

Syllabus

Last updated: October 17, 2013

Course description This course provides an introduction to modeling and analyzing systems that evolve dynamically over time and whose behavior is stochastic, or uncertain. This course focuses on models that are amenable to mathematical analysis, while using basic notions from simulation to develop intuition.

Textbook B. Nelson. *Stochastic Modeling: Analysis and Simulation*. Dover, 2010.

Schedule

This schedule is subject to change.

Date	Lesson	Topic	Reading
Introduction			
8/20	1	Introduction, sample paths	1, 2.1-2.3
8/22	2	Sample paths, cont., basic probability review	2.3, 3.1.1-3.1.3
8/27	3	Conditional probability review	3.1.4-3.1.5
8/29	4	Conditional probability review, cont.	3.1.4
9/3		Monday schedule	
9/5	5	Probability review wrap-up, random variate generation.	3.3-3.4
9/10	6	Introduction to simulation and stochastic processes	4.1-4.4
9/12	7	A generic stochastic process model	4.5-4.6
9/17		Review	
9/19		Exam 1	
Arrival counting processes			
9/24	8	A generic arrival counting process model	5.1-5.4
9/26	9	The Poisson arrival process	5.5, 5.8
10/1	10	Decomposition and superposition of Poisson processes	5.6.1-5.6.2, 5.8
10/3	11	Nonstationary Poisson processes	5.6.3, 5.8
10/8	12	Poisson processes - review	5.5, 5.6.1-5.6.2, 5.8
10/10	13	Nonstationary Poisson processes - review	5.6.3, 5.8
Discrete-time processes			
10/15	14	Introduction to Markov chains	6.1-6.3, 6.4.0-6.4.1, 6.4.3
10/17	15	Time-dependent performance measures	6.5-6.6
10/22	16	Long-run performance measures	6.7
10/24	17	Using Markov chains - parameterization, validity of assumptions	6.4.2, 6.8
10/29		Review	
10/31		Exam 2	

Date	Lesson	Topic	Reading
Continuous-time processes: queueing			
11/5	18	A quick start guide to Markov processes	8.2.2
11/7	19	A quick start guide to Markov processes, cont.	8.2.2
11/12	20	Introduction to queueing systems and birth-death processes	8.1-8.3, 8.4.1
11/14	21	Performance measures, basic formulations	8.4.2, 8.5
11/19	22	Parameterizing queueing processes, standard queues	8.6, 8.7
Putting it all together			
11/21	23	A case study	
11/26	24	A case study, cont.	
11/28		Thanksgiving	
12/3	25	Another case study	
12/5	26	Another case study, cont.	

Some potential additional topics, time permitting (i.e. if we go faster than or deviate from the schedule above):

- Dynamic programming and Markov decision processes
- Spatial Poisson processes
- Decision trees
- Brownian motion and stochastic calculus