ISE 4712/IHE 6712 – Simulation and Stochastic Models

Course Description

Study of quantitative techniques to analyze and predict systems performance. Topics include queuing models, system simulation, model validation, data collection, quantitative analysis of system performance, and system design evaluation

Undergraduate/Graduate level – 4 credit hours
IHE 6712 students will be asked to conduct an additional simulation term project. They will be asked to identify a problem, build the simulation model, perform input and output analysis, and give a 15 minute presentation in class.

Corequisite – 4712L/6712L
Offered both face-to-face and online

Course Learning Objectives

Students will learn to:

- explain the role of randomness in the performance of systems
- use simulation models for system analysis
- explain and formulate simple stochastic processes including Markov chains
- Use queuing systems and apply the results from the analysis of M/M/k systems
- explain the fundamental building blocks of Monte Carlo and discrete-event simulation;
- analyze the input data supporting a simulation model and the output data generated by a simulation model
- build, verify and analyze models using state-of-the-art simulation software
- use simulation models to design and improve systems related to areas such as manufacturing, inventory control, business processes and service processes

Course Learning Outcomes

After successful completion of the course, students will be able to:

- explain the role of randomness in the performance of systems
- use simulation models for system analysis
- explain and formulate simple stochastic processes including Markov chains
- Use queuing systems and apply the results from the analysis of M/M/k systems
- explain the fundamental building blocks of Monte Carlo and discrete-event simulation;
- analyze the input data supporting a simulation model and the output data generated by a simulation model
- build, verify and analyze models using state-of-the-art simulation software

- use simulation models to design and improve systems related to areas such as manufacturing, inventory control, business processes and service processes

Tentative Weekly Schedule

1. Introduction to randomness in systems and simulation; Discrete and continuous and fundamentals of simulation
2. Review of probability, random variables and their applications; Simple stochastic processes and Markov chains
3. M/M/k queueing systems; Little's law
4. Basic Process Modeling (Entities, Attributes, Variables, Flow of control); Examples using analytics and simulation (M/M/k Queue)
5. Basic Process Modeling (batching, separate, run control); Complicated queues
6. Input analysis and random number generation
7. Output analysis and comparison of system configurations
8. More examples in business process management; Exam I
9. Modeling queuing and inventory systems I : queuing
10. Modeling queuing and inventory systems II: inventory
11. Entity Movement and Material Handling Constructs I
12. Entity Movement and Material Handling Constructs II
13. Advanced modeling techniques and examples; Applications in practice
14. Project presentations
15. Final Exam