

EE 381V Advanced Algorithms

Instructor: Prof. Evdokia Nikolova

Lecture Hours: TTH 5:00-6:30 PM, PAR 303

Office Hours: TTH 6:30-7:00 PM; Wed 4-5 PM

Office: UTA 7.212, phone: 512-471-1932

E-Mail: nikolova@austin.utexas.edu

Web: <http://users.ece.utexas.edu/~nikolova>

TA: TBD

Overview: Algorithm design and analysis is a fundamental and important part of computer science. This course introduces students to advanced techniques for the design and analysis of algorithms, and explores a variety of applications. The emphasis will be on *approximation algorithms*.

The topics and applications that we tentatively plan to cover include combinatorial algorithms (set cover, steiner tree and TSP, multiway cut, knapsack, minimum makespan scheduling), LP-Based algorithms (LP Duality, set cover via dual fitting, LP rounding techniques, sparsest cut, facility location, semidefinite programming and max-cut) and other topics including approximation algorithms based on algorithmic game theory, hardness of approximation and open problems.

Prerequisites: Probability and Stochastic Processes (EE 381J or equivalent), Algorithms (EE 360C or equivalent), Optimization (EE 380N-11 or equivalent).

References:

- *Algorithm Design* by Jon Kleinberg & Eva Tardos.
- *Approximation algorithms* by Vijay Vazirani.

Additional relevant research papers and surveys will be posted as the class develops the list.

Course Policy: Course material will be available on Canvas.

You may discuss homeworks and papers with other students, but you are not allowed to copy from others. University disciplinary procedures will be invoked if any form of cheating is detected. Course and instructor evaluations will occur in the last week of lecture.

Grading:

20% Homeworks

25% Midterm Exam

50% Final Project (inc. proposal)

5% Class Participation

Homework problems assigned in a given week are due on Thursday of the following week by the start of class, either turned in class before the start of lecture or under the door of Prof. Nikolova's office. You may discuss homeworks and papers with other students, but you are not allowed to copy from others. You must write the names of all the students you collaborated with at the top of your homework, but turn in your own version. Simply copying another student's paper is not acceptable, even if referenced as such. Copying without referencing will be treated as cheating. Late homework will be accepted only in the most extraordinary of circumstances. Homework will taper off considerably towards the latter part of the course as students focus on their projects.

Regrade Policy: All requests for regrades, on homework or exam, must be submitted in writing within a week of their return to you. No verbal complaints will be considered. Mistakes can be made in the grading process and we will correct those, but it is unlikely that more partial credit will be given. The basic idea here is that we don't want to indirectly penalize those students who don't ask for regrades. Also be aware that the result of a regrade can actually be a lower score as we will regrade the entire problem being protested.

College Drop/Add Policy: An engineering student must have the Dean's approval to add or drop a course after the fourth class day of the semester.

Students with Disabilities: The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4382.

Tentative Syllabus

- **Weeks 1-5:** Combinatorial algorithms
 - Set cover
 - Steiner tree and TSP
 - Multiway cut
 - Knapsack
 - Minimum makespan scheduling
- **Week 6-10:** LP and SDP-based approximation algorithms
 - LP Duality
 - Set cover via dual fitting
 - LP rounding techniques
 - Sparsest cut

- Facility location
- Semidefinite programming
- Max-cut
- **Week 11-13:** Additional topics:
 - Hardness of approximation
 - Approximation Algorithms based on Algorithmic Game Theory
 - Open problems