lecture 3a	–	Office hours
(9) 28-Nov	Lecture 3a	Lecture 3a-3b	–	Recitation 6
(10) 5-Dec	Lecture 3b	Lecture 3c	Quiz 4	Recitation 7
(11) 12-Dec	Lecture 3d	Lecture 3d	Quiz 5	Recitation 8
(12) 19-Dec	Lecture 3e	Lecture 3e	–	Office hours
(13) 26-Dec	Lecture 3f	Lecture 3f	–	Recitation 9
(14) 2-Jun	Lab 5	Lab 6	Quiz 6	Recitation 10

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+.