

## **ORIE 6580 Simulation Spring 2016**

Stochastic simulation is one of the most widely used management science tools today with applications in, for example, manufacturing, healthcare, finance, and telecommunications. Its popularity stems from its versatility and power. The objectives of this course are

- To impart skills useful in a variety of simulation-related contexts,
- To provide a survey of simulation methodology, and
- To give an idea of selected research topics in simulation.

We will only get a “taste” of commercial simulation languages – if that is your interest then you should instead take ORIE 4580.

### **People:**

Lecturer: Shane G. Henderson, 230 Rhodes Hall. Email sgh9. Ph 607 255-9126. Office Hours MW 1.30-2.30, F 2.30-3.30 or by appointment (email)

Grader: Nanjing Jian

### **Assessment**

There will be approximately 5 homeworks and a final exam. Homeworks are worth a total of 40% with the lowest grade dropped under the condition that you make a conscientious attempt at all homeworks. The exam is worth 60%.

### **Prerequisites**

- Familiarity with basic probability, statistics and stochastic processes at, or close to, the level of ORIE 6500.
- A previous course in simulation (e.g., ORIE 4580) is **not** required, nor expected.
- Some programming experience. You will be required to write small computer programs for the homeworks. You should be familiar with, and have access to, a high-level programming language such as C, Python, Matlab etc.

### **Textbook**

No book is required. Please see the list of references for recommended reading.

### **Blackboard**

If you are just “sitting in” and not officially auditing then let me know so I can sign you up for the class webpage.

### **Course Content**

We will cover the following topics (not necessarily in this order), with more depth in some topics than in others.

- Overview of simulation: when it is needed, advantages/disadvantages
- Generating uniform pseudo-random numbers
- Generating non-uniform random variates
- Generating random vectors

- Generating stochastic processes
- Monte Carlo Integration
- Efficiency improvement (variance reduction) techniques
- Output analysis for finite and infinite-horizon simulation
- Optimization
- Other topics as time/interest allow

**Some References (starred ones are most relevant)**

<b>Author(s)</b>	<b>Title</b>
Law	Simulation Modeling and Analysis, 5 <sup>th</sup> ed.
Devroye	Non-Uniform Random Variate Generation
Nelson*	Foundations and Methods of Stochastic Simulation: A First Course
Glasserman*	Monte Carlo Methods in Financial Engineering
Henderson, Nelson, eds.*	Simulation. Handbooks in Operations Research and Management Science, Vol 13. Elsevier. 2006
Asmussen, Glynn*	Stochastic Simulation: Algorithms and Analysis. 2007. Springer
Banks, Carson, Nelson and Nicol	Discrete-event System Simulation, 3 <sup>rd</sup> ed.
Banks	Handbook of Simulation
Ross	Simulation
Fishman	Monte Carlo: Concepts, Algorithms, and Applications
Bratley, Fox, Schrage	A Guide to Simulation, 2 <sup>nd</sup> ed.
Knuth	The Art of Computer Programming v.2
Hammersley	Monte-Carlo Methods
Shedler	Regenerative Stochastic Simulation
	Proceedings of the xxxx Winter Simulation Conference (xxxx = 1997, 1998, ...) see <a href="http://www.wintersim.org">www.wintersim.org</a>

**Some Journals Publishing in Simulation:**

- ACM Transactions on Modeling and Computer Simulation
- Operations Research
- Mathematics of Operations Research
- Stochastic Systems
- Stochastic Models
- Probability in the Engineering and Informational Sciences
- Advances in Applied Probability
- Journal of Applied Probability
- IEEE, SIAM Journals

The principal “discrete-event simulation” meeting is the Winter Simulation Conference, held every year in early December [www.wintersim.org](http://www.wintersim.org). INFORMS has a simulation society <https://www.informs.org/Community/Simulation-Society/>