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 correctness and 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, numerical, graph), and lower bound theory will be covered. Parallel architectures and parallel algorithms will be studied in detail. Meanwhile, mathematical tools like interpolation, generating functions, 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 recent but rapidly growing area of research.

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

Reference Books:
- Algorithm Design, Jon Kleinberg, Eva Tardos, Addison Wesley, 2006
- Algorithm: The Spirit of Computing, David Harel, Yishai Feldman, Addison Wesley, 2004
- Algorithms: Sequential, Parallel, and Distributed, Kenneth A.Berman, Jerome L.Paul, Thomson, 2005
- Analysis of Algorithms: An Active Learning Approach, Jeffrey J.McConnell, Jones and Bartlett Pub., 2001

Lecture Hours and Rooms:
Tuesday  12:00-14:00  ETA A3
Wednesday 10:00-11:00  ETA A2

Course Schedule:
Introduction
Algorithmic complexity (Best-case, Worst-case, Average complexity)
Asymptotic analysis (Growth rate, Asymptotic 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, Generating functions)
Master Theorem
Numeric and graph algorithms (Fast matrix multiplication, Depth-first and breath-first search and traversal)
Parallel architectures (Flynn’s taxonomy, Shared memory, Distributed memory)
Parallel algorithms (Analysis, Goodness measures, Evaluation)
Correctness for parallel algorithms (0/1 sorting lemma)
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)
Assignments (2) :  % 10 (2 * 5%)
Projects (2) :  % 30 (2 * 15%)
Midterm :  % 25
Final :  % 35

Notes:
- Midterm will be during the week 8-12.4.2013.
- The midterm and final examinations will be “closed books and notes”.
- You can follow the announcements about the course from the course web site.
- You can obtain the text book from the bookstore and the reference books from the instructor/library.
- Attendance for both the midterm exam and the final exam, and submitting both projects are obligatory. Otherwise, you will fail the course, regardless of the grades obtained in other parts of the course.
- Attendance for lectures is not obligatory. But you are responsible from lectures’ contents.
- Please read the section “undergraduate courses” on the web page General Information for Students. 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.