

Stochastic Modeling
MATH 3425
Spring 2015, HKUST

Instructor & T.A. .

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TA: Dai, Linlin

Textbook & Reference Books.

Lecture Notes: To be posted every two weeks.

Textbook: An Introduction to Stochastic Modeling. (Academic Press 3rd Edition, 1998, ISBN012848874) by H.M. Taylor and S. Karlin.

(Or: An Introduction to Stochastic Modeling. (Academic Press 4th Edition, 2011, ISBN9780123814166) by M. A. Pinsky and S. Karlin.)

(The above two books are largely one same book, though we use the first one.)

Reference books: 1. Stochastic Modeling and the Theory of Queues. (Prentice-Hall International Edition) by R.W. Wolff. 2. Probability and Random Processes. 2nd edition. (Oxford Science Publications) by G.R. Grimmett & D.R. Stirzaker.

Intended Learning Outcomes:

Students will understand random processes such as Markov chains, Poisson processes, branching processes, birth/death processes and renewal processes and Brownian motion, and use them as models in real applications.

Gradings and Exams:

Homework 20%, Midterm 30%, Final 50%. Homework shall be assigned and collected once every two weeks. Midterm (March 27nd, Thursday, in class) and final exams are closed-book exams.

Prerequisites:

Math2421 (Probability) or equivalents.

Tentative Schedules.

Wk 1. (Ch.1-2, all sections). Review of the fundamentals of probability theory.

Wk 2-5. (Ch.3, sections 3.1-3.4; 3.8-3.9). Introduction to Markov chains: definitions, transition probability matrices, some Markov models, first step analysis; branching processes, branching processes and generating functions.

Wk 6-7. (Ch.4, sections 4.1-4.3). Markov chains: regular transition probability matrices, limit theorems, classification of states.

* Reading: basic limit theorems. (section 4.4).

Wk 8-9. (Ch.5, sections 5.1-5.3). Poisson processes: Poisson distribution and the Poisson process, the law of rare events, distributions,

* Reading: uniform distribution and Poisson processes. (section 5.4).

Wk 10-11. (Ch.6, sections 6.1-6.2). Continuous time Markov chains: birth-death processes.

* Reading: the limiting behavior, finite state continuous time Markov chains. (sections 6.4-6.5).

Wk 12-13. (Ch.7, sections 7.1-7.4). The renewal phenomena: definitions, examples, Poisson process viewed as renewal process, asymptotic theory.

Wk ... (Ch.8, sections 8.1-8.3). Introduction to Brownian motion (if time allows.)

Remark: The above course schedule may be subject to minor changes depending upon the teaching progress.