CS 7530 Randomized Algorithms - Syllabus

Spring 2027

This syllabus is dated 11/03. It may change until the end of the first week of class. Check the syllabus page for the most recent version: https://syllabus.gatech.edu/syllabi/7530/a

Instructor Information

Instructor: Prof. van den Brand

General Course Information

Description

Techniques for designing and analyzing randomized algorithms, derandomization techniques.

If you are a non-theory CS PhD Student, then this course satisfies your Theory breadth requirement. Ph.D. in Computer Science

If you are a MSCS Student with specialization in either

- Computational Perception and Robotics, or
- Machine Learning

then this course satisfies your Algorithms Core Course requirement: Master of Science in Computer Science | Georgia Tech Catalog

Course Learning Outcomes

Design algorithm, prove correctness, and bound failure probabilities, using the following techniques and concepts: Monte Carlo, Las Vegas, Amplification, linearity of expectation, Yao's minimax principle, Markov inequality, Chebyshev inequality, Chernoff/Hoeffding inequality, sketching, hashing, sampling. Alternate models of computation such as distributed computing, streaming algorithms, sublinear-time algorithms.

Pre-Requisites

The Oscar system lists 6505 and 6550 as requirements, but this is for historic reasons and is not actually enforced.

Instead, this course requires:

- A background in algorithms.
  E.g., CS 3510 (Design & Analysis of Algorithms) or CS 6515 (Intro to Graduate Algorithms) or another algorithms class. (This course will assume that you have written proofs for algorithms before.)
- Basic background in probability theory
  E.g., you should know: what are probabilities, what are conditional probabilities, what does it mean for random variables to be independent, what is an expected value.

Required Course Materials

There are no required books. Lecture notes will be provided. The following books may be helpful for further reading but are not required:

- Randomized Algorithms, Motwani and Raghavan
- Probability and Computing, Mitzenmacher and Upfal

Grading Policy:

The final grade is based on a weighted average of the following:

- Midterm Exams, 90%
  There will be 3 midterm exams throughout the semester. These are in-person, on paper.
  Exams are on: Feb 1st, March 8th, April 19th (Mondays)
- Final Project, 10%
  Apply techniques from this class to any algorithmic question of your interest. Submission will be a final report (and code if the project is applied in nature).
- Practice Problems (up to +5% extra credit)
  We will not grade your submissions for correctness. We want you to practice without pressure and allow you to learn from mistakes. Full credit is awarded for attempting the problems, even if your solution is not perfectly correct.
- Pop Quizzes (up to +2% extra credit)
  There will be unannounced pop quizzes in some lectures.

Final grade thresholds are A >= 90%, B >= 80%, C >= 70%, D >= 50%

Course Policies

Attendance and/or Participation

Attendance is expected.

Missed exams, sickness policy, approved absence, etc

You can take one (1) make-up exam on the last day of class (April 26th) if the Dean of Student Office excuses your absence from a prior exam.
https://studentlife.gatech.edu/request-assistance
Valid reasons are events out of your hands (e.g., sickness, family emergency, etc.), or events related to your program that you are required to attend and cannot be rescheduled (e.g., traveling to a conference to present a paper).

Poor planning is not an emergency. By signing up for this course, you agree to have read the exam schedule (see Grading Policy). It is your responsibility to be prepared for the exams on those dates and to not schedule other activities at the same time.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that

you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.