

San José State University
College of Science/Department of Computer Science
CS146, Data Structures and Algorithms, Section 3, Fall, 2019

Course and Contact Information

Instructor:	Nada Attar
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Office Hours:	M 1:45-2:45pm W 1:45-2:45pm
Class Days/Time:	M/W 3:00-4:15pm
Classroom:	MH 225

Course Format

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at <http://www.sjsu.edu/people/firstname.lastname> and/or on [Canvas Learning Management System course login website](http://sjsu.instructure.com) at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through [MySJSU](http://my.sjsu.edu) at <http://my.sjsu.edu> (or other communication system as indicated by the instructor) to learn of any updates.

Prerequisite

MATH 42, MATH 30, CS 46B, or CS 49J (or equivalent knowledge of Java) (with a grade of "C-" or better in each); Computer Science, Applied and Computational Math 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, merge sort, and quicksort). Design and analysis of data structures and algorithms. Divide-and-conquer, greedy, and dynamic programming algorithm design techniques.

Course Objectives

1. To ensure that students are familiar with ways to implement elementary data structures and their associated algorithms.
2. To introduce students to the implementation of more complex data structures and their associated algorithms.
3. To acquaint students with advanced sorting techniques.
4. To teach students how to determine the time complexity of algorithms.
5. To introduce students to algorithm design techniques.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students should 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 Texts/Readings

Textbook

Recommended reading:

Algorithms, 4th Edition by Robert Sedgewick and Kevin Wayne
Addison-Wesley Professional, 2011, ISBN 0-321-57351-X.

<https://www.amazon.com/dp/032157351X/>

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

<https://www.amazon.com/Introduction-Algorithms-3rd-MIT-Press/dp/0262033844>

You can find errata (bug reports) for the book <http://www.cs.dartmouth.edu/~thc/clrs-bugs/bugs-3e.php>, for whichever printing of the book you get.

Optional reading:

Introduction to Programming in Java: An Interdisciplinary Approach, 1st Edition by Robert Sedgewick and Kevin Wayne
ISBN-13: 978-0321498052

<https://www.amazon.com/gp/product/0321498054/>

Programming Environment

Please Follow the instructions on the Author's website: <http://algs4.cs.princeton.edu/home/>

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 S12-3at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

Homework assignments will be individual, regularly assigned, will include written problem assignments, and perhaps some online exercises. Solutions will be not posted all the time. The homework is a tool for you to learn the material and prepare you for the exams.

Midterm exams:

There will be two Midterm exams during the semester.

Final Examination:

One written final cumulative exam.

Section 3: Day: Tuesday, December 17

Time: 12:15-2:30pm

The exams will contain multiple choice questions, short answer questions and questions that require pseudocode and/or computations. Students must obtain >50% in each component of the course (homework, project, quizzes & written exams) in order to be eligible for a passing grade.

Grading Information

Your grade for the course will be based on the following components:

- Mid Term Exams - 30%
- Final Exam - 25 %
- Projects 20 %
- Assignments 20%
- Discretion - 5% (Including attendance, participations in class, answering forum posts on Piazza, Kahoot)

Exams are closed book; final exam is comprehensive. No extra point options in the final. No make-ups exams except in case of verifiable emergency circumstances

Determination of Grades

The following shows the grading scale to be used to determine the letter grade:

Percentage	Grade
95 and above	A+
92-94	A
90 - 91	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
67 - 69	D+
63-66	D
60-62	D-
59 and below	F

Classroom Protocol

Attendance is highly recommended. Please avoid disturbing the class: turn-off cell phones (or put them on vibrate mode), no text messaging in the class or the exams, no taking pictures and video, avoid coming late. You may not publicly share or upload material for this course such as exam questions, lecture notes, or solutions without my consent.

University Policies (Required)

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/> Make sure to review these policies and resources.

Policies

Late homework/projects

All homework and projects will be due on Thursday of the indicated week at 5:00pm. The assignment will be posted at least a week before the due date to give enough time to work, and ask for help during my office hours or online on Piazza. Please do not email me few hours before the deadline asking me to help you understand concepts. If I feel that you just start working on your assignment at the due date, I will ignore your emails because I know you won't be able to finish understanding the problem, coding, testing, compiling, and debugging in a few hours. So, please start early and manage your time wisely.

Late Submission: (max one assignment is ok)

- 0-6hr -> no penalty
- 6-12hr -> 30% penalty
- 12hr- 24hr ->60%
- +2 Day -> 100%

Classroom Etiquette

Please come to class on time and if you have to leave please do so quietly. It is fine to eat and drink during the lecture as long as it does not disturb your classmates and you are doing it quietly. Refrain from crunchy or smelly food (unless you bring enough for everyone else!). If you are not a surgeon who is on call, try to put your phone on silent mode (not vibrate mode). Abstain from talking to each other during class and if you have any question or concern, please bring them up to me.

Piazza Etiquette

Ask clear questions to get better answers. Make sure your question has not been already asked and answered. Read these guidelines (<http://superuser.com/help/how-to-ask>) when you ask a question. It is fine to share a couple of lines of code but please don't just post your code or share a significant amount of code. Try to ask general questions.

Piazza sign up link: <https://piazza.com/sjsu/fall2019/cs146section3>

Email Etiquette

I prefer if you use your school email. SJSU uses sjsu-email as an official means of communication. I demand that they use it when contacting me. If you decide to email me from your personal email (ex, gmail, yahoo, etc) that would be fine with me too, but I don't respond to anonymous account names. Also, if you email me during weekend and I am not responding, don't panic! Please give me some time as I am not ignoring your email, but I might be catching on errands. I promise to get back to your email on Monday. This is why I post assignments at least a week before the deadline and encourage you to use Piazza.

When you email me, please be on topic, be specific, and state your question clearly so I can assist you in the best way I can. I prefer if you use Piazza (private or public message). If you send your code due to some error or bug, state which

lines of code you think the problem is. Paste the error message you get from the compiler is helpful

Sayat.me Etiquette

I will check my account at Sayat.me weekly to read your feedback, comments, suggestions, what you like or what you do not. I will also check my account after each midterm. I will take every anonymous feedback into consideration and try to make this class better to all of you. Please be specific about your feedback, suggest an alternative approach, and finally be mindful to what we are capable to change for this class.

My account: <https://sayat.me/nadaattar>

Tips to succeed

- This is a challenging, programing-intensive course. It gets more difficult very quickly as the semester progress. It is not about coding, but it teaches you how to write an “efficient” and “elegant” code. So, please do not fall behind.
- Ask for help. I want you to be successful in this course and I love questions. It’s important to ask questions during the class. This is your chance to understand the materials before you go home and read it on your own. There is no stupid question and always know that other students will benefit from the questions you ask during class.
- Do not get frustrated. Programming takes patience. It is very common to spend hours doing your HWs/projects. Take short breaks. If you spend hours on one bug or an error, email me and I will help you. Always remember, the more you code, the better you will become.
- Always keep testing your code. After ever few lines of coding, test and compile your code. It is easy to find mistakes in a small scope. And remember to back up your code while you are working on it. I recommend saving it in the cloud.
- As the course is challenging, and required a significant time commitment for most students, ask your instructor for help, ask your friends on Piazza, but there is no excuse for plagiarism.

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Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1	W 8/21	Introduction, Course mechanic & Logistics (Reading: SW 1.1)
1	M 8/26	Programming Model (Reading: SW 1.1)
2	W 8/28	Data Abstraction (Reading: SW 1.2)
2	M 9/02	No Class (Labor Day) , Note: Tuesday 9/03 is the Last Day to Drop the Course
3	W 9/04	Basic Data Structures: Bags, Stacks and Queues (Reading: SW 1.3)
3	M 9/09	Analysis of Algorithms, Growth of functions-O, Ω , Θ , o, ω (Reading: CLRS Ch 3; SW 1.4)
4	W 9/11	Union-find (Reading: SW 1.5)
4	M 9/16	Elementary Sorts (Reading: SW 2.1)
5	W 9/18	Quick Sort & Divide and Conquer technique: Merge Sort (Reading: SW 2.2, 2.3)
5	M 9/23	Priority Queues (Reading: SW 2.4)
6	W 9/25	Sorting Applications (Reading: SW 2.5)
6	M 9/30	Symbol Tables & Binary Search Trees (Reading: SW 3.1, 3.2)
7	W 10/02	Balanced Search Trees 2-3 search trees (Reading: SW 3.3)
7	M 10/07	Balanced Search Trees Red-black BSTs (Reading: SW 3.3)
8	W 10/09	Hashing (Reading: SW 3.4)
8	M 10/14	Searching Applications (Reading: SW 3.5)
9	W 10/16	Midterm I
9	M 10/21	Undirected Graphs (Reading: SW 4.1)
10	W 10/23	Directed Graphs (Reading: SW 4.2)
10	M 10/28	Minimum Spanning Trees, Prim and Kruskal algorithms, Data Structures for Disjoint Sets (Reading: CLRS Ch 23, Ch 21; SW 4.3)
11	W 10/30	<i>Cont.</i> Minimum Spanning Trees, Prim and Kruskal algorithms, Data Structures for Disjoint Sets (Reading: CLRS Ch 23, Ch 21; SW 4.3)
11	M 11/04	Shortest Paths: Dijkstra's algorithm and Bellman-Ford (Reading: CLRS Ch 24; SW 4.4)
12	W 11/06	Greedy technique (Reading: CLRS Ch 16)
12	M 11/11	No Class (Veterans Day)
13	W 11/13	Dynamic Programming technique (Reading: CLRS Ch 15)
13	M 11/18	Midterm II
14	W 11/20	<i>Cont.</i> Dynamic Programming technique (Reading: CLRS Ch 15)
14	M 11/25	NP-complete problems (Reading: CLRS Ch 34:1-4)
15	W 11/27	No Class (Thanksgiving Holiday)
15	M 12/02	<i>Cont.</i> NP-complete problems (Reading: CLRS Ch 34:1-4)
16	W 12/04	Advanced Topics in NP
16	M 12/09	Review

Week	Date	Topics, Readings, Assignments, Deadlines
17	Tu 12/17	Final Exam: Section 3, Time: 12:15-2:30pm