San José State University
School of Science/Department of Computer Science
CS 146-08 / 09, Data Structures and Algorithms, Fall Semester, 2021

Course and Contact Information

Instructor:	Navrati Saxena
Office Location:	MH 214 MacQuarrie Hall **Online Via Zoom during CoVID**
Telephone:	(408) (924-5121)
Email:	navrati.saxena@sjsu.edu
Office Hours:	Tuesday, 10 AM ~ 12 PM PST (Days and time) [If the office hours does not suit you, **please email me and I will be happy to set up a zoom meeting with you**]
Class Days/Time:	CS 146-08 - Monday/Wednesday; 12:30 PM - 1:45 PM CS 146-09 - Monday/Wednesday; 2:15 PM - 3:30 PM
Classroom:	Online course. Zoom meetings
Prerequisites:	MATH 30, MATH 42, and (CS 46B in Java or (CS 49J and CS 46B))
Class Zoom Link	
Scholar Support Hours/Office Hours Zoom Link	Join from PC, Mac, Linux, iOS or Android: https://sjsu.zoom.us/j/85434957977?pwd=djVZT1hsdjBnWXRuY2JySTJqRlhHdz09 **Password:** 564924

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 Format

Technology Intensive, Online Course

1. Online synchronous class. In class, each student is required to have an internet-connected device (e.g. smartphone, tablet, laptop computer) to be used exclusively for learning-related activities. In addition a microphone and webcam will be needed if they are not inbuilt in the internet-connected device.
2. This course utilizes the Learning Management System (LMS), Canvas. General information about the LMS can be found at the eCampus website - http://www.sjsu.edu/at/ec (Links to an external site.)
3. Any operating system which can support pdf files, SJSU canvas software, and Microsoft office is needed.
4. Java compiler (version 7 or later)

MYSJSU Messaging

1. Course materials such as syllabus, handouts, notes, assignment instructions, announcements etc. can be found on Canvas Learning Management System course login website. All communications relevant to the course will be sent out using the Canvas messaging system (Canvas email and announcement board).
2. Students are responsible for regularly checking with the messaging system through Canvas to learn of any updates.
3. For help with using Canvas see Canvas Student Resources page (http://www.sjsu.edu/ecampus/teaching-tools/canvas/student_resources (Links to an external site.)) or reach out to Technical Support for Canvas: Email: ecampus@sjsu.edu; Phone: (408) 924-2337; https://www.sjsu.edu/ecampus/support/ (Links to an external site.)

Course Learning Outcomes (CLO)

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

1. Understand, use, and implement different types of data structures – tress, graphs, hash tables, red-black trees, B-trees, etc.
2. Design efficient algorithms using these data structures
3. Perform depth-first search and breath-first search on graphs
4. Use advanced sorting techniques and understand calculating their complexities
5. Understand algorithms designed using greedy, divide-and-conquer, and dynamic programming techniques
6. Analyze the complexity of different algorithms

7. Solve practical problems using efficient data structures and algorithms

Required Texts/Readings

Textbook

No fixed textbooks. Study materials compiled using different sources will be provided on the Canvas site.

Suggested Reading:

Main Book

1. Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, 3rd Edition. ISBN-10: 0262033844. ISBN-13: 978-0262033848. MIT Press, 2009. Available at: https://sjsu-primo.hosted.exlibrisgroup.com/permalink/f/egdih2/TN_cdi_askewsholts_vlebooks_9780262270830 (Links to an external site.) You will need to enter your SJSUOne ID to access the book from the above link.

Other Supported Books

2. Horstmann and Cornell, Core Java, Vol. I, Ninth Edition, Prentice-Hall, 2013.
3. Kleinberg and Tardos, Algorithm Design, First edition, Addison Wesley, 2005.
4. Dasgupta, Papadimitriou and Vazirani, Algorithms, McGraw-Hill, 2006

Library Liaison

Megwalu, Anamika
Phone: 408-808-2089
Email: anamika.megwalu@sjsu.edu

Important

- **Course materials such as syllabus, handouts, notes, assignment instructions, announcements etc. can be found here on the Canvas Learning Management System course login website.**
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Course Requirements and Assignments

1. 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.
2. This course requires students to go through the lecture materials in detail.
3. Sample problems on data structures, algorithms, and corresponding analysis will be provided in the lecture materials.
4. Students are expected to develop their skills and do similar problems and analyses on their own.
5. Attainment of the learning objectives (as listed above) will be assessed via in-class activities, homework, quizzes, mid-term examination, and the final-term examination.
6. Weights of the above-mentioned assessment activities are given below. Their tentative schedule could be found in the week-wise schedule of the course (in the next page).

Assessment Type	Weightage
Pre-requisite Assignment	**N/A**
Quizzes 1 ~ 5	**35%**
Mid Term	**20%**
End Term	**20%**
Homework 1 ~ 5	**25%**
Total	**100%**

Assessment Type	Weightage
Pre-requisite Assignment	**N/A**
Quiz 1	**7%**
Quiz 2	**7%**
Quiz 3	**7%**
Mid Term	**20%**
Quiz 4	**7%**
Quiz 5	**7%**
End Term	**20%**
Homework 1 ~ 5	**25%**
Total	**100%**

Class Participation/In-class Activities

1. You will be presented with in-class exercises/activities in synchronous class sessions to be completed individually or in groups.
2. These in-class exercises will be due at the end of class
3. These exercises are intended to serve as a review to help you and the instructor assess learning in the class.
4. In order to keep the class interactive and interesting - students' participation is highly appreciated. IClicker and Zoom Breakout Rooms will be used in the class too.

NOTE that University policy F69-24 (Links to an external site.) at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Assignments, Examinations, or Evaluation

The course will have graded home-works, quizzes, mid-term examination, and final-term examination. Their percentage weightage are mentioned above. The syllabus and details of each of these will be posted in Canvas. The dates of the examinations and quizzes are indicated in the Lecture Schedule.

Make-up exams and quizzes will be granted only for extenuating circumstances. Contact the instructor as soon as possible during the semester if you have such a circumstance. Absence from examinations and quizzes without prior approval will result in a score of 0.

Grading Information

Determination of Grades

- As mentioned in the **Course Requirements and Assignments**, this course will contain quizzes, homework, Mid-Term, and Final Term Exam. The individual weights of these are mentioned above under Course Requirements and Assignments.
- Students' grades will be determined based on the overall percentage obtained across all of the mentioned above. The benchmarks of the grades are mentioned in the table below.

Grade	***Percentage***
A plus	*95% to 100%*

Grade	*Percentage*
A	*90% to 94%*
B plus	*85% to 89 %*
B	*80% to 84%*
C plus	*75% to 79%*
C	*70% to 74%*
D plus	*65% to 69%*
D	*60% to 64%*
F	*< 60%*

Regrades

If you believe an error was made in the grading of your quiz or exam, you may request a regrade from me, Professor Saxena, either during my zoom office hours (preferred) or by sending me an email. A request for a regrade must be made no more than a week after the quiz or exam is returned.

Classroom Protocol

Recording Zoom Classes

This course or portions of this course (i.e., lectures, discussions, and student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the course through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording).

Students are not allowed to record without instructor permission.

Students are prohibited from recording class activities (including lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of the students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Zoom Classroom Etiquette

- **Mute Your Microphone:** To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- **Be Mindful of Background Noise and Distractions:** Find a quiet place to "attend" class, to the greatest extent possible.
    - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
    - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- **Position Your Camera Properly:** Be sure your webcam is in a stable position and focused at eye level.
- **Limit Your Distractions/Avoid Multitasking:** You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away(unless you are using it to access Zoom).
- **Use Appropriate Virtual Backgrounds:** If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

Attendance and arrival times

Students are expected to be set up for lecture by the time the class begins for synchronous sessions. Attendance in class is not mandatory and shall not be used per se as a criterion for grading. However, class attendance and participation are highly recommended.

Behavior

Students should remain respectful of each other at all times. Interruptive or disruptive attitudes are discouraged. During the online synchronous sessions, the use of electronic devices (laptops, tablets, and smartphones) should be limited to activities closely related to the learning objectives. All cell phones must be silenced prior to entering the synchronous sessions. Students are encouraged to keep their webcams "ON" as much as possible. To avoid disturbances, please keep yourself in mute mode, unless you would like to speak something or ask a question. You can also use the "Raise Hand" tool of zoom if you have any questions.

Students are expected to respect a diversity of opinions, ethnicities, cultures, and religious backgrounds. Students will treat online discussions with their peers as if they were in-class, face-to-face interactions.

Safety

Students should familiarize themselves with all emergency exits and evacuation plans.

Communication with the instructor

Students are encouraged to approach the instructor, Prof. Navrati Saxena, in case of any doubts or issues. The best way to approach her is to meet her during her office hours or to mail her and request for a zoom meeting. She usually responds within 2 working days. In the subject of the mail, do specify if the matter is urgent and needs immediate attention. Please start the subject of your email with the course code.

University Policies and Procedures

Per University Policy S16-9 (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 Syllabus Information web page (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources

Academic Integrity

For this class, you should obviously not cheat on tests. For quizzes and exams, you should not discuss or share code or problem solutions between groups or friends! At a minimum a 0 on the quiz or exam will be given. A student caught using resources like Rent-a-coder will receive an F for the course. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development. All quizzes and exams that a student submits will be checked by turn-it-in for plagiarism.

Accommodations

If you need a classroom accommodation for this class and have registered with the Accessible Education Center (https://www.sjsu.edu/aec/ (Links to an external site.)), please come see me earlier rather than later in the semester to give me a heads up on how to be of assistance. Your experience in this class is important to me. If you have already established accommodations with Student Accessibility Services, please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

Course Week-wise Schedule

Week	Class #	Day/Date	Contents
2	1	Mon, Aug. 23, 2021	Welcome and course introduction Review of basic data structures **Pre-requisite Assignment due Wednesday, Aug. 25, 2021**
			END OF MODULE 1
2	2	Wed, Aug. 25, 2021	Review Estimating Complexity I Growth of Functions- O, Ω, Θ Homework 1 out (Estimating Complexity – recurrences & Masters Theorem) – 5%
3	3	Mon, Aug. 30, 2021	Estimating Complexity II - Growth of Functions- O, Ω, Θ Solving Recurrences, Iterative Method
	4	Wed, Sept. 1, 2021	Estimating Complexity III - Solving Recurrences
4	5	Mon, Sept. 6, 2021	Labor Day; Campus Closed; No Classes
	6	Wed, Sept. 8, 2021	Estimating Complexity IV - Masters Theorem Homework 1 due
5	7	Mon, Sept. 13, 2021	Estimating Complexity Solving Problems Together; Review
			END OF MODULE 2
5	8	Wed, Sept. 15, 2021	Quiz 1. 20~30 minutes quiz. (Estimating Complexity) – 7% Analyzing and Designing Algorithms: Iterative Sorting Algorithm Homework 2 out (Coding: Iterative Sorting Algorithms) – 5%
	9	Mon, Sept. 20, 2021	Analyzing and Designing Algorithms: Iterative Sorting Algorithms

			Selection, Bubble and Insertion Sort and their analysis
6	10	Wed, Sept. 22, 2021	Recursive Sorting Divide and Conquer Approach: Merge Sort and its analysis Homework 2 due Homework 3 out (Coding: Merge and Quick Sort) – 5%
7	11	Mon, Sept. 27, 2021	Recursive Sorting Quicksort and its analysis
	12	Wed, Sept. 29, 2021	Homework 3 due Review Session on Sorting Algorithms
8	13	Mon, Oct. 4, 2021	Quiz 2. 20~30 minutes quiz. (Iterative & Recursive Sort) – 7% Introduction to Heaps
	14	Wed, Oct. 6, 2021	Heaps and Heap Sort
9	15	Mon, Oct. 11, 2021	Heap Sort and Priority Queues
	16	Wed, Oct. 13, 2021	Sorting in Linear Time: Radix Sort and its analysis
			END OF MODULE 3
10	17	Mon, Oct. 18, 2021	Mid-Term Exam – 20% (All sorting including heap)
	18	Wed, Oct. 20, 2021	Review on Trees, Binary Trees Advanced Trees: Red-Black Trees Homework 4 out (Red-Black trees and B-Trees) – 5%
11	19	Mon, Oct. 25, 2021	Advanced Trees: Red-Black Trees
	20	Wed, Oct. 27, 2021	Advanced Trees: B-Trees Homework 4 due

			END OF MODULE 4
12	**21**	Mon, Nov. 1, 2021	Quiz 3. 20 ~30 minutes quiz. (RB Tree, B Tree) – 7% Introduction to Hashing
	22	Wed, Nov. 3, 2021	Hashing, Hash Tables and Hash Functions
13	**23**	Mon, Nov. 8, 2021	Resolving collisions in Hashing
			END OF MODULE 5
13	**24**	Wed, Nov. 10, 2021	Quiz 4. 20~30 minutes quiz. (Hashing) – 7% Trees and Graphs – BFS & DFS
14	**25**	Mon, Nov. 15, 2021	Minimum Spanning Tree: Prim's Algorithm
	26	Wed, Nov. 17, 2021	Greedy Algorithms and technique: Single Source Shortest Paths: Dijkstra's Algorithm
15	**27**	Mon, Nov. 22, 2021	Quiz 5. 20~30 minutes quiz. (Prim's & Dijkstra's) – 7% All-Pairs Shortest Paths: Floyd-Warshall Homework 5 Out (Floyd-Warshall Algorithm) – 5%
	28	Wed, Nov. 24, 2021	No Class - Non-Instruction Day
16	**29**	Mon, Nov. 29, 2021	All-Pairs Shortest Paths: Floyd-Warshall Continued
	30	Wed, Dec. 1, 2021	Dynamic Programming concepts/technique Homework 5 due
17	**31**	Mon, Dec. 6, 2021	NP-completeness, Reductions - Last Day of Instruction – Last Day of Classes
			Final Examination (DFS, BFS, Prim's, Dijkastra's, Floyd-Warshall, DP) – 20%