

# MATH/STAT 416, Section 1 Introduction to Stochastic Models

MWF 1:25 - 2:15 PM

104 Thomas Bldg

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**Instructor:** John Fricks  
office: 314 Thomas Bldg  
email: fricks@stat.psu.edu  
web: [johnfricks.org](http://johnfricks.org)  
office hours: M 4:00-5:00 R 2:30-3:30

**Teaching Assistant:** Joshua Goldstein  
email: jrg326@psu.edu  
office: Thomas 331A  
office hours: T 4:00-5:00

**Textbook:** *Introduction to Probability Models, 10th edition by Sheldon M. Ross*

**Web:** <http://johnfricks.org/teaching/stat416spring2013/>

**Prerequisite:** Stat 318 or Math/Stat 414

## Course Objectives:

The course can be broken into four broad categories plus a few miscellaneous models if there is time.

1. Conditional probability and expectation
  - Identify and properly apply the law of iterated expectation.
  - Identify one step-type problems and apply basic techniques to solve.
2. Discrete time Markov chains
  - Understand and apply the Markov property and Chapman-Kolmogorov equations.
  - Express Markov chain models from verbal descriptions.
  - Identify standard properties of Markov chains.
  - Identify when limiting distribution exists and calculate appropriate limiting distribution.
3. Poisson Process
  - Know the three definitions of the Poisson process and how they are connected.
  - Use the definitions of the Poisson process to identify when it is an appropriate model corresponding to a verbal description.
  - Perform basic calculations using properties of the Poisson process.
4. Continuous time Markov chains
  - Understand the Markov property in continuous time and be able to apply appropriately.
  - Understand the the three different constructions of continuous-time Markov chains and how they are interrelated.
  - Express continuous time Markov chain models from verbal descriptions.
  - Identify when limiting distribution exists and calculate appropriate limiting distribution.
5. Miscellaneous topics
  - Understand the definition of Brownian motion and use it to perform basic calculations.
  - Be able to apply the invariance principle to identify an approximating Brownian motion.
  - Use the reflection principle to perform calculations with Brownian motion.

**Grade Policy:** Grades will be determined by the following components:

Quiz .....	75
Comprehensive Final .....	25

Your final grade will be no lower than those assigned using the following intervals.

[93, 100] .....	A
[90, 93) .....	A-
[87, 90) .....	B+
[83, 87) .....	B
[80, 83) .....	B-
[77, 80) .....	C+
[70, 77) .....	C
[60, 70) .....	D
[0, 60) .....	F

**Quizzes:**

Quizzes will be administered according to the schedule found below. There will be six quizzes throughout the semester. They will consist of four questions, possibly with sub-questions.

Each quiz will cover new topics as indicated in the schedule. However, each quiz may include previous course material up to two questions. New material will be half of the quiz or more. The quizzes are closed-note and closed-book. The quizzes will be partially based upon homework questions which are assigned but not collected. No additional practice problems or sample quizzes will be distributed.

No make-up quizzes will be given, so you should be careful about missing quizzes. However, the two lowest quiz scores will be dropped.

Quiz schedule:

Quiz 1 Review and conditional probability .....	January 31
Quiz 2 Markov chains .....	February 21
Quiz 3 Markov chain limits .....	March 7
Quiz 4 Poisson process .....	March 28
Quiz 5 Continuous time Markov chain .....	April 11
Quiz 6 Continuous time Markov chain limits .....	April 25

**Final Exam:**

The comprehensive final exam will take place at the registrar-designated time and place during the week of May 5-9. Like the quizzes, it will be closed-book and closed-notes. It will cover the entire semester. No rescheduled final exams will be allowed except for those mandated by the Penn State registrar because of conflicts. This means that you must attend the final exam and should under no circumstances make end-of-semester travel arrangements before knowing your final exam schedule.

**Integrity:**

All Penn State University and Eberly College of Science policies regarding academic integrity apply to this course. Those policies are available at: [www.science.psu.edu/academic/Integrity/index.html](http://www.science.psu.edu/academic/Integrity/index.html)

Please pay particular attention to the student conduct section from those policies:

All course work by students will be done on an individual basis unless an instructor clearly states that an alternative is acceptable. Any reference materials used in the preparation of an assignment, whether quoted or paraphrased, must be explicitly cited. In an examination setting, unless the instructor gives explicit prior instructions to the contrary, regardless of whether the examination is in-class or take-home, violations of academic integrity shall consist of any attempt to receive assistance from any person or papers or electronic devices, or of any attempt to give assistance, whether the student doing so has completed his or her own work or not. Other violations include, but are not limited to, any attempt to gain an unfair advantage in regard to an examination, such as tampering with a graded exam or claiming another's work to be one's own.

**Statement on Disability Services:**

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the documentation guidelines at <http://equity.psu.edu/ods/guidelines/documentation-guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.