Data Structures and Algorithms II
Spring 2019
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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 the second in a 2-semester sequence 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 is crucial, both for the one implementing the data structure (obviously), and for 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 text for the course is *Algorithm Design,* by Jon Kleinberg and Éva Tardos. It is available in Hardcover, Paperback and Kindle editions on Amazon.

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 office hours are in FEC 2045, Mondays and Wednesdays 10:30-11:30 or by appointment. She can be reached by email at `jafaris2008@gmail.com`, or `sjafarikhouzani@unm.edu`

Homework

A substantial portion of your grade will be based on homework assignments, which may involve solving written problems using mathematical reasoning, and/or programming problems.

These assignments will be given out periodically throughout the course, and are to be turned in *on time*, on the specified dates. You are expected to solve the homework on your

own, but *may* discuss the problems with your classmates, 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. There is a clear expectation that all code will be written by you; plagiarism will not be tolerated!

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

Tests

There will be two in-class written examinations. The first will be during class on Thursday, March 7 (just before Spring Break). The second will be during class on Thursday, May 2 (this is the "break" day before the official Finals week). There will not be an examination 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:

> 50% Written and Programming Homework
> 20% First exam
> 30% 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.htm#studentcode) 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.