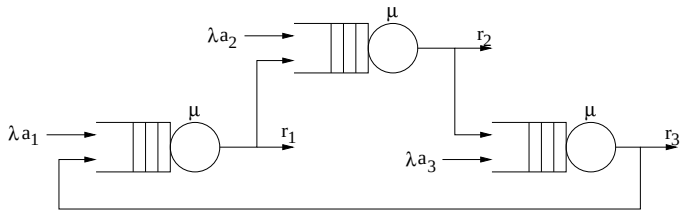
The University of Texas at Dallas
CS/CE 6352, Performance of Computer Systems and Networks
Spring 2017

Programming Assignment 2
Due Friday, April 28, 2017

In this assignment, you will implement a simulation for a three-node unidirectional ring network. The queuing model for the network is illustrated below:



Packets arrive from outside the network according to a Poisson process with rate λ. With probability a_i, an arriving packet enters the ith queue, where $a_1 + a_2 + a_3 = 1$. The service time for a packet at a Node is exponentially distributed with an average service time of $\frac{1}{\mu}$ seconds. When a packet departs from queue i, it departs from the network with probability r_i, and it is forwarded to the queue of the next node with probability $1 - r_i$. The packets can only be transmitted in one direction around the ring. Each queue has infinite capacity.

Implement a discrete event simulation for the above system. For each of the experiments below, run the simulation until 500,000 packets have departed from the system.

1. Let $a_1 = \frac{1}{2}, a_2 = \frac{1}{4}, a_3 = \frac{1}{4}, r_1 = \frac{1}{2}, r_2 = \frac{2}{3}, r_3 = \frac{1}{4}$, and $\mu = 8$. Plot the simulation and theoretical results for expected number of customers in each queue as a function of λ for $\lambda = 1, 2, \cdots, 9$. (You may have your program output numerical values, and then create plots using any plotting/graphing/spreadsheet program such as Excel.)
2. Let $\lambda = 8$ and the other parameters are as above. Find the throughput and utilization for each queue. Compare the simulation results to theoretical results.

To be submitted:

1. Source code files. Be sure to include sufficient comments. **Include your name and netid at the top of every source code file that you submit.**
2. "Readme" file specifying OS (UNIX, Windows, etc.), compilier/platform, instructions for compiling and running the program.
3. File(s) containing output plots (PostScript, PDF, MS Word, or MS Excel). Be sure to label plots appropriately.

For C++, source code files should end with .cpp or .h extensions. For C, source code files should end with .c or .h extensions. For Java, source code files should end with a .java extension. Place all files in a single folder or directory named with your netid, e.g. xyz061000, and zip this directory into a single zip file. Upload this zipped file to eLearning.

An example simulation for an M/M/1 system is available at: http://www.utdallas.edu/%7Ejjue/cs6352/sim/

You may use this code as a template for your simulation, or you may write your own code. *Under no circumstances may you use code from any other source.* Programs will be checked using copy-detection software. If your code is found to be similar to another person's code, you will be subject to disciplinary action according to University policies. If you are unable to complete your project on time, submit whatever you have done. Partial credit will be given.