

## CS 502: Algorithms II

Instructor: Mehmet Koyutürk

## 1 Course Objectives

*“Computer Science is no more about computers than astronomy is about telescopes.”*

– E. W. Dijkstra

This course provides an in-depth introduction to the design and analysis of advanced algorithms for solving computational problems. It is expected that, upon completion of this course, the students will achieve the following learning objectives:

- Become fluent in analyzing algorithms and data structures in terms of correctness and required computational resources.
- Comprehensively understand, use, and manipulate advanced and efficient data structures.
- Develop a comprehensive and in-depth understanding of common algorithm design techniques.
- Be able to design and analyze algorithms to solve new problems.
- Understand how to formulate different problems in terms of each other.
- Develop a comprehensive understanding of the theory of computational complexity.
- Have fun! (make no mistake though, as you have already experienced in Algorithms I, this is an important and rather challenging course that has to be taken seriously)

## 2 Class Meeting

Wed 9:40-10:30, Fri 10:40-12:30, EB-202.

Spare Hour: Wed 8:40-9:30

## 3 Instructor

Mehmet Koyutürk

- **Office:** EA-501
- **e-mail:** `koyuturk@cs.bilkent.edu.tr`, `mehmet.koyuturk@case.edu`.
- **Office Hours:** Tue 14:00 – 15:00, Wed 11:00-12:00.

## 4 Textbook

T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein. *Introduction to Algorithms*, 3rd Ed. Cambridge, MA: MIT Press, 2009. [ISBN: 978-0-262-03384-8.]

## 5 Prerequisites

CS 473: Algorithms I.

## 6 Course Work & Grading

**Participation:** The students are expected to review the material to be covered before each class meeting, attend the class meetings, and actively participate in class discussions. It is imperative that students ask questions whenever something is not clear to them in the class. Active participation in class discussions will be used to the student's advantage while grading borderline cases. Use of laptops and tablet computers in class meetings is allowed as long as this does not cause any disturbance in the classroom atmosphere. The use of mobile phones is not permitted.

**Assignments:** (30%) There are 5 assignments, each consisting of a few problems related to the material that was covered in class after the last assignment. The assignments will be graded on the basis of effort and understanding of material. The assignments will be graded by sampling questions from the entire problem set, thus you will not receive feedback on your solutions. Therefore, it is imperative that you discuss your solutions with the instructor to receive feedback on your solution and to make sure that you will not lose grades in case you happen to answer the graded question wrong.

The students are *allowed* (but **not required**) to work on assignments in teams of two and submit a joint assignment. If two students submit a joint assignment, their assignment will be graded and both students will receive the same grade with no reduction. However, the number of assignments that can be submitted with the same partner is **limited to 2**. A student can submit all assignments with a partner, provided that no more than 2 assignments are submitted with each partner. While the students are allowed to talk about assignments and receive help from each other as needed, each submitted assignment must uniquely represent the genuine work of submitting individuals. **Copying answers from other students/teams or from material on the web will not be tolerated.**

The students will return **hard copies**. Handwriting is accepted, as well as use of typesetting software (LaTeX is highly recommended), and the students are responsible for the legibility of their answers.

**Midterm Exam:** (30%) There is one 110-minute midterm exam.

**Final Exam:** (40%) The final exam will cover all of the course material comprehensively.

The exam will consist of questions that aim to assess the student's understanding and ability to analyze, use, and manipulate the methods and algorithms covered in class. **The students are allowed to use the textbook (but no other printed material or electronic devices) in all exams.**

## 7 Calendar

- Chapter 22: Elementary Graph Algorithms  $\approx$  2,5 weeks (Assignment 1)

- Chapter 19: Binomial Heaps  $\approx$  1 week
- Chapter 20: Fibonacci Heaps  $\approx$  1 week
- Chapter 21: Disjoint Set Data Structure  $\approx$  1 week (Assignment 2)
- Chapter 23: Minimum Spanning Trees  $\approx$  1 week
- Chapter 24: Single-Source Shortest Paths  $\approx$  2 weeks (Assignment 3, Midterm Exam)
- Chapter 25: All-Pairs Shortest Paths  $\approx$  1,5 weeks
- Chapter 26: Maximum Flow  $\approx$  2 weeks (Assignment 4)
- Chapter 34: NP-Completeness  $\approx$  2 weeks (Assignment 5)
- Chapter 35: Approximation Algorithms (as time permits and as desired by students)
- Heuristic Algorithms for Graph Problems (as time permits and as desired by students)
- Randomized Algorithms (as time permits and as desired by students)

## 8 Plagiarism Policy

Zero-tolerance policy on plagiarism is enforced. Following the departmental plagiarism policy, cheating on homeworks or tests will result in an F grade for the whole course and appropriate disciplinary action, independently of the extent of plagiarism. In case of doubt, the students are responsible for checking with the TA or the instructor on what is allowed and what is not.