

Instructor: [Xue Chen](#)

Email: xuechen@gmu.edu

Location: Online (Zoom Link available on Blackboard)

Class Time: Tuesday 4:30-7:10 pm

Office Hour: Monday/Friday 5:00 - 6:00 pm and Tuesday after the class, or by appointment.

Course homepage: TBA

TA: TBA

Description

The class covers classic and modern algorithmic ideas that are central to many areas of Computer Science. The goal for the class is to be broad rather than deep. The focus is on most powerful paradigms and techniques of how to design algorithms and analyze their performance. Besides advanced algorithmic techniques, we will also explore a variety of applications.

(Tentative) Course outline

- (1) Hash functions: balls into bins, cuckoo hashing, bloom filters, almost universal hash functions.
- (2) Hash in big data: JL lemma, heavy hitters --- how google/FB/Apple keep track of the most 100 popular websites.
- (3) Randomized algorithms: Karger's min-cut algorithm, random walks, MCMC.
- (4) Linear program and convex program.
- (5) Approximation algorithms.
- (6) Algorithms for machine learning/data science: Fourier transform, sparse recovery, sketching.

Course requirement

Except CS 583, I will assume some mathematical maturity. The class is based on theoretical ideas and is proof-heavy. You are expected to be able to read and write formal mathematical proofs. Some familiarity with algorithms and randomness will be assumed as well.

Grading

10% participation, 50% homework, 20% midterm exam, and 20% final exam.

The two exams, including the final, each cover about a half of the semester. So the final is not cumulative. All testing is open book, but you may find it will be helpful to prepare 2-3 sheets of notes.

Homework

We will have 4-5 homework sets. I strongly recommend students to type their answers. Here is one [LaTeX template file](#) and a LaTeX [reference](#) from Prof. Dov Gordon (Thanks Dov!).

Homework Policies

All coursework is to be done independently WITHOUT reading any published literature or websites besides the class text and notes. Plagiarizing the homework will be penalized by maximum negative credit and cheating on the exam will earn you an F in the course. See the GMU Honor Code System and Policies at George Mason University Honor Code.

Collaboration policy: You are encouraged to discuss the material BEFORE you do the homework. However, you MUST write up your own solutions. You should also state the names of those you collaborated with on the first page of your submission. Homework that appear overly similar will be considered to violate the honor code.

No late homework will be accepted.

Text and references

There is no required textbook. Lecture notes will be available from the Blackboard.

Disability statement

If you have a learning or physical difference that may affect your academic work, you will need to furnish appropriate documentation to the Disability Resource Center. If you qualify for accommodation, the DRC staff will give you a form detailing appropriate accommodations for your instructor. In addition to providing your professors with the appropriate form, please take the initiative to discuss accommodation with them at the beginning of the semester and as needed during the term. Because of the range of learning differences, faculty members need to learn from you the most effective ways to assist you. If you have contacted the Disability Resource Center and are waiting to hear from a counselor, please tell me.