Data Structures and Algorithms
Fall 2018
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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 main course text will be an interactive online book, hosted on zybooks.com. You should be able to access this by the following steps:

1. Sign in or create an account at learn.zybooks.com
2. Enter zyBook code: UNMCS361LHayesFall2018
3. Subscribe.

The book costs $58 for the semester. You can access the content on the web, and if desired, you can also print the chapters as PDFs.

Lectures

Lectures are held Tuesdays and Thursdays, 12:30-1:45 in Woodward 149. Students are expected to attend, arrive on time, and be prepared for learning (see below). Students in the Online section of the course are expected to connect to the class through the Zoom link on the UNM Learn page for the course, which provides a two-way audio/video feed.

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

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, 2:00-2:50, and Wednesdays, 1:00-1:50. My office is in FEC 3130. Occasionally, I 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`.

Teaching Assistant

There is also a teaching assistant for the course, Soheila. Her contact information and office hours will be given to you as soon as they are available.

Reading Assignments and Participation Exercises

Probably the biggest advantage of our online textbook is that it features many interactive exercises that go along with the text. Doing these as you read the text helps you stay engaged with the material, and test your understanding.

There will be weekly reading assignments that need to be done before the corresponding lecture. This will form 20% of your course grade. In order to receive the credit for each assignment, you must have completed at least 90% of the available "participation exercises" points.

Needless to say, doing these assignments beforehand will also make the lectures easier to understand, and help you get the most out of the course.

You are allowed to do the reading assignments farther ahead if you want, but if you do, I strongly encourage you to review the reading assignments again during the week they are due..

Reading Schedule

Chapters 1 and 2: before Tuesday's class, Week 2.

Chapter 3: before Tuesday's class, Week 3.

Chapter 4: before Tuesday's class, Week 4.

Chapter 5: before Tuesday's class, Week 5.

Chapter 6: before Tuesday's class, Week 6.

Chapter 7: before Tuesday's class, Week 7.

Chapter 8: before Tuesday's class, Week 8.

Week 9: Exam 1: Thursday, October 18.

Chapter 9A: before Tuesday's class, Week 10.

Chapter 9B: before Tuesday's class, Week 11.

Chapter 10: before Tuesday's class, Week 12.

Chapter 11: before Tuesday's class, Week 13.

Chapter 12: before Tuesday's class, Week 14

Week 15: review and extra topics.

Week 16: Exam 2: Thursday, December 6.

The above schedule should give you a rough idea of the pacing for the class. However, I may make some adjustments to the schedule as the course proceeds. Pay attention to any announcements or posted changes to the assignments.

Homework Problems

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 library or internet, but if you do get an idea from such a source, you must acknowledge the source in your writeup.

If you have great difficulty with the homework, please let me know right away.

Programming Labs

There will also be some programming assignments. 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.

Tests

There will be two in-class examinations, on Thursday, October 18, (the week after Fall Break), and Thursday, December 6 (the week before Finals Week). There will be **no exam during Finals Week.**

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.

Students in the online section: unless you arrange for a proctoring solution with me **at least ten days in advance** of the exams, you must take the exams with the main section in the lecture hall. Please plan accordingly.

Grading

Grades will be determined using the following weights:

20% Reading assignments and zyBook participation exercises.
20% Homework Problems
20% Programming Labs
20% First exam
20% Second exam

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 UNMs 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.