Solution to Hands-on Problems on Slide 16

(a) $M/M/1/N$ system with $N = 2+1 = 3$ (system capacity)

$\lambda = 16/\text{sec}$ $\quad w_s = 50\text{ ms} = 0.05\text{ sec} \Rightarrow \mu = \frac{1}{w_s} = 20/\text{sec}$

$$\alpha = \frac{\lambda}{\mu} = \lambda \cdot w_s = \frac{16}{20} = 0.8$$

$$\pi_0 = \frac{1-\alpha}{1-\alpha^{N+1}} = \frac{1-0.8}{1-0.8^4} = \frac{0.2}{1-0.4096} = 0.338753$$

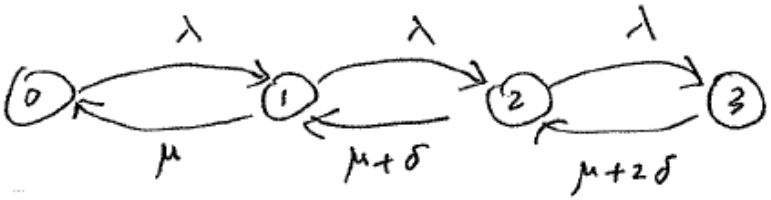
$$P = 1 - \pi_0 = 0.661247$$

(b) $\lambda_{eff} = \lambda(1 - P_B)$

$$P_B = \pi_N = \pi_3 = \alpha^3 \cdot \pi_0 = 0.8^3 * \pi_0 = 0.173442$$

$$\lambda_{eff} = 16 * (1 - P_B) = 13.22493$$

(c)



rate in = rate out

state	
0	$\pi_1 \cdot \mu = \lambda \cdot \pi_0$
1	$\pi_0 \cdot \lambda + \pi_2 \cdot (\mu+\delta) = (\lambda+\mu) \cdot \pi_1$
2	$\pi_1 \cdot \lambda + \pi_3 \cdot (\mu+2\delta) = (\lambda+\mu+\delta) \cdot \pi_2$
3	$\pi_2 \cdot \lambda = (\mu+2\delta) \cdot \pi_3$