ORIE 634 Approximation Algorithms

Course Information

August 24, 2006

1 Instructor Information

Instructor:	David Williamson
Office:	Rhodes 236
Office hours:	Mondays 1-2, Wednesdays 11-12, and by appointment.
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2 Lectures

Lectures will be held in Upson 109 on Tuesdays and Thursdays from 11:40-12:55.

3 Course website

The course website will be at `legacy.orie.cornell.edu/~dpw/or634/index.html`. Various materials from the course will be posted there.

4 Prerequisites

There is no formal prerequisite. In practice, I will be assuming a basic knowledge of linear programming, and some previous exposure either to algorithms or combinatorial optimization. If you've had a good undergraduate algorithms class, and some small exposure to linear programming, you should be fine. I will be giving out a handout on the first day with basic background information in linear programming for those who have not studied it. Please talk to me if you have questions about whether you have the necessary background.

5 Textbooks

There is no required textbook. Instead, we will be using the following sources. I will be distributing hardcopies of a draft of a book I am writing with David Shmoys. The text is incomplete and some sections are in better shape than others. Your feedback is requested on typos, sections that are unclear (or even incorrect), and anything else that you think would improve the presentation.

The text will be supplemented by lecture notes from a previous version of the course that will be available on the course web site.

For sections of the book that are not currently written in the draft textbook, my intention is to write up these sections as we cover them, and distribute them as supplementary notes.

Finally, for materials we cover that are not in any of the above nor will be in the textbook, I will ask for an official "scribe" to take notes for that day's class. The scribe will then get to me a clearly written version of the notes (preferably in LaTeX) within a week. Producing scribe notes will be either a requirement of the course or extra credit, depending on the ratio of students to lectures that need scribing.

Other materials that might be helpful for the course:

- Vijay V. Vazirani, *Approximation Algorithms*, Springer, 2004. A good, recent text.
- Bernhard Korte and Jens Vygen, *Combinatorial Optimization*, 3rd edition, Springer, 2005. 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 slightly dated, but some surveys are quite good.

6 Requirements

There will be 5 problem sets, handed out and collected on a biweekly basis. In addition, there may be a take-home final, which will count for somewhat more than a problem set.

7 Collaboration

You may collaborate with other students on the solution of problem sets. However, you must write up solutions on your own independently, and acknowledge your collaborators. If you use papers or books to help obtain your solution, you must cite those sources.

No collaboration will be allowed for the take-home final.

8 Schedule

Here is a rough schedule for the course, which will is subject to change without notice. This may be a bit ambitious; we will probably cover less material than is listed here.

Aug	24	Introduction to approximation algorithms. Set cover.
Aug	29, 31	Greedy algorithms and local search: Bank float. Minimum-degree spanning trees. k-center. Problem set 1 out.
Sept	5, 7	Rounding, scaling, and dynamic programming: Knapsack. Bin packing.
Sept	12, 14	Deterministic LP rounding: Bin packing. Facility location. Problem set 1 due. Problem set 2 out.
Sept	19, 21	Randomization: MAX SAT. Max Cut in dense graphs.
Sept	26, 28	Semidefinite programming: MAX CUT. Correlation clustering. Coloring 3-colorable graphs. Problem set 2 due. Problem set 3 out.
Oct	3, 5	Metric methods: Multiway cut. Multicut.
Oct	10	No class (Fall break).
Oct	12	Metric methods: Multicut. Balanced cut.
Oct	17, 19	Metric methods: Tree metrics. Problem set 3 due. Problem set 4 out.
Oct	24, 26	Primal-dual methods: Feedback vertex set. Shortest path. Generalized Steiner tree.
Oct	31	Primal-dual methods: Facility location. k-median via Lagrangean relaxation.
Nov	2	Problem set 4 due. Problem set 5 out.
Nov	7, 9	Greedy algorithms and local search revisited: k-median and facility location.
Nov	14, 16	Metric methods revisited: Sparsest cut and low-distortion embeddings. Problem set 5 due.
Nov	21	Advanced topics.
Nov	23	No class (Thanksgiving).
Nov	28, 30	Advanced topics. Take-home exam out (tentative)
Dec	7	Take-home exam due (tentative).

9 Your information

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

Name ____

Net ID _______________ Preferred email address _______________

Major ____________________ Year ____________________

Are you taking this class for credit? ____

I have studied the following subjects:

____ Linear programming
____ Algorithms
____ Combinatorial optimization
____ Complexity theory (including NP-completeness)
____ Linear algebra
____ Combinatorics and/or graph theory