

Chapter 6

Multiple Product Factory Models

6.1. (a) One machine needed at each station.

(b)

WS	Arrival Rate	Cycle Time	WIP
#1	1.299/hr	6.260 hr	8.132
#2	1.035/hr	3.878 hr	4.015
#3	1.363/hr	5.202 hr	7.090
System	0.5/hr	38.473 hr	19.236

6.3.

WS	Arrival Rate	Cycle Time	WIP
#1	10.555/hr	0.485 hr	5.119
#2	10.555/hr	0.382 hr	4.032
#3	5.555/hr	0.485 hr	2.692
#4	5.000/hr	1.845 hr	9.227
System	5.000/hr	4.214 hr	21.071

6.5.

WS	Arrival Rate	Queue Time	Cycle Time	WIP
#1	0.560/hr	6.524 hr	11.181 hr	6.262
#2	0.496/hr	13.414 hr	15.249 hr	7.564
#3	0.320/hr	9.670 hr	17.670 hr	5.654
System	0.320/hr		60.843 hr	19.479

$$th_s^1 = 0.064/\text{hr}, \quad th_s^2 = 0.096/\text{hr}, \quad th_s^3 = 0.08/\text{hr}, \quad th_s^4 = 0.08/\text{hr}$$

$$CT_s^1 = 57.83 \text{ hr}, \quad CT_s^2 = 70.65 \text{ hr}, \quad CT_s^3 = 69.65 \text{ hr}, \quad CT_s^4 = 42.81 \text{ hr}$$

6.7.

- (a)
 (b) $E[T_e(2, 1)] = 0.1111$ hr
 (c) $C_e^2(2, 1) = 3.7125$
 (d) $E[T_e(1)] = 0.1224$ hr and $C_e^2(1) = 3.1822$
 (e)

Workstation	1	2	3
Workload	1.3914	0.8437	0.7603
Min. Machines	2	1	1

- (f) $p_{21} = 0.1246$
 (g) $C_a^2(1) = 1.0798$
 (h) $CT_q(2) = 0.9417$ hr, $CT(2) = 1.0211$ hr $WIP(2) = 10.8398$
 (i) $WIP_s = 22.3968$ and $CT_s = 2.240$ hr
 (j) $th_s^1 = 5$ /hr, $th_s^2 = 5$ /hr, $CT_s^1 = 2.5465$ hr, $CT_s^2 = 1.9328$ hr

6.9.

- (a)
 (b) $E[T_s(2)] = 0.0746$ hr and $C_s^2(2) = 1.244$
 (c) $E[T_e(1)] = 0.127$ hr and $C_e^2(1) = 3.137$
 (d) $p_{31} = 0.178$
 (e)

Workstation	1	2	3	4
Workload	1.435	0.8167	0.787	0.7584
Min. Machines	2	1	1	1

- (f) $C_a^2(1) = 1.095$
 (g) $CT_q(3) = 0.774$ hr, $CT(3) = 0.861$ hr $WIP(3) = 7.789$
 (h) $WIP_s = 25.985$ and $CT_s = 3.712$ hr
 (i) $th_s^1 = 4$ /hr, $th_s^2 = 3$ /hr, $CT_s^1 = 4.394$ hr, $CT_s^2 = 2.799$ hr

6.12.

The second row of the table associated with Problem 6.12 should refer to Job Type 2 instead of Job Type 1.

6.13.

This problem refers to Problem 6.12. Please note that the second row of the table associated with that should refer to Job Type 2. Also note that for this problem, the two machines of Workstation 2 are reallocated so that each cell gets one machine.

$WIP_s = 42.643$ and $CT_s = 5.330$ hr.

$th_s^1 = 5$ /hr, $th_s^2 = 3$ /hr, $CT_s^1 = 3.992$ hr, $CT_s^2 = 7.561$ hr

Separating the two machines yields a mean factory cycle time of 5.330 hr which is a 4.3% improvement, although there is a slight increase in the mean cycle time for Product 2.