COMP9334 Revision Questions for Week 6

Question 1

The Matlab program *sim_mm1_func.m* simulates an M/M/1 queue with arrival rate λ and service rate μ over a time period of T. It returns the average response time for the given λ, μ and T.

We would like to investigate the effect of the length of simulation T on the simulation. Let us fix $\lambda = 0.7$ and $\mu = 1$. For each of the following values of T: 1000, 5000, 10000 and 50000, perform the simulation 20 times (with a different set of random numbers) and record the value of the average mean response time.

Answer the following:

1. What is the mean response time according to the M/M/1 result?
2. For each value of T used, compute the mean and standard deviation over 20 experiments.
3. How does the standard deviation vary with T?

Note on using *sim_mm1_func.m*: If you type at the matlab prompt: *sim_mm1_func(0.7,1,1000)*, it will simulate an M/M/1 queue with $\lambda = 0.7$, $\mu = 1$ and $T = 1000$.

Question 2

Write a simulation program (in whatever language you prefer) to simulate an M/M/2 queue. You should be able to control the arrival rate λ, service rate μ and the length of simulation T.

Use your M/M/2 and M/M/1 simulation program to compare:

1. The mean response time of an M/M/1 queue with $\lambda = 0.9$ and $\mu = 1$.
2. The mean response time of an M/M/2 queue with $\lambda = 0.9$ and for each server, $\mu = 0.5$.

Simulate each of the above configurations 10 times and record the mean response time in the simulation. You may use a simulation time of $T = 1000$.

You have learnt in Week 3 that the the first system should have a smaller mean response time. Did your simulation results also suggest a smaller mean response time for the first system?

Question 3

The Weibull distribution with parameters α and β has a cumulative probability function $F(x) = 1 - \exp(-\alpha x^{\beta})$. Write a computer program to generate random numbers that have a Weibull distribution with $\alpha = 1.5$ and $\beta = 6$. Verify by using a histogram that the numbers that you have generated do have a Weibull distribution.