

**CS-470**  
**Modeling and Simulation**  
**Lab 3**  
**Single Queue, Single Server**

**Date: Week #4 Lab**

**Due: Week #6 Lab**

Using the single queue, single server model from the previous lab, add analytical capabilities to it that compute M/M/1 statistics, provided below:

$$\begin{aligned}L_s &= \sum_{n=0}^{\infty} nP_n & L_q &= \sum_{n=s}^{\infty} (n-s)P_n \\L_s &= \lambda W_s & L_q &= \lambda W_q \\L_s &= L_q + \frac{\lambda}{\mu} & W_s &= W_q + \frac{1}{\mu}\end{aligned}$$

The relationship of these statistics to traffic density is as follows:

$$\begin{aligned}L_s &= E(n) = \frac{\rho}{1-\rho} \\L_q &= L_s - \frac{\lambda}{\mu} = \frac{\rho^2}{1-\rho} \\W_s &= \frac{L_s}{\lambda} = \frac{1}{\mu(1-\rho)} \\W_q &= \frac{L_q}{\lambda} = \frac{\rho}{\mu(1-\rho)}\end{aligned}$$

Test your single queue, single server simulation again, this time comparing the results you get to the Markov statistics above. If your results vary significantly, modify your work to more closely follow the M/M/1 queuing model described in lecture and the text.

As always, make sure your lab report summarizes the approach you've taken to the problem, describes the implementation to adequate detail, and validates your results to test compliance with the objective.