

Department of Mathematics, Statistics, and Computer Science
Marquette University
Syllabus

Course: MSCS 6020 Simulation, Spring 2017

Time: TuTh 5:00-6:15 Cudahy Hall 114

Instructor: Daniel B. Rowe, Ph.D.

Office Hours: TuTh 4:00 pm – 5:00 pm

Office: CU 313

E-mail: daniel.rowe@marquette.edu

Texts: Ross, Sheldon (2012). *Simulation*, Fifth edition, Academic Press. ISBN: 0124159710

Grading: A midterm (in-class and take-home portions) on March 9, weekly or biweekly homework and participation, and a final exam (in class and take-home portions) on Dec 9, 5:45 pm – 9:45 pm. Homework & Class Participation (30%), Mid-Term Exam (30%), and a Final (40%).

Chapter 2: Elements of Probability

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

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

Chapter 5: Generating Continuous RVs

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

Chapter 6: Multivariate Normal and Copulas

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

Chapter 7: Discrete Event Simulation

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

Chapter 8: Analysis of Simulated Data

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

Chapter 9: Variance Reduction Techniques

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

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