

MATH 6221: Syllabus

Lectures: Tuesday / Thursday 4:35 - 5:55 pm, Skiles 169

Instructor: Will Perkins

Office Hours: Tuesdays / Thursdays 3:30 - 4:30, or by appointment

Course Webpage: <http://people.math.gatech.edu/~wperkins3/6221/>

Course Discussion Page: <http://piazza.com/gatech/spring2013/math6221/> (required).

The course is intended for graduate students in math, computer science, and related fields giving a rigorous mathematical foundation of probability theory. We will focus on the classical limit theorems in probability, methods in probabilistic analysis, and applications to random walks, random graphs, Martingales, and Markov Chains.

Main Topics of the Course

1. Probability Spaces, Measures, and Abstract Integration
2. Discrete and Continuous Random Variables
3. Expectation and Variance of Random Variables
4. Laws of Large Numbers and Convergence of Series
5. Central Limit Theorem and Characteristic Functions
6. Large Deviation Theory
7. Martingales and Conditional Expectation
8. Markov Chains

Grading

Your grade will be determined by mastering the 8 course topics listed above. Grading is very simple: if you master all 8, you get an A; 6 or 7 a B; 4-5 a C; 2-3 a D; 0-1 an F.

Mastering a topic means understanding it from all angles. You should understand the definitions, theorems, and examples we've discussed in class. You should be able to apply the theorems and methods to problems you've never seen before (and not just be able to do problems of the same type you've seen). Understanding a theorem means understanding how it can be used (and knowing some specific examples); understanding why each of its conditions is necessary (and knowing counterexamples); understand why its conclusion cannot be made more strong.

There will be several ways to demonstrate that you've mastered a topic:

1. An oral quiz.
2. We will have two tests scheduled, and on each you will have the chance to show mastery of 4 topics.
3. The final exam will be a last chance for any topics you still have left.

Once you've showed that you've learned a topic, you're done with it for the whole semester.

The Georgia Tech Honor Code applies to the tests and final exam, but for everything else in the class (including the homework!) I encourage you to work together.

Homework

I will assign homework every two weeks. I encourage you to work on the problems alone at first, then check answers with each other, and explain the parts you don't understand to each other. You can use the piazza discussion site to do this. I will not collect or grade the homework, but I expect you to finish and understand all of the problems. You will need to understand all the solutions to pass the oral quizzes.

Oral Quizzes

Please read the rules carefully. I've designed them to encourage you to keep up with the course, while still allowing you to re-learn material you might have missed on a previous quiz or test.

1. You may take 3 oral quizzes: one before February 13, one between Feb. 14 and March 15, and one after March 15 but before April 26.
2. You may choose as many topics as you want to be tested on.
3. You can retake topics.
4. Each topic will be graded separately. You either pass (shown mastery) or not.
5. The first question for each topic will be chosen from the homework questions. You must answer this 100% correctly. This is designed to make sure you do the homework.
6. The other questions will be questions you have not seen before, but I will provide sample questions on the website.
7. You should certainly know all the definitions and theorems listed in the topic descriptions. "Knowing" means knowing the precise mathematical formulations, knowing examples and counterexamples, and knowing how to apply theorems or methods to unfamiliar problems.

Tests & Final Exam

1. Test #1: February 21, Topics 1-4
2. Test #2: April 16, Topics 5-8
3. Final Exam, April 30: All topics
4. Like the oral quizzes, the tests will be graded topic by topic, "mastered" or "not mastered".

Course Materials

The required textbook for the course is *Probability and Random Processes*, 3rd ed. by Grimmett and Stirzaker. In addition to the textbook, I will post lecture notes and occasional videos for the topics that aren't covered in the book. You will be responsible for knowing anything that we cover in class, whether or not it is in the textbook, but not responsible for the parts of the book that we don't cover in class. If you cannot make it to a class for some reason, please email me or stop by my office to find out what we covered. We also will have a course discussion board on Piazza for you to use for asking questions, discussing the homework with each other, and sharing useful resources for learning probability.