

# MATH 4221: STOCHASTIC PROCESSES I

## Syllabus

Days: Tues/Thurs  
Time: 12:30–1:45PM ET  
Location: Skiles 169

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<b>Instructor:</b>	Dr. Corrine Yap	<b>Office:</b>	Klaus 2111
<b>Email:</b>	<a href="mailto:cyap35@gatech.edu">cyap35@gatech.edu</a>	<b>Office Hours:</b>	TBD
<b>Website:</b>	<a href="https://canvas.gatech.edu">canvas.gatech.edu</a>		

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**About this class:** The course is a second course in probability, covering techniques and theorems seen from the perspective of random walks and other discrete stochastic processes. We will study different types of random processes and ask questions about their long-term behavior. Along the way we will develop theory and tools that form the foundations of research in probability and discrete mathematics.

This class will be primarily discovery-based. Much of class time will be spent in developing and exploring key concepts by working on problems in groups. Why? Because discovering ideas for yourself and discussing them with others can help you understand them more deeply. But we will always follow up on our discoveries with class check-ins and presentations of ideas and solutions.

**Course Materials:** A recommended textbook is *Probability and Random Processes* by Grimmett and Stirzaker; the outline of the course will roughly follow the sections in this book. Supplementary materials will be posted on our Canvas.

### Our skill-oriented goals for the semester:

- Discover probability concepts by generating examples and making conjectures.
- Communicate about mathematics in a clear and articulate manner, both orally and in writing, in large discussions and in small groups.
- Apply the theorems and proof techniques discussed in class to discrete problems.

### Our virtue-oriented goals for the semester:

- Develop persistence to struggle through problems and learn from that struggle.
  - Approach new and unfamiliar problems strategically but with an openness to creativity and imaginative solutions.
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**Some Guidelines:**

**Math does not exist in a void.** Each of you will enter the class with different math-and-life experiences. I do not expect us to leave our identities at the door - they inform how we learn, view, discuss, teach, and internalize math. No matter what, you are capable of excelling in this course, and I am here to help you.

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**Attendance and participation** are important, especially since much of class time will consist of activities that will help you discover new material or understand material more deeply. Repeated absences will affect your grade in the course. If your absence is unavoidable (e.g. religious holiday, personal emergency), speak to me beforehand about turning in work, and speak to me and your classmates about the material you missed.

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**Late submissions** for homework will generally not be accepted, unless due to an unavoidable circumstance. But I would prefer you turn in homework late, rather than plagiarize someone else's work in order to hand it in on time. If you find yourself having to make this choice, talk to me.

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**Makeups** for quizzes and the midterm will not be granted unless due to unavoidable absence. If granted, the makeup must be scheduled no later than a week from the original date.

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**Academic integrity** is taken seriously. All students are expected to comply with the Georgia Tech Honor Code which can be found at <http://osi.gatech.edu/content/honor-code>. In particular, copying work from the internet or another student and submitting it as your own is a violation, and it will not help you succeed in this course.

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**Collaboration is not the same as copying.** You are encouraged to work with other students when solving problems, but when you write up a solution to be handed in, you should do so on your own, without the aid of others.

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**Feedback** is more than welcome. If you have any thoughts on how the course is going, or personal circumstances that are affecting your ability to participate, I want to know. **Email me**, and I will try to answer as soon as possible, but give me 48 hours before expecting a response.

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**Course Outline:**

- Probability foundations (probability spaces, sets, random variables, expectation)
- Simple random walk and branching processes
- General Markov chains
- Laws of Large Numbers, Central Limit Theorems, Convergence of Random Variables
- Generating functions, characteristic functions
- Martingales

**Assessments:**

- Problem Sets: approximately every 2 weeks ..... 20%
- Quizzes: approximately every 2 weeks (alternating with problem sets)..... 28%
- Reflection writing assignments and surveys..... 2%
- Midterm exam..... 20%
- Final exam and presentation ..... 30%

The final problem set may be due in the last week of class.

**Midterm:** The midterm exam will take place in-class in either the second or third week of October. The midterm will be structured so that approximately half of the questions will correspond to quizzes taken before the midterm (e.g. questions on the same topic as a quiz but not the identical question). You will have the option of replacing each of these questions with the corresponding quiz scores. Conversely, you may boost one of your quiz scores with the corresponding midterm question.

**Final:** The final will be during final exam period, time and date TBD. The final will have two main parts: one part is the exam, which will be similar in structure to the midterm.

The other part is a writing and presentation portion. In advance of the final, you will submit a writeup of a problem or example (chosen from a large list of options). During the final exam dates, you will schedule an individual time to meet with me and present the ideas from your writeup, and I will have the opportunity to ask questions about the details.

**Letter Grades:**

I reserve the right to change the grade breakdown at the end of the semester. However, the threshold for each letter grade will only stay the same or decrease; it will not increase.

- A ..... [90%, 100%]
- B ..... [80%, 90%)
- C ..... [70%, 80%)
- D ..... [60%, 70%)
- F ..... [0%, 60%)

**Student Resources:****Disability Services**

(404) 894-2563 // <https://disabilityservices.gatech.edu/>

The Office of Disability Services collaborates with students, faculty, and staff to create a campus environment that is usable, equitable, sustainable, and inclusive of all members of the Georgia Tech community. To receive accommodations and services, students must register with the Office of Disability Services, participate in an intake meeting, and present official documentation of their disability. If the documentation supports your request for reasonable accommodations, please have a Faculty Notification Letter sent to me as early as possible. Details are on the website linked above.

**Academic Support**

- Academic Coaching: <https://advising.gatech.edu/academic-coaching>  
Appointment-based coaching for academic success
- Communication Center: <http://www.communicationcenter.gatech.edu>  
Help with writing and multimedia projects
- Advising: <http://advising.gatech.edu/>  
Academic advisors for your major

**Health and Wellbeing:**

- The LGBTQIA Resource Center: <https://lgbtqia.gatech.edu/>  
The LGBTQIA Resource Center has numerous events and programs. The center also has resources to help students in crisis, victims of sexual violence, and more.
- Center for Mental Health Care and Resources: <https://mentalhealth.gatech.edu/>  
Services include testing and assessment, referral to support services, counseling, crisis intervention, mental health workshops, and consultation for faculty and staff, family and friends of Tech students. All services are confidential and free of charge for all Georgia Tech students.
- STAR (Students' Temporary Assistance and Resources): <https://star.studentlife.gatech.edu/> Temporary assistance with food, housing, and financial emergencies
- Academic, Financial and Personal Assistance: <https://studentlife.gatech.edu/services/academic-financial-personal-assistance>  
Information about missing class, personal leave, and grievances.