Assignment 14 - M/M/1, M/M/1/C

1 Problem

A NC machine receives parts at a rate of 20 per hour. The expected service time is 2 minutes. The machine buffer has a capacity equal to 3. Compute the KPIs of the system.

2 Solution

The system can be modelled like a M/M/1/C queue. We have λ=20 per hour, $1/\mu$ = 2 minutes = 0.033 hours and k=3. The ρ is $\lambda/\mu = 0.66$. We can use next formulas:

$$p_n = \frac{(1-\rho)\rho^n}{1-\rho^{k+1}} \tag{1}$$

$$\lambda' = \lambda(1-p_k) \tag{2}$$

$$L = \frac{\rho}{1-\rho} - \frac{(K+1)\rho^{k+1}}{1-\rho k+1} \tag{3}$$

From these we can compute $p_0 = 0.42$, $p_k = 0.84$, $\lambda' = 3.2$ and $L = 1$. From L we can compute:

$$L_q = L - (1-p_0) = 0.42 \tag{4}$$

$$W = L/\lambda' = 0.31 \tag{5}$$

$$W_q = L_q/\lambda' = 0.13 \tag{6}$$