

ISYE 3044 SIMULATION ANALYSIS AND DESIGN

Required for BSIE

Prepared Profs. Alexopoulos and Song Fall 2025.

Credit: 3-0-3

Prerequisite(s): ISyE 3030 and ISyE 3232

Texts:

Simio, Python

Catalog Description:

Discrete event simulation methodology emphasizing the statistical basis for simulation modeling and analysis. Overview of computer languages and simulation design applied to various industrial situations.

Course Description

This course introduces simulation as a key tool for analyzing complex stochastic systems to support decision-making. Students will learn the key steps of the simulation modeling lifecycle from problem formulation, implementation, to validation as well as statistical modeling and analyses including input modeling, output analysis, experiment design, and optimization. Students gain experience working with modern simulation software while developing skills to tackle industrial problems.

Topical Outline

The topical outline is shown in the table below. The table has 2 columns. The first column lists the topics to be covered. The second column lists the number of weeks these topics will be covered.

Topics	Weeks
General principles and simulation languages	1
Estimation of error and risk in simulation experiments; simulation with spreadsheets	1.5
Fundamental Concepts from probability and statistics Queueing models	1
Random number generation	0.5
Random variate generation	1
Input modeling	1.5

Topics	Weeks
Verification and validation	0.5
Output analysis for a single system	1
Comparison and evaluation of alternative system designs	1
Introduction to Simio	1
Animation in Simio	0.5
Entity routing logic	1
Advanced Modeling Techniques: Simio Processes	1
Modeling with Tables and External Data	1
Simulation of Systems with Moveable Resources and Conveyors	1
Total	14

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Generate pseudo-random numbers and realizations from input distributions and random processes.
2. Develop discrete-event simulation models of engineering and service systems using appropriate modeling logic, simulation methodologies, and modern simulation software tools.
3. Model stochastic system inputs by postulating input models based on the characteristics of input processes (without data) or fitting distributions from data.
4. Analyze and interpret simulation output data using appropriate statistical techniques to estimate system performance, quantify uncertainty, and support statistically justified conclusions.
5. Verify and validate simulation models to establish model correctness, credibility, and suitability for the intended analysis and decision-making objectives.
6. Compare, evaluate, and improve alternative system designs or operational policies through experimental design, statistical analysis, and optimization methods.
7. Communicate simulation study results and recommendations effectively by translating technical findings into actionable engineering or managerial insights.

The Mapping from the Course Outcomes to ABET Student Learning Outcomes

The table below shows the relationship between course outcomes and ABET student learning outcomes. The table has 8 columns. The first column lists the course learning outcomes listed above. The next 7 columns list the abbreviated ABET Student Learning Outcomes. The entry of H in a row with specific course learning outcome and column

with specific ABET Student Learning Outcomes indicate the importance of attain this outcome is high and will be assessed.

Course outcome \ Program Outcomes	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirn, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Generate pseudo-random numbers and realizations from input distributions and random process							
2. Develop discrete-event simulation models of engineering and service systems ...	H						
3. Model stochastic system inputs by postulating input models based on ...	H						
4. Analyze and interpret simulation output data using appropriate statistical ...							
5. Verify and validate simulation models ...							
6. Compare, evaluate, and improve alternative system ...		H					
7. Communicate simulation study results and recommendations ...			M		M		

Evaluation of the important outcomes

Course outcomes 2, 3 and 6 will be assessed on direct questions on final exam.
Outcome 7 are assessed by the project or modeling assignment.