School of Computing
UNIVERSITY OF GEORGIA

Course Information Sheet

CSCI 4210

Simulation and Modeling

Brief Course Description
(50-words or less)

In this course, we will study complex dynamic systems, examining their performance, reliability, etc. The reason for doing this is to improve such systems either in the design phase (before a costly system is built) or the operation phase (tune or upgrade). A simulation model may be used for such studies. It is an approximation of the complex system that captures its essential properties and often mimics the behavior of the actual system. Behavior is studied by carrying out multiple runs of the simulation model to produce statistical outputs of properties such as system response time or throughput.

Extended Course Description / Comments

Further insight into system behavior can be gained by animating the model. The course will involve a major project to create a simulation model of a system chosen by the project group (multiple students). The model will be created using Java 21 or Scala 3 and parts of JSIM, a simulation system coded in Java or ScalaTion, a simulation system coded in Scala.

Pre-Requisites and/or Co-Requisites

Prerequisite: CSCI 2720 (Data Structures) OR CSCI 2725 (Data Structures for Data Science)

Required, Elective or Selected Elective

Selected Elective Course

Approved Textbook

Law,
Simulation Modeling and Analysis, sixth edition, 2024
Miller,
Introduction to Computational Data Science Using ScalaTion, 2024

Specific Learning Outcomes (Performance Indicators)

Students will learn how to construct and analyze simulation models of complex systems.

1. A basic ability to categorize various mathematical modeling techniques.
2. A basic ability to select and use various probabilistic and statistical models.
3. An ability to explain and develop models following the event scheduling simulation world view.
4. An ability to explain and develop models following the process- interaction simulation world view.
5. A basic ability to understand and use various queuing models (e.g., M/M/1, M/G/1).
6. An ability to generate random number and random variates
7. An ability to analyze and draw conclusions from the outputs of simulation models.
8. An ability to create simple computer games.
9. Experience with a term project/report involving the creation of a simulation model that includes 2D/3D animation.

ABET Learning Outcomes

A. Graduates of the program will have an ability to: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
B. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
C. Communicate effectively in a variety of professional contexts.
D. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
E. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
F. Apply computer science theory and software development fundamentals to produce computing-based solutions.

Relationship Between Student Outcomes and Learning Outcomes

		ABET Learning Outcomes					
		A	B	C	D	E	F
Specific Learning Outcomes	1	●					
	2	●					
	3		●	●			●
	4		●	●			●
	5	●					
	6	●	●				
	7	●					
	8		●				
	9		●	●	●	●	●

Major Topics Covered

1. Introduction to Modeling and Simulation (2 hours)
2. Simulation Examples (4 hours)
3. Discrete Event Simulation (6 hours)
4. Simulation Software (2 hrs)
5. Simulation Engines: Concurrent Programming/Threads (8 hours)
6. Animation Techniques (2D/3D) (4 hours)
7. Statistical Models (4 hours)
8. Markov Chains (2 hours)
9. Queueing Models (2 hours)
10. Verification and Validation (2 hours)
11. Random Number Generation (2 hours)
12. Random Variate Generation (2 hours)
13. Output Analysis (4 hours)
14. Simple Computer Games (6 hours)

Modified 3/29/2024 by Dr. John Miller

Approved Yes