Course Syllabus
IEMS 465: Simulation Experiment Design and Analysis
Barry L. Nelson
Fall 2003

Course Summary

This course is concerned with all aspects of a discrete-event simulation experiment *other* than developing the simulation model. Topics include: point estimation (means, probabilities, quantiles); error estimation (confidence intervals, comparison of alternatives); experiment design (number of replications, length of replications); steady-state simulation of stationary stochastic processes; initialization bias detection and mitigation; input modeling; variance reduction; and optimization via simulation.

Topic Outline

Simulation Review	Law & Kelton, Chapter 1
Quick Tour of Random-Number and Random-Variate Generation	Law & Kelton, Chapters 7, 8.1-8.2
Point Estimation and Initial-Condition Bias	Law & Kelton, Chapters 4 and 9.1-9.3, 9.5.1
Measures of Error	Law & Kelton, Chapter 9
Comparisons, Optimization and Sensitivity	Law & Kelton, Chapters 10 and 12
Variance Reduction	Law & Kelton, Chapter 11
Input Modeling	Law & Kelton, Chapter 6
Mathematics for Simulation	Law & Kelton, Chapter 4

Grading & Policies

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Homework 40%
Project 30%
Exam 30% (November 25, tentatively)
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There will be a number of homework assignments, due at the beginning of class on the assigned day. Place any computer program listings and outputs in appendices. The answers and results should stand by themselves without the computer listing; the listing is included just for support. Programming can be done in any language on any computer system. Possibilities include Arena/SIMAN, Visual Basic, Fortran, Matlab, Maple, Java, C and C++. Class examples will be coded in VBA/Excel and students are welcome to use this code for their assignments.

The goal of the project is to learn about a topic we did not cover fully in class by preparing a brief tutorial, written at a level that your classmates could read. The tutorial should include worked out examples, and should be based additional references beyond what I have suggested. Although you may suggest your own topic (subject to my

approval), I have a list of topics from which you may choose. You should be able to begin working on the project no later than the 7th week, and the project report is due on the date of the final examination for this course.

Course Materials

- Law, A. M. and W. D. Kelton (2000), *Simulation Modeling and Analysis*, third edition, McGraw-Hill, NY.
- *IEMS 465 Course Notes*, available from Copy Cat. **Bring to class daily**.
- Selected papers.

Assumed Background

- Simulation modeling and programming in *some* simulation language.
- Properties of the cumulative distribution function and probability distribution or mass function of discrete and continuous random variables. The following probability distributions and their basic properties: exponential, normal, bivariate normal, Poisson, t, F, chi-squared.
- Definitions and basic properties of expected value (E), mean, variance (Var), covariance (Cov) and correlation (Corr), both population and sample versions. Also mean squared error (MSE).
- Confidence-interval and hypothesis-testing procedures for the population mean based on a random sample of i.i.d. observations and central limit theorem results (e.g., confidence intervals based on the standard normal and t distributions). Basic least-squares regression.
- Discrete and continuous-time Markov chains and Markovian queueing models (at the level of IEMS 315 or 460-1).