

Course: MSCS 6020 Simulation, Spring 2019
Time: TuTh 3:30-4:45 Cudahy Hall 120
Instructor: Daniel B. Rowe, Ph.D.

Office Hours: TuTh 2:30 pm – 3:30 pm
Office: CU 313
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Texts: Ross, Sheldon (2012). *Simulation*, Fifth edition, Academic Press. ISBN: 0124159710

Grading: A midterm (in-class and take-home portions) on March 7, daily/weekly homework and participation, and a final exam (in class and take-home portions) on Thursday May 9, 8:00 am – 10:00 am. Homework & Class Participation (30%), Mid-Term Exam (30%), and a Final (40%).

Note: This course is heavily computational with extensive Matlab use.

~~Chapter 2: Elements of Probability (Skip)~~

~~Sample Space and Events, Axioms of Probability, Random Variables, Expectation, Discrete RVs, Continuous RVs, Conditional Expectation and Variance~~

Numerical Integration

Chapter 3: Random Numbers

Number Generation, Random Numbers to Evaluate Integrals

Chapter 4: Generating Discrete RVs

Inverse Transform, Poisson RV, Binomial RV, Acceptance-Rejection, Composition Approach, Alias Method, Random Vectors

Transformation of Variables

Chapter 5: Generating Continuous RVs

Inverse Transform, Rejection Polar Method for Normal RVs, Poisson Processes, Nonhomogeneous Poisson Processes, ~~2D Poisson Process~~.

Bivariate Transformation of Variables

Chapter 6: Multivariate Normal and Copulas

Multivariate Normal, Generating Multivariate Normal RVs, ~~Copulas, Generating Variables from Copula Models~~

Wishart Distribution

Line Fitting and Regression

Chapter 7: Discrete Event Simulation

Discrete Events, Queueing Systems, Inventory Model, Insurance Risk Model, Repair Problem, Stock Option

Multivariate Regression

Chapter 8: Analysis of Simulated Data

Sample Mean and Variance, Interval Estimates of Mean, Bootstrapping for Mean Square Error

Introductory Neural Nets for Multivariate Linear and Logistic Regression

Chapter 9: Variance Reduction Techniques

~~Antithetic Variables, Control Variates, Variance Reduction by Conditioning, Stratified Sampling, Importance Sampling, Common Random Numbers, Exotic Option~~

Confidence Intervals for Variance

Bayesian Statistics

Chapter 10: Additional Variance Reduction Techniques

~~Conditional Bernoulli Sampling, Normalized Importance Sampling, Latin Hyper Cube Sampling~~

Chapter 11: Statistical Validation Techniques

Goodness of Fit Tests, Two Sample Problem, Validating Assumptions of a Nonhomogeneous Poisson Process

Chapter 12: Markov Chain Monte Carlo Methods

~~Markov Chains, Hastings-Metropolis Algorithm, Gibbs Sampler, Markov Chains and Queueing Loss, Simulated Annealing, Sampling Importance Resampling~~

Other topics as needed.