

# TED UNIVERSITY

## IE 533 Deterministic Optimization

Fall 2023-2024

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**Credit Hours: (3+0+0) 3 TEDU Credits, 7.5 ECTS Credits**

Mathematical Programming for Engineering Management

**Instructor:**

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Lectures: 18:00-20:50 Tuesday (Room: A331)  
Office Hours: by appointment

**Course Description:** Convex analysis and polyhedral sets; Modeling linear programming problems; The Simplex method; Duality theory and sensitivity analysis; The revised simplex method and Farkas' Lemma; Modeling, relaxing and bounding techniques; Fundamental easy-to-solve problems; Branch and bound, cutting planes, branch and price, and column generation methods; Nonlinear optimization basics and Karush—Kuhn—Tucker conditions.

**Pre-requisites:** NONE

**Learning Outcomes:** Upon successful completion of this course, a student will be able to

1. Formulate and solve deterministic continuous optimization problems with a single objective as a linear program.
2. Model optimization problems with discrete or integer variables
3. Solve small problems with the simplex method and revised simplex algorithm.
4. Perform sensitivity analysis on the optimum solution of a given linear program.
5. Translate a given linear program into dual form.
6. Interpret the dual of a given linear program.
7. Perform sensitivity analysis on the optimum solution of a given linear program.
8. Use the branch and bound, column generation and the cutting plane algorithms for solving integer programming problems.
9. Use Karush—Kuhn—Tucker conditions for solving nonlinear programming problem.

<b>Grading:</b>	Article Pres.	10%	<b>Student Workload (estimated)</b>	Lectures	42 hrs
	Homework	25%		Readings	45 hrs
	Midterm	30%		Homework	25 hrs
	Final	35%		Mid-term Exam	20 hrs
				Final Exam	30 hrs
			Case Study / Oral Pres.	25 hrs	

**Computer Usage:** Use of solver software.

**Course Evaluation:** Course feedback survey will be conducted in the last two weeks of the semester.

**Required Text:** Hanif D. Sherali, John J. Jarvis, and M. S. Bazaraa Linear (2009) Programming and Network Flows, Wiley.

**Recommended Texts:**

Integer Programming by L. Wolsey, 1998, Wiley & Sons.  
Winston W. L. (2004), Operations Research (4th edition), Duxbury.

### **TENTATIVE COURSE SCHEDULE**

<b>Week</b>	<b>Topic</b>
1	Convex analysis and polyhedral sets.
2	Modeling optimization problems.
3	Modeling optimization problems.
4	The Simplex method; Duality theory and sensitivity analysis.
5	The revised simplex method and Farkas' Lemma.
6	Modeling, relaxing and bounding techniques.
7	Fundamental easy-to-solve problems.
8	Fundamental easy-to-solve problems.
9	Mid-term Exam
10	Branch and bound, column generation and the cutting plane algorithms
11	Branch and bound, column generation and the cutting plane algorithms
12	Branch and bound, column generation and the cutting plane algorithms
13	Nonlinear optimization basics and Karush—Kuhn—Tucker conditions.
14	Nonlinear optimization basics and Karush—Kuhn—Tucker conditions.

**Important Dates:**

- Mid-term Exam: Week 9 (28 November)
- Final Exam — Finals Week

## Other Course Policies

**Policy on Syllabus Change:** This course schedule is tentative, and it will be adapted to the pace of the class in agreement with the students.

**Makeup Policy:** A single make-up exam will be given only for medical excuses documented by medical reports that are approved by the Student Health Center or other documented excuses approved by the university's executive branches. All make-up examination(s) for all exams will be given at or after the end of the semester.

**Late Submission Policy:** Late submissions of the assignments will not be graded. You need to submit homework in hardcopy (preferably) or as a single pdf file attached to an e-mail message.

**Plagiarism:** "All of the following are considered plagiarism:

- Turning in someone else's work as your own
- Copying words or ideas from someone else without giving credit
- Failing to put a quotation in quotation marks
- Giving incorrect information about the source of a quotation
- Changing words but copying the sentence structure of a source without giving credit
- Copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not" (www.plagiarism.org)

Plagiarism is a very serious offense and will be penalized accordingly by the university disciplinary committee. The best way to avoid accidentally plagiarizing is to work on your own before you ask for the help of other resources.

**Cheating:** Cheating has a very broad description which can be summarized as "acting dishonestly". Some of the things that can be considered as cheating are the following: copying answers on exams, projects and homework, using prohibited material on exams, lying to gain any type of advantage in class, providing false, modified or forged data in a report, plagiarizing, modifying graded material to be re-graded, causing harm to colleagues by distributing false information about an exam, project or homework.

Cheating is a very serious offense and will be penalized accordingly by the university disciplinary committee. For more information on TEDU policy on intellectual integrity, please see the following link. [http://www.tedu.edu.tr/Assets/Documents/News/Public/TEDU\\_Ogrenci\\_El\\_Kitabi\\_2012.pdf](http://www.tedu.edu.tr/Assets/Documents/News/Public/TEDU_Ogrenci_El_Kitabi_2012.pdf)

**Assignment Rules:** Written homework is a very important part of this course. Your understanding of the course material will improve dramatically if you do the homework. Once again, late homework will not be accepted.

**Calculator Policy:** You may use a calculator unless instructed not to do so. You may not use a cellular device as a calculator.

**Attendance:** You are expected to attend all classes. Classes start on the hour. Cell phones should be switched to silent mode and kept out of sight during class.