Syllabus

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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 for such systems that are amenable to mathematical analysis.

Course objectives. By the end of this course, students will be able to (1) think probabilistically about real-world systems; (2) identify when a Markov chain, Poisson process, or birth-death queueing process is an appropriate model for a real-world system and construct such a model; and (3) analyze these models by computing and interpreting state probabilities and performance measures.

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

The textbook is referred to as "SMAS" in the lesson notes. The textbook is not required, but you might find it helpful.

Schedule. Here is a tentative schedule.

Weeks	Topic
Introduction	
1	Course overview and logistics
1	Sample paths
Markov chains	
2	Conditional probability review
3	Introduction to stochastic processes and Markov chains
3	Modeling with Markov chains
3-4	Markov chains – n-step probabilities
4	Markov chains – long-run probabilities
5	Modeling with Markov chains revisited
6	Markov chains – computing
6-7	Review for Exam 1
7	Exam 1
Poisson processes	
7-8	Review – Poisson, exponential, and Erlang random variables
8-9	Introduction to Poisson processes
9	Poisson processes – decomposition and superposition
10	Nonstationary Poisson processes
11	Poisson processes – computing
11-12	Review for Exam 2
12	Exam 2

(cont.)

Weeks	Topic
Queueing processes	
12	A very brief introduction to Markov processes
13-14	Introduction to queueing processes – the birth-death process
14	The birth-death process – performance measures
15	Standard queueing models
16	Queueing processes – computing
16	Review for Exam 3
17	Exam 3