MATH 4221: Stochastic Processes I Syllabus

Basics

Lectures: Monday / Wednesday / Friday 12:05 - 12:55 pm, Skiles 254
Instructor: Will Perkins, *wperkins3@math.gatech.edu*
Office Hours: Wednesdays 10 am - 12 in my office at Skiles 017, or by appointment
Course Webpage: *http://people.math.gatech.edu/~wperkins3/4221/*
Course Discussion Page: *http://piazza.com/gatech/fall2012/math4221* (required)

Course Material

The course is a second course in probability, covering techniques and theorems seen from the persepective of random walks and other discrete stochastic processes.

The required textbook for the course is *Probability and Random Processes*, 3rd ed. by Grimmett and Stirzaker. See below for a list of the topics and sections of the book we will cover. Some parts of the book are too specialized or advanced for us to cover in a one semester class, but it is my favorite probability textbook and will serve you well as a reference in the future. It also contains many fun and helpful examples and exercises.

Goals

Please read this section carefully as your enjoyment of the course will depend on our goals aligning.

- Learn probabilistic methods for analzying random processes and proving mathematical theorems
- Develop your probabilistic intuition
- Become an independent mathematician: learn to pose your own problems and ask your own questions
- Develop your mathematical taste: find topics and problems that you enjoy
- Learn on your own, by finding your own sources and by explaining concepts to fellow students.

Grading

Grading will be a little different than classes you've had before. I want the method of grading to give you incentives that align with my goals for the course, which is for you to learn probability and learn to work like a mathematician.

I will divide the course in 10 topics that I want you to master by the end of the semester. They are:

1. Basic Probability (sections 1.1 - 1.5, 2.1, 2.3, 3.1, 3.5, 4.1)
2. Expectation and Variance (3.3, 3.4, 4.3, 4.7, 5.6)
3. Simple Random Walk (3.9, 3.10, 5.3)
4. Conditional Distributions (3.2, 3.6, 3.7, 4.2, 4.5, 4.6)
5. Convergence of Random Variables (5.10, 7.1, 7.2, 7.3)

6. Limit Theorems (2.2, 3.8, 4.4, 4.8, 4.12, 5.10, 5.11, 7.4, 7.5)
7. Branching Processes (5.4, 6.7, 6.8)
8. Generating Functions and Characteristic Functions (5.1, 5.7, 5.8, 5.9)
9. Markov Chains (6.1 - 6.6, 6.14, 8.1 - 8.3)
10. Martingales (7.7 - 7.9, 12.1 - 12.5)

Your grade will be determined by how many of the 10 topics you have mastered by the end of the course.

- 9-10: A
- 7-8: B
- 4-6: C
- 2-3: D
- 0-1: F

Mastery goes beyond doing all the problems I've assigned. It means understanding why terms are defined as they are; why all the conditions of a theorem are necessary; how to apply a theorem or method to a type of problem you haven't seen before.

There will be several ways in which you can demonstrate to me that you have mastered each topic.

1. A short oral quiz (10 min.) on a single topic, at the time of your choosing. You have 2 tries for each topic.
2. To help prevent you from falling behind, we will have 4 tests scheduled (tentative dates: 9/14, 10/5, 11/2, 11/30), and each test will give you a chance to demonstrate mastery of 2-4 of the topics above.
3. Final Exam. The final will have questions on each of the topics and will be a final chance to show mastery of any of the topics you have yet to complete.

Once you've mastered a topic, you don't have to worry about it for the rest of the semester. I hope this method will reduce anxiety about tests and allow you to progress at your own pace and focus on learning rather than grades.

Assignments

I will post homework problems regularly (some problems of my own creation, some from the book). You do not have to hand the homework in, but in the oral quizzes for each topic, I am likely to ask you to explain the answer to previous homework problems or answer a related question.

Policies

Please read the Georgia Tech honor code at *http://www.honor.gatech.edu/*. Cooperation is encouraged for all homework and studying. Tests will be closed-book, no notes, no calculators. If you need to miss a class or a test for truly unavoidable reasons, you must let me know as far in advance as possible (at least 2 weeks) so I can schedule a make-up test.