**Course:** MSSC 6020 Statistical Simulation, Spring 2024 **Office Hours:** TuTh 4:00-5:00pm & 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 10-16 (Spring Break), March 28 – April 1 (Easter Break)

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

**Grading:** Midterm (In-Class & Take-Home) on March 7 (TH due March 19), homework participation, and a final (Take-Tome) due Tuesday May 7 at midnight. Homework/Participation (30%, ≥5→100%, =4→80%, =3→60%, =2→40%, =1→20%, =0→0%), Mid-Term Exam (30%), and 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**
**The Correlation Coefficient**
**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~~

**GRADING SCALE**:

| | | |
|---|---|---|
| 93% - 100% (A) | 90% - 93% (A-) | |
| 87% - 90% (B+) | 83% - 87% (B) | 80% - 83% (B-) |
| 77% - 80% (C+) | 73% - 77% (C) | 0% - 70% (F) |

Note: In all cases, lower end points are included not the upper end points. For example, 93% is included in A not in A-. 100% will be A.

SCORE = 0.3 * (HOMEWORK) + 0.3 * (MIDTERM) + 0.4 * (FINAL)