

## SYLLABUS

# Simulation Methods for Stochastic Systems

EE 511: Spring 2020 (1 unit)

This course complements your understanding of probability theory with a project-oriented investigation of random systems and stochastic simulation methods. You will learn practical skills to aid you in analysis of random phenomena. The course begins with basic methods that underlie stochastic computational applications. Early projects prepare you to put randomness to work with more complex optimization problems including Expectation Maximization and Markov chain Monte Carlo (MCMC) methods.

Instructor: Brandon Franzke  
Email: franzke@usc.edu  
Office: EEB 500B  
Hours: Wednesday 11:30 – 13:30  
Thursday 14:00 – 15:00

### Lecture

Monday (section: 30553)  
14:00 – 14:50

Wednesday (section:30988)  
14:00 – 14:50

### Piazza

Piazza gets you help fast and efficiently from classmates, the TAs, and me. I encourage you to post questions on Piazza rather than emailing questions to the teaching staff.

<https://piazza.com/usc/spring2020/ee511>

### Canvas and Autolab

Use Canvas to electronically submit your projects and view course grades. You will receive an email to register during the first week of classes. Contact the instructor with any issues.

<https://canvas.usc-ece.com>

### TAs and Graders

You have a TA to help you with EE511. They hold regular office hours and may make special hours available as necessary. The grader reviews and assigns marks to your project submissions. You should direct grading questions to the grader first and then escalate to the TAs or the instructor as necessary.

TA: Athanasios Rompokos  
Office: PHE 320  
Office hours: Wednesday 15:00 – 17:00  
Email: rompokos@usc.edu

Grader: Hao Zhang  
Office hours: by appointment  
Email: hzhang80@usc.edu

### Course materials

"Simulation", 5th edition, Sheldon Ross, Academic Press, 2002, (ISBN: 0124158250). (*required*).

## Course Outline (tentative)

week of

1	13 Jan	Probability review. Simulation concepts. Data presentation.
	<b>20 Jan</b>	<b>No class: Martin Luther King Day, University holiday</b>
2	27 Jan	Probability and statistics topics.
3	03 Feb	Random number generation.
4	10 Feb	Monte Carlo techniques.
	<b>17 Feb</b>	<b>No class: Presidents Day, University holiday</b>
5	19 Feb	<b>(combined)</b> . Bootstrapping. Resampling methods.
6	24 Feb	Discrete time Markov Chains.
7	02 Mar	Discrete time queues
8	09 Mar	Discrete event simulation.
	<b>16 Mar</b>	<b>No class: Fall Recess, University holiday</b>
9	23 Mar	Continuous random variables.
10	30 Mar	Statistical tests. Model validation.
11	06 Apr	Mixture models. Clustering. Expectation maximization.
12	13 Apr	Markov chain Monte Carlo (MCMC). Gibbs sampler.
13	20 Apr	Variance reduction techniques.
14	27 Apr	Optimization. Simulated annealing.

## Grading Procedure

### Projects

Eight computer projects consisting of five single-week projects and three multi-week projects. This is a project driven course and the topics covered in each project may extend beyond material directly covered in lecture. Each single-week project covers specific lecture topics and include smaller questions or implementation requirements. The multi-week projects will involve open-ended problems and may require some additional study to complete. Your total project score sums your best four single-week project scores (removing the lowest score) combined with the weighted sum of your multi-week project scores.

The grader will score each project out of 100 points following the rubric:

- 40% Code: program correctness and documentation
- 20% Simulation design: description of methods and reasons why
- 40% Results: discussion, analysis, and presentation

Graders may assign extra points for projects that go “beyond expectations”. Projects are due by the posted due date. Late projects will be accepted with a 15% deduction per day for up to 2 days.

### Course Grade

A	if 90 – 100 points	(“+” and “-” within approx. 3% of grade boundary)
B	if 80 – 89 points	
C	if 70 – 79 points	
D	if 60 – 69 points	
F	if 0 – 59 points	

### Cheating

Cheating is not tolerated on projects. Penalty ranges from F on exam to F in course to recommended expulsion.

## **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-andappropriate-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/departments/public-safety/online-forms/contactus>. 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/studentaffairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

### **Academic Integrity**

Academic integrity is critical the assessment and evaluation we perform which leads to your grade. In general, all work should be your own and any sources used should be cited. Gray-areas occur when working in groups. Telling someone how to do the problem or showing your solution is a VIOLATION. Reviewing examples from class or other sources to help a fellow classmate understand a principle is fine and encouraged. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code in Section 10, while the recommended sanctions are located in Appendix A. 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.

## **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](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.

### **Academic Accommodations**

Any student requiring 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 as early in the semester as possible. DSP is located in GFS 120 and is open 08:30 – 17:00, Monday through Friday. The phone number for DSP is (213) 740-0776.