CENG 567

Design and Analysis of Algorithms

Fall 2022

Syllabus

Course web page: `https://odtuclass.metu.edu.tr`

1   Course Catalog Description

Introduction to algorithms. The computational complexity of algorithms. Amortized analysis. Lower and upper bound theory. Approaches for designing algorithms: Divide-and-Conquer, Greedy Approach, Dynamic Programming, Backtracking and Branch-and-Bound. NP-Complete and NP-Hard problems. Approximation algorithms.

2   Instructor

Nihan Kesim Çiçekli
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3   Course Objectives

At the end of this course, you will learn:

- review of basic concepts of analysis of algorithms

- review of important algorithms

- lower and upper bound teory concepts and proof of them.

- a number of algorithm design approaches, such as divide and conquer, greedy design technique, dynamic programming, backtracking, branch and bound design techniques.

- amortized analysis

- NP-Complete and NP-Hard problems

- proof of NP-Completeness and reducibility

- approximation algorithms

4   Text book and References

- Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley, 2006 (*text book*).

- T.H. Cormen, C.E. Leiserson, and R.L. Rivest, Introduction to Algorithms, MIT Press, 2009.

- Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, Algorithms, 2006.

5   Course Schedule

Wed 9:40-12:30 (BMB3) During classes you will be expected to participate in in-class exercises. Your response to the exercises will be graded.

6   Tentative Weekly Outline

Week	Topics
1	Introduction and Stable Matching Problem
2	Algorithm Analysis
3	Graphs
4	Greedy Algorithms I
5	Greedy Algorithms II
6	Divide and Conquer I
7	Divide and Conquer II
8	MIDTERM
9	Dynamic Programming I
10	Dynamic Programming II
11	Network Flow
12	Amortized Analysis
13	Intractability
14	Approximation Algorithms

7   Grading

- Homework: 30%

- Midterm: 30%

- Final: 35%

- Participation: 5%

7.1 Homework and Late Submission Policy

There will be 5 written homework assignments. Homework will typically be due approximately 1 week after it is posted. Assignments must be submitted in pdf via odtuclass. I recommend using LaTeX to write your answers. Each assignment will include one or two questions related to the most recent topic covered in class.

Most homework problems will require you to prove some sort of formal claim (e.g., that your algorithm is correct). For these proofs, clearly state the claim that you are trying to prove. Treat these proofs as standard mathematical proofs, and make sure you include all relevant details. If I cannot understand your algorithms or proofs, you will receive 0 points for that problem.

You may work with others, but must write-up your own solutions. If you work with other students, then make a note of this on your homework. Directly copying solutions from other people, the internet, textbooks, or other sources is considered plagiarism.

Each student receives a total of 8 tokens to spend for late submission for the entire semester. You may use late day tokens on any written assignment. However no assignment may be submitted more than 2 days (48 hours) late without permission from the instructor. In other words, this means there is a practical upper limit of 2 late days usable per assignment.

7.2 Exams

Both the midterm exam and the final exam will be in-person in the classroom.

The final exam will consist of two parts: the first will cover the material from the midterm, the second will cover new material. If you score higher on the part of the final corresponding to the midterm than you did on the midterm, you can replace your score on midterm with your score from that part of the final.

7.3 Participation

Your participation to in-class activities is important. Participation includes attempting to answer the questions asked in class.

8 Makeup Policy

Make-up midterm exam is not permitted. If you have a legal excuse and miss the midterm exam, you will be able to replace that score by your score on the corresponding section of the final exam.

Make-up final exams will be permitted by the approval of the instructor only, and only when necessary due to an emergency situation.