Exercise 1:

Consider the Post-office of a small town. There is only Mr. McPhee working in the post office. It has been observed that the rate at which letters comes in for postage is about 3 per hour. McPhee being highly experienced is able to work at a rate that allows him to handle postage requests at the rate of 5 per hour. The interarrival time for letters is approximately exponential, and so the time McPhee takes to handle a postage request. What is the mean delay a letter experiences?

Solution:

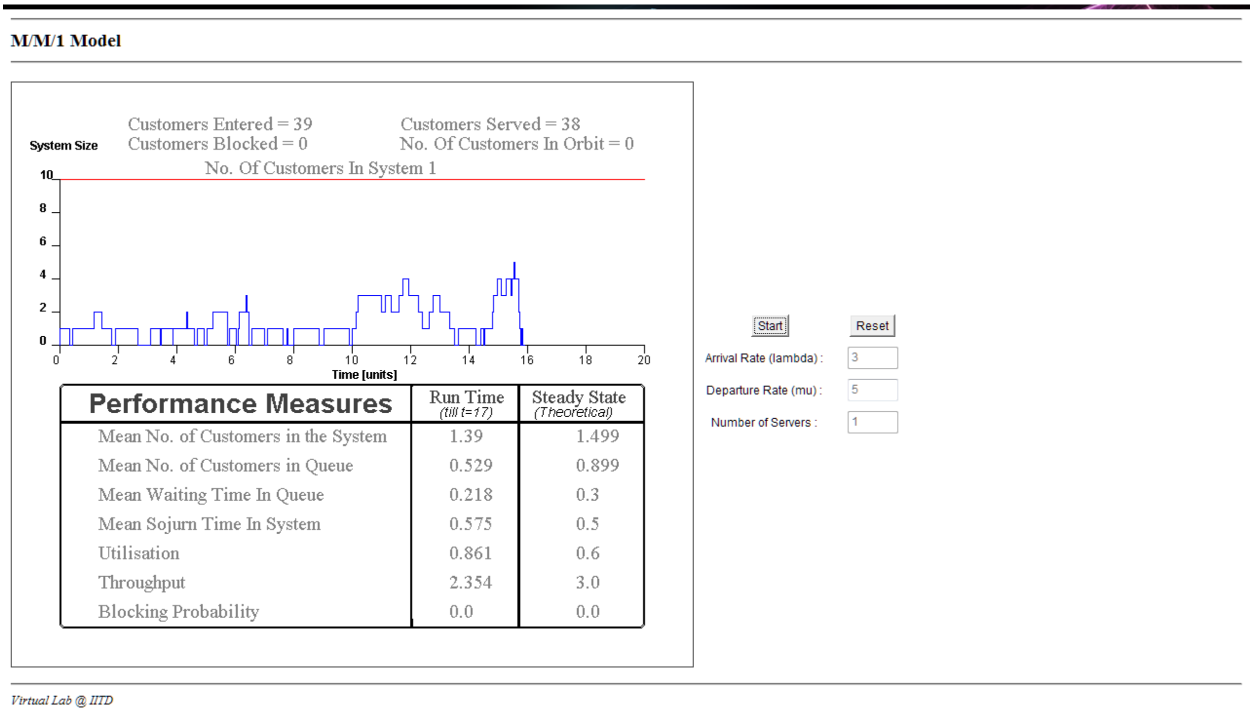
The postage system can be modelled as an M/M/1 FIFO queue. The arrival is a Poisson process with arrival rate $\lambda = 3$ per hour, the service is exponentially distributed with mean rate $\mu = 5$ per hour. The net input traffic is therefore $\rho = \lambda/\mu = 3/5 = 0.6$. Therefore, the mean number of messages is $N = \rho/(1- \rho) = 1.5$ messages. The delay of the system, as described by Little's Theorem, is now calculated as $T = N/\lambda = 1.5/3 = 0.5$ hour.

Simulation:

For a simulation of the Post office, perform the following steps:

→ Open the page where the simulation is to be performed.
→ Next feed the data as shown. Put lambda (λ) = 3 and mu (μ) = 5

→ Click Start. The applet will now generate a sample path for the queue.



Performance Measures	Run Time (till t=17)	Steady State (Theoretical)
Mean No. of Customers in the System	1.39	1.499
Mean No. of Customers in Queue	0.529	0.899
Mean Waiting Time In Queue	0.218	0.3
Mean Sojurn Time In System	0.575	0.5
Utilisation	0.861	0.6
Throughput	2.354	3.0
Blocking Probability	0.0	0.0

We see that the steady state data obtained from the applet matches beautifully with the theoretically calculated results.