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.

Text Book: Algorithms: Sequential, Parallel, and Distributed, Kenneth A.Berman, Jerome L.Paul, Thomson, 2005 (Chp.1, Chp.2, Chp.3 (3.1-3.3,3.5), Chp.4 (4.2), Chp.5 (5.1-5.3), Chp.6, Chp.7 (7.3), Chp.8 (8.4), Chp.9 (9.4), Chp.11 (11.2,11.3), Chp.15, Chp.24 (24.1-24.4), Chp.25)

Reference Books:

- An Introduction to the Analysis of Algorithms, Robert Sedgewick, Philippe Flajolet, 2nd ed., Addison Wesley, 2013
- Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd ed., MIT Press, 2009
- Introduction to the Analysis of Algorithms, Michael Soltys-Kulinicz, 3rd ed., World Scientific Pub., 2018
- Introduction to the Design and Analysis of Algorithms, Anany Levitin, 3rd ed., Pearson, 2011

Lecture Hours and Rooms:

Tuesday	12:00-13:00	Online
Wednesday	11:00-13:00	Online

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)

Evaluation: (subject to change)

Quiz (10)	:	50 % (10 * 5%)
Project (1)	:	25 %
Final	:	25 %

Notes:

- Final exam will be a take-home exam.
- You can follow the announcements via the university’s Moodle system (https://moodle.boun.edu.tr).
- The text book is available on Moodle. You can obtain the reference books from the instructor/library.
- *Attendance for the final exam, at least 5 of the quizes, and submitting the project are mandatory. Otherwise, you will fail the course, regardless of the grades obtained in other parts of the course.*
- *Attendance to all the quizes is not mandatory. However, if you attend less than 8 quizes (i.e. 5, 6 or 7 quizes), there will be grade reduction of 5% from the overall course grade for each missing quiz.*
  As a bonus, if you attend all the quizes, there will be a 5% extra credit for the overall course grade.
- 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.