

# Data Structures and Algorithms Section 06

## CS 146

Spring 2024 3 Unit(s) 01/24/2024 to 05/13/2024 Modified 01/23/2024

### 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

We will be using the Canvas discussion forums for class discussion. The system is catered to getting you help efficiently from fellow classmates and the instructor. Rather than emailing duplicated questions, students are encouraged to post questions on the Canvas discussion forums where the entire class can read and benefit from the responses. The instructor may re-post questions that are of general interest or discuss them in class.

While it is not a requirement, the best way to ask questions in the class / in office hours is as follows:

1. Explain what you are trying to accomplish.
2. Explain what your understanding of the problem is.
3. Explain what approaches you have already tried.
4. Explain what approaches you came across but didn't try, if any.
5. Show relevant work (code / writeup etc.).

This method of asking questions will get you much more helpful answers (from both the instructor as well as fellow students!)

# 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 should be able to:

- 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
- 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 (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
- 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
- Understand algorithms designed using greedy, divide-and-conquer, and dynamic programming techniques

## Course Materials

---

There are no required books for this class. All the necessary material will be available on the class Canvas web page.

## Grading Information

---

### **Extra-credits assignments**

No extra-credit assignments are planned; However, the instructor may assign extra-credit assignments at his discretion with fair notice.

### **Late Submission**

Late submissions within 24 hours will have 10% of the final grade deducted. Submissions over 24 hours late will have 20% grade of the grade deducted. Late submissions over 2 days will not be accepted unless prior consent has been granted by the instructor or in documented cases of emergency.

### **Criteria**

Type	Weight	Topic	Notes
Assignments	25%		
Quizzes	25%		
Midterm	25%		
Final	25%		

## Breakdown

Grade	Range	Notes
A+	95-100	
A	91 - 94	
A-	89-90	
B+	86-88	
B	82-85	
B-	80-81	
C+	77-79	
C	72-76	
C-	70-71	
D+	67-69	
D	63-66	
D-	60-62	
F	0-59	

## University Policies

Per [University Policy 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.

When	Topic	Notes
Jan 24	Introduction and Welcome	
<b>Jan 29</b>	Structuring our thoughts	Lists, Stacks, Queues, Trees (and more!)
Jan 31	How to screw in a lightbulb	Basic Algorithms
Feb 5	How many people do you need to screw in infinite lightbulbs?	Asymptotic Notation, Growth of Functions
Feb 7	Third lightbulb's the charm	Asymptotic Notation, Growth of Functions Part 2
Feb 12	Infinity Repeating	Recurrence Relations + Master's Theorem
Feb 14	An assortment of sorting techniques	Heapsort
Feb 19	An assortment of sorting techniques, part deux	Quicksort
Feb 21	An assortment of sorting techniques, part trois	Sorting in linear time, lower bounds
<b>QUIZ</b> Feb 26	Quiz 1	
Feb 28	When it doubt, hash it out	Hash Tables
Mar 4	Welcome to the jungle	Introduction to Trees, BSTs
Mar 6	Welcome to the jungle (part 2)	BTrees, Red-Black Trees
Mar 11	Seeing the forest for the trees	Trees Conclusion
Mar 13	Everything Everywhere All At Once	Introduction to graphs
Mar 18	Topological Sort and other party tricks	Topological Sort, Strongly connected components

When	Topic	Notes
Mar 20	Minimum Spanning Trees	
Mar 25	Midterm Review	
<b>MIDTERM</b> Mar 27		
<b>HOLIDAY</b> Apr 1		Spring Break
<b>HOLIDAY</b> Apr 3		Spring Break
Apr 8	Making Google Maps	Single-Source Shortest Paths
Apr 10	But I also wanted to go to...	All-Pairs Shortest Paths
Apr 15	Not screwing in the lightbulb twice	Dynamic Programming
Apr 17	Other Dynamic Situations	Dynamic Programming Part 2
<b>QUIZ</b> Apr 22	Quiz 2	
Apr 24	Being greedy isn't always bad	Greedy Approach
Apr 29	Some problems really are hard	NP Introduction
May 1	... And that's just a fact of life!	NP Continued
May 6	DSA in the real world	Special Topics, other discussions
May 8	Final Review	
<b>FINAL</b> 05/17/2024 9:45 AM - 12:00 PM		