CSCI 410: Modeling and Simulation

Assignment 2

Due October 14th, 23:59:59PM.

1. Using the equation for D$_{i+1}$ in Example 4.19 in the textbook, write a C program to simulate the M/M/1 queue with a mean inter-arrival time of 1 and a mean service time of 0.5. The program should not require a simulation clock, an event list, or a timing routine. The program generates 1000 D$_i$'s. Based on the 1000 observations of D$_i$'s, the program then
   a) (10 pts) Compute $\bar{D}(1000), S^2(1000)$.
   b) (10 pts) Estimate $\rho_1, \rho_2, \cdots, \rho_{10}$ according to Equation 4.9 in the textbook.
   c) (10 pts) Calculate a 95 percent confidence interval for the mean.
   d) (10 pts) Calculate a 95 percent t confidence interval for the mean.
   e) (10 pts) Calculate a 95 percent Willink confidence interval for the mean.
   f) (10 pts) Test the null hypothesis H$_0$: μ = 1 at level α = 0.05.

   Run the program 30 times, collect the above statistics computed by the program and enter them into an Excel sheet. In the Excel sheet,

   a) (10 pts) Calculate the coverage of each of the three types of the confidence interval. Draw a conclusion on the relationship between the actual coverage and the percentage of confidence interval (for this case).
   b) (8 pts) Calculate the ratio of rejection. Draw a conclusion on the relationship between the ratio of rejection and the test level (for this case).
   c) (2 pts) Calculate the average of the estimate of $\rho_1, \rho_2, \cdots, \rho_{10}$ (to be used in Problem 3).

2. (15 pts) Repeat Problem 1 but change the null hypothesis to H$_0$: μ = 1.5 at level α = 0.05. What's the change of the ratio of rejection? Provide your justification.

3. (20 pts) Repeat Problem 1 with a mean service time of 0.9. Calculate the average of the estimate of $\rho_1, \rho_2, \cdots, \rho_{10}$. Compare the correlation estimate between Problem 1 and 3. Plot them together in the same chart. Provide any insight.

Submit your C code, Excel file and the answers. Please zip the files together for submission.