Fall 2019

CS 337-001: Performance Modeling in Computing

J. M. Calvin

CS 337 Performance Modeling in Computing, Fall 2019

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Course Information

Office: GITC 4311

Office Hours: Mon. 1:00-1:40, Wed. 1:00-1:40

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Prerequisites

CS 114 and (Math 333 or Math 341).

Objective

This course introduces probability models and techniques useful in computer science. The emphasis is on evaluating and optimizing the performance of algorithms and computing systems, using both analytical methods and discrete-event simulation.

Learning Outcomes

- The ability to construct stochastic models of algorithms and computing systems.
- The ability to efficiently estimate and optimize performance measures.

Textbooks

No textbook is required for this course. I will post class notes that cover all course material. The following resources each have some overlap with what we will be doing.

- "Think Stats: Probability and Statistics for Programmers", by Allen B. Downey; see web page at

  `https://greenteapress.com/wp/think-stats-2e/`

  This is a computing-oriented introduction to probability and statistics. If your probability skills are rusty, this is a good source for a review.

- "From Algorithms to Z-Scores: Probabilistic and Statistical Modeling in Computer Science", by Norm Matloff; see the web page

  `http://heather.cs.ucdavis.edu/~matloff/132/PLN/probstatbook/ProbStatBook.pdf`

- "Probability Models in Computer Science", Sheldon Ross, Harcourt, 2002.

  This book contains the basic probability that we will need in this course.

Software

You will need to write programs to solve homework and quiz problems. You may write your programs in C++, Java, Python, or Matlab. If you wish to use a different language, check with me first.

Course Materials and Communications

We will be using the Canvas system (http://canvas.njit.edu). All class information (including this syllabus) will be posted there. You can post questions (and answers) there, and I will post occasional updates.

If you have a personal issue that you wish to bring to my attention (for example if you want to inquire about your grade, or inform me that you need to miss class for some reason) you should email or call me, or speak to me in person. For other communications, you should use Canvas (for example, questions on homework or what will be on the exam).

In order to be excused from a class requirement you must go to the office of the Dean of Students and supply them with any information they may require. They in turn will contact me.

Grading

Homework assigments will have both analysis and programming components. You may discuss the problems in general terms with your colleagues, but you must come up with your own solutions. There will be a short online quiz each week based on the homework for the previous week. You must bring a computer to class to be able to take the quiz, and you must be present in class for the quiz.

The final exam will also be online, with a similar format to the quizzes.

The course grade will be based on the in-class quizzes (70%) and final exam (30%). The lowest three scores from among the quizzes will be dropped. The grading scale (out of 100) is: $83-100$ A, $75-82$ B+, $65-74$ B, $50-64$ C+, $40-49$ C. I reserve the right to change these grade ranges.

Academic Integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

`http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf`

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Tentative Course Outline

- Introduction
- Probability review.
- Inequalities.
- Convergence concepts.
- Central limit theorem.

- Markov chains.
- Continuous-time processes.
- Queueing models.
- Simulation modeling.
- Process model simulation (Python).
- Simulation output analysis.
- Markov chain Monte Carlo.
- Optimization.
- Simulation-based optimization.