

IE 311: Operations Research I

FALL 2024

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

Lecture Hours Tuesday 09:40 – 10:30 (FENS G032)
Thursday 08:40 – 10:30 (FENS G032)

Recitation Hours A1-A2: Friday 15:40 – 16:30
B1-B2: Friday 12:40 – 13:30

Office Hours (Instructor) Tuesday & Thursday: 11:00–12:00 (FENS 1029)

Office Hours (LAs) Monday 17:40 - 18:30: Sude Tiras (FENS L065)
Wednesday 13:40 - 14:30: Onur Orman (FENS L065)
There will be extra office hours before the exams and they will be announced via SuCourse+.

Graduate Teaching Assistants Deniz Tuncer (deniz.tuncer@sabanciuniv.edu)
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Undergrad. Learning Assistants Cansu Karalezli (cansu.karalezli@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	<p>This course will cover the following main topics:</p> <ol style="list-style-type: none"> 1. Modeling Linear and Integer Programs: <ol style="list-style-type: none"> (a) Modeling Linear Programs. (b) Modeling Integer Programs. 2. 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	Operations Research: Applications and Algorithms, 4th edition. W.L. Winston. Thomson/Brooks/Cole, 2004.																		
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>November 10, 17:15 - 19:45</td> </tr> <tr> <td>Midterm 2</td> <td>(25%)</td> <td>December 8, 12:00 - 14:30</td> </tr> <tr> <td>Final</td> <td>(35%)</td> <td></td> </tr> <tr> <td>Labs</td> <td>(5% BONUS)</td> <td></td> </tr> <tr> <td>Participation</td> <td>(5% BONUS)</td> <td></td> </tr> </table>	Quizzes	(15%)		Midterm 1	(25%)	November 10, 17:15 - 19:45	Midterm 2	(25%)	December 8, 12:00 - 14:30	Final	(35%)		Labs	(5% BONUS)		Participation	(5% BONUS)	
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Lecture Style	<p>–On Tuesdays and in the first hour of Thursday lectures, we will have theoretical lectures.</p> <p>–The second hour of Thursday lectures will be <u>mostly</u> computer-based labs and there will be implementation tasks. So you should bring your computers to the classroom! Please see the tentative schedule - the changes will be announced on SuCourse+.</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 and LAs 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 Thursdays** (in the second hour).
- 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.
- There will be **6 labs** in total, and the **best 5** of them will be considered. Each lab will have the same weight.
- The lab grades will be considered as **5% BONUS** in total.

Quizzes

- The quizzes will be given on **Fridays** during the **recitation hours** reserved for the quizzes:
 - A1-A3: Friday 14:40 - 15:30
 - B1-B2: Friday 13:40 - 14:30
- The quizzes will be **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 **closed-book**.
- Midterm 1 and the Final exams will have **computer-based** components.
- 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, 8:40	Thursday, 9:40	Quiz	Recitation
(1) 23-Sep	Lecture 1	Lecture 2a		–	Recitation 0
(2) 30-Sep	Lecture 2a	Lecture 2a	Lab 0	–	Recitation 1
(3) 7-Oct	Lecture 2a	Lecture 2a	Lab 1	–	Recitation 2
(4) 14-Oct	Lecture 2a	Lecture 2a	Lab 2	Quiz 1	Recitation 3
(5) 21-Oct	Lecture 2b	Lecture 2b	Lab 3	Quiz 2	Recitation 4
(6) 28-Oct	–	Lecture 2b	Lab 4	Quiz 3	Recitation 5
(7) 4-Nov	Lecture 2b	Lecture 2b		–	Recitation 6
(8) 11-Nov	Lecture 3a	Lecture 3a		–	Recitation 7
(9) 18-Nov	Lecture 3a	Lecture 3a-3b		–	Recitation 8
(10) 25-Nov	Lecture 3b	Lecture 3c		Quiz 4	Recitation 9
(11) 2-Dec	Lecture 3d	Lecture 3d		Quiz 5	Recitation 10
(12) 9-Dec	Lecture 3e	Lecture 3e		–	Recitation 11
(13) 16-Dec	Lecture 3f	Lecture 3f	Lab 5	–	Recitation 12
(14) 23-Dec	Review	Lab 6		Quiz 6	–

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+.