Course Information

Staff

Lecturer: Luca Trevisan, luca@cs.columbia.edu. Office 462 CSB, tel. 939 7019. Office hours: Monday 6-7pm and Thursday 11-12am.
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General

The course deals with the design and analysis of algorithms. Emphasis is on algorithmic efficiency and correctness. The course will present algorithmic ideas that are of general use, and mathematical tools to analyse them.

References

The following text will be used

[CLR] Thomas H. Cormen, Charlie E. Leiserson and Ronald L. Rivest. *Introduction to Algorithms*. MIT Press, 1990.

A good reference text is

[AHU] Alfred V. Aho, John E. Hopcroft, and Jeffrey D. Ullman. *The Design and Analysis of Computer Algorithms*. Addison-Wesley, 1974. Contains all the material covered in the course except approximation algorithms. Proofs are shorter than in CLR but not necessarily harder to follow.

The ultimate reference is

[K] Donald E. Knuth. *The Art of Computer Programming*. Addison-Wesley, 1997/98 (3rd edition). Encyclopedic work in three volumes. See more about the author at http://www-cs-faculty.Stanford.EDU/~knuth/

The textbook has been ordered at Labyrinth bookstore and is already in stock. Purchase of the other books is not needed for the course.

Additional notes will be distributed during the course.

Grades and Policies

Grades are given by: homeworks 55%, midterm 20% and final 25%. There will be six problem sets. The homeworks average will be taken over the grades of the best five homeworks. This policy has an obvious loophole: a student that gets full grades on the first five homeworks may see no point in turning in the sixth assignment. However submission of all six homeworks will typically be a necessary condition to receive an A+ grade, and so the hypothetical student better turn in the sixth assignment as well.

Collaboration during the solution of problem sets is not allowed. Discussion of the results presented in class is allowed, but discussions on how to apply them to the solution of a homework is not. See `http://www.cs.columbia.edu/home/academics/cheating.html`. It is allowed to consult books and other publications, provided references are included in the solutions. Contact the instructor if you are unsure about the collaboration policy.

Homeworks are due *in class*, on the due date. Late submissions are not accepted. Extensions may be requested *before* the due date, and be motivated. Under no circumstance we will accept the submission of a homework after solutions have been posted.

Students attending this course through CVN can submit their homework via express mail or electronic mail. Email submissions should be sent to Dario with CC to Luca. As a general policy, the due date for CVN students is *two days later* than the due date for the other students. When the regular due date is Thursday, the CVN due date is Monday. For express mail submissions, the submission must be *sent* by the due date.

The midterm and the final are *closed book* exams, no books, notes or calculators are allowed. However each student can prepare and take with him/her a *single sheet of paper* with notes.

Prerequisites

Data structures and discrete mathematics. Knowledge of the material covered in Chapters 1, 2, 5, 7, 8, 11 of [CLR] is assumed.

Course Web Page

A course web page has been set up at `http://www.cs.columbia.edu/~luca/w4231/fall99`. The web page will contain all the handouts, problem sets, problem set solutions, and lecture notes handed out during lectures, as well as copies of the slides used during lectures.

This course is an introduction to the design and analysis of efficient algorithms. Topics covered include: models of computation, efficient sorting and searching, algorithms for algebraic problems, graph algorithms, dynamic programming, probabilistic methods, NP-completeness.

Tentative schedule

Sept. 7 Administrativia. Introduction: review of the RAM model of computation, analysis of algorithms, time and space complexity, asymptotic notation, lower bounds.

Sept. 9 Divide-and-conquer, Master Theorem to solve recurrences.

Sept. 14 Linear time median.

Sept. 16 Probability, randomized median selection

Sept. 21 Linear time sorting.

Sept. 23 Introduction to data structures. Hashing.

Sept. 28 Randomized hashing.

Sept. 30 Binomial heaps.

Oct. 5 Amortization.

Oct. 7 Fibonacci heaps.

Oct. 12 Fibonacci heaps.

Oct. 14 Fibonacci heaps.

Oct. 19 Midterm.

Oct. 21 Graphs. Definitions, topological sort.

Oct. 26 Connectivity, random walks.

Oct. 28 Max flow, min cut.

Nov. 4 Randomized min cut.

Nov. 9 Dynamic programming.

Nov. 11 Dynamic programming.

Nov. 16 NP-completeness.

Nov. 18 NP-complete problems.

Nov. 23 NP-complete problems.

Nov. 30 Number-theoretic algorithms.

Dec. 2 Number-theoretic algorithms.

Dec. 7 RSA encryption.

Dec. 9 Primality testing.

Problems Set 0

Send email to `dario@cs.columbia.edu` with the following information:

- Name
- Undergraduate or Graduate student
- Level/Year
- Email address (if different from the one used to send the message)

This information will be used to generate a mailing list of all the students enrolled in the course. You will receive a confirmation message in a few days.

Your problem set 1 will not be graded if you do not send this information.