CS 361 Algorithms and Data Structures I
Fall 2020

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Course Handout

Overview

Algorithms are part of everyday life. Step by step instructions are useful for everything from washing your hands to fixing an automobile. Of course, every computer program is fundamentally algorithmic in nature, and just getting one to compile requires it to be specified with a high standard of rigorous precision.

This course is about algorithm design and analysis. These are skills that will be useful to you throughout your career as a computer scientist. Hopefully they will give you a new way of thinking about computational tasks and algorithms; a lens that will help you solve real-life programming tasks better, faster, and with less debugging time.

You will also learn a new language. Not a programming language, although we will see a bit of that too. A language for talking about programming tasks, algorithms, and measuring their performance. This is a language that all computer science professionals should be familiar with and comfortable using. Learn to speak it well: it can make a big difference in your career prospects and in your professional relationships!

Along the way, we will acquire familiarity with some of the important tools that All Computer Scientists Should Know (TM). This includes algorithms for basic tasks such as sorting information, searching, and making decisions to optimize tasks such as scheduling, pairing, and assigning. Some of the tools we use to accomplish these tasks include arrays, lists, stacks, queues, graphs, trees, heaps, priority queues, hash tables, and more specialized data structures built up from these. Even if you aren't already familiar with all of these, hopefully by the end of the course you will know them inside and out!

Course goals

Data and algorithms are at the core of practically everything you can do with a computer. This course will focus on understanding some of the most essential aspects of algorithms: the relationship between the input and output, guaranteeing correctness of the result, and assessing scalability using asymptotic runtime analysis.

Fundamental to all of this is the recognition that any problem of interest has (in principle) infinitely many possible inputs, and so no suite of unit tests can be complete enough to guarantee correctness for all of them. To be sure a given

piece of code does what it is supposed to, a mathematical proof is required.

The term "data structure" usually refers to data (the information used, processed, or generated by algorithms), together with a set of algorithms that are somehow relevant to the data. Understanding how this information is to be stored and operated on are crucial, both for the one implementing the data structure (obviously), and to the end user.

During the course, you will learn both high-level characteristics and implementation details for many important and useful data structures.

Course Text

The required textbook for the course is Algorithm Design, 1st Edition by Jon Kleinberg and Eva Tardos. This book is available in hardcover, paperback, and e-textbook editions; you can use whichever you prefer. You may be able to save money by getting a used copy or the paperback or e-textbook version.

Lectures

Lectures are held Tuesdays and Thursdays, 11:00-12:15, on Zoom. The zoom meeting number will ordinarily stay the same for each class, and is posted on the Learn page.

Students are expected to attend, connect on time, and be prepared for learning (see below).

If you are unable to attend for some reason, please let me know in advance.

Outside of Class

I hold regular weekly office hours for my classes. These are "drop in," no appointment needed. This semester, these will be Tuesdays and Wednesdays, 2:00-2:50pm. Office hours will be held over Zoom, in the same meeting room as lectures. Occasionally, I may need to change these; I will generally send out an email announcement beforehand.

You can also meet me outside of office hours by appointment. The best way to make an appointment is to email me at least 24 hours in advance to schedule a time. My email address is hayes@cs.unm.edu. Your email should

- have subject line "CS 361 Office Hour Request,"
- suggest some times you would be available (these do not need to be during business hours)
- indicate whether you need a one-on-one (i.e. private) meeting, or would be happy to have some classmates join also.

Teaching Assistant

There is also a teaching assistant for the course, Julie Hayes. Her contact information and office hours are posted on Learn under "Contact Info." Currently her office hours are Mondays 5-6p; Thursdays 5-6p; and Fridays 10-11a.

Reading Assignments and Participation

There will be announced reading assignments from the textbook. Although these will not be graded directly, it is important that you do them promptly, as they will be essential to your ability to understand the material presented in class, and to help prepare you for the homework and exams.

Similarly, on-time class participation is expected for every lecture. Again, this is for your benefit, and is a key part of your success in the class. If, for some reason, you must miss one or more classes, please notify me as soon as possible.

Written Assignments

Homework problems will be assigned on a regular basis, and are to be turned in on time. You are expected to solve the homework on your own, but may work together occasionally, as long as each student writes (not copies!) his own solution. If you do collaborate to solve part of an assignment, this must be acknowledged on your paper. Similarly, you are expected to solve the problems **without using the internet**, but if you do get an idea from an external source, you must clearly acknowledge the source in your writeup. If you experience great difficulty with the homework, please let me know right away.

Programming Labs

Some of the homework assignments will involve some programming, and may sometimes be called "programming labs." These are to be solved and turned in on time. You are responsible for writing and turning in your own stand-alone code. In general, you may not borrow any code, or use any libraries, and you should not look for the answers on the internet.

The text, lectures, and programming labs will assume familiarity with languages in the C/Java/Python family. If you are not comfortable reading and coding in these languages, you should probably consider doing some online tutorials to get up to speed on them.

If you need help, you may discuss the lab problems in a general way with your friends. However, do not share your written code or pseudocode with your classmates. If you need to, you can show your code to the instructor or the TA.

Exams

There will be two examinations, on dates to be announced. The exams will be cumulative. There is no separate final examination.

Each exam will cover all course material covered up to that point. In particular, the second exam will include material covered on the first exam. Therefore, it is very important that you study your first exam and learn the correct way to solve all the problems!

There will be no make-up exams under any circumstances. Absences will be excused only in cases of extreme human tragedy.

Since the course is being taught on-line, each exam will take place during a four-day window. You may download the exam any time during this window. However, once you begin, you will have a limited time to complete and upload your solution. Each exam should take roughly 60-90 minutes to complete, however you will be allowed a 4-hour window to complete it, to allow for delays or technical difficulties.

Grading

Grades will be determined using the following approximate weights:

- 40% Written assignments, including the programming labs
- 25% First exam
- 35% Second exam.

These are estimates, but I will try to stay very close to them. The final percentages may deviate slightly from these numbers.

Website

I have set up a site for this course on UNM Learn.

Most course materials, including this syllabus, will be available through this website. The site will be used for class discussions and homework assignments, as well as important announcements such as updates to this syllabus.

Questions about homework questions should ordinarily be posted on the discussion forums on UNM Learn, to allow for class participation in the discussion. However, when this is not appropriate, you should email me instead.

UNM Policies

Copyright Issues

All materials in this course fall under copyright laws and should not be downloaded, distributed, or used by students for any purpose outside this course. (http://www.unm.edu/ counsel/general/copyright.htm)

Students with Disabilities

The American 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 accommodations of their disabilities.If you have a disability requiring accommodation, please contact me immediately to make arrangements as well as Accessibility Services Office in 2021 Mesa Vista Hall at 277-3506 or http://as2.unm.edu/index.html. Information about your disability is confidential.

Academic Honesty

You should be familiar with UNM's Policy on Academic Dishonesty and the Student Code of Conduct (http://pathfinder.unm.edu/policies.htmstudentcode) which outline academic misconduct defined as plagiarism, cheating, fabrication, or facilitating any such act.

You are expected to solve all assigned homework problems on your own. If you choose to work together, you must write up your solutions individually (not copied!) and include a disclaimer telling me whom you worked with and the nature of your collaboration. All work you turn in must be your own!

By the same token, you should avoid showing your work to other students, or posting it online where others may be able to download it. If someone else turns in work that is overly similar to yours, it will be bad for both of you.

Consequences for plagiarism or other cheating will generally may include failing the course, being reported to the dean of students; you may even be expelled from the university.

To ensure that you understand this policy, everyone in the class must sign and submit the Academic Honesty Affirmation form by the second Tuesday lecture, or risk being dropped from the course by the instructor.