# TED UNIVERSITY

## IE 331 Mathematical Modeling and Optimization II

## Fall 2016-2017

Credit Hours: (3+0+0) 3 TEDU Credits, 6 ECTS Credits

**Instructor**:
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Lectures: 12:00-13:00 Monday (A331)
10:00-12:00 Tuesday (A331)
Office Hours: by appointment

**Course Description**: Network models. Integer programming. Branch and bound method. Cutting plane algorithm. Nonlinear programming. Dynamic programming

**Pre-requisites:** IE 232

**Learning Outcomes:**

Upon succesful completion of this course, a student will be able to
1. Construct mathematical models for network, integer and nonlinear programming problems. [e] [B3]
2. Solve integer models and nonlinear models by using programming techniques and programming software.[e, k] [B3]
3. Use the branch and bound algorithm and the cutting plane algorithm for solving integer programming problems. [e, k] [B3]
4. Use algorithms developed for solving nonlinear programming problems. [e, k] [B3]
5. Solve network problems. [e, k] [B3]
6. Use dynamic programming approach to model and solve optimization problems. [e, k] [B3]
7. Analyze model inputs and outputs. [b2,] [B4]

**Grading:**

| | |
|---|---|
| Assignments (4) | 15% |
| Quiz (2) | 10% |
| Midterm I | 20% |
| Midterm II | 20% |
| Final Exam | 25% |
| Active Learning Exercises | 10% |

## Required Textbook:

- Winston W. L. (2004), Operations Research (4th edition), Duxbury

## Recommended Textbooks:

- **Hillier F.S. and Lieberman G.J. (2014), Introduction to Operations Research (10th edition), McGraw-Hill**
- Taha, H. A. (2007), Operations Research (8th edition), Prentice Hall

**Software:** OPL (Optimization Programming Language) will be used to create mathematical programming models. CPLEX will be used to solve those models.

## Your role in the course:

Students are expected to be prepared for each class by studying the material scheduled to be covered in that class. Participation in class discussions is an important part of student learning and will be encouraged throughout the course. Some lectures will not be limited to the textbook, so attendance is important. In addition, "Active Learning Exercises" sessions will be conducted in some lectures and constitute 10% of your total grade.

## Important Dates:

- Midterm I – November 10, 2016
- Midterm II – December 15, 2016
- Final Exam – Finals Week (To be dated)

## Tentative Course Schedule

| Week | Topic |
|---|---|
| 1 | Course Introduction, Network Models: Basic Definitions, Minimum Spanning Tree Problem |
| 2 | Network Models: Minimum Cost Network Flow Problem |
| 3 | Network Models: Shortest Path Problem, Maximum Flow Problem, Ford-Fulkerson Algorithm, Bi-partite Matching Problem |
| 4 | Network Models: Bi-partite Matching Problem |
| 5 | Integer Programming (IP) Modeling: Basic definitions, Fixed Charge Problem, Facility Location Problem, Set Covering Problem, IP modeling guidelines, Either-Or constraints |
| 6 | IP Modeling: If-Then constraints, Traveling Salesman Problem |
| 7 | IP Modeling: Traveling Salesman Problem, Midterm I |
| 8 | Branch and bound method, Branch and bound examples |
| 9 | Branch and bound examples, Branch and cut method |
| 10 | Using optimization software (OPL, CPLEX) |
| 11 | Nonlinear Programming (NLP): Modeling, Convexity Review |
| 12 | NLP: Unconstrained Optimization; Midterm II |
| 13 | NLP: Constrained Optimization, KKT Conditions |
| 14 | Dynamic Programming |

## General Policy

**Syllabus Change:** The course schedule announced is tentative. It will be adapted to the pace of class in agreement with the students.
**Make up policy:** Make up exams 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. There will only be one comprehensive make up exam.

### Assignment submission policy:

- Assignment solutions must be handed in at the beginning of class on the day that it is due.
- Late submissions are not accepted.
- Your solutions must be written neatly and in an understandable fashion.
- Under no circumstances it is allowed to copy another student's work. Otherwise, the student(s) involved will receive 0 for that assignment.

### Academic Integrity:

Please avoid all types of actions that can be considered as cheating or plagiarism. All of the following are considered plagiarism among others according to the web site www.plagiarism.org:

(i) turning in someone else's work as your own, (ii) copying words or ideas from someone else without giving credit, (iii) failing to put a quotation in quotation marks by referencing it, (iv) giving incorrect information about the source of a quotation, (v) changing words but copying the sentence structure of a source without giving credit, (vi) copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not.

**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** has a very broad description which can be summarized as "acting dishonesty". Some of the things that can be considered as cheating are the following:

(i) copying answers on exams and all types of assignments, (ii) using prohibited material on exams, (iii) lying to gain any type of advantage in class, (iv) providing false, modified or forged data in a report, (v) modifying graded material to be re-graded, (vi) causing harm to colleagues by distributing false information about an exam or an assignment.

TED University takes academic integrity seriously. We, the students and faculty of the TED University, dedicate ourselves to upholding the highest standards of academic integrity. Academic integrity means that one's work is the product of one's own effort, and one neither receives nor gives unauthorized assistance in any assignment. Because advanced academic work depends on the sharing of information and ideas, academic integrity at the college level includes rigorous adherence to the conventions for acknowledging one's use of the words and ideas of other people, and instruction in this fundamental skill of college life is available to all TED University students (www.tedu.edu.tr)