

FALL 2016

Applied Stochastic Models: MATH 7/8670

Instructor: E. Olusegun George, WD 237

Phone: 678-5088

Class Time and Room: M W 5:30pm–6:55pm; Dunn 231 Office Hour: Tu, Th 1-2 and by Appointment

This course will introduce students to stochastic processes. The emphasis will be on applications involving Markov Chains, Markov Processes. In addition to covering the standard methods of deriving limiting distributions of Markov chains and processes, the course will be related to contemporary Bayesian methodology through the theory of computations of posterior distributions by Markov Chain Monte Carlo and Metropolis-Hastings methods. Specific topics that will be covered include

1. A Review of Basic Probability Theory
 - (a) Basic Definitions and Theorems
 - (b) Standard Multivariate Discrete and Continuous Distributions
 - (c) Conditional distribution and Conditional Expectation
 - (d) Iterated Expectation and Variance
 - (e) Applications to: Quick -Sort Algorithm, Matching Problem, Ballot Problem, Random Graph, Compound Random Variable Identity
2. Introduction to Stochastic Processes
3. Kolmogorov Consistency Conditions
4. Introduction to Markov Chains
 - (a) Chapman-Kolmogorov Equations
 - (b) Classification of States
 - (c) Random Walks

- (d) Limiting Distributions
 - (e) Application to Branching Processes
 - (f) Time Reversible Markov Chains
 - (g) Markov Chain Monte Carlo Methods
5. Some Properties of the Exponential Distribution
 6. Poisson Processes
 - (a) Distributions of Inter-arrival, Waiting Times and Conditional Distribution of Arrival Times
 - (b) Nonhomogeneous Poisson Processes
 - (c) Compound Poisson Processes
 7. Continuous Time Markov Chains
 - (a) Birth and Death Processes
 - (b) Limiting Probabilities
 8. Brownian and Stationary Processes
 - (a) Brownian Motion
 - (b) Gaussian Processes
 9. **Textbook:** Introduction to Probability Models; 11th Edition, by Sheldon Ross, Academic Press
 10. **LECTURE NOTES and HAND-OUTS:** I will hand out detailed lecture notes and occasionally, copies of published research and review articles.
 11. **HOMEWORK**

Problems will be assigned Weekly and graded. Homework will account for 20% of the course grade.
 12. **TESTS** There will be two tests each counting for 20% of course grade.

13. **FINAL EXAMINATION**–Date Dec 7: 5:30 - 7:30p

A comprehensive Final Exam: Will count for 40% of course grade.