

CS 2210: Computational Complexity

Course Overview and Contact Information

Course Overview

Semester and Year: Fall 2024
Day/Times: MW 11:15am-12:30pm (lecture)
Location: SEC LL2.221
Format: Lecture

The Ed Discussion board is our preferred method of contact, but private questions concerning extensions or accommodations should be sent to cs2210.fall2024.course.heads@gmail.com, which routes to the Instructor and TF(s).

Instructor's Contact Information

Name: Madhu Sudan
Office hours: MW 12:30-1:30pm, SEC 3.434
Email: madhu@cs.harvard.edu

TF Contact Information

Name: Aaron (Louie) Putterman
Office hours: Tue 4-5 PM, Location TBD
Email: aputterman@g.harvard.edu

Name: Prashanth Amireddy
Office hours: Mon 3-4 PM, SEC 3.317
Email: pamireddy@g.harvard.edu

Course Description and Learning Objectives

This course covers advanced topics in computational complexity. It studies the effect of non-traditional resources, such as randomness, non-determinism, alternation, and counting on our ability to compute: Which problems become easier with such resources, and which ones remain intractable? And what tradeoffs are possible among these resources? Specific themes include:

- Review of time and space complexity.
- Non-determinism and alternation.
- Non-uniform models of computation and lower bounds.
- Interaction, proof, and knowledge.
- Probabilistic Proof Systems

Other current topics may be covered depending on time and interest. More information will be available from the [course website](#). And here's information from the [last offering](#) of this course.

Prerequisites

CS 1210 (previously CS 121) or equivalent + sufficient math background. A strong background in mathematics and/or theoretical computer science is crucial to learn from this course. The course will be entirely theorem/proof based. Prior experience to CS124, and math prep at Math 25 level or above are expected.

Course Materials

- The [course timetable](#) has information about the course outline and schedule.
- Course discussion and announcements will be on [Ed](#).
- Assignments and exams will be submitted on [Gradescope](#).
- There is no required text. The text by Arora and Barak is strongly recommended.

Grading (Tentative)

- 6 problem sets (75%)
- An optional course project that may be used to replace the last two problem sets (25%)
- Class participation (weighted towards later lectures in course) (15%)
- Lecture scribing (10%)
- Additionally: **Lecture attendance is mandatory** and will have a non-linear effect on grades. Specifically, 2 unexcused absences will have zero effect on grade. Every lecture missed after that is half a grade loss. So if you miss 3 lectures you are still eligible for an A. 4 lectures makes your max grade an A- ; Six makes max a B+ and so on.
- **Late days:** 8 total late days for the semester with up to 2 late days per pset.

Expectations and Policies

- Lecture attendance and participation are crucial to learning well in the class (and to get a good grade). Lectures are not guaranteed to be recorded (though we will make an effort). Problem sets are mainly used to get you engaged in the material and to give you an excuse to go to office hours. You are expected to participate actively.
- Collaboration is actively encouraged - you are expected to learn from others and teach others. This includes problem sets (except Pset 0, which you must solve on your own). But when writing up all solutions, you must write them on your own. [Wikipedia, Chat GPT etc. are equivalent to collaborators ... you may consult them, but write solutions on your own after you've figured out the answers.]

Accommodation Requests

We're committed to supporting diversity, inclusion and belonging, and accessibility. The [University Disability Office](#) and [Extension School Accessibility Office](#) offer a variety of accommodations and services to college and extension school students, respectively, with

documented disabilities. We seek to create a learning environment that supports a diversity of thoughts, perspectives and experiences: if you feel uncomfortable sharing your thoughts with the class, please tell us. We include and support students and staff of many identities (including race, gender, class, sexuality, socioeconomic status, religion, and ability), and ask that you similarly support your fellow students. If something was said in class (by us or anyone else) that made you feel uncomfortable, please talk to us about it. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with us. (Credit: based on the statements of Professor Boaz Barak and Dr. Monica Linden at Brown University.).

Student Well-being

Your physical and mental wellbeing is very important to us. If you have any concerns or issues in this course, please reach out to us (Madhu, Louie or Prashanth) or (for college students) your resident dean, or Harvard services such as Counseling and Mental Health Services (phone: 617-495-2042 (on business hours), 617-495-5711 (all other times)).