

San José State University
Department of Computer Science
CS146, Data Structures and Algorithms, Sections 5 and 6,

Fall Semester, 2015

Basic Information

Instructor: Anna Shaverdian

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Office & office hours: MQH 215, Tuesdays 8-10am

Course Information

Catalog 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.” 3 units

Course Goal

To examine various ways to represent data used by programs and to compare these representations in terms of their memory requirements and the resulting program execution times.

Course Objectives

- Ensure that students are familiar with ways to implement elementary data structures and their associated algorithms.
- Introduce students to the implementation of more complex data structures and their associated algorithms.
- Acquaint students with advanced sorting techniques (radix sort, heapsort, mergesort, quicksort).
- Teach students how to determine the time complexity of algorithms.
- Introduce students to algorithm design techniques.

Student Learning Outcomes

Upon successful completion of this course, you should be able to:

- Implement lists, stacks, queues, search trees, heaps, union-find ADT, 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

Prerequisites

Math 030 Calculus I

Math 042 Discrete Mathematics

CS 049J Programming in Java or equivalent knowledge of Java

CS 046B Introduction to Data Structures

A grade C- or better, or instructor's consent. The Department of Computer Science strictly enforces prerequisites. If you are not already pre-enrolled, you must come to the first class meeting and pick up an Add Form from the instructor. If applicable, show the instructor your card that indicates you're a graduating senior. It will be the instructor's and the department's decision whether or not to send you an add code by email. The instructor may drop any student who does not show up during the first two class meetings.

Material assumed from prerequisite courses

Math 30 (Calculus I)

- Limits and integration

Math 42 (Discrete Mathematics)

- Proof by induction, proof by contradiction
- Sequences and summations
- Equivalence relations, equivalence classes
- Recursive definition, recurrence relations
- Permutations, r-combinations, simple counting and probability

CS 46B (Introduction to Data Structures) and CS49J (Programming In Java)

- Linked lists, stacks, queues
- The Comparator interface
- Concepts of an iterator and iteration over a collection
- Binary search, binary search trees, hashing
- Elementary sorting (insertion, selection, and bubble sorts)
- Big-Oh notation
- Javadoc tags @param, @return, @throws

Laptops and lab time

Bring your laptops to class — we'll try to set aside some "lab" time for all the students to get together and share tips and accomplishments. This class will move rapidly and cover a lot of material. Class attendance and participation are very important.

Required text

Title: Data Structures and Algorithm Analysis in Java, 3rd edition Author: Mark Allen Weiss
Publisher: Pearson ISBN-13: 978-0-13-257627-7 Errata:
<http://users.cis.fiu.edu/~weiss/dsaajava3/errata.htm>

Schedule

Subject to change!

Weeks	Topics and activities	Dates	Chapters
1	Introduction From arrays to generics Algorithm analysis	Aug 20	1,2
2	Algorithm analysis	Aug 25, 27	2
3	Lists	Aug 31, Sept 3,	3
4	Stacks and queues	Sept 8, 10	3
5	Trees	Sept 15, 17	4
6	Trees	Sept 21, 24	4
7	Priority queues (heaps)	Sept 29, Oct 1	6
8	Midterm Review Midterm Oct 8	Oct 6, 8	7
9	Sorting	Oct 13, 15	7
10	Sorting Disjoint set class	Oct 20, 22	7, 8
11	Graphs	Oct 27, 29	9
12	Graphs	Nov 3, 5	9

13	Hashing	Nov 10,12	5
14	String pattern matching	Nov 17, 19	10
15	Algorithm design techniques	Nov 24,26	10
16	NP-completeness Special Topics	Dec 1,3,8	9, 12

Programming assignments

There will be several programming assignments requiring you to use the major data structures and algorithms covered in the course. Programs must be appropriately documented via javadoc comments and should adhere to the coding style posted on the CS Department web page: http://www.cs.sjsu.edu/web_mater/java_code.html. If you work together with another student on an assignment, both of you will receive the same score.

Each assignment is worth a maximum of 100 points. Late assignments will lose 20 points and an additional 20 points for each 24 hours after the due date.

Exams

The midterms and final examinations will be open book and notes. Instant messaging, e-mails, texting, tweeting, or other communication with anyone else during the exams will be strictly forbidden.

Class grade

Your individual class grade will be weighted as follows:

15% Written Assignments

50% Programming Assignments

15% Midterm exam

20% Final exam

Each project and exam will be scored (given points) but not assigned a letter grade. The mean score and standard deviation will be announced after each project and exam.

Final individual class letter grades will be assigned based on the class curve. Your final class grade can be adjusted up or down depending on your level and quality of participation on your project team as determined by the project tracking tools and your team members' assessments of your performance.

Note that “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of

their course grades.” See [University Policy F13-1](http://www.sjsu.edu/senate/docs/F13-1.pdf) at <http://www.sjsu.edu/senate/docs/F13-1.pdf> for more details.

Policies

Workload

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

NOTE that [University policy F69-24](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.”

University Policies

General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU’s policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See [University Policy S90–5](http://www.sjsu.edu/senate/docs/S90-5.pdf) at <http://www.sjsu.edu/senate/docs/S90-5.pdf>. More detailed information on a variety of related topics is available in the [SJSU catalog](http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html), at <http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html>. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at http://www.sjsu.edu/provost/services/academic_calendars/. The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

Consent for Recording of Class and Public Sharing of Instructor Material

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor’s permission to record the course and the following items to be included in the syllabus:

- “Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
 - It is suggested that the greensheet include the instructor’s process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
 - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- “Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent.”

Academic integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. [Presidential Directive 97-03](http://www.sjsu.edu/president/docs/directives/PD_1997-03) at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.