San José State University
School of Science/Department of Computer Science
CS 146-01, Data Structures and Algorithms, Spring Semester, 2022

Course and Contact Information

Instructor:	Navrati Saxena
Office Location:	MH 214 MacQuarrie Hall
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 146-01 - Monday/Wednesday; 12:00 PM - 1:15 PM
Classroom:	Online until Feb. 14, 2022 https://sjsu.zoom.us/j/87113368401?pwd=VDRUelozNkowdmR1d1E5RVFObm9QQT09 Password: 222347 Boccardo Business Center 202
Prerequisites:	MATH 30, MATH 42, and (CS 46B in Java or (CS 49J and CS 46B)) **Prerequisite Courses** You must show me that your prerequisite courses have been satisfied. If you do not show me by Friday, January 28, 2022, you might be dropped from the course, if other students are waiting for your space. If you don't show me prerequisites by drop date, you will be dropped. Further, I will not give out any add codes without first seeing prerequisite proof. The prerequisite courses are: Math 30, Math 42, and (CS46B in Java or (CS49J and CS46B)). You should show me grades for CS46B, Math30, and Math42, or their equivalents on a San Jose departmental course equivalence form. You must have a C- or better in each course. If you took CS46B elsewhere, you should also show me either proof that you have taken CS49J, or proof that your CS46B was in Java.

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 Course

1. 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 might 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_978026 2270830 (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 class sessions to be completed individually or in groups. These in-class exercises will be due at the end of class
2. These exercises are intended to serve as a review to help you and the instructor assess learning in the class.
3. In order to keep the class interactive and interesting - students' participation is highly appreciated. IClicker maybe used in the class too.

NOTE that [University policy F69-24 (Links to an external site.)](http://www.sjsu.edu/senate/docs/F69-24.pdf) 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%
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

<u>Students are not allowed to record without instructor permission.</u>

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.

Attendance and arrival times

Students are expected to be set up for lecture by the time the class begins. 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 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 sessions.

Students are expected to respect a diversity of opinions, ethnicities, cultures, and religious backgrounds.

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

***Follow the Calendar: https://www.sjsu.edu/registrar/calendar/spring-2022.php

Class #	Day/Date	Contents
1	Wed, Jan 26, 2022	Welcome and course introduction Review of basic data structures **Pre-requisite Assignment due Friday, January 28, 20221**
	END OF MODULE 1	
2	Mon, Jan 31, 2022	Review Estimating Complexity I - Growth of Functions- O, Ω, Θ Homework 1 out (Estimating Complexity – recurrences & Masters Theorem) – 5%
3	Wed, Feb 2, 2022	Estimating Complexity II - Growth of Functions- O, Ω, Θ Solving Recurrences, Iterative Method
4	Mon, Feb 7, 2022	Estimating Complexity III - Solving Recurrences ***Last Day to Drop Classes without a "W" grade
5	Wed, Feb 9, 2022	Estimating Complexity IV - Masters Theorem Homework 1 due
6	Mon, Feb 14, 2022	Estimating Complexity Solving Problems Together; Review ***Last Day to Add Classes via MySJSU
	END OF MODULE 2	
7	Wed, Feb. 16, 2022	Quiz 1. 20~30 minutes quiz. (Estimating Complexity) – 7% Analyzing and Designing Algorithms: Iterative Sorting Algorithm Homework 2 out (Coding: Iterative Sorting Algorithms) – 5%

8	Mon, Feb. 21, 2022	Analyzing and Designing Algorithms: Iterative Sorting Algorithms
		Selection, Bubble and Insertion Sort and their analysis
9	Wed, Feb. 23, 2022	Recursive Sorting
		Divide and Conquer Approach: Merge Sort and its analysis
		Homework 2 due
		Homework 3 out (Coding: Merge and Quick Sort) – 5%
10	Mon, Feb. 28, 2022	Recursive Sorting
		Quicksort and its analysis
11	Wed, Mar. 2, 2022	Homework 3 due
		Review Session on Sorting Algorithms
12	Mon, Mar. 7, 2022	Quiz 2. 20~30 minutes quiz. (Iterative & Recursive Sort) – 7%
		Introduction to Heaps
13	Wed, Mar. 9, 2022	Heaps and Heap Sort
14	Mon, Mar. 14, 2022	Heap Sort and Priority Queues
15	Wed, Mar. 16, 2022	Sorting in Linear Time:
		Radix Sort and its analysis
END OF MODULE 3		
16	Mon, Mar. 21, 2022	Mid-Term Exam – 20% (All sorting including heap)
17	Wed, Mar. 23, 2022	Review on Trees, Binary Trees
		Advanced Trees: Red-Black Trees
		Homework 4 out (Red-Black trees and B-Trees) – 5%
18	Mon, Mar. 28, 2022	Spring Recess - no classes
19	Wed, Mar. 30, 2022	Spring Recess - no classes

20	Mon, Apr. 4, 2022	Advanced Trees: Red-Black Trees
21	Wed, Apr. 6, 2022	Advanced Trees: B-Trees Homework 4 due
		END OF MODULE 4
22	Mon, Apr. 11, 2022	Quiz 3. 20 ~30 minutes quiz. (RB Tree, B <u>Tree)</u> – 7% Introduction to Hashing
23	Wed, Apr. 13, 2022	Hashing, Hash Tables and Hash Functions
24	Mon, Apr. 18, 2022	Resolving collisions in Hashing
		END OF MODULE 5
25	Wed, Apr. 20, 2022	Quiz 4. 20~30 minutes quiz. (Hashing) – 7% Trees and Graphs – BFS & DFS
26	Mon, Apr. 25, 2022	Minimum Spanning Tree: Prim's Algorithm
27	Wed, Apr. 27, 2022	Greedy Algorithms and technique: Single Source Shortest Paths: Dijkstra's Algorithm
28	Mon, May 2, 2022	Quiz 5. 20~30 minutes quiz. (Prim's & Dijkstra's) – 7% All-Pairs Shortest Paths: Floyd-Warshall Homework 5 Out (Floyd-Warshall Algorithm) – 5%
29	Wed, May 4, 2022	All-Pairs Shortest Paths: Floyd-Warshall Continued
30	Mon, May 9, 2022	Dynamic Programming concepts/technique Homework 5 due
31	Wed, May 11, 2022	Review Session
32	Mon, May 16, 2022	NP-completeness, Reductions - Last Day of Instruction – Last Day of Classes
Mon, May 23, 2022; 9.45 AM ~ 12 PM; Final Examination (DFS, BFS, Prim's, Dijkastra's, Floyd-Warshall, DP) – 20%		

Final Exam Schedule: https://www.sjsu.edu/classes/final-exam-schedule/spring-2022.php