CS378 - Randomized Algorithms (Spring 2024)

Logistics:
MW 2-3:30, GDC 4.302
Unique Number: 51245
Course web page: http://www.cs.utexas.edu/~diz/378

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Who should take this? Students interested in theory, probability, and algorithms, and who like a challenge. This course is excellent preparation for graduate school.

Text: Mitzenmacher and Upfal, *Probability and Computing*, 2nd edition.

Course Overview: Randomness is extremely useful in computer science. Algorithms that make random choices during their execution, known as randomized algorithms, are often faster or simpler than algorithms that don't use randomness. Examples include Quicksort, primality testing, and Monte Carlo simulations. However, such randomized algorithms usually come with a small probability of error, so it is important to bound this error probability. In this undergraduate course, we develop tools and techniques to design and analyze efficient randomized algorithms. This course is theoretical and mathematical; there will be no programming assignments. Each section of the course is built around a method, with example applications to randomized algorithms. We list the topics below.

Topic	**Chapter(s)**	**Approximate Time**
Introduction, Simple Randomized Algorithms	1-2	1-2 weeks
Moments, Deviations, and Random Sampling	3	1 week
Tail Bounds	4	1 week
Balls, Bins, and Random Graphs	5	1 week
Probabilistic Method	6	1 week
Markov Chains and Random Walks	7	1-2 weeks
Entropy	10	1 week
Monte Carlo Method	11	1-2 weeks
Pairwise Independence and Universal Hashing	15	1-2 weeks

Prerequisites: Computer Science 331 or 331H or 357 or 357H. This means that you need the prerequisites and corequisites for CS 331, including Discrete Math (CS 311 or 311H), Probability (SDS 321 or M 362K), and Linear Algebra (SDS 329C, Math 340L, or Math 341). Strong intuition about probability is essential; I recommend only taking this class if you received an A in Probability.

Grading:
65%: 3 Exams
35%: Homework

Exams: The exams will be held in class on the following dates: Exam 1 on Wednesday, February 14, Exam 2 on Wednesday, March 27, and Exam 3 on Monday, April 29. No make-up tests will be given, so plan accordingly. You may bring a single, 8.5x11 inch, handwritten sheet of paper (you may use both sides). No calculators are allowed (they won't be necessary).

Eclipse Schedule Change: To give students and teaching staff the opportunity to view the rare eclipse on April 8, class on that date will be moved to Friday, April 5, at the same time, 2-3:30.

Homework: Most weeks a problem set will be assigned.

Collaboration policy: While you should first think about the problems on your own, you are encouraged to discuss the problems with your classmates. Please limit your collaborations on any particular homework to at most three other students. Discussion of homework problems may include brainstorming and verbally walking through possible solutions, but should not include one person telling the others how to solve the problem. In addition, each person must write up their solutions independently, and these write-ups should not be checked against each other or passed around or emailed. You must acknowledge any collaboration by writing your collaborators' names on the front page of the assignment. You don't lose points by having collaborators.

Citation policy: Try to solve the problems without reading any published literature or websites, besides the class text and links off of the class web page. If, however, you do use a solution or part of a solution that you found in the literature or on the web, you must cite it. Furthermore, you must write up the solution in your own words. You will get at most half credit for solutions found in the literature or on the web.

Use of AI: You may not use ChatGPT or any AI to help you solve homework problems.

Submission policy: Each student has two late days that they can use during the semester with no penalty (one assignment two days late, or two assignments one day late). Once late days are used up, no credit will be given for late assignments. A day here means 24 hours. The weekend doesn't count, so Friday to Monday counts as one day. I may not allow late days for certain assignments.

Laptops/Phones: The use of laptops and mobile devices is generally prohibited; however, I will allow use of tablets if you sit in the first row and only use them for class-related purposes. Other exceptions may be made in unusual circumstances. All phones must be silenced.

Canvas: We will use Canvas, which contains Ed Discussion. Homeworks and grades will be posted on Canvas. We will use Ed Discussion for class discussion. Instead of emailing questions to the teaching staff, please post your question to Piazza.

Students with Disabilites: Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Office of the Dean of Students at 471-6259 (voice) or 471-4641 (TTY for users who are deaf or hard of hearing) as soon as possible to request an official letter outlining authorized accommodations.

Last updated January 17, 2024.