

San José State University
Department of Computer Science
CS 255: Design and Analysis of Algorithms

Instructor: Soon Tee Teoh

Email: soontee.teoh@sjsu.edu

Office Hours: Thu 9 - 11 am, Zoom link: <https://sjsu.zoom.us/j/132407857>

Class Days/Time: MW 4:00 - 5:15 pm

Zoom link: <https://sjsu.zoom.us/j/132407857>

Prerequisites: CS 155

Course Format

This course will be taught primarily via classroom presentations. Zoom lectures will be recorded. Students are expected to be present for the exam(s) held during the class period. Otherwise, attendance is optional. In addition, homework demos are scheduled during regular class time. However, students can schedule other times to demo if the regular class time is inconvenient.

Canvas Course Website

Course materials, syllabus, assignments, grading criteria, exams, and other information will be posted on the Canvas Learning Management System course login website at <http://sjsu.instructure.com>.

You are responsible for regularly checking these websites to learn of any updates. You can find Canvas video tutorials and documentations at <http://ges.sjsu.edu/canvas-students>.

Course Catalog Description

Randomized algorithms. Parallel algorithms. Distributed algorithms. NP-completeness of particular problems. Approximation algorithms. revolution, and tubularization.

Course Objectives

The objectives of this course are to:

- Acquaint students with algorithm design and analysis in the areas of parallel, distributed, randomized, and approximation algorithms.
- Teach students how to perform a polynomial time reduction.
- Familiarize students with the concept of amortized analysis.
- Demonstrate the use of number-theoretic algorithms to perform basic cryptographic protocols.

Student Learning Outcomes

Upon completing this course, students should be able to:

- Code an example of each of the following types of algorithms:
 - parallel
 - distributed
 - randomized
 - approximation
- Perform a polynomial time reduction as required in an NP-completeness proof.
- Conduct an amortized analysis.
- Use number-theoretic algorithms to perform basic cryptographic protocols.

Academic Integrity

You may study together and discuss the assignments, but what you turn in must be your individual work. Copying code from another student's program or sharing your program code are equally serious violations of academic integrity. Never use code you find on the web, unless you have the instructor's permission, and then you must give proper attribution in your comments.

This is similar to giving attribution to a quote that you use in a term paper. Assignment submissions will be checked for plagiarism using Moss from the Department of Computer Science at Stanford University. See <http://theory.stanford.edu/~aiken/moss/>.

Violators of academic integrity will suffer severe sanctions, including academic probation.

Students who are on academic probation are not eligible for work as instructional assistants in the university or for internships at local companies.

Recommended Texts

- Kleinberg and Tardos, Algorithm Design, First edition, Addison Wesley, 2005.
- Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, 3rd Edition, MIT Press, 2009. You can find errata (bug reports) for the book <http://www.cs.dartmouth.edu/~thc/clrs-bugs/bugs3e.php>.

Software and Computer

A few of the programming assignments will require the drawing of points, lines and shapes in 2D. You can use any programming language you want, and any library that can draw points, lines, and shapes. In the lectures, we will specifically be referring to the open source *openFrameworks* C++ library. However, using this library is optional. You are allowed to use other graphics libraries in your programming assignments.

Other programming assignments use threads and GPU programming. In lectures, we discuss C++ threads and OpenCL. However, you may use other thread libraries and other programming languages for your homework assignments.

Your computer must be equipped to demo your program over Zoom screen share.

Course requirements and assignments

There will be homework assignments and exams.

Assignments

There will be multiple homework assignments throughout the semester. Each assignment will be worth a specified maximum number of points. Assignments can be turned in within 48 hours late for 20% deduction. After 48 hours, no submission is allowed (it will get a 0 score).

Exams

The exams are open-book. You can refer to all class material. However, you may not communicate with any other person, or search solutions on the Internet. The exams will test understanding (not memorization) of the material taught during the semester. Instant messaging, e-mails, texting, tweeting, file sharing, or any other forms of communication with anyone else during the exam will be strictly forbidden. There can be no make-up exam unless there is a documented medical emergency.

The university's syllabus policies:

- University Syllabus Policy S16-9 at <http://www.sjsu.edu/senate/docs/S16-9.pdf>
- Office of Graduate and Undergraduate Programs' Syllabus Information web page at <http://www.sjsu.edu/gup/syllabusinfo/>.

"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 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."

Grading Information

Your final class grade will be weighted as follows:

8 Homework Assignments: 40% (5% each)

3 Exams: 60% (20% each)

Final score to letter grade conversion is as follows:

Overall Score	Grade
100 - 96	A
95.99 - 92	A-
91.99 - 88	B+
87.99 - 84	B
83.99 - 80	B-
79.99 - 77	C+
76.99 - 74	C
73.99 - 70	C-
69.99 - 0	F

Classroom Protocol

It is very important for each student to attend classes and to participate. Cell phones in silent mode, please. No use of electronic devices (phones, tablets, laptop computers etc.) in class, except to take notes.

University Policies

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 at <http://www.sjsu.edu/gup/syllabusinfo/>.

Course Schedule

Week	Mon	Wed
1	8/23/2021	8/25/2021
	Analysis of Non-recursive Algorithms	Analysis of Recursive Algorithms
2	8/30/2021	9/1/2021
	Brute Force	Divide and Conquer
3	9/6/2021	9/8/2021
	Labor Day	Amortized Analysis
4	9/13/2021	9/15/2021
	Randomized: Quicksort, Convex Hull	Randomized: Min Cut
5	9/20/2021	9/22/2021
	Greedy: Max Flow	Homework Demo
6	9/27/2021	9/29/2021
	Review	Exam 1
7	10/4/2021	10/6/2021
	Parallel: Pointer jumping	Parallel: Tree Depth
8	10/11/2021	10/13/2021

	Parallel Algorithms using threads	Homework Demo
9	10/18/2021	10/20/2021
	Parallel Algorithms on the GPU	NP-completeness
10	10/25/2021	20/27/2021
	NP-completeness	Homework Demo
11	11/1/2021	11/3/2021
	Review	Exam 2
12	11/8/2021	11/10/2021
	Approximate Algorithms	Distributed: Byzantine Agreement
13	11/15/2021	11/17/2021
	Byzantine Agreement: Signed Messages	Number theoretic Algorithms
14	11/22/2021	11/24/2021
	RSA Public Key	Thanksgiving
15	11/29/2021	12/1/2021
	Homework Demo	Review
16	12/6/2021	
	Exam 3	