ISYE 3044 SIMULATION ANALYSIS AND DESIGN

Prepared Prof. Christos Alexopoulos, Fall 2013

Credit: 3-0-3

Prerequisite(s): ISyE 2028 or 3030 and ISyE 3232

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.

Texts:
Banks, J., Carson, J. S., Nelson, B. L., and Nikol, D. M. *Discrete-Event System Simulation*, 4th edition, Prentice-Hall, 2010.
Pegden, C. D., and Sturrock, D. T. *Rapid Modeling Solutions: Introduction to Simulation and Simio*, Simio LLC (included with software).
Joines, J. A. and S. D. Roberts, *Simulation Modeling with SIMIO: A Workbook*. Available online at www.simio.com/academics/workbook/index.html (optional).

Objectives
(1) Introduction to simulation models and simulation studies; (2) Organization of simulation languages; (3) Modeling with a state-of-the art simulation package with 3-D, true-to-scale animation capabilities such as Simio; (4) Statistical aspects including input data analysis, generation of realizations from statistical distributions, output data analysis, and simulation-based optimization.

Academic Honor Code and Student Faculty Expectations
You can find Georgia Tech student body developed Honor Code: http://osi.gatech.edu/content/honor-code.
You can also find Georgia Tech student and faculty developed Student-Faculty Expectations at: http://www.catalog.gatech.edu/rules/22/

Attendance
We will follow the institute attendance policy http://www.catalog.gatech.edu/rules/4/.
The accepted absences include

1. Email notification from Dean's office. The accommodation depends on the suggestions in the email.
2. Institute Approved Absences https://registrar.gatech.edu/info/institute-approved-absence-form-for-students.

Special Needs
If you have special needs, please contact the Office of Disability Services: http://www.catalog.gatech.edu/policies/disabled-assistance

Topical Outline
The topics and approximate number of weeks of coverage are in the table below.

Topics	Weeks
General principles and simulation languages	1
Estimation of error and risk in simulation experiments; simulation with spreadsheets	1.5
Queueing models	0.5
Random number generation	0.5
Random variate generation	1
Input modeling	1.5
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 Vehicles and Conveyors	1
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Outcomes

At the end of this course, students will be able to:

1. Evaluate the effects of randomness on system behavior and performance.
2. Develop credible and valid simulation models.
3. Fit statistical distributions to input data.
4. Analyze output data from simulations.
5. Compare alternative system designs using simulation.

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. Evaluate the effects of randomness on system behavior and performance						M	
2. Develop credible and valid simulation models					H	H	
3. Fit statistical distributions to input data	H						
4. Analyze output data from simulation	H					H	
5. Compare alternative system design using simulation		H					

Evaluation of the important outcomes

Course outcomes 3 and 4 will be assessed on direct questions on final exam.
2 and 5 are assessed by the project or modeling assignment.

Comparison of old ABET Student Outcomes a – k to new 1 - 7

OLD Criterion 3. Student Outcomes The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.	NEW Criterion 3: Student Outcomes The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.
(a) an ability to apply knowledge of mathematics, science, & engineering (e) an ability to identify, formulate, and solve engineering problems	(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health & safety, manufacturable, & sustainable	(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(g) An ability to communicate effectively.	(3) An ability to communicate effectively with a range of audiences.
(e) an understanding of professional and ethical responsibility (h) the broad education necessary to understand the impact of engg solutions in a global, economic, environmental, & societal context (j) a knowledge of contemporary issues	(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(i) a recognition of the need for, and an ability to engage in life-long learning	(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
(d) an ability to function on multidisciplinary teams	(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative & inclusive environment, establish goals, plan tasks, and meet objectives.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Implied in 1, 2 and 6.