Course: MSSC 6020 Statistical Simulation, Spring 2023 **Office Hours:** TuTh 2:30-3:30pm & by appt.
Time: TuTh 5:00-6:15 Cudahy Hall 137 **Office:** CU 313
Instructor: Daniel B. Rowe, Ph.D. **E-mail:** daniel.rowe@marquette.edu

Breaks: March 12-19 (Spring Break), April 6-9 (Easter)

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

Grading: A midterm (take-home & in-class) on March 9, homework participation, and a final (take-home & in-class) on Tuesday May 9, 5:45 pm – 7:45 pm. Homework/Participation (30%, $\geq 5 \rightarrow 100\%$, $=4 \rightarrow 80\%$, $=3 \rightarrow 60\%$, $=2 \rightarrow 40\%$, $=1 \rightarrow 20\%$, $=0 \rightarrow 0\%$), Mid-Term Exam (30%), and a Final (40%).

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

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 Univariate Multiple Regression
~~**Chapter 7: Discrete Event Simulation**~~
~~Discrete Events, Queueing Systems, Inventory Model, Insurance Risk Model, Repair Problem, Stock Option~~
Multivariate Multiple 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 Multiple 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 the 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.