IE3354 Stochastic Operations Research – Project

Due date: May 12, Friday 23:00.

Write a report to explain what you do for the following two parts of the project. Provide your computer codes in the appendix of the report. You may use any programming language for the coding tasks (MS Excel/ARENA is not a programming language!). Your report should include an Introduction chapter to summarize what you do for each part, and separate chapters for detailed explanation of the steps (explain your algorithms in details along with their pseudo codes).

PART I Discrete Time Markov Chains - Chain Generation and Simulation

Step 1: Develop an algorithm to construct all possible one-step transition probability matrices with the following properties:

i. There are 5 states, from 0 to 4, and states 3 and 4 are absorbing.
ii. The transient states are in the same equivalence class.

Write a computer code for your algorithm.

Step 2: For a sample matrix that you obtain as an output of Step 1, develop a Simulation algorithm to estimate the following:

Step 2.1 mean time until absorption for all the initial states.

Step 2.2: absorption probability for each initial state - absorbing state couple.

Write a computer code for your algorithm.

Step 3: Compare the results of Step 2 with the theoretical solutions. Sketch how the error changes with the number of replications. Explain how you obtain the theoretical solutions.

PART II Continuous Time Markov Chains - Chain Generation and Simulation

Step 1: Develop an algorithm to construct all possible CTMCs with the following properties:

i. There are 5 states, from 0 to 4.
ii. All states are in the same class.

Write a computer code for your algorithm.

Step 2: For a sample CTMC that you obtain as an output of Step 1, develop a Simulation algorithm to estimate the steady-state distribution. That is, estimate the long-run fraction of time that the process is in any given state.

Step 3: Compare the results of Step 2 with the theoretical solutions. Sketch how the error changes with simulation run time. Explain how you obtain the theoretical solutions.