Stochastic Processes
Stat219/Math136
Fall 2010

Place: Building 320, Room 105
Time: Monday, Wednesday, Friday, 12:15am – 1:05am

Instructor:
Jessica Zúñiga, jzuniga@math.stanford.edu, Building 380 Room 382K

Teaching Assistants:
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Course websites:
http://coursework.stanford.edu
Please check the websites regularly for announcements and other course materials. If you are enrolled in the course, you should have access to the coursework website; send an email to HelpSU if you have problems. If you are auditing the course send an email to the Instructor to get access to the coursework website.

Course Goals
This course prepares students for a rigorous study of Stochastic Differential Equations, as done in Math236/Stat316. Towards this goal, we cover — at a very fast pace — elements from the material of the (Ph.D. level) Stat310/Math230 sequence, emphasizing the applications to stochastic processes, instead of detailing proofs of theorems. A critical component of Stat219/Math136 is the use of measure theory.

The Stat217-218 sequence covers many of the same ideas and concepts as Stat219 but from a different perspective. The Stat217-218 sequence can be seen as an extension of undergraduate probability (e.g. Stat116) in both level of mathematical sophistication (i.e. no measure theory) and in emphasis on “real world” applications (modeling, computation, etc). Thus, it is possible, and in fact recommended, to take both Stat217-218 and Stat219 for credit. However, be aware that Stat217-218 alone is NOT adequate preparation for Math236.

Main topics of Stat219/Math136 include: introduction to measurable, $L^p$ and Hilbert spaces, random variables, expectation, conditional expectation, uniform integrability, modes of convergence, stationarity and sample path continuity of stochastic processes, examples such as Markov chains, branching, Gaussian and Poisson processes, martingales and basic properties of Brownian motion.
Prerequisites

Students should be comfortable with probability at the level of Stat116/ Math105/ Math151 and with real analysis (a.k.a. advanced calculus) at the level of Math115. For a good review of undergraduate probability see the optional Grimmett & Stirzaker text. Appendix A of the optional Rosenthal text includes a brief review of prerequisite material from real analysis.

Required Text

Amir Dembo’s Stat219/Math136 lecture notes (September 25, 2008 version). Download the .PDF file from the course webpage. Read each section of the notes prior to the corresponding lecture (see reading schedule on course webpage).

Optional Texts (on reserve in the Math & CS Library)

All course material and homework assignments are contained in the required text. While neither of the following texts is required, both are good supplements to the lecture notes and are excellent references for future study.


Other References

There are many excellent texts covering probability and/or stochastic processes. We list here just a few, which are on reserve in the Math & CS Library. (See also the list of references in Appendix B of the Rosenthal text.)

- Jacod and Protter, *Probability Essentials*

- Karlin and Taylor, *A First Course in Stochastic Processes*, Ch. 6, 7, 8 (many examples and applications of martingales, Brownian motion and branching processes). processes without measure theory, as in Stat218, and more problems/examples).

- Lawler, *Stochastic Processes* (more modern examples and applications than in Karlin and Taylor).


- Ross, *Stochastic Processes*
Grading & Exam Schedule

- Homework 25% Due each Wednesday in class
- Midterm 25% Friday, October 22 in class
- Final 50% Friday, December 10, 8:30am – 11:30am

NO MAKE-UP EXAMS will be given except for serious illness, religious holidays, or family emergencies. Students who miss the final will receive an automatic failure in the course. In any case, if you anticipate difficulty in taking the examination at the scheduled time, you should contact the course instructor as soon as possible.

Homework

Homework problems will be posted on the course webpage. Homework is due IN CLASS on the due date. NO LATE HOMEWORK WILL BE ACCEPTED. The lowest homework grade will be dropped to accommodate for emergencies and late enrollment.

Collaboration is allowed in solving the problems, but each student should hand in his or her own independently written solutions. You are strongly encouraged to see the instructor or TA’s during office hours if you have questions about the homework assignments (or about the course material in general.)

Assignments will be graded by the following Wednesday and returned in class. Homework solutions will be posted within 24 hours of the due date.