Capacity Layout

1-

DEVELOPING A PRECEDENCE DIAGRAM FOR AN ASSEMBLY LINE

a- Boeing wants to develop a precedence diagram for an electrostatic wing component that requires a total assembly time of 65 minutes.

Staff gather tasks, assembly times, and sequence requirements for the component in Table 9.2 .

TABLE 9.2	Precedence Data for Wing Component		
TASK	ASSEMBLY TIME (MINUTES)	TASK MUST FOLLOW TASK LISTED BELOW	
A	10	—	This means that tasks B and E cannot be done until task A has been completed.
B	11	A	
C	5	B	
D	4	B	
E	11	A	
F	3	C, D	
G	7	F	
H	11	E	
I	3	G, H	
	Total time 65		

b-

On the basis of the precedence diagram and activity times given, Boeing determines that there are 480 productive minutes of work available per day. Furthermore, the production schedule requires that 40 units of the wing component be completed as output from the assembly line each day. It now wants to group the tasks into workstations.

Following the three steps above, we compute the cycle time using Equation (9-4) and minimum number of workstations) , and we assign tasks to workstations—in this case using the most following tasks heuristic.

c- DETERMINING LINE EFFICIENCY

b-

This is a reasonably well-balanced assembly line. The second and third workstations use 11 minutes. The fourth workstation groups three small tasks and balances perfectly at 12 minutes. The fifth has 1 minute of idle time, and the sixth (consisting of tasks G and

I) has 2 minutes of idle time per cycle. Total idle time for this solution is 7 minutes per cycle.

If task I required 6 minutes (instead of 3 minutes), how would this change the solution?

c-solution

2- AERO MAINTENANCE

Aero Maintenance is a small aircraft engine maintenance facility located in Wichita, Kansas. Its new administrator, Ann Daniel, decides to improve material flow in the facility, using the process layout method she studied at Wichita State University. The current layout of Aero Maintenance's eight departments is shown in Figure 9.14 .
 The only physical restriction perceived by Daniel is the need to keep the entrance in its current location. All other departments can be moved to a different work area (each 10 feet square) if layout analysis indicates a move would be beneficial.
 First, Daniel analyzes records to determine the number of material movements among departments in an average month. These data are shown in Figure 9.15 . Her objective, Daniel decides, is to lay out the departments so as to minimize the total movement (distance traveled) of material in the facility. She writes her objective as:

$$\text{Minimize material movement} = \sum_{i=1}^{8} \sum_{j=1}^{8} X_{ij} C_{ij}$$

where X_{ij} = number of material movements per month (loads or trips) moving from department i to department j
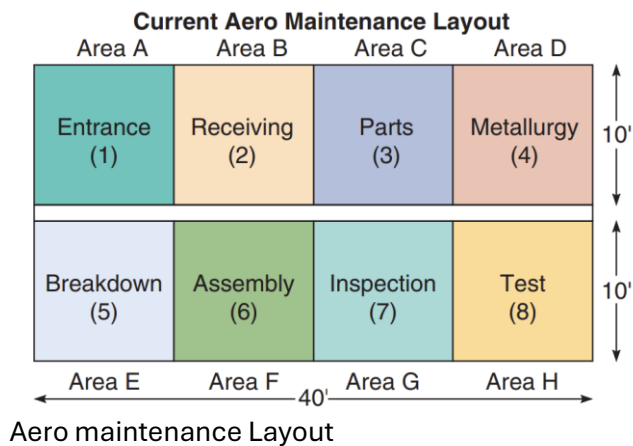
C_{ij} = distance in feet between departments i and j (which, in this case, is the equivalent of cost per load to move between departments)

(which, in this case, is the equivalent of cost per load to move between departments)
Daniel assumes that adjacent departments, such as entrance (now in work area A) and receiving (now in work area B), have a walking distance of 10 feet. Diagonal departments are also considered adjacent and assigned a distance of 10 feet.
Nonadjacent departments, such as the entrance and parts (now in area C) or the entrance and inspection (area G) are 20 feet apart, and nonadjacent rooms, such as entrance and metallurgy (area D), are 30 feet apart. (Hence, 10 feet is considered 10 units of cost, 20 feet is 20 units of cost, and 30 feet is 30 units of cost.)

Given the above information, redesign Aero Maintenance's layout to improve its material flow efficiency.

Current Aero Maintenance Layout

Area A	Area B	Area C	Area D
Entrance (1)	Receiving (2)	Parts (3)	Metallurgy (4)
Breakdown (5)	Assembly (6)	Inspection (7)	Test (8)
Area E	Area F	Area G	Area H

Aero maintenance Layout

	Entrance (1)	Receiving (2)	Parts (3)	Metallurgy (4)	Breakdown (5)	Assembly (6)	Inspection (7)	Test (8)
Entrance (1)		100	100	0	0	0	0	0
Receiving (2)			0	50	20	0	0	0
Parts (3)				30	30	0	0	0
Metallurgy (4)					20	0	0	20
Breakdown (5)						20	0	10
Assembly (6)							30	0
Inspection (7)								0
Test (8)								

Number of material loads during one month between departments

b-Propose a new layout that will reduce the current figure of 6,700 feet. Two useful changes, for example, are to switch departments 3 and 5 and to interchange departments 4 and 6. This change would result in the schematic shown: