(Advanced) Discrete Stochastic Modeling and Simulation (SE/ME714)
Spring 2015

Instructor

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Office hours

Wednesdays 1-2 pm.

Textbook

No required textbook. Lecture notes will be provided on Blackboard (learn.bu.edu)

Sample references

- **Stochastic Processes**
  1. *Stochastic Processes, 2nd Edition*, Sheldon Ross, Wiley, 1996.
  2. *Stochastic Modeling and the Theory of Queues*, Ronald W. Wolff, Prentice Hall, 1989.
  3. *Stochastic Processes: Theory for Applications*, Robert G. Gallager, Cambridge University Press 2013.
  4. *Markov Chains: Gibbs Fields, Monte Carlo Simulation, and Queues*, Pierre Bremaud, Springer-Verlag, 1999.
- **Simulation**
  1. *Simulation, 5th Edition*, Sheldon Ross, Academic Press, 2012.
  2. *Stochastic Simulation: Algorithms and Analysis*, Soren Asmussen, Peter W. Glynn, Springer, 2007.
  3. *Monte Carlo methods in Financial Engineering*, Paul Glasserman, Springer, 2004.

Grading

Homework: 25%, Exams (and/or projects) 65%, class participation 10%.

Syllabus

1. *Stochastic simulation I*
   (a) Simulating (generating samples of) stochastic models
2. *Poisson process (simple type of a point process model)*
   (a) Point processes; Definition and modeling tool
   (b) Homogeneous Poisson Processes: Definition and properties
   (c) Generalizations: Nonhomogeneous, compound, conditional, & Markov-modulated Poisson Processes
3. *Renewal theory (a basic theoretical tool for analysis)*
   (a) Convergence of random sequences (a review)
   (b) Renewal, renewal-reward, and associated processes
   (c) Elementary renewal and renewal-reward theorems
   (d) Key renewal theorem and applications
4. *Discrete & Continuous-time Markov chains (models with short memory)*
   (a) Definition: Models with discrete state space & short memory
   (b) Stochastic dynamics (linear difference & differential equations)
   (c) Classification of states: transient, null-recurrent, positive recurrent
   (d) Long-run "performance measures" & limit theorems
   (e) Transient "performance measures"
   (f) Applications
5. *Stochastic simulation II*
   (a) Statistical analysis of simulated data
   (b) Variance reduction techniques