SYLLABUS - EE 512 (Fall 2018)
STOCHASTIC PROCESSES

Lecture Information:

Location: OHE 132

Time: Friday 1730h – 2020h

Instructor: Dr. Osonde Osoba

Office Hours: Friday 1630h - 1730h in EEB 420

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TA: Shiva Navabi

Office Hours: TBD

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Course Summary: The course presents stochastic processes with a special focus on computation. This entails a rigorous mastery of the underlying probability theory and statistics as well as familiarity with a programming language (Python or R recommended). There will be two midterms, a final exam and a final simulation project.

Recommended texts:

Efron, B., Hastie, T., *Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*, Cambridge University Press, 2016.

Gubner, J. A., *Probability and Random Processes for Electrical and Computer Engineers*, Cambridge University Press, 2006.

Ross, S. M. *Simulation*. Academic Press, 2013.

Hsu, H. P. *Schaum's outline of theory and problems of probability, random variables, and random processes.* 2nd Ed. McGraw-Hill, 2014.

Durrett, R., *Essentials of Stochastic Processes*. Springer, 2016.

Glasserman, P. *Monte Carlo methods in financial engineering*. Springer, 2013.

COURSE OUTLINE

AUG 24:   Overview of stochastic processes. Probability spaces.

AUG 31:   Random sequences. Random walk. Bayesian inference.

SEP 7:   Compounding. Laws of large numbers. Central limit theorems.

SEP 14:   Monte Carlo. Variance Reduction. Importance sampling.

SEP 21:   Optimal estimation. Expectation Maximization. Backpropagation.

SEP 28:   **Midterm I**. Markov chains. Ergodicity.

OCT 5:   Markov Chain Monte Carlo. Gibbs sampling for hierarchical Bayes.

OCT 12:   Poisson processes. Renewal theory and limit theorems.

OCT 19:   Linear time-invariant systems. Martingales. Brownian motion.

OCT 26:   Mean-squared calculus. Stochastic integrals, Levy Processes.

NOV 2:   Ito diffusions. Geometric Brownian motion, Euler simulation.

NOV 9:   **Midterm II/Project Proposals Due**. Black-Scholes model.

NOV 16:   Girsanov change of measure. Kolmogorov equations.

NOV 23:   No class: Thanksgiving holiday.

NOV 30:   Advanced applications. Review.

DEC 7:   FINAL EXAM.   Projects due.

GRADING PROCEDURE

1. **Midterms**. Two midterms. Each worth 25 points. Closed book.

2. **Final exam**: Worth 30 points. Closed book.

3. **Homework**. Worth 10 points.

4. **Project:** Instructor must approve an original computational project involving random processes. Worth 10 points.

5. **Course Grade**. 100 points possible in course.
A   if   90 - 100 points
B   if   80 - 89 points
C   if   70 - 79 points
D   if   60 - 69 points
F   if   0 - 59 points .

6. **Cheating**. Not tolerated on homework or exams. Penalty ranges from F on exam to F in course to recommended expulsion.

7. Statement for Students with Disabilities. Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

8. **Statement on Academic Integrity.** USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

9. **Academic Conduct**

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

10. **Support Systems**

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.