CMPE 576 (Spring 2015): Assignment 3

Due date: 30 May 2018, 16:30
You may work in groups of two. In that case, please submit only one copy of the assignment with two names on it.
– Please submit a hardcopy in my departmental mailbox and email me a softcopy of your assignment.
– Do not copy programs from each other.
– You might be asked to demonstrate the running of your programs.

Discrete Event Simulation of a Packet Switch

The objective of this assignment is to write a discrete event simulator in C/C++ or MATLAB to analyze packet delays and queue sizes at a packet switch for different utilization levels of the switch. You will model the packet switch as a first-come first-serve single-server queue, and you may implement the discrete event simulation algorithm (and the flowcharts) described in class for simulating the single-server queue.

The system to be simulated has the following parameters:

- Processing capacity of the packet switch is 10,000 bits/second.
- Packet sizes are chosen from an exponential distribution[1]; average size is 1,000 bits. Therefore, mean service time in the server is 1,000/10,000=0.1 seconds.
- Packet arrival process is Poisson.
- Note that the utilization of the server is defined as (mean arrival rate)$\times$(mean service time).

Your program should keep track of variables of interest upon occurrence of arrival and departure "events" to analyze the **average packet delay** (i.e., the time spent at the switch by packets, both queueing and receiving service) and the **average number of packets in the system** (both waiting in queue and receiving service) for utilization levels that will be varied between 5% and 95%. For this assignment, you can choose a simulation duration of $T = 5,000$ seconds for each utilization level.

Use an application such as Matlab or Excel to plot the 95%-confidence intervals of the mean packet delay and the mean number of packets in the system for utilization levels between 5% and 95% with 5% intervals based on 20 simulation runs. You may use the normal approximation for calculation of the confidence intervals.

[1] Assume that packet sizes are floating-point numbers.