Randomized Algorithms
CSCI 6220/4030
Mondays and Thursdays, 10:00am–11:50am, Greene 120

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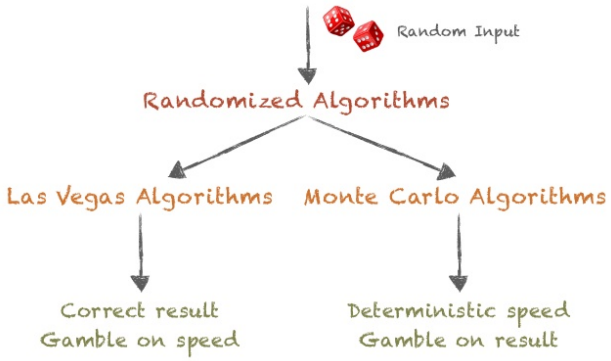
Course Description: Randomized Algorithms are the state of the art in contemporary algorithm design. They are usually simple, sometimes even easy to analyze, and they work well in practice. This course provides an introduction to basic concepts in the design and analysis of randomized algorithms.



Course Text: (Recommended, not required) *Probability and Computing*, by M. Mitzenmacher and E. Upfal. We will also cover material from other sources, that will be made available on the course web page.

Course Website: http://www.cs.rpi.edu/~gittea/teaching/fall2019/csci6220-and-4030.html

Course Objectives: At the end of the semester, students will have grasped the fundamentals of randomized algorithm design, and the probabilistic tools and techniques used to analyze randomized algorithms. Among other accomplishments, they will have:

- An understanding of the major categories of approaches to using randomness to solve problems, and the difference between Las Vegas and Monte Carlo algorithms
- Mastered basic probability, including the linearity of expectation, conditional expectations, and the law of total probability
- Learned how to employ basic tail inequalities including Markov bounds, Chebyshev bounds, Chernoff–Hoeffding bounds; including determining which is appropriate for a given application
- Familiarity with balls and bins arguments and the coupon collector problem
- Learned how to employ the probabilistic method to establish properties of combinatorial structures
- An understanding of the fundamentals of Markov Chains and the Monte Carlo Method

- Be comfortable with the analysis of the performance of classical randomized data structures
- Students in 6220 will additionally be able to derive novel Chernoff–Laplace bounds
- Students in 6220 will additionally be capable of performing performance analyses of randomized algorithms with limited dependence using the martingale framework.

Grading Criteria:

Homeworks	50%
In-class Pop Quizzes	25%
Project	25%

Letter grades will be computed from the semester average. Lower-bound cutoffs for A, B, C and D grades are 90%, 80%, 70%, and 60%, respectively. These bounds may be moved lower at the instructors discretion.

Students are expected to have writing supplies on hand in each class to complete the in-class pop quizzes. These quizzes will reflect the difference in the course objectives for students enrolled in 6220 and 4030. If you are an athlete or for some other reason are not able to attend each class, make alternative arrangements with the instructor in the first two weeks of the course.

Homework Policy

All assignments *must be typed using proper mathematical typesetting* and are due, as paper copies, at the start of class. There will be at least 6 homework assignments and they will reflect the difference in the course objectives for students enrolled in 6220 and 4030. Homework assignments will be made available via the course web site. Homework assignments must be submitted at the start of class on the specified due date. Generally, they will have a two-week duration. Late assignments will not be accepted, unless you contact the instructor at least two days before the due date to receive a deferral. Deferrals will be granted at the instructor's discretion.

Project Policy

Students will work in groups of 1 to 3 persons to explain a randomized algorithm of their choice and present theoretical and empirical evaluations of the algorithm's performance. The grading will be based on the clarity and comprehensiveness of the presentation. The algorithm must be significantly different from those covered in class, and can be from the literature, or a novel algorithm designed by the students. The presentation will be given in-class, using a slide deck. Details are forth-coming.

Academic Integrity

The Rensselaer Handbook of Student Rights and Responsibilities and The Graduate Student Supplement define various forms of Academic Dishonesty and you should make yourself familiar with these. In this course, all assignments that are turned in for a grade must represent the students own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration.

Submission of any assignment that is in violation of this policy will result in no credit for that assignment, reporting to the Dean of Students office, and at the instructor's discretion, a grade of F for the course.

If you have any question concerning this policy before submitting an assignment, please ask for clarification.