MATH 3170 - Elementary Stochastic Processes - Spring 2014
Syllabus

(Final version, January 6, 2014)

- **Instructor:** Joe P. Chen

- **Contact:** MSB M232, joe.p.chen@uconn.edu.

- **Lecture time & location:** TuTh 12:30-13:45, MSB 319.

- **Office Hours:** Tuesdays 15:30-17:00 and Wednesdays 15:00-17:00.[1] Other times by appointment.

- **Course components:** Weekly assignments (30%); two take-home midterm exams (40%); final exam (30%).

- **Honors conversion** is available. Those who enroll in this option will be asked to submit a 5∼10 page paper (rough draft + revision) on a single topic in stochastic processes. Contact the instructor for more details.

- **Textbook:** *Essentials of Stochastic Processes* (2nd ed.) by Rick Durrett (beta version available online; final version available for a fee at the UConn Co-op). The goal is to cover all 6 chapters of the book, though we'll skip the last third of Chapter 4 (queueing networks), and may omit some parts of Chapters 5 (martingales) and 6 (mathematical finance) based on the available time left.

- **Course outline:** This is an undergraduate-level course on the theory and applications of time-dependent probability problems. A rough topic-by-topic breakdown is as follows.

    - Discrete-time Markov chains (approx. 6 weeks), which encompass everything from betting, random walks, branching processes, population dynamics, to what not.
    - Poisson processes (both simple and compound) and renewal theory (approx. 2 weeks).
    - Continuous-time Markov chains (approx. 2 weeks).
    - Martingales (approx. 1 week), including their basic properties and applications (especially with regard to the aforementioned Markov processes).
    - Brownian motion, and applications to mathematical finance (approx. 2-3 weeks): the goal is to tell you about how options pricing works, and ultimately, the famous Nobel Prize-winning Black-Scholes formula.

- **Supplementary textbooks:** In previous years the following textbooks have been used.

    - *Introduction to Probability Models* (now in its 10th ed.) by Sheldon Ross.
    - *Adventures in Stochastic Processes* by Sidney Resnick.

    They will be placed on course reserve at the Babbidge library.

    I may also use select chapters from the following books, which are available on-line.

    - Chapters 11 & 12 of *Introduction to Probability* by Charles Grinstead and J. Laurie Snell.
    - *Markov Chains and Mixing Times* by David Levin[2], Yuval Peres, and Elizabeth Wilmer.
    - *Brownian Motion* by Peter Mörters and Yuval Peres.

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[1]These office hours are common with those for my multivariable calculus class (MATH 2110Q). Depending on the number of calculus students visiting my office, I may or may not be immediately available for MATH 3170 inquiries. Please pardon me for this slight inconvenience.

[2]former UConn postdoc

- **Prerequisites:** Officially, MATH 3160, STAT 3345, STAT 3375, or equivalent.

  From this instructor's point of view, I expect that you would be familiar with combinatorial probability, random variables (binomial, Poisson, normal, exponential), and conditional probabilities and expectations[3]. These topics are covered in the first 7 chapters of Ross's *A First Course in Probability*, and are summarized in the Appendix of Durrett's text. If reading the Appendix does not give you a sense of *déjà vu*, then this course is not for you, with positive probability. Experience with linear algebra is a plus.

  If you need a refresher on the materials covered in MATH 3160, see the lecture notes by Prof. Richard Bass, or my own lecture notes when I taught the course in Fall 2013.

  Talk to me if you are unsure about your preparation.

- **Course web site:** https://piazza.com/uconn/spring2014/math3170/home

  This semester we will use **Piazza** for course announcements, Q&A's, polls, and feedbacks. This is an interactive platform where professors and students can ask (anonymously or publicly to the class) and answer questions in real time. Please check it regularly, so you don't miss anything important![4]

  Want to ask a HW/lecture question? **Post your question on Piazza.** By doing so you save me the trouble of having to answer the same question multiple times. Plus, once your question appears on Piazza, everyone can see and respond to it, and the whole class benefits. **I will not respond to HW problems via e-mail.**

  Want to ask an individual question regarding course attendance, exam rescheduling, or other private matters? Then send me an e-mail.

- **Homework guidelines & grading**

  Homework assignments are due **at the beginning of class on Thursdays**. Please clearly write down your name on top of the first page. And if your assignment contains multiple pages, please staple them!

  Please write down your solutions legibly and neatly. Don't skimp on margins! Remember to properly define your variables, label your diagrams, etc., so that I know what you're trying to communicate. You may also opt to type up your assignment using LaTeX.[5]

  In general, you should show enough work/reasoning in deducing the final answer. If you need to refer to a specific result mentioned in class or in the textbook, please indicate so as well. *Insufficient or uncited work will receive reduced or no credit.*

  Collaboration on HW is allowed and encouraged, so far as idea-sharing is concerned. Please indicate on the top of the first page the name(s) of those with whom you collaborate. However, *you should write up your work on your own and in your own words.* Blatant duplication of others' work is considered plagiarism and will be dealt with under UConn's academic integrity policy.

  To keep up with the class, it is best that you complete the assignments according to the scheduled deadlines. If you have trouble meeting a certain due date, because of other exams, illness, family emergency, or other commitment, please inform me in advance. I reserve the right not to grade an unreasonably late assignment.

  Solutions to the homework assignments will be posted $2 \sim 3$ days after the due date.

- **Any question?** Please don't hesitate to contact me! Don't put off till the last minute for help!

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[3]though depending on your 3160 instructor, this last topic may or may not be treated in depth

[4]Piazza is also available on smartphones and tablets. Download the app from the App Store (iOS) or from Google Play (Android).

[5]To those who use Microsoft Word to generate scientific documents, I encourage you to switch to LaTeX. It will make your equations look beautiful and the layout professional. Just look at the document you're reading now.