

CSCE 629 : Analysis of Algorithms, Fall 2018

Tim Davis

Department of Computer Science and Engineering

Class: Tues/Thurs, 11:10am-12:25pm, HRBB 124

last modified September 8, 2018

1 Catalog Description

CSCE 629. Analysis of Algorithms

Credits 3 (3 Lecture Hours). Concrete algorithm design and analysis; abstract models to analyze the complexity of problems; NP-Completeness; approximation and probabilistic algorithms. Prerequisite: CSCE 411.

2 Learning outcomes and Course objectives

At the end of the semester, you should:

1. be familiar with advanced algorithms and algorithmic techniques;
2. given a particular application, be able to decide which algorithm among a set of possible choices is best;
3. be able to prove correctness and analyze the running time and space complexity of a given algorithm;
4. be able to design efficient algorithms for new situations using the techniques learned;
5. be able to prove a problem is NP-complete using reduction and understand the implications;
6. understand the notion of undecidability, know that some problems are undecidable and the implications thereof.

3 Instructor Information

Dr. Tim Davis, email: davis@tamu.edu (but **always** use Piazza instead). office: 425E H.R.Bright, <http://faculty.cse.tamu.edu/davis>. phone: (979) 845 4094 office; (352) 359 2812 cell.

Office hours: 12:40pm to 2pm, Tuesdays and Thursdays. I'm often available at other times as well. Feel free to stop by. My door is always open and I can often pause whatever else I'm doing. If I can't do that and I'm tied up with something else, I'm always happy to set up another time we can meet.

4 TA Information

- TA: Pulakesh Upadhyaya, pulakesh@email.tamu.edu. Office hours and location to be determined.
- Grader: Himanshu Gupta, himgupt2@email.tamu.edu. No office hours; contact directly to arrange meeting if you have grading questions.

5 Class websites

- Piazza: <https://piazza.com/tamu/fall2018/csce629601/home>
We will be using Piazza for class dialog, posting of homeworks, projects, and solutions. Do not send me email; use Piazza instead. Many questions can be posted publicly on Piazza for other students to see and reply to, and they can also benefit from the answers. For private messages, I will be able to reply more quickly to Piazza. I get way too much email to read it quickly. A Piazza notification bypasses my lengthy email queue. So use Piazza for the quickest response from me.
- eCampus: this will only be used for submitting homeworks and any take-home quizzes or exams, and for posting grades.

6 Class times and location:

Class: Tues/Thurs, 11:10am-12:25pm, HRBB 124. Final exam: Friday, Dec 7, 12:30pm to 2:30pm, in HRBB 124. Other exams/quiz dates to be determined.

7 Book:

- Required: Cormen, Leiserson, Rivest, and Stein, *Introduction to Algorithms*, **THIRD EDITION**, MIT Press, 2009. You cannot use earlier editions.

8 Grading:

Based on exams, quizzes (if any), homework, and projects (if any):

- exams: we will have two in-class or take-home exams during the semester, and a final exam. Each exam is worth 23.3% each.
- homeworks: 30%, written problems and possibly programming assignments. Late policy: no late assignments accepted except with prior permission. Late assignments cannot be accepted if the solution is already posted.

By default, all work is solo; no collaboration allowed unless it's stated that in the project description.

Grading scale (after curving of individual items, as needed):

- 90 or higher: A
- 80: B
- 70: C

- 60: D
- less than 60: F

The University views class attendance as the responsibility of an individual student. Attendance is essential to complete the course successfully. University rules related to excused and unexcused absences are located on-line at <http://student-rules.tamu.edu/rule07>. In general, I do not give excused absences for interviews or travel, but exceptions may be granted on a case-by-case basis. You must ask me beforehand, however. If you have to miss class because of medical reasons or for an interview (for work or for graduate / professional school) that cannot be rescheduled, I reserve the right to require written confirmation. For interviews or other scheduled events, a priori confirmation is required.

9 Topics

Topics are listed below. This is subject to change.

1. Foundations (quick review)
 - Chapter 1: role of algorithms
 - Chapter 2: getting started
 - Chapter 3: growth of functions
 - Chapter 4: divide and conquer (but not 4.6)
2. Sorting
 - Section 8.1: lower bound for sorting
3. Advanced Design and Analysis Techniques
 - Chapter 15: dynamic programming
 - Chapter 16: greedy algorithms
 - Chapter 17: amortized analysis
4. Advanced Data Structures
 - Chapter 18: B-trees
 - Chapter 19: Fibonacci heaps
 - Chapter 20 van Emde Boas trees
 - Chapter 21: disjoint sets
5. Graph Algorithms
 - Chapter 22: elementary graph algorithms (some is review)
 - Chapter 23: minimum spanning trees
 - Chapter 24: single-source shortest paths
 - Chapter 25: all-pairs shortest paths
 - Chapter 26: max flow
6. Selected Topics
 - Chapter 27: multithreaded algorithms

- Chapter 28: matrix operations
- Chapter 31: number-theoretic algorithms
- Chapter 32: string matching
- Chapter 33: computational geometry
- Chapter 34: NP-completeness
- Chapter 35: approximation algorithms
- undecidability: other sources

10 Policies:

- The use of laptops is prohibited in class, unless I approve otherwise (for example, if you have horrible handwriting and require a laptop to take notes). Laptops are a distraction to your fellow students. Please see me if you need an exception. Do not use cell phones or tablets in class, either.
- The use of bootleg copies of the textbook is strictly prohibited.
- For the assignments in this class, discussion of concepts with others is encouraged, but all assignments must be done on your own, unless otherwise instructed. If you use any source other than the text, reference it/him/her, whether it be a person, a book, a solution set, a web page or whatever. You MUST write up the solutions in your own words. Copying is strictly forbidden. Every assignment must be turned in with a cover page (available on Piazza), which lists all sources you used.
- The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit <http://disability.tamu.edu>.
- You must observe the Aggie Code of Honor: <http://student-rules.tamu.edu/aggiecode>.