CSE 246 Analysis of Algorithms, Spring 2019

Instructor: Assist. Prof. Ömer Korçak **E-mail:** omer.korcak@marmara.edu.tr

Office: 452 **Office hours:** Thursday 10:30-11:30, Friday 11:00-12:00

TA: Muhammed Nur Avcil

Course Description: Introduction, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency, Brute Force and Exhaustive Search, Decrease-and-Conquer Algorithms, Divide-and-Conquer Algorithms, Transform-and-Conquer Algorithms, Space and Time Trade-Offs, Dynamic Programming, Greedy Technique, Iterative Improvement, Limitations of Algorithmic Power, P, NP, NP-Complete Problems, Coping with the Limitations of Algorithmic Power.

Lecture hours: Thursday 09:30 – 10:20 (MC 165), Friday 14:00 – 15:50 (MC 165)

Textbook: A. Levitin, Introduction to the Design and Analysis of Algorithms, 3rd edition, Pearson.

Grading:
Midterm: 30%
Homeworks and Experiments: 30%
Final: 40%

Academic Integrity: Any kind of cheating and plagiarism will be severely penalized. Write everything in your own words and sentences (your own English, even if it is broken!).

Course Outline:
1. Introduction: The Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures. (3 hours)
2. Fundamentals of Analysis of Algorithms Efficiency, Asymptotic Notations and Standard Efficiency Classes, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Empirical Analysis of Algorithms. (4 hours)
3. Brute Force and Exhaustive Search: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching. Exhaustive Search, Depth-First Search and Breath-First Search. (3 hours)
4. Decrease-and-Conquer: Insertion Sort, Topological Sorting, Generating Permutation and Subsets, Binary Search, Decrease-by-a-Constant-Factor Algorithms, Variable-Size-Decrease Algorithms. (4 hours)
5. Divide-and-Conquer: Master Theorem, Mergesort, Quicksort, Binary Tree Traversals and Related Properties, Strassen's Matrix Multiplication, Closest-Pair Problem. (4 hours)
6. Transform-and-Conquer: Presorting and its Applications, Heaps and Heapsort, Horner's Rule.(3 hours)
7. Space and Time Tradeoff in Algorithms, Sorting by Distribution Counting, String Matching Algorithms, Hashing. (4 hours)
8. Dynamic Programming: Basic Examples, The Knapsack Problem, Binomial Coefficients, Warshall's and Floyd's Algorithms, Optimal Binary Search Trees. (4 hours)
9. Greedy Technique: Prim's Algorithms. Kruskal's Algorithms. Dijkstra's Algorithms, Huffman Coding. (3 hours)
10. Iterative Improvement: Maximum Flow Problem, Maximum Matching in Bipartite Graphs. (3 hours)
11. Limitations of Algorithm Power: Lower-Bound Arguments, Decision trees, P, NP, NP-Complete Problems. (3 hours)
12. Coping with the Limitations of Algorithm Power: Backtracking, Branch-and-Bound, Introduction to Approximation Algorithms. (4 hours)