SIMULATION METHODS COURSE SUMMARY

Introduction, Probability Background, Random #s

- Probability Background, RVs, Expectation, Variance
- Basic Discrete Distributions:
  - binomial, geometric, Poisson
- Basic Continuous Distributions:
  - uniform, normal, exponential, gamma, Poisson processes.
- Pseudorandom numbers
- Monte Carlo integration

Discrete Random Variable Generation

- Inverse Transform method: binomial, Poisson examples
- Acceptance-Rejection method
- Composition method

Continuous Random Variable Generation

- Inverse Transform method: uniform, exponential examples
- Acceptance-Rejection method:
  - gamma, beta, normal examples
- Generation of Homogeneous Poisson processes

Discrete Event Simulation

- Queueing Systems:
  - Single-Server, Two-Server Parallel, Two-Server Series systems.
- Other Examples:
  - Insurance Risk, Machine Repair, Stock Option Valuation
Statistical Analysis of Simulated Data
  • Sample Mean and Variance
  • Confidence Intervals

Variance Reduction Methods
  • Antithetic Variates
  • Control Variates
  • Conditioning
  • Stratified Sampling
  • Importance Sampling

Statistical Validation Methods
  • Chi-Square Test for Discrete Data
  • Kolmogorov-Smirnov Test for Continuous Data

Markov Chain Monte Carlo Methods
  • Markov Chain background
  • Hastings-Metropolis Algorithm
  • Gibbs Sampling