CEN 570: Simulation & Modeling

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1 Description

During this course, a student is exposed to different subjects in the topic of simulation and modeling. These subjects include discrete-event simulation approaches, simulation cycle, probability and statistics in simulation, mathematical and statistical models, validation and verification of simulation models, random number generation, building valid and credible simulation models, modeling of data simulation, and analyzing output data. The student is also introduced to some simulation software, the concept of distributed and parallel simulation, simulation techniques of some well-known systems such as queues, some applications to computer systems, and a number of realistic case studies.

2 Objectives

Get exposed to the necessary mathematical, probabilistic and simulation programing tools used to study the performance of some well-known systems such as queues, some applications to computer systems, and a number of realistic case studies..

3 Text and References

- Discrete event system simulation, by J. Banks, J. Carson, B. Nelson and David Nicol, Fifth Edition, Prentice - Hall, 2010.

- Probability and Random Processes for Electrical Engineering, by Alberto Leon-Garcia, Addison-Wesley.

4 Topics

Session no	Chapter
Part One	
1	Systems, Models, and Simulation
2	Review of Probability and Statistics
Part Two	
3	Random Number Generators
4	Randomness Tests
5	Generation of random variates
6	Input Modeling
7	Event-driven Simulation: case of M/M/1
8	Validation tools
Part Three	
9	Stochastic Processes: Poisson Process
10	Markov Chains: Basics of queues
11	M/G/1 Queue
12	Network of queues
Part Four	
13	Simulation Tools (Opnet, NS2, NS3, Omnet)
14	Simulation in Computer Networks (case studies)

5 Projects

At least two projects will be assigned, and one should be presented orally. The projects will be of two types:

- Writing or modifying a simulation program: soft copies of both the source code and excecutable of the simulation should be submitted along with some test runs. A report should be written to explain the method followed by the student, including all steps and subroutines. The use of flow charts is advised to present the structure of the program. Also, schematic diagrams are preferred to clarify your ideas and comments. A partial grade will be given for a well-organized and structured program, and for a clear and ordered report.

- Modeling and analysis of a computer network system: it will be based on either a system presented in class, or a system presented in a paper. The report should include the assumptions made, the system model, the main results and their derivation.

6 Grading

Category	Percent
Project One	15
Homework	20
Project Two	25
Final	40