STAEDTLER® No. 937 811E Engineer's Computation Pad

Example 3:

λ = arrival rate = 5 students / hour

μ = service rate = 1 student / 10 minutes = 6 students / hour

$$\rho = \frac{\lambda}{\mu} = \frac{5 \text{ students/hour}}{6 \text{ students/hour}} = 5/6$$

$$L = \frac{\lambda}{\mu - \lambda} \text{ (for an M/M/1 system) } = \frac{5}{6-5} = 5$$

$$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)} = \frac{5^2}{6(6-5)} = \frac{25}{6} = 4\tfrac{1}{6}$$

- % of time student can walk in without waiting = % of time system has no customers = P_0

P_0 for an M/M/1 system $= 1-\rho$

$$P_0 = 1-\rho = 1 - 5/6 = 1/6$$

- Probability of having to stand is $P_n \big|_{n>4}$

$$P_n \big|_{n>4} = \sum_{n=5}^{\infty} P_n = 1 - \sum_{n=0}^{4} P_n = 1 - (P_0 + P_1 + P_2 + P_3 + P_4)$$

$$= 1 - \left((1-\rho) + (1-\rho)\rho + (1-\rho)\rho^2 + (1-\rho)\rho^3 + (1-\rho)\rho^4\right)$$

$$= 1 - (1-\rho)\left[1 + \rho + \rho^2 + \rho^3 + \rho^4\right]$$

$$= 1 - \left(1/6\right)\left(1 + \frac{5}{6} + \left(\frac{5}{6}\right)^2 \ldots \left(\frac{5}{6}\right)^4\right)$$

$$\cong .4018$$

$$W_q = \frac{\rho}{\mu - \lambda} = \frac{5/6}{6-5} = \frac{5}{6}$$ (ugh! Thats a long wait. Hope it is worth it)

$$W = \frac{1}{\mu - \lambda} = \frac{1}{6-5} = 1$$ (makes sense! 50 minutes waiting + 10 minutes w/ Prof Nace)