

1 General Information

Instructor: Nathan Klein (nklei1@bu.edu)

Webpage: <https://nathan-klein.github.io/advanced-algs.html>

Lectures: Tuesday and Thursday, 9:30am - 10:45 in MCS B37

Teaching Fellow: Pooria Jalali Farahani

Discussion Sections: Wednesday 10:10am - 11:00 and 11:15am - 12:05 in CDS 801

Office Hours: Monday 2:00 - 3:30, Thursday 11:00 - 12:30, and by appointment in CDS 1026

Course Description: This course surveys a collection of beautiful ideas in algorithms. We will learn about topics like linear and semidefinite programming, the curse of dimensionality, and spectral graph theory, with the goal of understanding some of the most important conceptual contributions of the field of algorithms over the last 50 years.

Prerequisites: Strong undergraduate-level knowledge of algorithms, linear algebra, and probability. Motivated, mathematically mature undergraduate students who have excelled in CS 237 and CS 330 are also welcome.

2 Coursework

Grade Calculation: Homework (35% with lowest score dropped), midterm (20%), participation and (basic informational) quizzes (20%), and a final exam (25%).

Homework: Group work is encouraged. However, when working with a group, you may not write down solutions and consult them later. All homework write-ups must be completed alone and without the aid of notes from group work. Submit your homework to [Gradescope](#).

Late Homework: You have four late days to use as you'd like over all assignments for turning in late homework. A late day is considered used if you end up turning in the homework: remember, I will drop the lowest homework score. After these days are used up, I will not accept late homework unless there are extenuating circumstances.

Participation and Quizzes: As long as you come to class engaged, you should receive essentially full points. You can also receive participation points from posting on Piazza (see below).

The quizzes will be based on a flashcard deck that I post online and will contain basic definitions from the course. They will involve briefly explaining concepts from the flashcard deck. This is designed to help students follow lectures. In some ways learning math is like learning a language, and it is important to know the basic building blocks by heart. Don't be stressed by the quizzes: as long as you know the flashcards, you'll get 100%. There won't be any curveballs.

Exams: There will be an in-class midterm and a final exam.

Final Project: Students who are interested in doing theory research have the option of applying to do a final project to be a 25% component of your grade, with the percentages listed in the grade calculation above then scaled down to sum to 75%. A project involves undertaking original research or surveying work in an area or related to an open problem. They may be done alone or in small groups of up to 3 students. Interested students would need to discuss and clear their final project topic with me by October 17th and send a 3-4 page proposal to my email by October 24th. Proposals need to clearly demonstrate a strong understanding of your topic of interest. The end result of a project will be a short talk delivered to me and other interested students and a 10-15 page write-up.

LLM Usage: Use of LLMs as a *learning tool* is welcome. They are a great way to find good resources and, sometimes, for getting additional explanation on a topic you're confused about (although there are many, many instances of even the most advanced models getting math very wrong, so please be careful and consider coming to office hours instead). Asking an LLM "what do you think about this solution to problem X (but don't tell me the answer)" is also allowed as a form of quick feedback, although often the LLM will tell you you're right even if your argument is flawed.¹ However, you may not use it to solve any homework problem or to write any of the text you might turn in for a final project. If you undertake a final project and any significant part of it is LLM produced, I will consider it academic misconduct and report it, as well as give you a 0 on the project.

3 Additional Information

Piazza: We will be using [Piazza](#) for discussions, homework questions, and logistics. A code to join will be emailed to all students.

Anki: I will post Anki flashcards on the course website of definitions to know for the quizzes and, more importantly, to know so that it is easier to follow lectures.

Health: Please let me know if you are struggling at all with health issues and I am more than happy to help make the course more manageable for you. For mental health, consider [Student Health Services](#) as a resource: they provide free assessments and can help connect you to a therapist covered by your healthcare. They also run meditation sessions and support groups, with one explicitly aimed at graduate students.

¹The only reason I allow it is that this strategy can facilitate learning through a kind of "[rubber duck debugging](#)" where in the process of explaining it, you notice a problem yourself.