

# Data Structures and Algorithms Section 11

## CS 146

Spring 2024 3 Unit(s) 01/24/2024 to 05/13/2024 Modified 01/19/2024

### □ Contact Information

Instructor: Vidya Rangasayee

Email: vidya.rangasayee@sjsu.edu

Office Hours: By appointment.

Classroom: TBD

Day/Time: Tuesdays and Thursdays 6:00 PM – 7:15 PM

### □ Course Description and Requisites

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

Prerequisite(s): MATH 30, MATH 42, CS 46B, and [(CS 48 or CS 49J) if CS 46B was not in Java], each with a grade of "C-" or better; Computer Science, Applied and Computational Math, Forensic Science: Digital Evidence, Software Engineering, Data Science majors only; or instructor consent.

Letter Graded

### □ Classroom Protocols

Communication with the instructor

Students are requested to use the provided email to contact the instructor.

## Classroom Protocol

Course material developed by the instructor is the intellectual property of the instructor. Students cannot publicly share or upload instructor generated material for this course such as exam questions, Programming assignment, lecture notes, lecture slides, hands-on exercises or homework solutions without instructor permission.

## □ Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

## □ Course Learning Outcomes (CLOs)

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

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

## □ Course Materials

Textbook:

Cormen, Leiserson, Rivest, and Stein, Introduction to Algorithms, third edition. MIT Press, 2009. ISBN-10: 0262033844 ISBN-13: 978-0262033848

Other technology requirement / equipment / material:

You will need a wireless laptop with internet access. All students are required to have access to a wireless laptop (running OSX, Windows, or some version of UNIX), upon which you can install required software.

Technology used will include Canvas, programming in Java, and an IDE (Integrated Development Environment).

## □ Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in [University Policy S12-3 \(http://www.sjsu.edu/senate/docs/S12-3.pdf\)](http://www.sjsu.edu/senate/docs/S12-3.pdf) at [http://www.sjsu.edu/senate/docs/S12-3.pdf \(http://www.sjsu.edu/senate/docs/S12-3.pdf\)](http://www.sjsu.edu/senate/docs/S12-3.pdf).

## □ Grading Information

Course weightings will be as follows:

- 40% Programming Assignments
- 15% First In-semester exam (Midterm #1)
- 15% Second In-semester exam (Midterm #2)
- 30% Final Exam

Final grades may be curved (up) to raise grades if needed.

Your course grade will be determined by your final weighted average:

A plus = 97% or higher

A = 93% to 97%

A minus = 90% to 93%

B plus = 87% to 90%

B = 83% to 87%

B minus = 80% to 83%

C plus = 77% to 80%

C = 73% to 77%

C minus = 70% to 73%

D plus = 67% to 70%

D = 63% to 67%

D minus = 60% to 63%

F = 0% to 60%

Boundary cases count as the higher of the two grades.

## □ University Policies

Per [University Policy S16-9 \(PDF\) \(http://www.sjsu.edu/senate/docs/S16-9.pdf\)](http://www.sjsu.edu/senate/docs/S16-9.pdf), 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 the [Syllabus Information \(https://www.sjsu.edu/curriculum/courses/syllabus-info.php\)](https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to

review and be aware of these university policies and resources.

## □ Course Schedule

Here's a breakdown of the course, lecture-by-lecture.

Note: This is a tentative schedule and is subject to change but with fair notice.

Week	Date	Topics
1	1/25/2024	Introduction
2	1/30/2024	Review (Recursion, Lists, Stacks, Queues)
	2/1/2024	Loop Invariants
3	2/6/2024	Asymptotic Growth
	2/8/2024	Recurrence Relations
4	2/13/2024	Master Theorem
	2/15/2024	Quicksort, Quickselect, and Mergesort
5	2/20/2024	Heaps and Heapsort
	2/22/2024	Sorting Lower Bounds
6	2/27/2024	Linear Time Sorts (Counting, Bucket, Radix)
	2/29/2024	Balanced Search Trees
7	3/5/2024	Balanced Search Trees
	3/7/2024	Balanced Search Trees
8	3/12/2024	Balanced Search Trees
	3/14/2024	Review
9	3/19/2024	<b>Exam #1</b>
	3/21/2024	Dynamic Programming
10	3/26/2024	Dynamic Programming
	3/28/2024	Dynamic Programming
11	4/2/2024	Spring Break
	4/4/2024	Spring Break
12	4/9/2024	Graph Introduction (Representation, BFS, DFS)
	4/11/2024	Topological Sort, Strongly Connected Components

13	4/16/2024	MSTs, Disjoint Sets
	4/18/2024	Shortest Paths
14	4/23/2024	Shortest Paths, Floyd-Warshall
	4/25/2024	NP
15	4/30/2024	NP
	5/2/2024	NP
16	5/7/2024	<b>Exam #2</b>
	5/9/2024	Review
17	5/21/2024	<b>Final Exam</b>