

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

**Course:** MSCS 6020 Simulation, Spring 2018

**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 8, daily/weekly homework and participation, and a final exam (in class and take-home portions) on Dec 10, 8:00 pm – 10:00 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