ME 355 (Winter 2000)

Solutions for H.W. Set #5

6-5

(a) $E = \frac{T_c}{T_p} = T_c \cdot R_p$

$E = 0.95$, $R_p = 30{,}000$ units/yr $= \frac{30{,}000}{2{,}000}$ units/h $= 15$ units/h

$T_c = \frac{E}{R_p} = \frac{0.95}{15}(60) = 3.8$ minutes

$d = \frac{nT_c - T_{wc}}{nT_c} = \frac{n(3.8) - 21}{n(3.8)}$

$d = 0.06 \sim 0.10$

For $d = 0.06$, $n = 5.88$

For $d = 0.10$, $n = 6.14$

$\therefore n = 6$

(b) $f_p = \frac{1}{T_c} = \frac{V_c}{S_p}$, $T_t = \frac{L_s}{V_c}$

$T_t > T_c$ is required for worker process time variability.

Try $T_t = 1.5\,T_c = 5.7$ min

6.5 (b) continue

$$V_c = \frac{L_s}{T_t} = \frac{6}{5.7} = 1.053 \text{ ft/min}$$

This is not acceptable because V_c must be between 1.1 and 2.0 ft/min

Try $T_t = 1.3\,T_c = 4.94$ min

$$V_c = \frac{L_s}{T_t} = \frac{6}{4.94} = 1.215 \text{ ft/min}$$

This is an acceptable solution.

$$f_p = \frac{1}{T_c} = \frac{V_c}{S_p}$$

$$\frac{1}{3.8} = \frac{1.215}{S_p}$$

$$S_p = (1.215)(3.8) = 4.615 \text{ ft}$$

An acceptable solution is

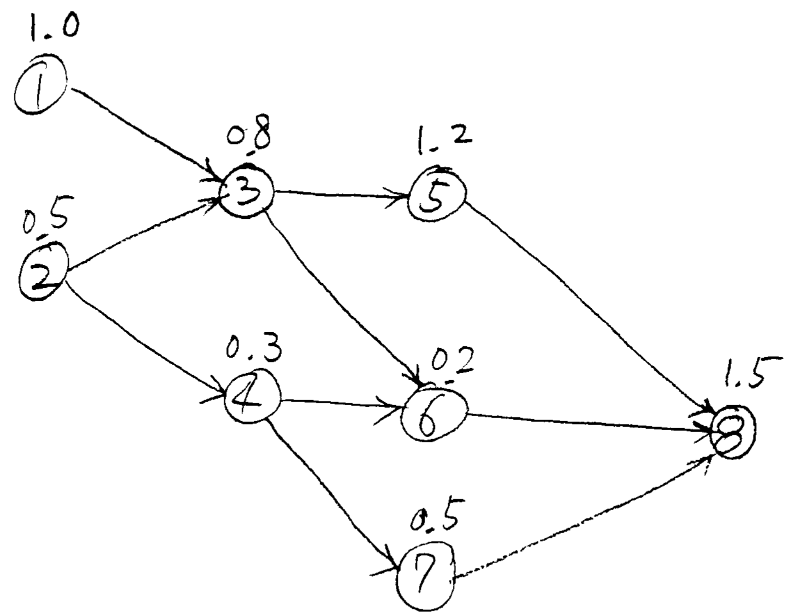
$T_t = 4.94$ min

$V_c = 1.215$ ft/min

$S_p = 4.615$ ft

6.11

(a) Precedence diagram



(b) List of work elements in decending T_e:

Work element	T_e (min)	Immediate predecessors
8	1.5	5, 6, 7
5	1.2	3
1	1.0	—
3	0.8	1, 2
2	0.5	—
7	0.5	4
4	0.3	2
6	0.2	3, 4

$$T_c = \frac{40 \times 60}{1600} = 1.5 \text{ min}$$

Largest-candidate rule:

station	element	T_e	ΣT_e
1	1	1.0	
	2	0.5	1.5
2	3	0.8	
	4	0.3	
	6	0.2	1.3
3	5	1.2	1.2
4	7	0.5	0.5
5	8	1.5	1.5

The balance delay is

$$d = \frac{nT_c - T_{wc}}{nT_c} = \frac{5 \times 1.5 - 6.0}{5 \times 1.5} = 20\%$$

6-11 (b) continue.

For the assembly line, the uniform annual cost is

$$UAC = IC\,(A/P,\ i\%,\ n) + NACF$$

$$= 20{,}000\,(A/P,\ 10\%,\ 3) + 5 \times 50 \times 40 \times 5$$

$$= 20{,}000 \times 0.4021 + 50{,}000$$

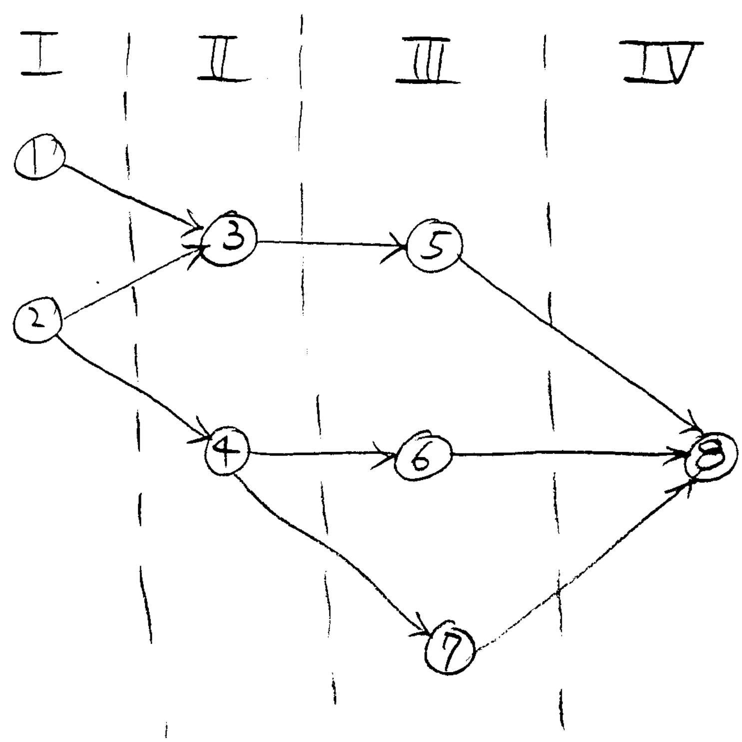
$$= 58{,}042$$

For individual manual workers,

$$UAC = 8 \times 50 \times 40 \times 5 = 80{,}000$$

The assembly line is justifiable.

6.12



List of work elements according to column:

Work element	column	T_e
1	I	1.0
2	I	0.5
3	II	0.8
4	II	0.3
5	III	1.2
6	III	0.2
7	III	0.5
8	IV	1.5

Kilbridge and Webster's method:

station	Element	T_e	ΣT_e
1	1	1.0	
	2	0.5	1.5
2	3	0.8	
	4	0.3	
	6	0.2	1.3
3	5	1.2	1.2
4	7	0.5	0.5
5	8	1.5	1.5

The solution is the same as that obtained using the largest candidate rule.