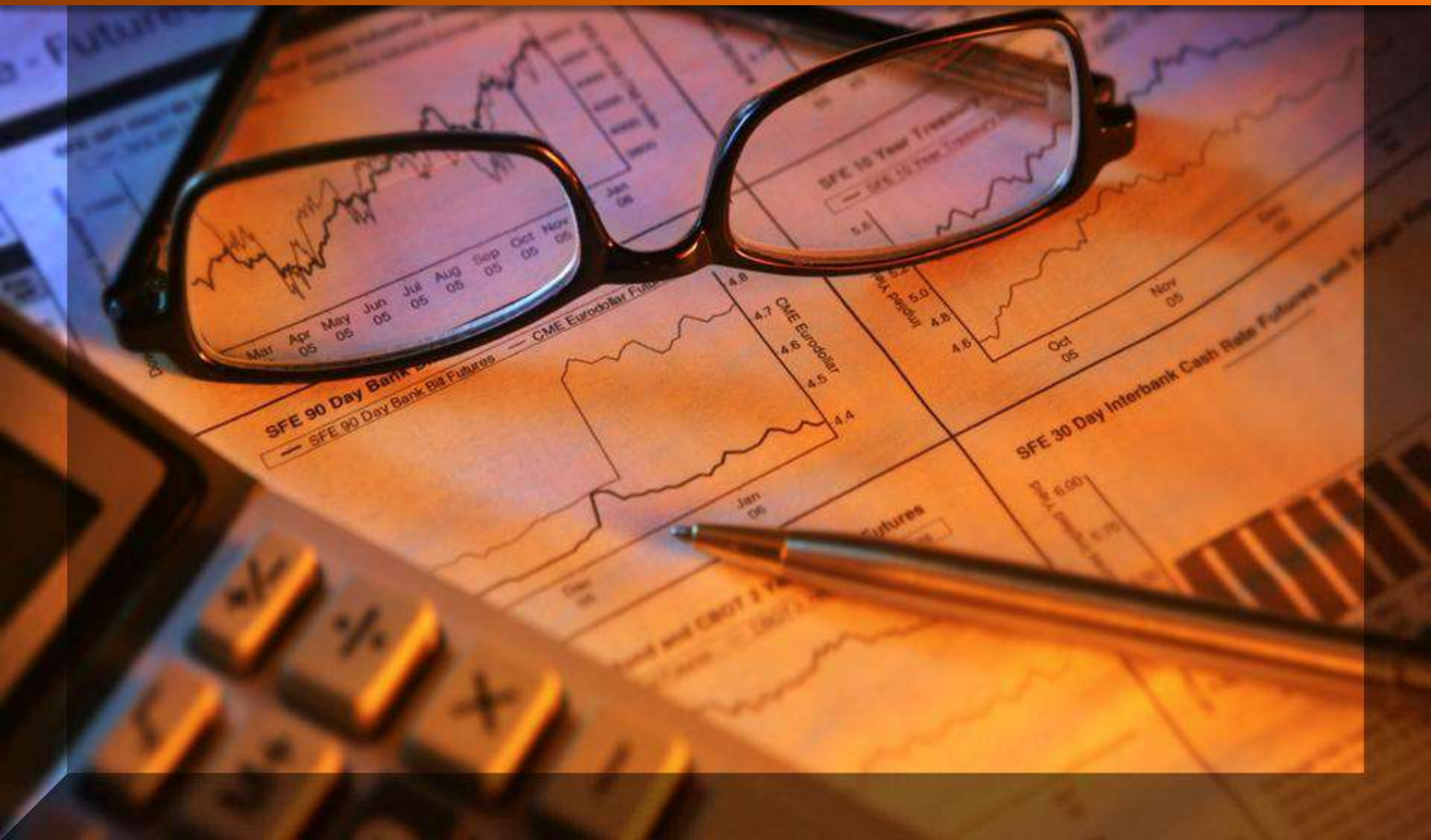
IE 314: Operations Management II

Assembly-Line Balancing

Lecture 5

KAMAL



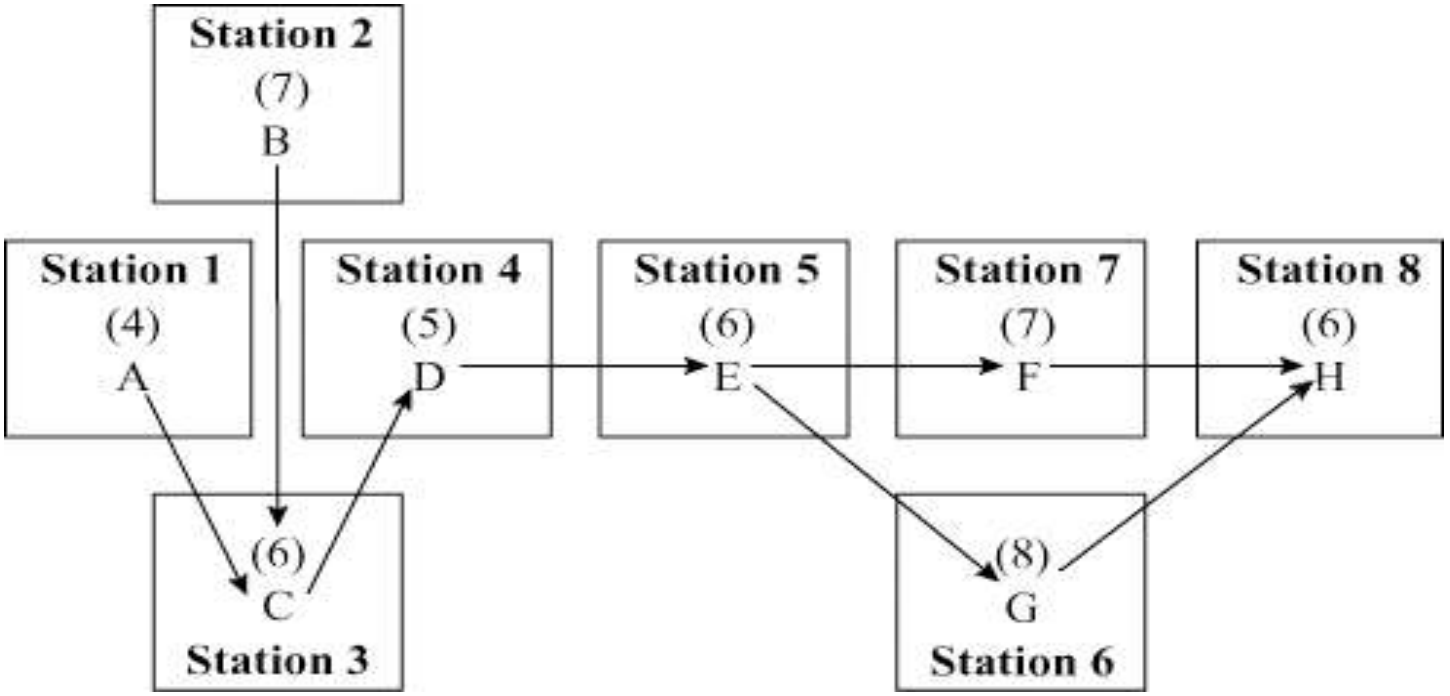
A drug company has a daily demand of 40 units, and they work 8 hours a day. Shown in the table the tasks to make the drug. Balance the line.

Task	Time (min)	Subseq.
A	4	-
B	2	A
C	3	B
D	6	A
E	1	D
F	6	C, E
G	8	F
H	2	F
I	5	F
J	6	H
K	4	G, I, J

• • • **9.12** South Carolina Furniture, Inc., produces all types of office furniture. The "Executive Secretary" is a chair that has been designed using ergonomics to provide comfort during long work hours. The chair sells for $130. There are 480 minutes available during the day, and the average daily demand has been 50 chairs. There are eight tasks:

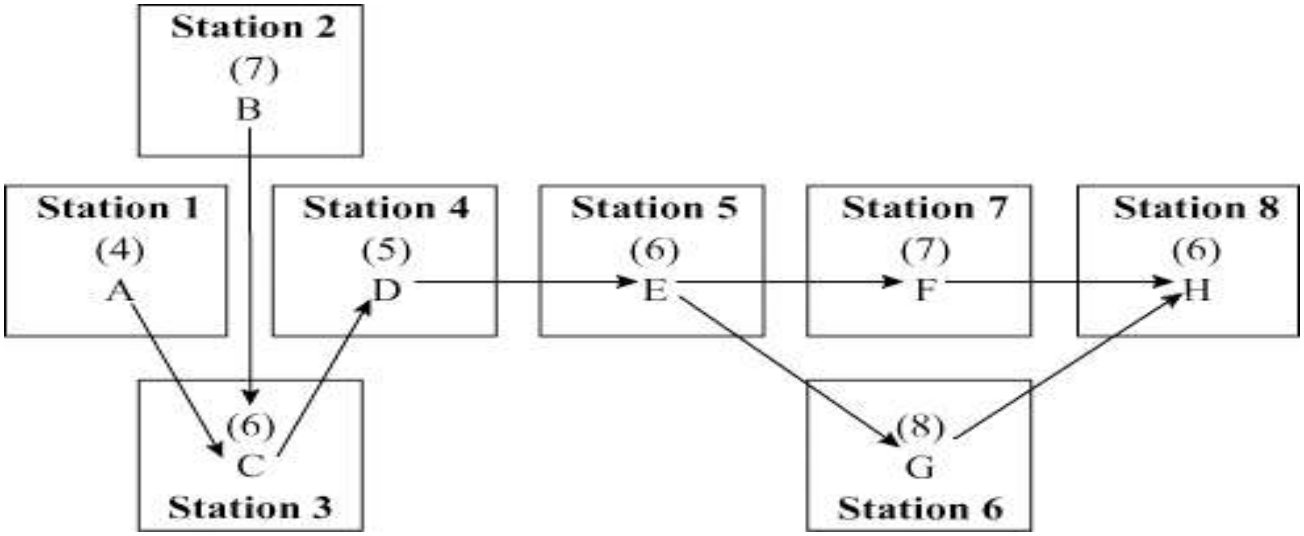
Task	Performance Time (min)	Task Must Follow Task Listed Below
A	4	—
B	7	—
C	6	A, B
D	5	C
E	6	D
F	7	E
G	8	E
H	6	F, G

a) Draw a precedence diagram of this operation.
b) What is the cycle time for this operation?
c) What is the *theoretical* minimum number of workstations?
d) Assign tasks to workstations.
e) What is the idle time per cycle?
f) How much total idle time is present each day?
g) What is the overall efficiency of the assembly line? PX



(b) $\text{Cycle time} = \dfrac{480 \text{ minutes}}{50 \text{ units}} = 9.6 \text{ minutes}$

(c) $\text{Theoretical minimum number of stations} = \dfrac{\sum t_i}{\text{cycle time}} = \dfrac{49}{9.6} = 5.1 = 6 \text{ stations}$



(e) Total idle time/cycle = 4 + 1 + 2 + 3 + 2 + 1 + 2 = 15 mins per cycle

(f) Total idle time/day. Since there are 480 mins, and each chair takes 8 mins (which is the longest
operation time), there are 480/8 = 60 cycles/day.

Total idle time = 15 mins/cycle × 60 cycles = 900 min = 15 hrs

(g) Efficiency = 49 mins/ (8 stations * 8 mins) = 0.766 = 76.6 %

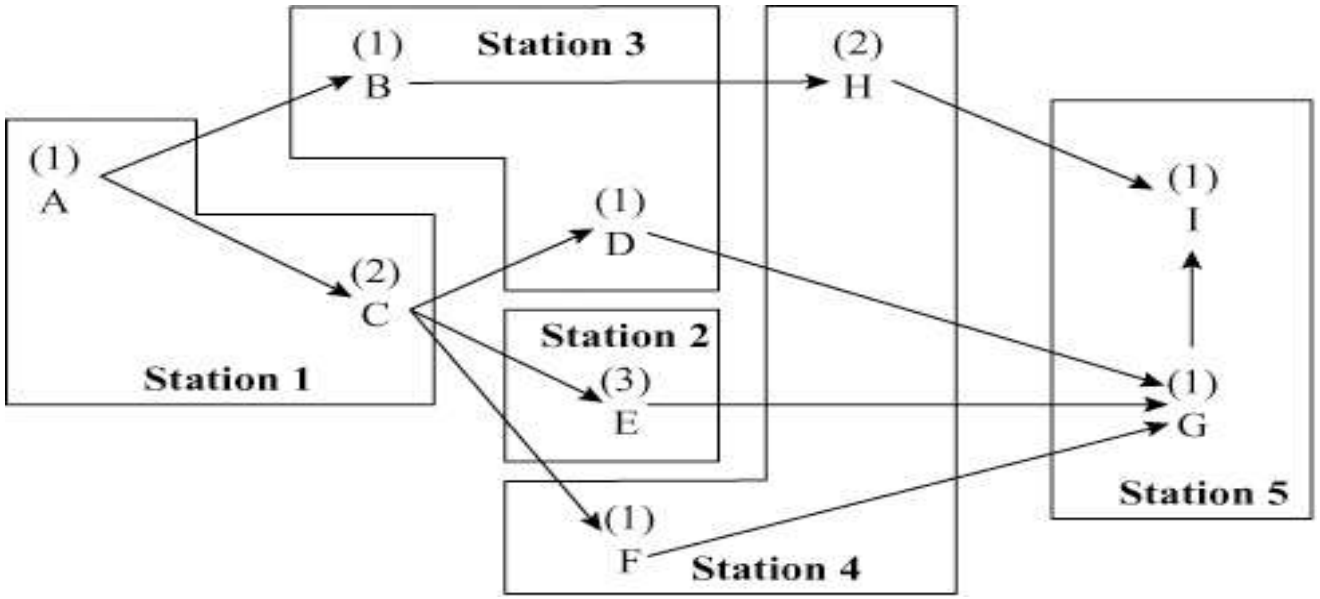
•• **9.17** The Mach 10 is a one-person sailboat manufactured by Creative Leisure. The final assembly plant is in Cupertino, California. The assembly area is available for production of the Mach 10 for 200 minutes per day. (The rest of the time it is busy making other products.) The daily demand is 60 boats. Given the following information,

a) Draw the precedence diagram and assign tasks using five workstations.
b) What is the efficiency of the assembly line, using your answer to (a)?
c) What is the *theoretical* minimum number of workstations?
d) What is the idle time per boat produced? PX

Task	Performance Time (min)	Task Must Follow Task Listed Below
A	1	—
B	1	A
C	2	A
D	1	C
E	3	C
F	1	C
G	1	D, E, F
H	2	B
I	1	G, H

(a) Cycle Time = 200 mins/ 60 = 3.33 mins

(b) Minimum number of Worstations = 13 / 3.33 = 3.9 ≈ 4 Workstations



(c) Theoritical Efficiency = 13 mins/ (5 stations * 3.33 mins) = 0.78 = 78%

Actual Efficiency = 13 / (5 * 3) = 0.867 = 86.7%

(d) Idle time = 1 (at station 3) + 1 (at station 5) = 2 mins per boat

EXERCISE 9.18

•• **9.18** Because of the expected high demand for Mach 10, Creative Leisure has decided to increase manufacturing time available to produce the Mach 10 (see Problem 9.17).

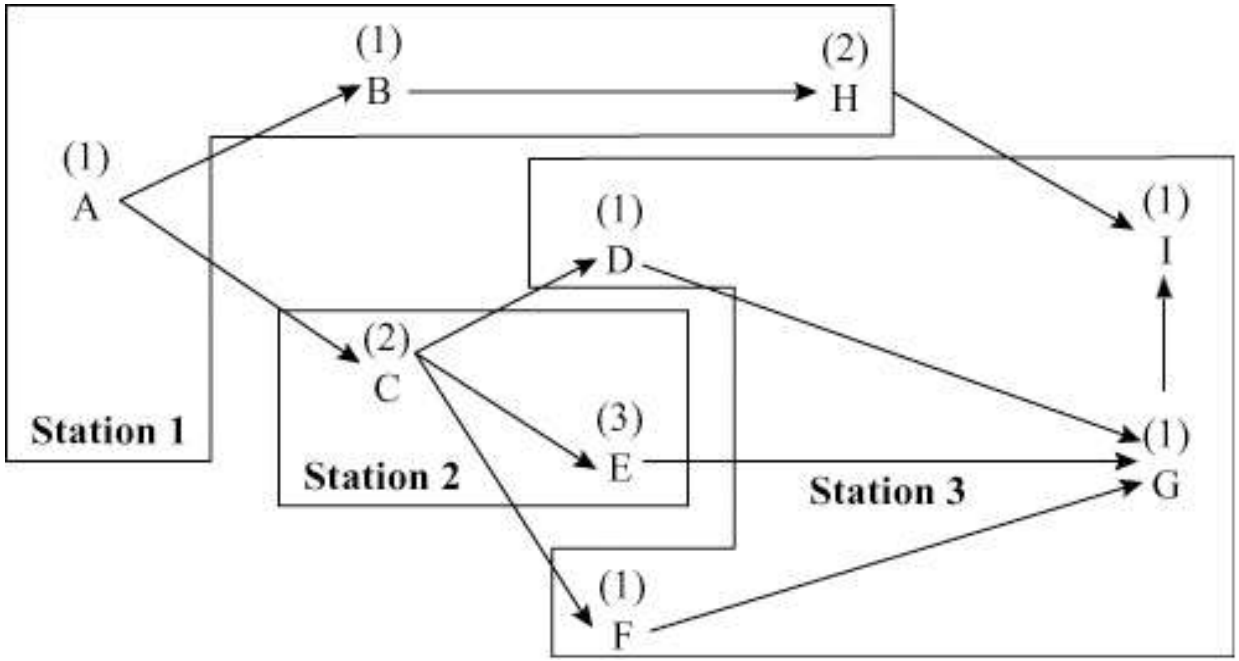
a) If demand remained the same but 300 minutes were available each day on the assembly line, how many workstations would be needed?

b) What would be the efficiency of the new system?

c) What would be the impact on the system if 400 minutes were available? PX

(a) Cycle Time = 300 mins/ 60 = 5 mins

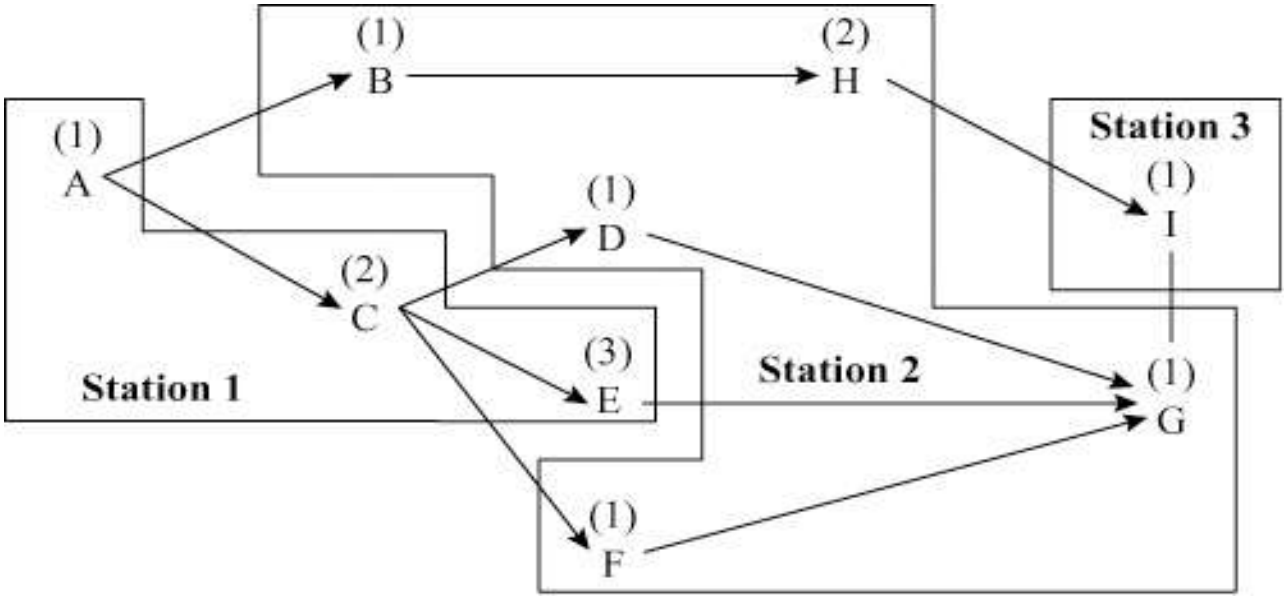
Minimum number of Worstations = 13 / 5 = 2.6 ≈ 3 Workstations



(b) Efficiency = 13 mins/ (3 stations * 5 mins) = 0.867 = 86.7%

(c) Cycle Time = 400 mins/ 60 = 6.67 mins

Minimum number of Worstations = 13 / 6.67 = 1.95 ≈ 2 Workstations



(b) Theoritical Efficiency = 13 mins/ (2 stations * 6.67 mins) = 0.649 = 64.9%

Actual Efficiency = 13 / (2 * 6) = 0.722 = 72.2%

Quiz

A company is designing a product layout for a new product. It plans to use this production line eight hours a day in order to meet a schedule of 400 units per day. The tasks necessary to produce this product are detailed in the table below.

Task	Predecessor	Time (seconds)
A	-	50
B	A	36
C	-	26
D	-	22
E	B, D	70
F	C, E	30

a.Draw the network described in the table.

b.Without regard to a production schedule, what is the minimum possible cycle time (in seconds) for this situation; what is the maximum?

c.What is the required cycle time (in seconds) in order to meet the schedule?

d.What is the theoretical minimum number of workstations needed to meet the schedule?

e. Balance this line using shortest processing time, longest processing time, Ranked positional weight and compare.

f. What is the efficiency of the balance obtained?