SJSU SAN JOSÉ STATE UNIVERSITY

College of Science · Computer Science

Randomized Algorithms and Applications Section 01

CS 262

Spring 2024 3 Unit(s) 01/24/2024 to 05/13/2024 Modified 01/21/2024

Contact Information

Instructor	Dr. Anant Dhayal
Email	anant.dhayal@sjsu.edu
Class Timings	Monday - Wednesday 19:30 to 20:45 in MH 233
Office Hours	Tuesday 12:00 to 13:00 over zoom
	zoom link >> https://sjsu.zoom.us/j/86415116245 (https://sjsu.zoom.us/j/86415116245)

Course Description and Requisites

Design and analysis of algorithms which incorporate randomness in their design. Applications will be given in several of the following areas: data structures, pattern matching, cryptography, parallel computing, distributed computing, and interactive proof systems.

Prerequisite(s): CS 154 or CS 155, and Graduate standing. Allowed Declared Major: Computer Science, Bioinformatics, Data Science. Or instructor consent.

Letter Graded

Classroom Protocols

1. Students are advised to attend all lectures.
2. Regrade requests should only be made through Canvas:
    - Requests made during the class will not be entertained.

    - Requests that don't address the (instructor) comments will not be entertained.
    - If canvas replies are not satisfying, only then office hours should be used.
3. Office hours are only for:
    - Clarifying doubts regarding the class material.
    - Clarifying the exact meaning of assignments questions (in case of any discrepancies).
4. When in doubt, use canvas discussion tab (in appropriate threads):
    - For assignment related doubts and ideas: This is fair since all the students will have the same set of hints while solving assignments.
    - For class material related doubts: This will reduce the workload of instructors since each post will help multiple students simultaneously and students will also be able to help each other.

Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

Course Goals

To understand basic tools from probability theory and how randomness can be used as a tool to improve deterministic algorithms along the following axes:

- Efficiency
- Accuracy
- Simplicity

Course Learning Outcomes (CLOs)

1. Understand multiple ways in which randomness can improve a deterministic algorithm.
2. Be able to compute the trade offs randomness offers: efficiency vs accuracy vs simplicity.
3. Be able to identify the scenarios where randomness can be applied.
4. Understand the basic tools probability theory offers for analyzing randomized algorithms.
5. Be able to identify which probability theory tool should be used when.

Course Materials

We will not follow any specific book but we might refer some parts of the following books:

- Motwani and Raghavan. Randomized Algorithms, Cambridge University Press, 1995.
- Mitzenmacher and Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 2005.

* Free pdfs of these books will be provided (but only for personal use).
** The course theme will remain the same but exact material is subject to change with fair notice and changes will only be made to make the class more inclusive for the attending students.

Course Requirements and Assignments

1. Midterm exam will be over zoom where you can only refer class material.
    - Any case of plagiarism will get a straight F.
2. Final exam will be 48 hours take home where you can only refer class material.
    - Any case of plagiarism will get a straight F.
3. Project presentations will be in class in groups of 2 or 3.
4. Each student will have to volunteer for preparing class notes for at least one class.
    - This activity constitutes 5% of the total grade.
    - The notes will be posted on the canvas and should meet a certain standard.
    - Instructors will provide extra help if needed.
5. Students may discuss assignments but should write the solutions individually.
    - Any case of plagiarism will get a straight F.
    - Any collaborators and sources (other than class material) should be cited for each answer.

Grading Information

Breakdown:

Item	Percentage
Take Home Final	30
Mid Term	20
Assignments *	30
Project PPT	15
Class Notes	5

* best x of x+1 will be considered where x will be 3 or 4

Criteria:

Percentage **	Grade
> = 90	A+
85 - 89	A

80 - 84	A-
75 - 79	B+
70 - 74	B
65 - 69	B-
60 - 64	C+
55 - 59	C
50 - 54	C-
40 - 49	D
< = 39	F

** ceiling of the actual percentage

University Policies

Per University Policy S16-9 (PDF) (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 the Syllabus Information (https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to review and be aware of these university policies and resources.

Course Schedule

Week	Dates	Topic *
1	01/24	Introduction & logistics
2	01/29 - 01/31	Randomness in Algorithms: Usage and Tradeoffs
3	02/05 - 02/07	Probability Review I: Probability Axioms and Random Experiments
4	02/12 - 02/14	Probability Review II: Linearity of Expectation
5	02/19 - 02/21	Probability Review III: Deviation from Expectation
6	02/26 - 02/28	De-randomizing Randomized Algorithms
7	03/04 - 03/06	Probability Review IV: Chernoff Bounds

8	03/11 - 03/13	Review and Midterm Exam
9	03/18 - 03/20	Randomized Complexity Classes
10	03/25 - 03/27	Probabilistic Method
11	04/08 - 04/10	Probability Review V: Markov Chains
12	04/15 - 04/17	Random Walks and their Applications
13	04/22 - 04/24	Probability Review VI: Lovasz Local Lemma
14	04/29 - 05/01	Project Presentations
15	05/06 - 05/08	Project Presentations
16	05/13 - 05/15	Review and Final Exam

* each topic will be supplemented with enough example problems / algorithms