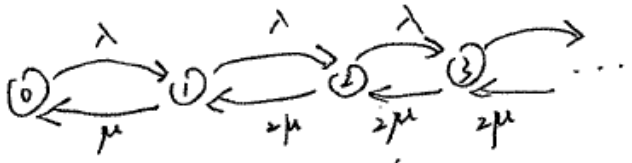
Solution to Hands-on Problems on Slide 24

(a)



(b) $M/M/2$ system, $\lambda = 40/\text{sec}$, $W_s = 45\text{ ms} = 0.045\text{ sec}$, $c = 2$

$$\rho = \frac{\lambda}{\mu \cdot c} = \lambda \cdot W_s / c = 40 * .045 / 2 = 0.9 = 90\%$$

(c) $$\pi_0 = \left[\sum_{n=0}^{c-1} \frac{\alpha^n}{n!} + \frac{\alpha^c}{c!(1-\frac{\alpha}{c})} \right]^{-1} \qquad \alpha = \frac{\lambda}{\mu} = 1.8$$

$$= \left[1 + \frac{\alpha}{1} + \frac{\alpha^2}{2!(1-\rho)} \right]^{-1}$$

$$= \left[1 + \alpha + \frac{\alpha^2}{2(1-\rho)} \right]^{-1}$$

$$= \left[1 + 1.8 + \frac{1.8^2}{2 * 0.1} \right]^{-1} = \frac{1}{19} = 0.05263$$

(*) at least one of the servers is busy $= 1 - \pi_0$

(d) $$\pi_4 = \frac{\alpha^n}{c!\, c^{n-c}} \pi_0 \qquad n = 4$$

$$= \frac{\alpha^4}{2!\, 2^2} \pi_0 = \frac{1.8^4}{8} * \pi_0 = 0.069063$$

1 - system