CMPE 300 ANALYSIS OF ALGORITHMS

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Course Description:
This course is intended to introduce the student to the main paradigms of algorithm analysis, methods and mathematical tools used for analyzing the performance of algorithms, the theory of parallel algorithms, as well as known sequential and parallel algorithmic solutions to frequently encountered problems.

The theory of complexity analysis, basic techniques that are commonly used in analyzing the performance, basic classes of algorithms (comparison-based, recursive, divide-and-conquer, dynamic, greedy, numerical, graph), and lower bound theory will be covered. Parallel architectures and parallel algorithms will be studied in detail. Meanwhile, mathematical tools like interpolation, master theorem, etc. will be introduced. The last part of the course will be the study of the topic of probabilistic algorithms, which is a rapidly growing area of research.

Textbook:
- Algorithms: Sequential, Parallel, and Distributed, Kenneth A.Berman, Jerome L.Paul, Thomson, 2005

Reference Book:
- Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd ed., MIT Press, 2009

Lecture Hours and Rooms:
Tuesday   12:00-13:00
Wednesday   10:00-12:00

Course Schedule:
Introduction
Algorithm complexity (Best-case, Worst-case, Average complexity)
Asymptotic analysis (Growth rate, Aymptotic notation, Comparison of growth rates)
Analysis of example algorithms
Interpolation (θ-invariant under scaling, Scale invariant classes)
Stable, in-place, on-line algorithms
Adjacent-key comparison-based algorithms
Recurrence relations (Forward substitution, Backward substitution, Change of variable)
Master Theorem
Divide-and-conquer and graph algorithms (Fast matrix multiplication, Depth-first and breadth-first search and traversal)
Dynamic programming and greedy method (Longest common subsequence, Knapsack problem)
Parallel architectures (Flynn's taxonomy, Shared memory, Distributed memory)
Parallel algorithms (Analysis, Goodness measures, Evaluation)
Lower bound theory (Optimality, Simple counting, Enumeration, Adversary arguments, Decision trees, Reduction)
Probabilistic algorithms (Randomizing deterministic algorithms, Monte Carlo algorithms, Las Vegas algorithms)

Notes:
- Midterm will be held on 16.11.2022 Wednesday during lecture hours.
- The midterm and final examinations will be "closed books and notes".
- You can follow the announcements via the university's Moodle system (https://moodle.boun.edu.tr). (Students registered to the course are automatically added to the course in Moodle.)
- The textbook is available on Moodle.
- *Attendance for both the midterm exam and the final exam, and submitting the projects are mandatory. Otherwise, you will fail the course, regardless of the grades obtained in other parts of the course.*
- Please read the section "undergraduate courses" on the web page General Information for Students (https://www.cmpe.boun.edu.tr/~gungort/informationstudents.htm). This page explains the course policy, the grading system, and information about the assignments and projects. Please note especially the "procedure for cheating behaviour", which will be followed strictly.