9 CHAPTER

Layout Strategy

DISCUSSION QUESTIONS

Discussion questions 1 through 18 appear in the text.

19. What are the three factors that complicate a fixed-position layout?

20. How would an analyst determine the number of trips between different processes in
    (a) a hospital?
    (b) a machine shop?
    (c) an auto repair shop?

21. What are the four assumptions or preconditions of establishing layout for high-volume, low-variety products?

22. What are the three forms of "work cells" discussed in the textbook?

23. What are the requirements for a focused work center or focused factory to be appropriate?

24. What are the two major trends influencing office layout?

25. What is "random stocking"?

26. Explain the concept of "cross docking".

PROBLEMS

Problems 9.1 through 9.20 appear in the text.

P : ***9.21*** Six processes are to be laid out in six rooms along a long corridor at James Wade Bookkeeping Service. The distance between adjacent work centers is 40 feet. The number of trips between work centers is given in the following table.

	Trips Between Rooms					
	To					
From	**A**	**B**	**C**	**D**	**E**	**F**
A		18	25	73	12	54
B			96	23	31	45
C				41	22	20
D					19	57
E						48
F						

(a) Assign the processes to the rooms in a way that minimizes the total flow using a method that places rooms with highest flow adjacent to each other.
(b) What assignment minimizes the total traffic flow?

P: 9.22 The Temple Toy Company has decided to manufacture a new toy tractor, the production of which is broken into six steps. The demand for the tractor is 4,800 units per 40 hour work week:

Task	Performance Time (in seconds)	Predecessors
A	20	None
B	30	A
C	15	A
D	15	A
E	10	B, C
F	30	D, E

(a) Draw a precedence diagram of this operation.
(b) Given the demand, what is the cycle time for this operation?
(c) What is the theoretical minimum number of work stations?
(d) Assign tasks to work stations
(e) What is the overall efficiency of the assembly line?

P: 9.23 The table below details the tasks required for Inderfurth Industries, Inc. (III) to manufacture a fully portable industrial vacuum cleaner. The times in the table are in minutes. Demand forecasts indicate a need to operate with a cycle time of 10 minutes.

Activity	Activity Description	Immediate Predecessors	Time
A	Attach wheels to tub	—	5
B	Attach motor to lid	—	1.5
C	Attach battery pack	B	3
D	Attach safety cutoff	C	4
E	Attach filters	B	3
F	Attach lid to tub	A, E	2
G	Assemble attachments	—	3
H	Function test	D, F, G	3.5
I	Final inspection	H	2
J	Packing	I	2

(a) Draw the appropriate network for this project.
(b) Which tasks are assigned to which workstation, and how much idle time is present?
(c) Discuss how this balance could be improved to 100 percent.

P: 9.24 Dr. Wu, operations manager at Nesa Electronics, prides herself on excellent assembly-line balancing. She has been told that the firm needs to complete 96 instruments per a 24 hour day.

The assembly line activities are:

Task	Time (in minutes)	Predecessors
A	3	None
B	6	None
C	7	A
D	5	A, B
E	2	B

Task	Time (in minutes)	Predecessors
F	4	C
G	5	F
H	7	D, E
I	1	H
J	6	E
K	4	G, I, J
	50	

(a) Draw the precedence diagram.
(b) If the daily (twenty-four hour) production rate is 96 units, what is the greatest possible cycle time?
(c) If the cycle time after allowances is given as 10 minutes, what is the daily (twenty-four hour) production rate?
(d) With a 10 minute cycle time, what is the theoretical minimum number of stations with which the line can be balanced?
(e) With a 10 minute cycle time and 6 work stations what is the efficiency?
(f) What is the total idle time per cycle with a 10 minute cycle time and 6 work stations?
(g) What is the best work station assignment you can make without exceeding a 10 minute cycle time and what is its efficiency?

CASE STUDY

COLLIER TECHNICAL COLLEGE

Collier Technical College, located in downtown Chicago, wishes to rent additional space in the suburbs for its Office Assistant, Network Technician, and Computer Technician certificate programs. The main campus is on Michigan Ave. in the heart of the city, but the satellite campus is to be in a suburb about 25 miles from the main campus. These additional programs will have eight 'departments' and therefore require a total of eight rooms, each about 1200 square feet in area. Two buildings have been found that meet the general criteria, and, surprisingly, they rent for almost the same amount. Building One is linear—eight rooms in a strip; the other is a two-story cube: four rooms above four rooms.

While it may seem that the college's problem is one of cost or of location, it really is not. Both locations are within the suburb where the location must be, and costs are practically the same, as are access, security, and parking. The decision boils down to layout—which of the two buildings can be used more efficiently to facilitate communication and movement of faculty, staff, and students.

The first building is an unoccupied strip shopping center and the building is 320 feet from left edge to right edge; each room is approximately 40 feet in width, and 30 feet in depth. Each of the eight rooms has a double door on the parking lot (front) side of the building. Each room has a single door facing the alleyway behind the building. The college plans that all faculty, staff, and students would use the double front doors, and that the rear doors would be emergency exits only.

Building Rear

Room A	Room B	Room C	Room D	Room E	Room F	Room G	Room H

Building Front

The second building is two stories; it was once an office for a group of lawyers, which has since moved to more expensive offices in an adjacent office park. The first floor has a central corridor with the main

stairs. (There's a fire escape in the rear of the building). There are two rooms left of the corridor, and two rooms to the right. The same pattern is found on the second floor. The building is 90 feet wide and 60 feet deep. Each room is approximately 40 feet by 30 feet, with a door on the narrow wall opening into the hallway. The hallway is approximately 10 feet wide.

First Floor

Room B	Hall	Room D
Room A		Room C

Second Floor

Room F	Hall	Room H
Room E		Room G

As an analyst for the college, you have been asked to make a recommendation to the board at its next meeting. You began your analysis by taking some additional measurements of each building. In order to build the table of distances, you determined the distance from the center of each room to the center of every other room. This analysis shows that Building One has 15 feet from one room's center to its doorway, 40 feet from that doorway to the next, then 15 feet to the center of that room.

Rooms in Building Two that are on the same floor can be measured as they were in Building One. Rooms on different floors of Building Two require use of the stairs. The length of the stairway is 40 feet and it is in the center of the corridor.

You then need to combine the distances with a table of traffic between Departments. The departments are:

1. Admissions, 2. Financial Aid, 3. Dean's office, 4. Computer Classroom, 5. Office Simulation Classroom; 6. Network Simulation Laboratory, 7. General Classroom, and 8. Lounge/Restrooms.

After substantial analysis you were able to determine the flows of faculty, staff, and students and developed the following table.

	Dept 1	**Dept 2**	**Dept 3**	**Dept 4**	**Dept 5**	**Dept 6**	**Dept 7**	**Dept 8**
Dept 1	—	20	5	0	0	0	10	50
Dept 2	15	—	5	0	10	0	15	30
Dept 3	25	0	—	0	0	0	5	40
Dept 4	0	30	0	—	150	60	120	100
Dept 5	0	10	0	50	—	30	180	60
Dept 6	0	5	0	100	20	—	100	30
Dept 7	0	20	10	50	90	30	—	120
Dept 8	0	20	10	60	80	20	140	—

DISCUSSION QUESTIONS:

(1) Which building offers the lowest total movement from room to room?

(2) Using a criteria of lowest total movement, which building do you recommend for the satellite campus?

(3) What other factors should be considered before the college makes its decision?

Source: Professor L. Wayne Shell, Nicholls State University.