CMSC 451: Design and Analysis of Algorithms

Spring 2004

http://www.cs.umd.edu/class/spring2004/cmsc451/

Instructor: Aravind Srinivasan - Office: AVW 3227. Office phone: 405-2695; E-mail: *srin@cs.umd.edu*. Office hours: Tue, Thu 11 AM - 12 noon.

Class Time: TuTh 12:30 - 1:45 PM, Room: CSI 3117

Teaching Assistant: Srinivasan Parthasarathy, *sri@cs.umd.edu*. Office hours to be announced.

Final and Mid-Term Exams The final examination, according to the official university schedule, will be on Tuesday, May 18, 1:30 – 3:30PM. The midterm will be on Thursday, March 18, during class hours (12:30–1:45 PM). Both exams will be held in the classroom, and will both be closed-book, closed-notes.

Course Overview: This course presents the fundamental techniques for designing efficient computer algorithms, proving their correctness, and analyzing their complexity. General topics include graph algorithms, and basic algorithm design paradigms (such as divide-and-conquer, dynamic programming and greedy algorithms), lower bounds and NP-completeness.

Text: Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, *Introduction to Algorithms* (Second Edition), MIT Press and McGraw-Hill, 2001.

Prerequisites: CMSC 351. Each student is expected to know the basic concepts of programming (e.g. loops, pointers, recursion), discrete mathematics(proof by induction, sets), simple data structures (lists, stacks, queues, trees, heaps), and calculus (logarithms, differentiation, integration). I will assume knowledge of the basic algorithm-analysis techniques covered in CMSC 351.

Course Work: Course work will consist of 5-6 homework assignments, a small project and two exams (one midterm and a comprehensive final). Homework problems will be mathematically oriented.

Homeworks are to be turned in at the start of class on the due date. Since homework solutions will be handed out on the day the homework is due NO LATE HOMEWORKS WILL BE ACCEPTED. (In other words, hand in whatever you have finished. You are also welcome to turn in hoemworks *before* the due date if you cannot come to class on the due date.) If you cannot come to class for some reason, please mail the homework to me (should be postmarked a day *before* the due date).

All homeworks are to be done independently, with no help from the web, or other sources. If you have questions, please talk to the TA or the Instructor. Assignments are to be written up NEATLY. Badly written assignments WILL NOT be graded. Please staple your homework. *It is your responsibility to make sure that you pick up all homeworks and handouts. All course information and handouts will be available on the web page.*

Grading: Final grades will be based on homework assignments, the project, the midterm exam, and the comprehensive final exam. The relative weights of these will be 20% for the homework total, 10% for the project, 30% for the midterm, and 40% for the final exam. Graduate students in this class will be given extra work on homeworks and exams.

Syllabus: The topics, times and order listed below are tentative and are subject to small changes.

1. Graph exploration: connected components, topological sorting, strongly connected components (4-5 lectures).
2. Greedy algorithms: minimal spanning trees, shortest paths, scheduling (4 lectures).
3. Divide and Conquer algorithms: geometric algorithms, selection, lower bounds for minimum and sorting, matrix multiplication (4 lectures).
4. Dynamic programming: shortest paths, Warshall's algorithm, optimal search-trees (5 lectures).
5. String matching, other string-type algorithms (2 lectures).
6. NP-completeness: introduction to reductions, the classes P and NP, NP-complete problems, approximation algorithms (5-6 lectures).
7. Randomized Algorithms: The model and some basic algorithms (2 lectures)