CMSC 651: Advanced Algorithms
Fall 1999

Course Information: *http://www.cs.umd.edu/~samir/651/651.html*

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Office hours: Monday, Wednesday 10-11 (before class).

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Office Hours: Tu 12:30 to 2:00 and Th 9:00-10:30 in AVW 1151.

Class Time: MW 11-12:15, Room: CLB 0109.

Course Overview: Techniques for the design and analysis of algorithms and data structures. Study of efficient algorithms from areas such as graph theory, networks, pattern matching, geometry etc. Understanding of the inherent complexity of problems: polynomial time, NP-completeness and approximation algorithms.

The following broad aims will be attempted.

- Understanding techniques to design and analyse data structures. These will find applications in combinatorial algorithms that we study.
- Learning and designing efficient algorithms for basic graph theoretic problems that are used as building blocks elsewhere. These include shortest paths, minimum spanning trees, matching, flow etc.
- An understanding of the inherent complexity of problems: Polynomial time, NP-completeness, Approximation Algorithms etc.

Texts: There is no one book for the course – we will cover material from three books. All three will be on reserve in the CS library. (The first book most of you should have, the second two are actually quite cheap – Tarjan's book can be purchased through SIAM and the Papadimitriou and Steiglitz book is very cheap through Amazon.)

Thomas Cormen, Charles Leiserson, Ron Rivest, *Introduction to Algorithms*, McGraw Hill and MIT Press, 1990.

Robert Tarjan, *Data Structures and Network Algorithms*, SIAM, 1983.

Papadimitriou and Steiglitz, Combinatorial Optimization: Algorithms and Complexity.

I will also make my lecture notes available on the home page for the class.

Prerequisites: CMSC 451 or an equivalent course.

Course Work: Course work will consist of a midterm, a final exam and homeworks.

Grading: The relative weights of these will be 25% for the homeworks, 35% for the midterm, and 40% for the final.

Syllabus: The topics listed below give a general idea about the course content.

1. Advanced Data Structures (splay trees, F-heaps, union-find).
2. Graph Algorithms (minimum spanning trees, shortest paths, light approximate shortest path trees, spanners, flows, matchings).
3. NP-completeness (Cook's theorem, reductions).
4. Approximation Algorithms (set cover, vertex cover, bin packing, traveling salesman, optimal location problems).