



# FACILITY LAYOUT

*by*

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# Plant Layout

Plant layout refers to the arrangement of machinery, equipment and other industrial facilities for achieving quickest and smoothest production at the least cost.

## ➤ Objectives of a Good Layout

- Improving productivity is the overall objective of good layout.

# Factors Influencing facility Layout

- Materials
- Product
- Worker
- Machinery
- Types of Industry
- Managerial Policies

# Principles of Layout

- Principle of Minimum Travel
- Principle of Sequence
- Principle of Usage
- Principle of Safety and Satisfaction
- Principle of Flexibility
- Principle of Minimum Investment

# Types of Layout

- i. Workcenter**(also called as Process layout or functional layout or job shop layout)
- ii. Assembly Line** (also called Product layout or *flow-shop layout*)
- iii. Manufacturing cell Layout** (Group Technology layout or Cellular manufacturing (CM) )
- iv. Project Layout** (fixed position layout)

# Process layout

- The most common approach to developing a process layout is to arrange departments consisting of like processes in a way that optimizes their relative placement.
- Eg: Suppose that we want to arrange the eight departments of a toy factory to minimize the interdepartmental material handling cost.
  - 40 feet by 40 feet, building is 80 feet wide & 160 feet long.
  - Nature of the flow b/w the dept & how the materials are transported.
  - All materials are transported in a std size crate by forklift truck, one crate to a truck (which constitutes one load)
  - Now suppose that a transportation cost  $s$  are Re 1 to move a load between adjacent dept and Re 1 extra for each department in between.
  - The expected loads between department for the first year of operation are tabulated in table.

### Flow between Workcenters (Number of Moves)

### Workcenter

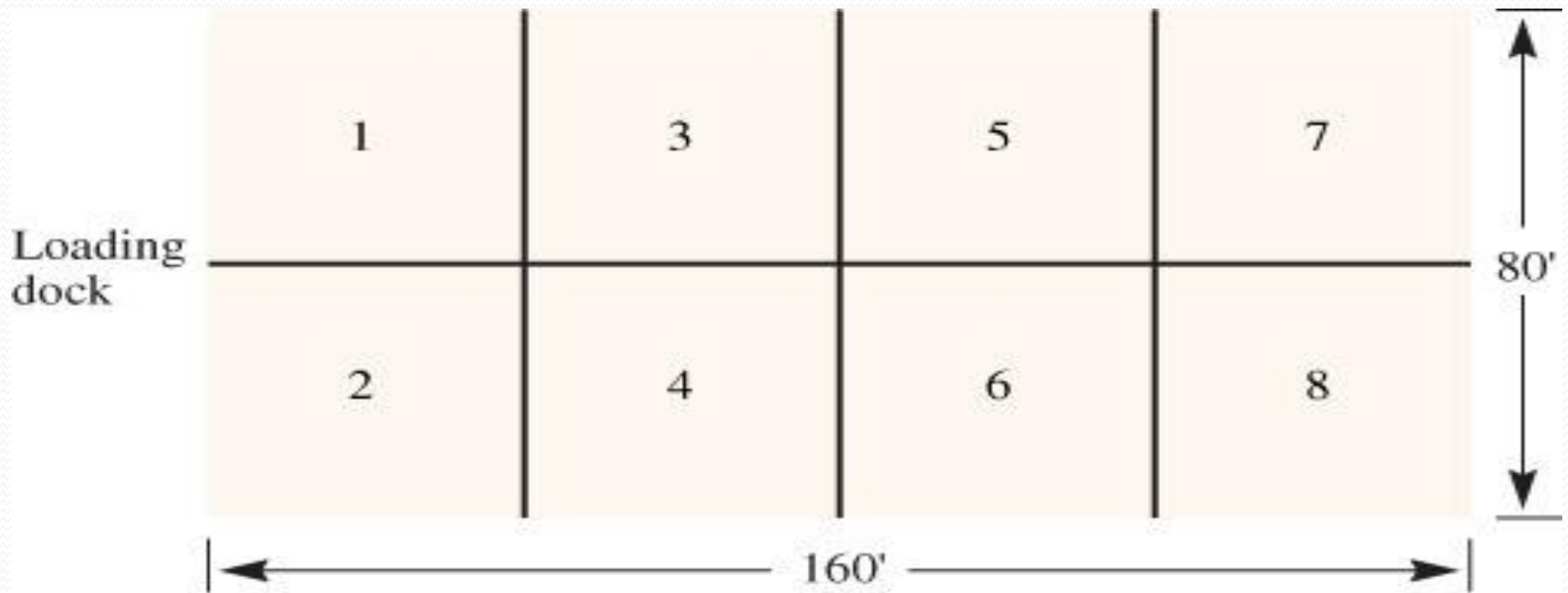
### Activity

1    2    3    4    5    6    7    8

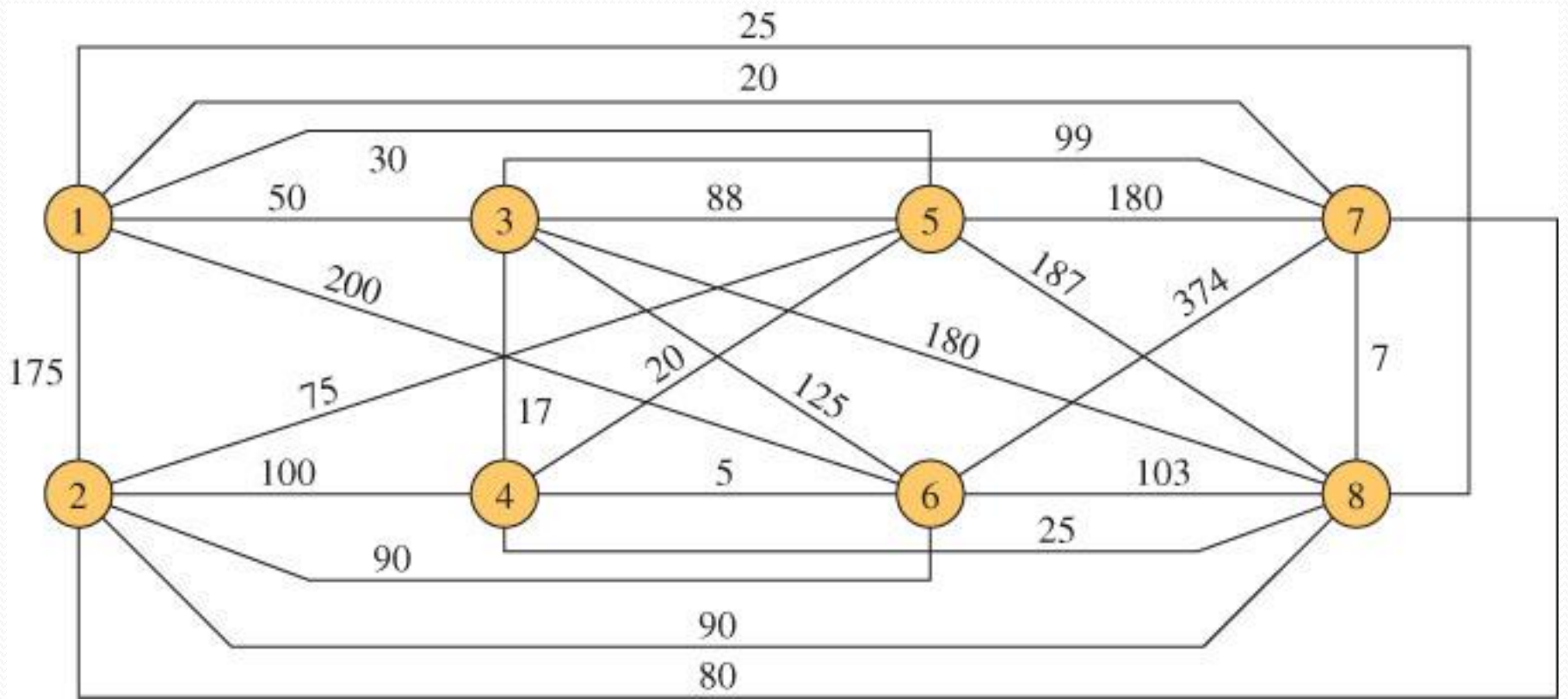
1		175	50	0	30	200	20	25
2			0	100	75	90	80	90
3				17	88	125	99	180
4					20	5	0	25
5						0	180	187
6							374	103
7								7
8								

1
2
3
4
5
6
7
8

Shipping and receiving
Plastic molding and stamping
Metal forming
Sewing department
Small toy assembly
Large toy assembly
Painting
Mechanism assembly

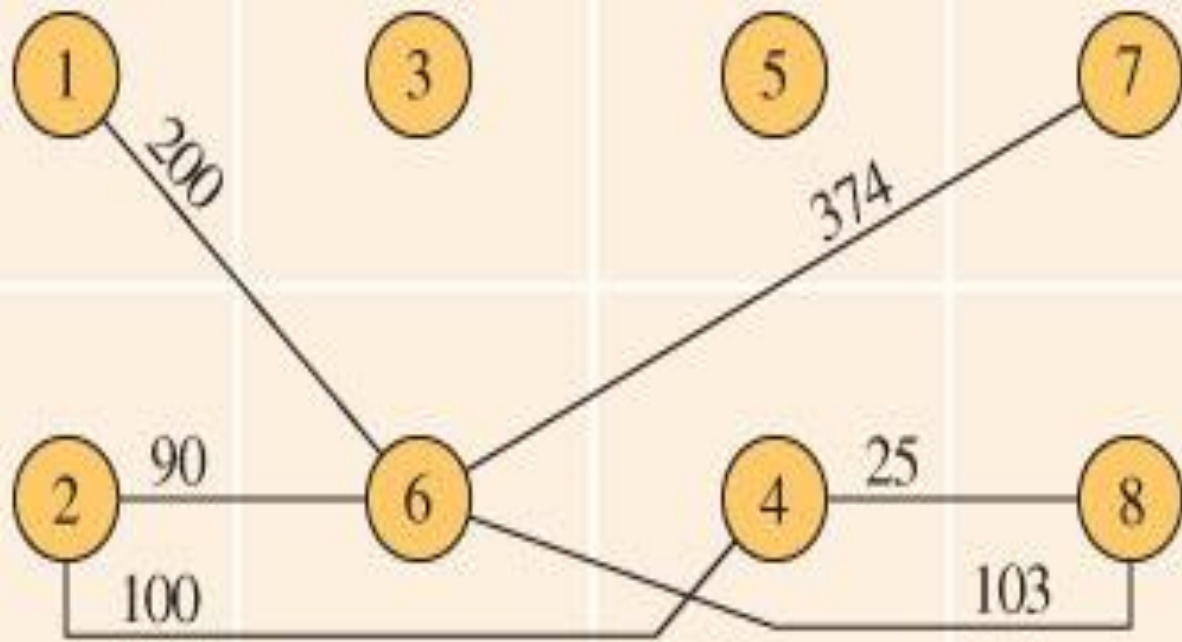






S	1	2	3	4	5	6	7	8
1		175	50	0	60	400	60	75
2			0	100	150	180	240	270
3				17	88	125	198	360
4					20	5	0	50
5						0	180	187
6							374	103
7								7
8								

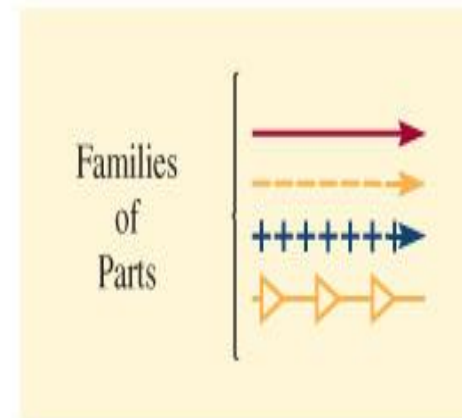
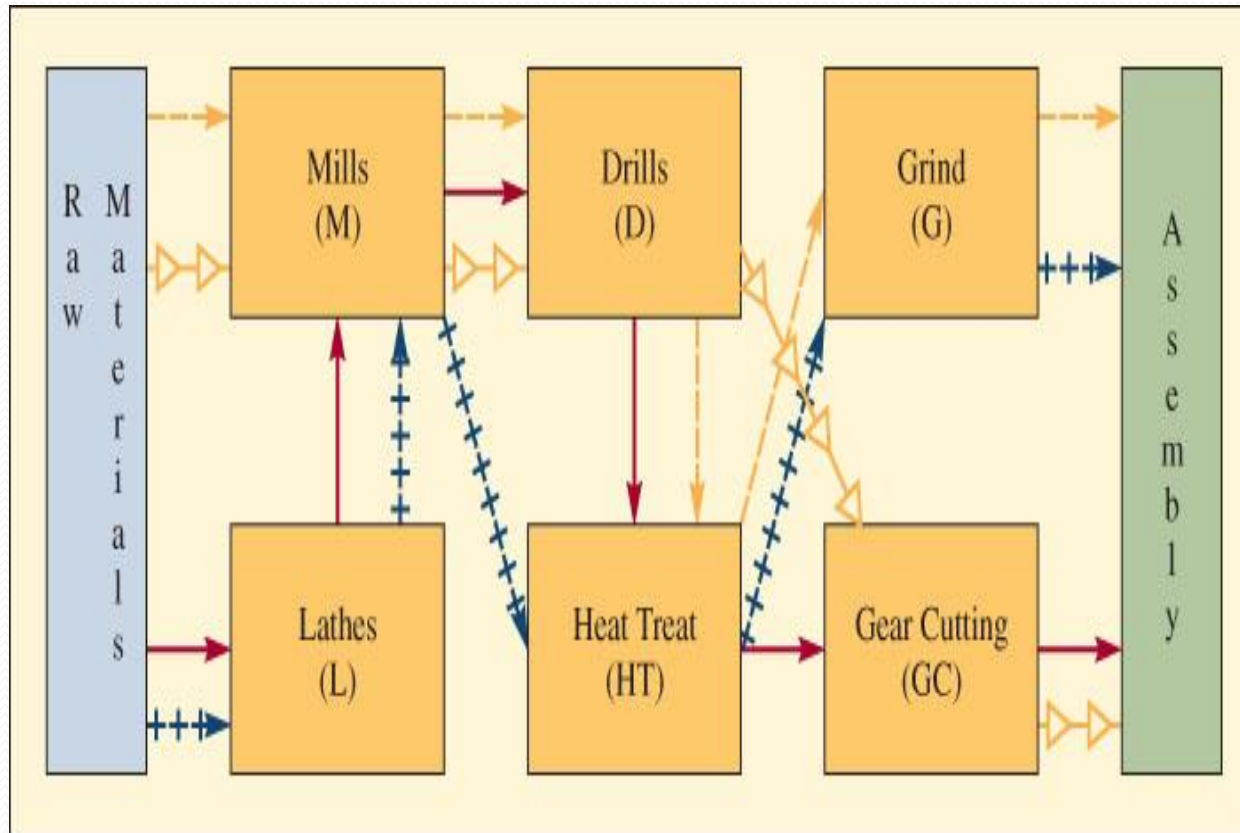
Total cost: \$3,474









	1	2	3	4	5	6	7	8	Net cost change
1		175	50	0	60	200	60	75	-\$200
2			0	200	150	90	240	270	+ 10
3				17	88	125	198	360	
4					20	5	0	25	- 25
5						0	180	187	
6							748	206	+ \$374, + \$103
7								7	
8									
									+ \$262
									Total cost: \$3,736

Small toy assembly 5	Mechanism assembly 8	Shipping and receiving 1	Large toy assembly 6
Metal forming 3	Plastic molding and stamping 2	Sewing 4	Painting 7

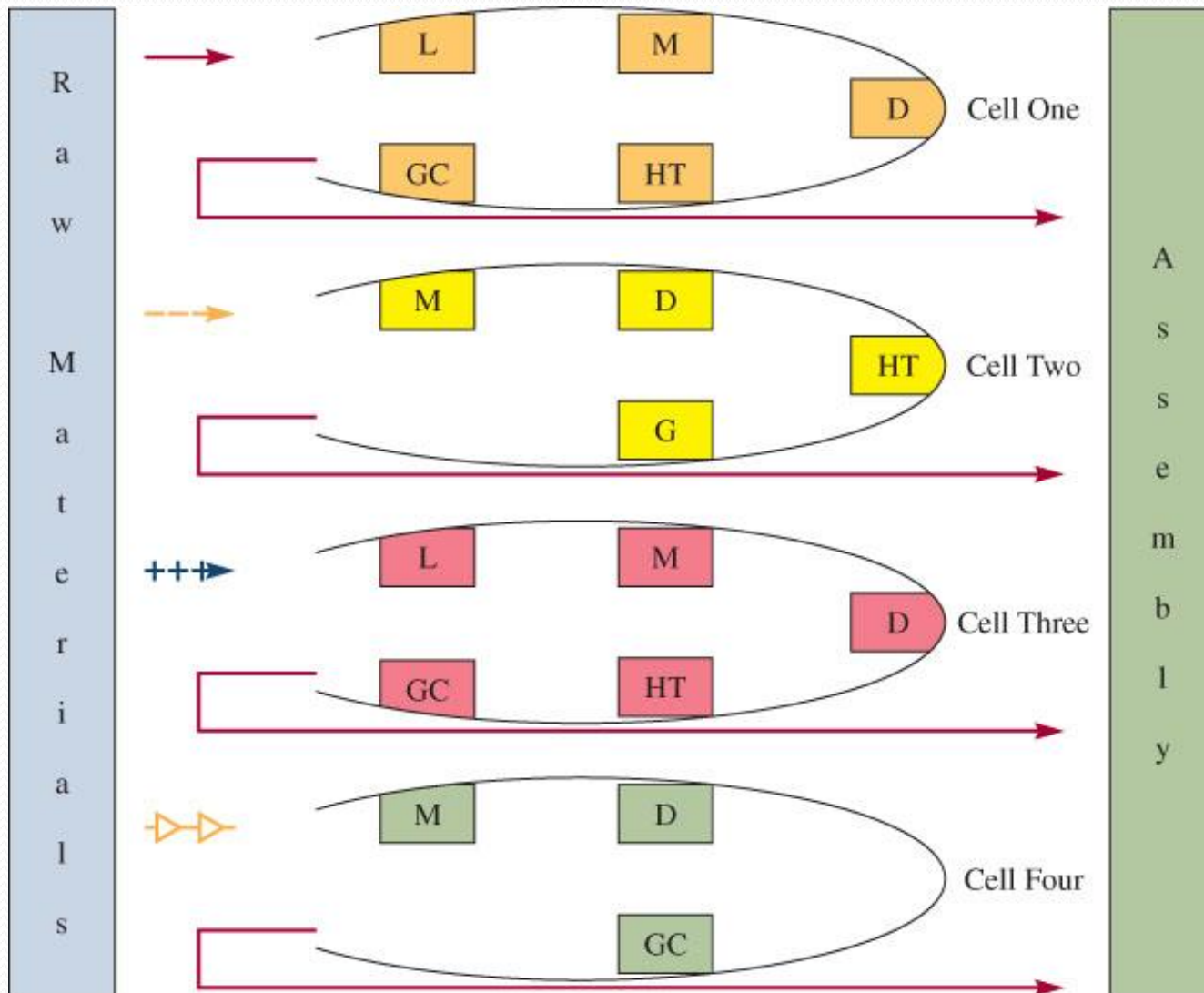
# Cellular Layout



# Routing matrix based upon flow of work

Raw Materials	Part Family	Lathes	Mills	Drills	Heat Treating	Grinders	Gear Cutting	To	Assembly
		X	X	X	X		X		
			X	X	X	X			
		X	X	X	X		X		
			X	X			X		

# Reallocating Machines to form cells according to part family processing requirements.



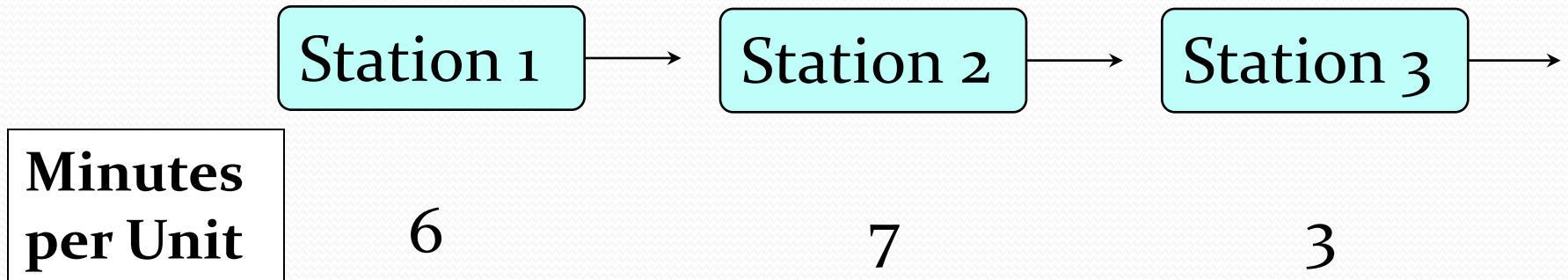


# Assembly Lines Balancing

- Assigning all tasks to a series of workstations so that each workstation has no more than that can be done in the work station cycle time and so that the unassigned or idle time across the work station is minimized.

# Assembly Lines Balancing Concepts

**Question:** Suppose you load work into the three work stations below such that each will take the corresponding number of minutes as shown. What is the cycle time of this line?



- Answer:** The cycle time of the line is always determined by the work station taking the longest time. In this problem, the cycle time of the line is 7 minutes. There is also going to be idle time at the other two work stations.

# Example of Line Balancing

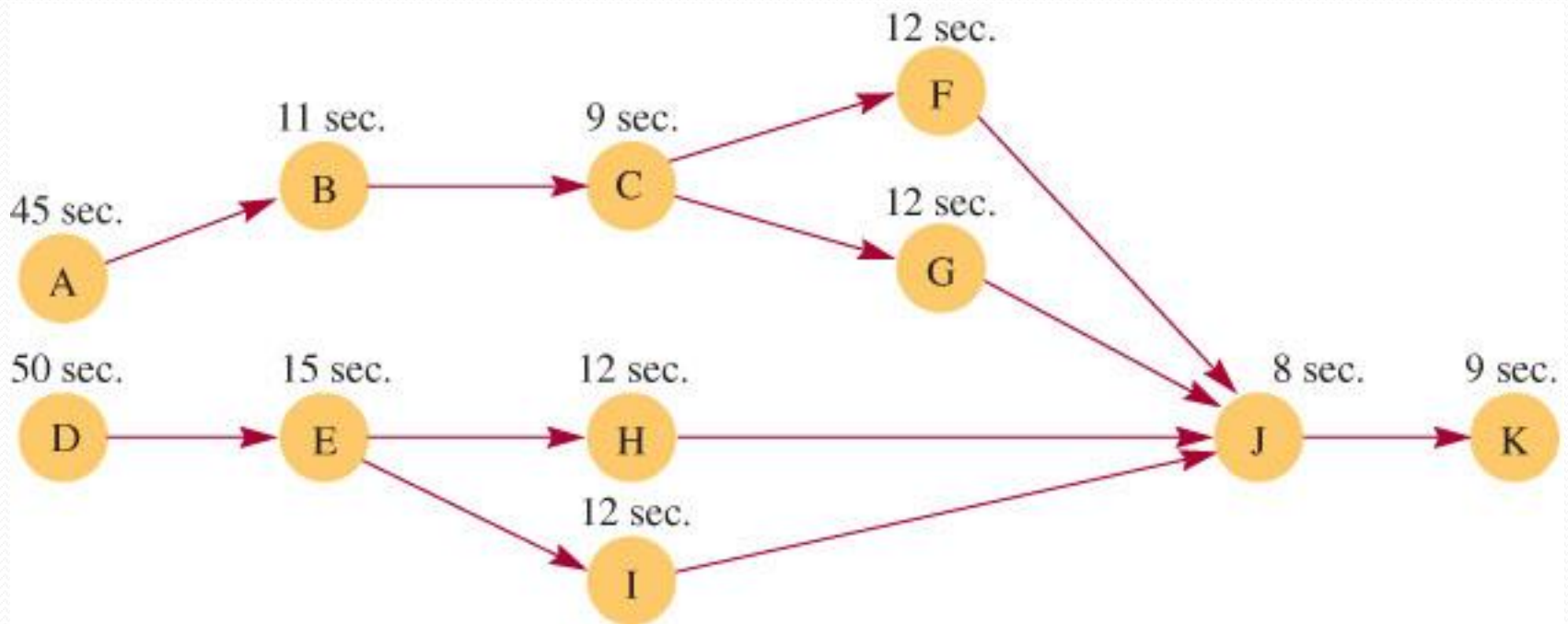
- You've just been assigned the job of setting up an electric fan assembly line with the following tasks:

Task	Time (Mins)	Description	Predecessors
A	2	Assemble frame	None
B	1	Mount switch	A
C	3.25	Assemble motor housing	None
D	1.2	Mount motor housing in frame	A, C
E	0.5	Attach blade	D
F	1	Assemble and attach safety grill	E
G	1	Attach cord	B
H	1.4	Test	F, G

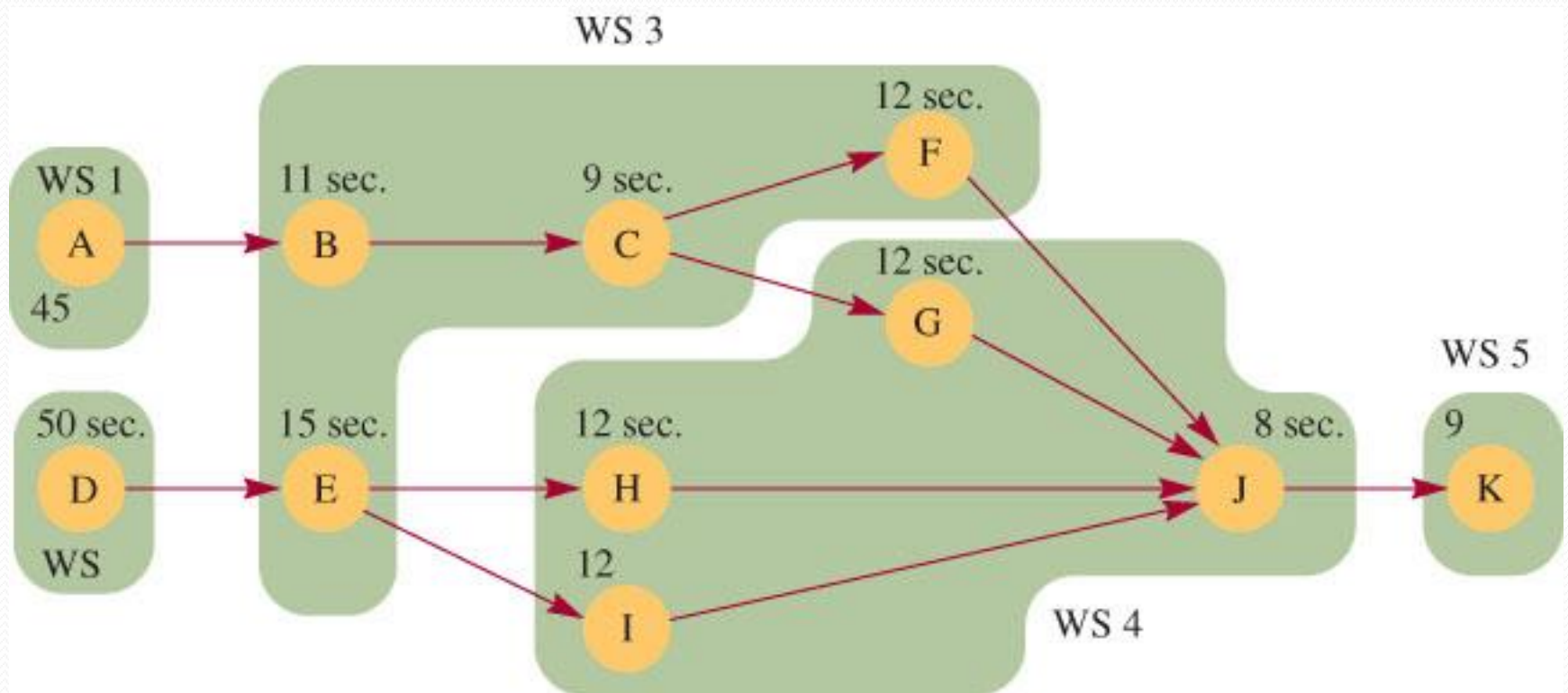
The Model J Wagon is to be assembled on a conveyor belt. 500 wagons are required per day. Production time per day is 420 minutes, & the assembly steps & times for the wagon are given in table below. Find the balance that minimizes the number of workstations, subject to cycle time.

TASK	TASK TIME (IN SECONDS)	DESCRIPTION	TASKS THAT MUST PRECEDE
A	45	Position rear axle support and hand fasten four screws to nuts.	—
B	11	Insert rear axle.	A
C	9	Tighten rear axle support screws to nuts.	B
D	50	Position front axle assembly and hand fasten with four screws to nuts.	—
E	15	Tighten front axle assembly screws.	D
F	12	Position rear wheel #1 and fasten hubcap.	C
G	12	Position rear wheel #2 and fasten hubcap.	C
H	12	Position front wheel #1 and fasten hubcap.	E
I	12	Position front wheel #2 and fasten hubcap.	E
J	8	Position wagon handle shaft on front axle assembly and hand fasten bolt and nut.	F, G, H, I
K	9	Tighten bolt and nut.	J
	<u>195</u>		

# Precedence Graph for Model J Wagon



# Precedence Graph for Model J Wagon



# Sources:

- Chase R. B. ,Jacobs F. R , Aquilano N.J. and Agarwal N. K., Operations Management for competitive Advantage,11<sup>th</sup> edition, Tata McGraw Hill.
- Russell, Roberta S. and Taylor, Bernard W., Operations Management along the supply chain, John Wiley and Sons (Wiley India).



*Thank you*