

MATH 5128: Applied Probability I

Syllabus

Book: *Introduction to Stochastic Processes with R*, by R.P. Dobrow

- Appendix B: Review of Probability
 - Sample spaces, events, and axioms of probability
 - Discrete and continuous random variables, expectation and variance
 - Joint distributions, expectation of a function of several random variables, and covariance
- Chapter 1 (Sec 1.4-1.5 only): Conditional Probability and expectation
 - Conditional probability, Law of total probability, and Bayes' Rule
 - Conditional distributions
 - Conditional expectation as a random variable
 - Computing probability, expectation, and variance by conditioning
 - Random sums of random variables
- Chapter 2,3, Sec 5.1: Markov Chains
 - Basic definitions
 - Classification of states, transient vs. recurrent states, absorbing states, periodicity
 - Regular Markov chains, stationary and limiting distributions, Law of Large number for regular MCs
 - Absorbing MCs – Fundamental Matrix, Number of visits to transient states
- Chapter 6: Poisson Processes
 - Memoryless property of the exponential
 - Counting processes
 - Relation between the Poisson process and the gamma process
 - Thinning and Superposition
 - Compound Poisson process
 - Nonhomogeneous Poisson process
- Additional Topic: Poisson point processes
 - Poisson point processes in 2 and 3 dimensions
 - Mean functions
 - Homogeneous and nonhomogeneous cases
 - Thinned Poisson point processes