Home work

1) M/M/1 : 2 model.

$\lambda = 8/hr$, $\mu = 9/hr$, $N = 2$

$P_0 = \frac{1-\rho}{1-\rho^{N+1}}$; where $\rho = \frac{\lambda}{\mu}$

$P_0 = \frac{1 - 8/9}{1-(8/9)^{N+1}} = \frac{1-0.8888}{1-(0.8888)^3}$

$= \frac{0.1112}{0.2979} = 0.3732$

$P_1 = \rho P_0 = \frac{8}{9} \times 0.3732 = 0.3317$

$P(\text{no queue}) = P_0 + P_1 = 0.7049$

$P_2 = \rho^2 P_0 = (0.8888)^2 \times 0.3732$

$= 0.7899 \times 0.3732$

$= 0.2948$

Probability of not joining the 8lm

$= 1 - 0.2948 = 0.7052$

Effective arrival rate

$$\lambda_e = \lambda \times 0.7052$$

$$= 8 \times 0.7052$$

$$= \underline{5.6416}$$

$$L_s = \frac{\rho\left[1 + N\rho^{(N+1)} - (N+1)\rho^N\right]}{(1-\rho)(1-\rho^{N+1})}$$

$$= \frac{0.8888\left(1 + 2\times(0.8888)^3 - 3\times(0.8888)^2\right)}{(1-0.8888)(1-0.8888^3)}$$

$$= \cancel{\frac{0.8888(1+1.4042-5.3328)}{0.1112\times0.2978}}$$

$$= \frac{0.888(1+1.404-2.3656)}{0.1112\times0.2978}$$

$$= \frac{0.888\times0.0384}{0.0331} = \underline{\underline{1.019}}$$

$$W_s = \frac{L_s}{\lambda_e} = \frac{1.019}{5.641} = \underline{\underline{0.1806}}$$

$$W_q = W_s - \frac{1}{\mu}$$

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