

CS388G: Algorithms: Techniques & Theory-WB (#51350) Fall 2020

The University of Texas at Austin
Department of Computer Science

COURSE DESCRIPTION

(August 17 Draft, final version should be similar)

Time. TTh 3:30-5 p.m.

Course Mode. Online. Some of the lectures will be live, and others will have pre-recorded videos that can be viewed asynchronously. More details are given below under 'Lectures'.

Professor. [Vijaya Ramachandran](mailto:VLR@cs.utexas.edu) (VLR"at"cs.utexas.edu). For office hours, see below after 'Lectures'.

TA. Kuan-Yi Ho

TA Office Hours. TBD

Textbook and Course Material.

- (Recommended textbook) T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, Introduction to Algorithms, Third Edition, MIT Press, Cambridge, MA, 2009.
- A large part of the material covered in this class will be from the recommended textbook. It is recommended that you acquire a copy.

Prerequisites. Graduate standing, and an undergraduate theory algorithms course such as undergraduate CS331.

COURSE OUTLINE.

This course will cover advanced topics in algorithm design and analysis including selected topics in algorithmic paradigms, data structures, randomized algorithms, maximum flow, NP-completeness and approximation algorithms.

All algorithms will be analyzed to obtain provable bounds. There is no programming

component to the course.

This is a graduate diversity course in the theory area. In this course, the emphasis is on rigorous theoretical analysis of the algorithms and results you develop. With this theoretical focus, you will learn techniques for the design and analysis of efficient algorithms for important computational problems, as well as the challenges that arise due to NP-completeness.

Here are the topics that will be covered in the course.

Topics in Algorithmic Paradigms: Divide and conquer, greedy, dynamic programming; graph algorithms.	2-3 weeks
Data structures: Amortized analysis, Fibonacci heap; union find, splay tree, hashing.	2-3 weeks
Randomized algorithms: Tail bounds; universal hashing; randomized algorithms.	2 weeks
Maximum flow, maximum matching, and linear programming: Ford-Fulkerson; Edmond-Karp; push-relabel; matchings in graphs.	2-3 weeks
NP-completeness: P and NP; Cook's theorem, NP-completeness; approximation algorithms.	3-4 weeks

Daily Schedule: A more detailed schedule, listing topics by class, will be posted on Canvas.

Lectures. Some of the lectures will be live, and others will have pre-recorded videos that can be viewed asynchronously. I anticipate the class meetings to proceed as follows. (Please be sure to review the rules on these FERPA-protected class recordings noted below under Class Recordings.)

- A class with no pre-recorded video will proceed with me lecturing over Zoom, and interacting with you through live questions and answers. The class will be recorded and made available on Canvas.
- A class with a pre-recorded video will have discussions on the viewed material, and this discussion will be primarily initiated by you, the students. If this discussion does not extend till the end of the class period, recording will cease and the class will become an office hour. The recorded part of the class will be made available on Canvas.
- At this time I have pre-recorded videos for about half of the classes.
- I expect to have copies of slides or lecture material posted under "Files" on Canvas, ahead of class.
- I strongly recommend that you plan to attend every class. I also recommend that you review the lecture material (and view the videos for classes with pre-recorded videos) ahead of the class period.

Office Hours. As mentioned above, office hours will take place during regular lecture periods for classes where pre-recorded videos are available. For live classes, office hours will begin immediately after the end of the class and will continue until no student remains. All office hours will be on Zoom.

Canvas and Piazza. Course material will be posted on Canvas. All discussions will be on Piazza. Also, most announcements will be on Piazza. Please be sure to monitor the Piazza and Canvas pages for this class regularly. You can set up Piazza to notify you of new posts.

Sharing of Course Materials is Prohibited. No materials used in this class, including, but not limited to, lecture hand-outs, videos, assessments (quizzes, exams, papers, projects, homework assignments), in-class materials, review sheets, and any additional material, may be shared online or with anyone outside of the class unless you have my explicit, written permission. Unauthorized sharing of materials promotes cheating. It is a violation of the University's Student Honor Code and an act of academic dishonesty. Any materials found online that are associated with you, or any suspected unauthorized sharing of materials, will be reported to Student Conduct and Academic Integrity in the Office of the Dean of Students. These reports can result in sanctions, including failure in the course.

Class Recordings. Class recordings are reserved only for students in this class for educational purposes and are protected under FERPA. The recordings should not be shared outside the class in any form. Violation of this restriction by a student could lead to Student Misconduct proceedings.

Course Grade. The course grade will include plus and minus grades, and will be based on the following:

- Two tests, each worth 18 points for a total of 36 points. Tests will be scheduled during class hours (see dates listed below).
- Six problem sets with peer grading, worth 10 points each, for a total of 60 points.
- Quizzes and class participation, worth totally 4 points.

Further Information on the Two Tests. The tests are in-class and closed-book, except you are allowed to bring one two-sided sheet of personally-prepared notes to the test. Further instructions will be posted on Piazza ahead of the tests

Dates for the Tests.

- The dates for the two in-class tests are:
 - *Thursday, October 15*
 - *Thursday, December 3*
- Please make a note of the dates --- there will be no make-up dates.
- You will need to indicate your acceptance of these dates (or otherwise list concrete conflicts) during the first quiz.

Problem Sets. Problem set solutions are due on Canvas. Any problem set solution not

submitted by the due date and time will incur a 10% late penalty if submitted within 24 hours of the due date. No problem set solutions will be accepted later than 24 hours after the due date and time.

Peer Grading. The peer grading period will begin shortly after the late submission deadline. Peer grading assignments will be made on Canvas, and will need to be performed on Canvas within about 2 days (part of which may be over the weekend). The exact deadline will be noted on the class schedule.

Grading Queries. Any questions on grading should be brought to the attention of the TA or the instructor no later than a week after the graded material is returned to the class.

Grade Cut-offs. The exact grade cut-offs for the class will be determined after the point totals are finalized. The following cut-off guarantees will hold: 85 points or above guarantees an A grade (A- or A), with A guaranteed for 90 points or above; 72 points or above guarantees a B (B+, B or B-); 60 points or above guarantees a C (C+, C, or C-). While these cut-offs are guaranteed, it is possible some of them may be lowered (this can only benefit some students; however do not count on having these cut-offs lowered).

Academic Integrity. Each student in the course is expected to abide by the University of Texas Honor Code: “As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity.”

Plagiarism is taken very seriously in this class and at UT. Therefore, if you use words or ideas that are not your own (or that you have used in previous class), you must cite your sources. Otherwise you will be guilty of plagiarism and subject to academic disciplinary action, including failure of the course. You are responsible for understanding UT’s Academic Honesty and the University Honor Code which can be found at the following web address: <https://deanofstudents.utexas.edu/conduct/standardsofconduct.php>

Statement on Scholastic Dishonesty. Anyone who violates the University of Texas Honor Code or the rules for this class is in danger of receiving an F for the course. Additional penalties may be levied by the Computer Sciences department and the University.

Students with Disabilities. Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities. In particular, any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities at 471-6259 (voice) or 512-410-6644 (Video Phone) as soon as possible to request an official letter outlining authorized accommodations. For more information, visit <http://ddce.utexas.edu/disability/about/>. If you require any assistance or accommodations from me, *please let me know by September 11.*

Counseling and Mental Health Center. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support

during times of struggle. There are many helpful resources available on campus and asking for support sooner rather than later is often helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. <http://www.cmhc.utexas.edu/individualcounseling.html>

Covid-19. You are encouraged to stay up-to-date on the latest news as related to the student experience. <https://coronavirus.utexas.edu/students>

Title IX Reporting. Title IX is a federal law that protects against sex and gender-based discrimination, sexual harassment, sexual assault, sexual misconduct, dating/domestic violence and stalking at federally funded educational institutions. UT Austin is committed to fostering a learning and working environment free from discrimination in all its forms. UT's relevant policies are at <https://titleix.utexas.edu/relevant-policies/>.

Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas universities, including faculty, report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be reported. Before talking with me, or with any faculty or staff member about a Title IX related incident, be sure to ask whether they are a responsible employee. If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email advocate@austin.utexas.edu. For more information about reporting options and resources, visit <http://www.titleix.utexas.edu/>, contact the Title IX Office via email at titleix@austin.utexas.edu, or call 512-471-0419.

Although graduate teaching and research assistants are not subject to Texas Senate Bill 212, they are still mandatory reporters under Federal Title IX laws and are required to report a wide range of behaviors we refer to as sexual misconduct, including the types of sexual misconduct covered under Texas Senate Bill 212. The Title IX office has developed supportive ways to respond to a survivor and compiled campus resources to support survivors.

Accommodations for Religious Holidays. If you must miss a class or an examination in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time before or after the absence, provided proper notification is given. If you intend to make use of such accommodations, *please let me know by September 11.*

Caveat. This syllabus is subject to change; students who miss class or fail to monitor announcements on Piazza and Canvas are responsible for learning about any changes to the syllabus.