OID 930 - STOCHASTIC MODELS I

Fall 2017 - Q2, Oct. 19 - Dec. 7

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Lectures: Tuesday, Thursday 10:30 a.m.-11:50 p.m., JMHH F92
Office hours: Tuesday 2:00-3:30 p.m.; Thursday noon – 1:00 p.m., and by appointment

Evaluation: Weekly/biweekly homework assignments (25%);
participation (10%);
midterm evaluation (20%);
final exam (45%)

Prerequisites: Calculus (including differential equations), linear algebra, probability
(no measure theory required)

Resources: Main text (required):
- Ross *Stochastic Processes,* 2nd edt, Wiley

Secondary texts:
- Karlin and Taylor *A First Course in Stochastic Processes,* 2nd edt., 1975, Academic Press
- Ross *Introduction to Probability Models,* 11th edt, Elsevier

- Copies of these texts as well as some other books of interest have been put on reserve at the Lippincott library. You are encouraged to find the right text for your level. I will give an overview of the rich literature in this field in Lecture 1. The required texts will also be used in OIDD 931.
- Class handouts and assignments will be made available on the course website.
- Lecture slides will be posted online.

Course Description:

Mathematical models based on probability theory prove to be extremely useful in describing and analyzing complex systems that exhibit random (or stochastic) components. The goal of this course is to introduce important classes of stochastic processes, to analyze their behavior over a finite or infinite time horizon and to provide the student with probabilistic intuition and insight into the modeling process. The theory of stochastic processes will be developed based on elementary probability theory and calculus; measure theory is not required. Applications of stochastic models will be presented in a variety of areas including operations management, inventory, reliability, finance, marketing as well as computer/communication systems.

Computational aspects and solution techniques that complement the theory will also be addressed.
This course, Stochastic *Models I,* is part of the Stochastic Model course sequence and covers the Poisson process as well as Markov chains in discrete and continuous time. A separate course, *OPIM 931 Stochastic Models II,* will focus on renewal theory, martingales, and Brownian motion.

Course Topics:

A tentative course outline follows (with the number of lectures on each topic in parenthesis). Content and focus may vary based on student background and interest.

Introduction to Stochastic Processes (1)
Basic Probability Tools (2)
The Poisson Process (3)
Discrete Time Markov Chains (5)
Continuous Time Markov Chains (3)

Website:

We will be using a Canvas website that facilitates information sharing, course logistics and assignments. To access your Canvas sites, go to https://canvas.upenn.edu. Log in with your PENN username & password. Please, check the Canvas website frequently during the semester for up to date information, assignments, and class handouts.

Homework:

Assignments will be given on a weekly/biweekly basis. Please, submit a hard copy of your solutions at the beginning of class on the due date listed; if you can't make the deadline due to extenuating circumstances, please ask the instructor before the due-date for a possible extension. Unless otherwise stated, homework is to be done individually. You are encouraged to discuss the problems (and any of the material covered in class) with each other; yet the work that you submit must be your own. If you benefited from discussions with a peer, please do acknowledge the collaboration. Students are expected to refrain from soliciting solutions from other sources (e.g. internet, previous years' classes, etc). If you do use outside information, academic honesty requires you to state such sources.

Participation:

This is a Ph.D. level course. Our class sessions are meant to provide a learning environment that involves all participants. I am always open for questions, both inside the classroom and during office hours. Students are expected to come prepared to class, ask relevant questions, and actively participate in classroom discussions.

Exams:

There will be a midterm examination, in the form of an oral exam, as well as an open book written final exam on **Wednesday, 12/20, 9-11.** Logistical details will be discussed in the first week of classes.