H.W. Set #6 ME 355 (Winter 2000)

7.1

(a) $T_c = 10\ s$

$(20-10)\times 10 = 100\ s = 1.667\ min$

(b) $f = 25$ parts/min

$\theta = 0.25$

$R_c = \frac{1}{T_c} = \frac{60}{10} = 6.0$ parts/min

The rate of delivery of components to the feed track is $f\theta = 6.25$ parts/min

The rate of increase of parts when the feeder-selector device is turned on is

$f\theta - R_c = 6.25 - 6.0 = 0.25$ parts/min

The time taken for the parts to reach the upper-sensor level from the lower-sensor level is

$(20-10)/0.25 = 40$ min

(c) Proportion of the feeder-selector being on is

$$\frac{40}{40+1.667} = 96\%$$

Proportion of the feeder-selector being off is 4%

7.9

(a) $q = q_i = 1\% = 0.01$, $m = m_i = 0.6$

$$Y = P_{ap} = \prod_{i=1}^{8} (1 - q_i + m_i q_i)$$

$$= (1 - q + mq)^8$$

$$= (1 - 0.01 + 0.01 \times 0.6)^8$$

$$= 0.9684 = 96.84\%$$

(b) $$T_p = T_c + \left[1 - \prod_{i=1}^{n} (1 - m_i q_i)\right] \cdot T_d$$

$$= T_c + \left[1 - (1 - mq)^n\right] T_d$$

$$= \frac{10}{60} + \left[1 - (1 - 0.6 \times 0.01)^8\right](3.0)$$

$$= 0.1667 + (0.047)(3.0) = 0.3077 \text{ min}$$

$$R_p = \frac{1}{T_p} = 3.250 \text{ assemblies/min}$$

$$R_{ap} = Y \cdot R_p = (0.9684)(3.25) = 3.147 \text{ good assemblies/min}$$

(c) $1 - 0.9684 = 0.0316 = 3.16\%$

(d) The unit cost of good assembly is

$$C_{pc} = \frac{C_m + C_L T_p + C_t}{Y} = \frac{0.60 + \left(\frac{90}{60}\right)(0.3077)}{0.9684} = 1.0962 \text{ dollars}$$

7.13 (continue)

(c) The problem is that the rate of delivery of components in station 4 is

$$f\theta = 20 \times 0.2 = 4.0 \text{ components/min}$$

This says that it takes 15 seconds to deliver one component in station 4. This duration is larger than the cycle time used in calculation of the average production time in (a).

(d) The cycle time used in calculating T_p should be no less than the rate of delivery of components to any of the work stations, thus $T_c = 15$ second and

$$T_p = 15 + 4.738 = 19.738 \text{ s}$$

$$R_p = \frac{1}{T_p} = \frac{3600}{19.738} = 182.4 \text{ assemblies/hr}$$

$$R_{ap} = Y \cdot R_p = (0.995)(182.4) = 181.5 \text{ good assemblies/hr}$$

7-13

(a) $T_p = T_c + \left[1 - \prod_{i=2}^{5}(1 - m_i q_i)\right] \cdot T_d$

$= (2+7) + [1 - (1-0.01\times1)(1-0.005\times0.6)$
$(1-0.02\times1)(1-0.01\times0.7)](2.0)(60)$

$= 9 + 4.738 = 13.738\ s = 0.229\ min$

$R_p = \frac{1}{T_p} = 4.367$ assemblies/min $= 262$ assemblies/hr

(b) $Y = P_{ap} = \prod_{i=2}^{5}(1 - q_i + m_i q_i)$

$= (1-0.01+0.01\times1)(1-0.005+0.005\times0.6)$
$(1-0.02+0.02\times1)(1-0.01+0.01\times0.7)$

$= (1)(0.998)(1)(0.997)$

$= 0.995$

The proportion of defective assemblies is

$P_{qp} = 1 - Y = 0.005 = 5\text{‰}$