ADM III Approximation Algorithms, Winter 2010/11

Course Information

October 19, 2010

1 Instructor and TA Information

Instructor:	Prof. David Williamson
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Teaching Assistant:	Jannik Matuschke
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2 Lectures

Lectures will be held in MA 750 on Tuesdays and Thursdays from 14:15-15:45.

3 Exercise Session

Exercise sessions will be held in MA 750 on alternate Wednesdays from 14:15-15:45. The first session will be October 27.

4 Course website

The course website will be at http://www.math.tu-berlin.de/coga/teaching/wt10/approx/. Various materials from the course will be posted there.

5 Prerequisites

There is no formal prerequisite. In addition to the usual mathematical basics, good knowledge of combinatorial optimization (ADM I) and linear programming (ADM II) will be assumed. Please talk to me if you have questions about whether you have the necessary background.

6 Textbooks

The required text is "The Design of Approximation Algorithms", written by myself and David B. Shmoys. We will be making copies for anyone interested in obtaining one; the cost will depend on how many students end up ordering a copy, but will be no more than 25 euros. Alternatively, the book is obtainable in electronic (unprintable) form at

`http://www.designofapproxalgs.com`. Many assigned exercises will come from the book, so you will need to have access to it in one form or another.

Other materials that might be helpful for the course:

- Vijay V. Vazirani, *Approximation Algorithms*, Springer, 2004. A good text.
- Bernhard Korte and Jens Vygen, *Combinatorial Optimization*, 4th edition, Springer, 2008. A reasonably good-sized section on approximation algorithms with some material not covered by Vazirani.
- Dorit S. Hochbaum, editor, *Approximation Algorithms for NP-hard Problems*, PWS Publishing Company, Boston, 1997. A collection of surveys. Now somewhat dated, but some surveys are still quite good.

7 Requirements

There will be problem sets, handed out every other week, and a final oral exam for those who request one. The problem set will be due at the beginning of the exercise session in which the answers will be discussed. Students are strongly encouraged to do the problem sets, as this is the best way to learn the course material. Questions from the problem sets may appear on the final oral exam. The student with the best overall score on the problem sets will get a free copy of the book once it is published. Other incentives, such as chocolate, will be offered to students presenting solutions in the exercise session.

8 Collaboration

Your work on problem sets should be your own. You may discuss approaches to problems with other students. You may write up solutions in groups of at most two. You should acknowledge anyone with whom you discussed the problem by writing their names on your problem set. I suggest that you do not use papers or books or other sources (e.g. material from the web) to help obtain your solution, as this is the best way to learn the material for yourself.

9 Schedule

Here is a rough schedule for the course, which will is subject to change without notice. Depending on the background of the class, I may go either faster or slower than this schedule indicates.

Oct	19, 21	Introduction to approximation algorithms: Set cover. Problem set 1 out.
Oct	26, 28	Greedy algorithms and local search: Bank float. Minimizing maximum-degree spanning tree.
Oct	27	Exercise session. Problem set 1 due.
Nov	2	No class.
Nov	4	Greedy algorithms and local search: Scheduling identical parallel machines. Problem set 2 out.
Nov	9, 11	Rounding data and dynamic programming: Scheduling identical parallel machines.
Nov	10	Exercise session. Problem set 2 due.
Nov	16, 18	Deterministic LP rounding: Prize-collecting Steiner tree. Facility location. Problem set 3 out.
Nov	23, 25	Random sampling and randomized rounding: MAX SAT. Prize-collecting Steiner tree. Facility location.
Nov	24	Exercise session. Problem set 3 due.
Nov	30	Semidefinite programming: MAX CUT.
Dec	2	Semidefinite programming: Quadratic programming. Coloring 3-colorable graphs. Problem set 4 out.
Dec	7, 9	Primal-dual method: Shortest path. Generalized Steiner tree.
Dec	8	Exercise session. Problem set 4 due.
Dec	14, 16	Primal-dual method: Facility location. k-median via Lagrangean relaxation. Problem set 5 out.
Dec	21, 23	Christmas break.
Dec	28, 30	
Jan	4, 6	Cuts and metrics: Multicut. Tree metrics.
Jan	11, 13	Cuts and metrics: Tree metrics.
Jan	12	Exercise session. Problem set 5 due.
Jan	18, 20	Greedy algorithms and local search revisited: k-median and facility location. Problem set 6 out.
Jan	25, 27	Deterministic LP rounding revisited: Min-cost bounded-degree spanning tree.
Jan	26	Exercise session. Problem set 6 due.
Feb	1, 3	Random sampling and randomized rounding revisited: Single-source rent-or-buy. Steiner trees. Problem set 7 out.
Feb	8, 10	Semidefinite programming revisited: Coloring a 3-colorable graph. Unique games.
Feb	9	Exercise session. Problem set 7 due.
Feb	15, 17	Cuts and metrics revisited: Sparsest cut and low-distortion embeddings.
Feb	22, 24	Cuts and metrics revisited: Oblivious routing. Minimum bisection.

10 Your information

Please fill out the information below and return it by the end of the lecture.

Name _____

Preferred email address _____

Will you be requesting a final oral exam? _____

Would you like a printed copy of the book? (Cost: At most 25 euros) _____

I have already studied some amount of approximation algorithms (Yes/No; if Yes, how much):

I would like to see the following material covered: