CS 146: Data Structures and Algorithms, Section 81, Spring 2023
Computer Science Department
San José State University

Course and Contact Information

Instructor: Alexandra Gendreau Chakarov, PhD
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Office Hours: Tuesdays from 10:30 to 11:30 and Thursdays from 10:30 to 11:30 or by appointment
Class Days/Time: Tuesdays and Thursdays from 7:30 am to 8:45 am
Classroom: Zoom

Prerequisite(s): MATH 30, MATH 42, CS 49J (or equivalent knowledge of Java), and CS 46B (with a grade of "C-" or better in each); Computer Science, Applied and Computational Math, Forensic Science: Digital Evidence, or Software Engineering Majors only; or instructor consent.

Course Description

Implementations of advanced tree structures, priority queues, heaps, directed and undirected graphs. Advanced searching and sorting (radix sort, heapsort, mergesort, and quicksort). Design and analysis of data structures and algorithms. Divide-and-conquer, greedy, and dynamic programming algorithm design techniques.

Course Goals

- Ensure that students are familiar with ways to implement elementary data structures and their associated algorithms.
- Introduce students to the implementation of more complex data structures and their associated algorithms.
- Acquaint students with advanced sorting techniques.
- Teach students how to determine the time complexity of algorithms.
- Introduce students to algorithm design techniques.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Understand the implementation of lists, stacks, queues, search trees, heaps, union-find ADT, and graphs and be able to use these data structures in programs they design
2. Prove basic properties of trees and graphs
3. Perform breadth-first search and depth-first search on directed as well as undirected graphs
4. Use advanced sorting techniques (heapsort, mergesort, quicksort)
5. Determine the running time of an algorithm in terms of asymptotic notation
6. Solve recurrence relations representing the running time of an algorithm designed using a divide-and-conquer strategy
7. Understand the basic concept of NP-completeness and realize that they may not be able to efficiently solve all problems they encounter in their careers
8. Understand algorithms designed using greedy, divide-and-conquer, and dynamic programming techniques

Required Text

Textbook

Introduction to Algorithms, 3rd Edition
Cormen, Leiserson, Rivest, and Stein
ISBN-10: 0262033844
ISBN-13: 978-0262033848
MIT Press, 2009

You can find errata (bug reports) for the book http://www.cs.dartmouth.edu/~thc/clrs-bugs/bugs-3e.php.

This is one of the most universal books for learning about data structures and algorithms. I used it myself as an undergraduate and it's been one of the most useful books to have on hand (i.e., I have moved it across the country many times).

Technology

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. If you do not have access to an electronic device, SJSU has a free equipment loan program available for students (link). You will need a reliable WIFI connection to attend class. Learn Anywhere (link) has information about accessing WIFI. If you run into issues with technology or WIFI, please reach out to the instructor.

Course Format

The lecture portion of the class will be recorded and posted on Canvas. Students will engage in small group work (in breakout rooms) supported by the instructor. These breakout rooms are not recorded.

Zoom

Lecture: https://sjsu.zoom.us/j/84776670818?pwd=WlVOYUZMQ1BQUTZXQTNYaW9lSWRlZz09

Office Hours: https://sjsu.zoom.us/j/87585495994?pwd=MlBZaHJ4ckwzTU9qazVpMkc2WFpYdz09

Canvas

All course material will be posted on canvas including lectures slides, in class exercise, homework, quizzes, and exams. It is your responsibility to check canvas regularly. For help with using Canvas see Canvas Student Resources page.

Discord

Please join the class discord channel (https://discord.gg/D8yCmbTA2B). This channel serves as a place to ask questions and collaborate with classmates. Please make your nickname your actual name (e.g,, Emily Cooper).

Course Requirements and Assignments

Lecture: Students are expected to attend lectures and participate in small group exercises.

Participation: Most lectures will consist of an in class exercise where students will submit a canvas quiz. Submitting (not correctness of) these canvas quizzes will determine your participation grade. You are allowed to miss two participation exercises. I reserve the right to increase a student's participation grade if they are particularly active answering questions on the discord server.

Homework: Homework will be assigned approximately every other week. Homework is usually due Friday at 11:59PM.

Grading Interviews: Students will participate in three grading interviews during the semester. Two of these grading interviews will be with the instructor based on Homework #3 and Homework #6. These interviews will be 15 minutes and are designed for students to demonstrate the knowledge of the programs they produced. These interviews will be virtual on Zoom. The third grading interview will involve students creating a flip grid video answering a series of questions posed by the instructor about Quiz #8.

Lightning Talk Review: You will have 90 seconds to explain a topic from the course. You can assume that your audience has knowledge similar to your current classmates. More information will be provided including a list of topics near the end of the semester. These talks will take place via zoom on the last day of class.

Quizzes: There will be 12 quizzes during the semester. Some of these quizzes will consist of short programming activities while others will be written. The two lowest scoring quizzes will be dropped.

Final Exam: The final exam will be a take home exam released on Monday, May 15 and will be due on Monday, May 22, at 11:59PM. The final exam will be cumulative.

Per University Policy S16-9, success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

Grading Information

Grades will be posted to canvas.

- Quizzes (20%)
- Homework (20%)
- Grading Interviews (30%)
- Participation (5%)
- Lightning Talk (5%)
- Final (20%)

Grade	*At least*
A	*93 %*
A minus	*90 %*
B plus	*87 %*
B	*82 %*
B minus	*80 %*
C plus	*77 %*
C	*72 %*
C minus	*70 %*
D plus	*67 %*
D	*62 %*
D minus	*60 %*

These percentages are the highest possible percentages needed to receive the grade. I reserve the right to lower these percentages, but not increase them.

Collaboration Policy

Collaboration is encouraged on homework, **but you must cite the classmates you work with** and you cannot copy their code. This includes sharing large blocks of code on discord.

Cheating

If a student is caught cheating on a homework assignment, the student will receive a 0 on that assignment. If a student is caught cheating on a quiz or exam, the student will receive a 0. A second incident of cheating will result in the student receiving an F in the course. All incidents of cheating must be reported to the University per University Policy F15-7.

Latework

Latework is subject to penalty based on how late it is. Work submitted over one week late will not be accepted unless arrangements have been made with the instructor. **If you are struggling to complete an assignment on time, please reach out to me as soon as possible. It's much easier for me to provide an accommodation if you reach out to me several days before the assignment is due.**

For homework, my typical latework policy is as follows.

- Assignment is due at 11:59PM on Friday
- Everyone gets a free no questions asked extension until 11:59PM on Sunday
- After that a 10% deduction is taken for each day late until the following Friday at 11:59PM.

Classroom Protocol

During online instruction, cameras do not have to be on during the lecture portion of the class. Cameras are encouraged when working in breakout rooms and when presenting to the class.

University Policies

> Per University Policy S12-7, course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without permission. Students may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent. This includes unauthorized recording or posting of recordings of lectures. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. These policies are designed to protect student privacy and ensure academic integrity.

Per University Policy S16-9, relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (https://www.sjsu.edu/curriculum/courses/syllabus-info.php). Make sure to visit this page to review and be aware of these university policies and resources.

Additional Information

Basic Needs

It is hard to succeed in any course if your basic needs are not met. SJSU has resources to assist with food or housing insecurity, emergency financial loans, and other assistance at SJSU Cares. A list of SJSU resources for student success (tutoring and other educational support), basic needs, mental health resources, COVID-19 relief resources, affinity groups on campus, and other helpful resources can be found on Canvas and here (link). This list is adapted from a list created by Dr. Wilkinson in the biology department. These resources are available in order to help you succeed and make sure your basic needs are met. Please do not hesitate to make use of any available resources. If you have any questions or additions to this list, please reach out to the instructor.

Supplemental Instruction

This semester we have a supplemental instructor from peer connections working with both of my lecture sections. He will attend our sections and facilitate workshops and study sessions outside of the regularly scheduled class time. These sessions are focused on active student involvement and incorporate both content and learning strategies.

Tutoring

There are tutors available to help you through both the computer science department and peer connections. Look on canvas for schedules and more information.

Computer Science 146 Spring 2023 Course Schedule

Topics are subject to change.

Week	Date	Topic	Chapters Covered
1	1/26	Introduction and Review of Data Structures.	Ch. 10
2	1/31	Algorithm Analysis Review and Growth of Functions	Ch. 2, Ch.3
2	2/2	Mergesort	Ch. 2.3
3	2/7	Divide and Conquer	Ch. 4.1 - 4.2
3	2/9	Divide and Conquer	Ch. 4.3 - 4.4
4	2/14	Master's theorem	Ch. 4.5
4	**2/16**	**No Class**	
5	2/21	Red-Black Trees (start with Binary Search Tree Review)	Ch. 12 - 13.2
5	2/23	Red-Black Trees	Ch. 13.3 - 13.4
6	2/28	B Trees	Ch. 18.1 -18.2
6	3/2	B Trees	Ch. 18.3
7	3/7	Heap Sort	Ch. 6.1-6.3
7	3/9	Heapsort (cont.) & Priority Queues	Ch. 6.4 - 6.5
8	3/14	Quicksort	Ch. 7

8	3/16	Sorting in Linear Time	Ch. 8
9	3/21	Hash Tables	Ch. 11
9	**3/23**	**No Class**	
10	4/4	Dynamic Programming	Ch. 15
10	4/6	Dynamic Programming	Ch. 15
11	4/11	Greedy Algorithms	Ch. 16.1-16.3
11	4/13	Graphs - Intro, Undirected	Ch. 22.1
12	4/18	Searching in Graphs (Depth First and Breadth First)	Ch. 22.2, 22.3
12	4/20	Graphs - Directed	Ch. 22.4
13	4/25	Graphs - Strongly Connected Components	Ch. 22.5
13	4/27	Minimum Spanning Trees	Ch. 23.1
14	5/2	Minimum Spanning Trees	Ch. 23.2
14	5/4	Shortest Path Algorithms	Ch. 24.1, 24.3
15	5/9	NP-Completeness	Ch. 34.1 - 34.5
15	5/11	Lightning Talks and Review	
Final Exam	5/22 at 11:59PM	Take Home	