Topics in Algorithms

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Brief course description

The course revolves around graph algorithms. We will cover basic principles in algorithm design, such as randomized algorithms, and demonstrate their applicability to areas such as dynamic graph algorithms, graph compression problems, and distributed computing.

At least a third of the course will be devoted to dynamic graph algorithms, which are, roughly speaking, algorithms that aim to efficiently cope with the constantly changing physical world.

A *tentative* list of topics that will be covered

- Introduction to randomized algorithms: Matrix multiplication, Karger's min-cut algorithm, Turan's theorem
- Graph compression problems: Spanners for general graphs and geometric spanners
- Dynamic graph algorithms: Maximal and approximate maximum matching, vertex cover, MIS, forest decomposition
- Distributed algorithms: Luby's algorithm and more (if time permits)

Course Material

The course is based on material from several textbooks (see the list below) as well as papers that have been published in the last few years, which will be linked from the course website.

Textbooks:

- M. De Berg et al. *Computational Geometry.* Springer, 1997.
- R. Motwani and P. Raghavan. *Randomized Algorithms.* Cambridge University Press, 1995.
- C. H. Papadimitriou and K. Steiglitz. *Combinatorial optimization: algorithms and complexity.* Courier Corporation, 1998.
- D. Peleg. *Distributed computing: a locality-sensitive approach.* Society for Industrial and Applied Mathematics, 2000.
- V. Vazirani. *Approximation Algorithms.* Springer, 2001.

Course Requirements

There will be a final exam, which will determine the grade.