

Syllabus

Last updated: June 5, 2019

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.

Course outcomes Upon successful completion of this course, you will be able to:

1. Think probabilistically, particularly as it relates to common situations encountered by Navy and Marine Corps officers.
2. Effectively model and analyze systems that evolve dynamically over time and whose behavior is stochastic.
3. Understand basic concepts of simulation in order to develop intuition about dynamic systems.
4. Understand basic notions of the arrival-counting process, discrete-time processes, continuous-time processes and queueing systems.

Class schedule This schedule is subject to change.

Week	Lesson	Topic	Reading
Introduction			
1	1	Introduction, Sample paths	1, 2.1-2.3
2	2	Basic probability review	3.1.1-3.1.3
	3	Conditional probability review	3.1.4-3.1.5
3		Labor Day holiday	
	4	Random variate generation	3.3-3.4
4	5	Simulation and stochastic processes	4.1-4.4
	6	A generic stochastic process model	4.5-4.6
5		Review	
		Exam 1	

Week	Lesson	Topic	Reading
Arrival-counting processes			
6	7	A generic arrival-counting process model	5.1-5.4
	8	The Poisson arrival process	5.5, 5.8.1-5.8.2
7	9	Decomposition and superposition of Poisson processes	5.6.1-5.6.2, 5.8.3-5.8.4
8	10	Nonstationary Poisson processes	5.6.3, 5.8.5
Discrete-time processes			
9		Columbus Day holiday	
	11	Introduction to Markov chains	6.1-6.3, 6.4.0-6.4.3
10	12	Time-dependent performance measures	6.5-6.6
	13	Time-independent (long-run) performance measures	6.7
		Parameterizing Markov chains, validity of assumptions	6.4.2, 6.8
11		Review	
		Exam 2	

Week	Lesson	Topic	Reading
Continuous-time processes			
12	14	Introduction to continuous-time processes	7.1-7.3
		The Markov process	7.4, 7.5.1
		Time-dependent performance measures	7.5.2, 7.6.1-7.6.3
		Time-independent (long-run) performance measures	7.6.4-7.6.5, 7.8
Queueing processes			
13		Veterans Day holiday (no class)	
	15	Introduction to queueing and birth-death processes	8.1-8.3, 8.4.1
14	16	Performance measures; Standard formulations	8.4.2, 8.5
15	17	Parameterizing queueing processes; Standard queues	8.6, 8.7
		Thanksgiving holiday (no class)	
16		Additional topics/Review	
TBD		Final Exam	

Course coordinator: CAPT McGrath, phone: 3-6756, email: rmcgrath@usna.edu