PLANT MANAGEMENT

(IT / HS / B / T / 422)

Lecture Notes by

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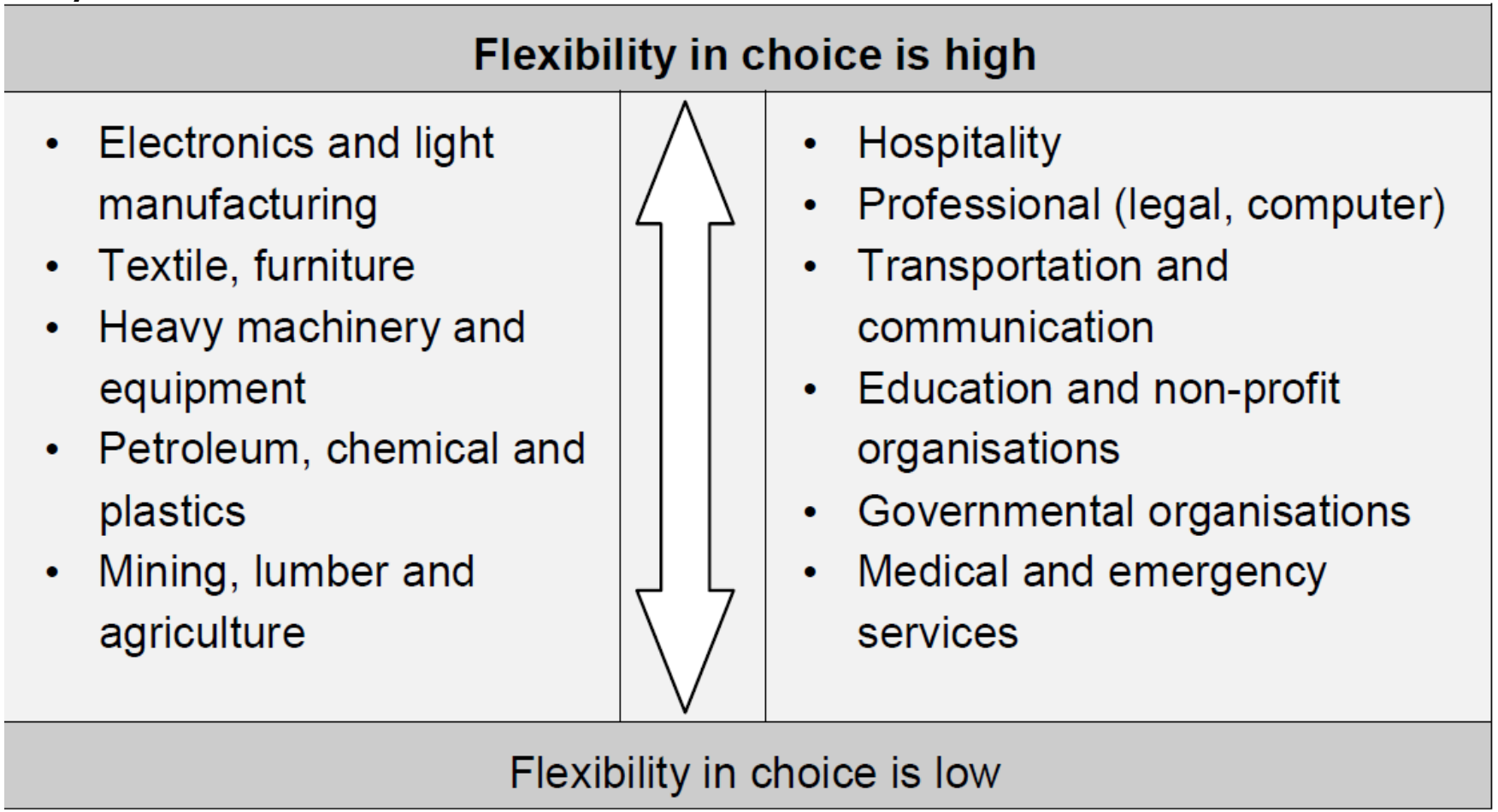
Focus Areas

- Plant location
- Plant layout
- Types of maintenance such as break down, predictive & preventive maintenance,
- Stores management
- Industrial safety, causes & cost of accidents, safety programs,
- Production planning & control
- Job, Batch & process type of production

Plant Location

- A plant location cannot be changed frequently
- A long range forecasting is to be made to foresee the future needs of the company.
- Flexibility Factor



Planning the location of the plant

- Availability of land
- Availability of inputs
- Closeness to market places
- Communication facilities
- Infrastructure
- Transport
- Government support
- Housing and recreation

Rating methods

- In the case of general factors or special factors – each factor has its own importance in determining the location of a plant. Therefore, ranking them and giving weightage for them is one of the ways of determining the location.

- The methods which determine the most likely location are:

  - Rating plan method
  - Factor rating method
  - Point rating method
  - Break-even analysis
  - Centre of gravity method

Rating Plan Method

Factors	Proportional Value % age	Chandigarh	Bhopal	Bangalore	Cochin
Availability of labour	20	20	10	15	05
Raw material sources	15	15	10	15	10
Market proximity	20	20	20	15	10
Site	15	10	10	15	10
Government policies	10	5	10	5	10
Infrastructure for employees	10	10	5	10	5
Scope for expansion	10	10	10	5	5
Total	**100**	**90**	**85**	**80**	**55**

Pavan is planning to start an industry in India. He has four options to locate the plant, Chandigarh, Bhopal, Bangalore, and Cochin. He used the rating plan method to select the best location suitable for his business needs.

Pavan initially listed important factors of the business need.

According to the rating plan method, in column 2 of the same table, he has given the proportional values for each factor in percentages. For example, the proportionate values given to the factors are 20%, 15%, 20%, 15%, etc. The total of the proportionate value is 100%. Table depicts the rating plan approach used by Pavan.

Factor Rating Method

Sl. No.	Factor	Factor rating	Location rating			Product of rating		
			A	B	C	A	B	C
1	Suitability of labour	6	8	6	5	48	36	30
2	Proximity to suppliers	7	6	9	6	42	56	42
3	Transportation facilities	5	8	7	9	40	35	45
4	Tax advantage	4	3	8	7	12	32	28
5	Power	7	8	6	9	56	42	63
6	Water	6	8	8	8	48	48	48
7	Housing	3	5	7	9	15	21	27
8	Education	4	6	6	8	24	24	32
9	Climate	3	5	9	6	15	27	18
10	Community	3	5	6	5	15	18	15
11	Availability of land	5	6	8	7	30	40	35
12	Owner's preference	3	4	6	5	12	18	15
			Total score :			**357**	**397**	**398**

In factor rating method, each of the factors for location is rated and the rating of the competitive locations is considered Then, the products of the rating are added and the location which gets the
maximum product of rating is selected
Column 3 - of table shows the factor rating of each factor as determined by the managers. For example, the factor rating of housing is determined to be 3. Similarly for remaining factors the manager has listed the factor ratings.

Column 4 – Location rating, displays the ratings of location A, B, and C as determined by the managers. For example, for suitability of labour factor, the manager has rated 8 for Location A, 6 for Location B, and 5 for

Location C. Similarly, the location rating for remaining factors is listed in the table.
Column 5 – Product of rating, lists the product of ratings of location A, B, and C.

Factor Rating Method - QS

Ravi is planning to start a new industry in India. For locating the plant, he tabulated the factor rating and the location rating of 2 locations - Goa and Cochin. Find the best location based on the factor rating method with the details depicted in table

Sl. No.	Location factor	Factor rating	Rating	
			Goa	Cochin
1	Facility utilisation	7	3	5
2	Total production per month	4	4	3
3	Tax advantage	7	4	5
4	Land and construction costs	5	1	2
5	Employee preferences	3	5	3

Sl. No.	Location factor	Factor rating	Location rating		Product of rating	
			Goa	Cochin	Goa	Cochin
1	Facility utilisation	7	3	5	21	35
2	Total production per month	4	4	3	16	12
3	Tax advantage	7	4	5	28	35
4	Land and construction costs	5	1	2	5	10
5	Employee preferences	3	5	3	15	9
				Total	**85**	**101**

The total score for Cochin is higher than that of Goa. Hence location Cochin is the best choice.

Point Rating Method

Sl. No.	Factor	Max points	Location A	Location B	Location C	Location D
1	Proximity to suppliers	250	150	120	200	175
2	Proximity to customers	350	200	300	250	250
3	Labour availability	200	100	150	150	175
4	Educational facilities	100	60	60	30	70
5	Climate	100	30	40	60	75
	Total	**1000**	**540**	**670**	**690**	**745**

In point rating method, we apportion a fraction of a suitably selected total rating and see how many points we can allocate to the locations under consideration. We should compare the totalled ratings and decide the preference.

Consider the data in table In column 3, max points, if we decide to have 1000 points as the maximum possible score considering all factors, we can then evaluate each location and allocate points. Column 4, 5, 6, & 7 indicates the maximum rating for each factor. By adding the given ratings for factors of each location, we get 540 for Location A, 670 for Location B, 690 for Location C, and 745 for Location D. The location which gets the maximum rating would be chosen, that is, location D is chosen. Table depicts the point rating method used for various locations

Point Rating Method - Qs

A chain of auto components store wishes to build a new distribution centre to serve the southern region of a country. It is considering three possible locations namely Gopalpur, Kalyan Nagar and Penwar. Table depicts the factors, weights, and ratings being considered. Which city should they choose?

		Ratings		
Factor	Weights	Gopalpur	Kalyan Nagar	Penwar
Nearness to markets	20	4	7	5
Labour cost	5	8	8	4
Taxes	15	8	9	7
Nearness to suppliers	10	10	6	10

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		Ratings			Weighted Ratings		
Factor	**Weig-hts**	**Gopalpur**	**Kalyan Nagar**	**Penwar**	**Gopalpur**	**Kalyan Nagar**	**Penwar**
Nearness to markets	20	4	7	5	80	140	100
Labour cost	5	8	8	4	40	40	20
Taxes	15	8	9	7	120	135	105
Nearness to suppliers	10	10	6	10	100	60	100
		Sum of Weighted ratings:			340	375	325

Break-even analysis

- Every manufacturing company will have three major contributors to cost:

    1. Investments made for land, plant and machinery resulting in interest and depreciation
    2. Recurring expenses, which are not proportional to the quantity of production
    3. Variable costs, which are directly proportional to the quantities produced

- For our calculations, we combine the first two costs together and call them **fixed costs.**
- We call those costs that depend on the quantity of production as **variable costs**

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Break-even analysis

- Kote Steel company is considering building a plant in one of three possible locations. They have estimated the following parameters for each location. Identify the volume for which each location would be suitable

Location	Fixed Cost	Variable Cost
Belladur	300,000	5.75
Kisanganj	800,000	2.75
Shafypet	100,000	8.00

Transition between Belladur and Kisanganj:

$$300,000 + (5.75x) = 800,000 + (2.75x)$$
$$3x = 500,000$$
$$x = 166,000$$

Transition between Belladur and Shafypet

$$300,000 + (5.75x) = 100,000 + (8.00x)$$
$$200,000 = 2.25x$$
$$88,888 = x$$

Hence from 0 to 88888 units, Shafypet is suitable
From 88888 to 166000 units, Belladur is suitable
From 166000 units onwards Kisanganj would be suitable

Break-even analysis

- Suvarna enterprises are planning to set up a new plant and are considering three locations namely Pantnagar, Ganganagar, and Goripara. Table depicts the estimated fixed and variable costs. For what range of output each location will be suitable. If the company has a target volume of units, which location is best?

Location	Fixed cost in Rs.	Variable cost in Rs.
Pantnagar	200000	50
Ganganagar	400000	30
Goripara	700000	15

Break-even analysis

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Location	Fixed cost in Rs.	Variable cost in Rs.
Pantnagar	200000	50
Ganganagar	400000	30
Goripara	700000	15

Solution

From 0 to 10,000 units, Pantnagar is suitable
From 10,000 to 20,000 units, Ganganagar is suitable
Above 20,000 units, Goripara is suitable

Centre of gravity method

This method is used mainly when:

- Transportation costs, either for distribution of products or collection of materials from different suppliers, is the main criterion
- Production rates are high
- The volume and weights of materials that have to be moved are huge
- Time taken, either to receive material from suppliers or delivery to customers, is critical

- It is better to locate the facility at such a place, which caters to the different points most optimally.
- The vital factor is the load, that is, number of items, or the weights that need to be moved from the central location to the existing or demanding points.
- We use this method when, both distance and load have to be considered for optimality in terms of cost

Centre of gravity method

	Load	Coordinates (X, Y)
Location A	2100	(50, 250)
Location B	3800	120,500
Location C	3200	475, 610
Location D	1200	680,370
Location E	2500	470,120

Location	Coordinates (X, Y)	Load (L_i)	L_x (or) $\sum L_i X_i$	L_y (or) $\sum L_i Y_i$
Location A	(50, 250)	2100	105000	525000
Location B	(120,500)	3800	456000	1900000
Location C	(475, 610)	3200	1520000	1952000
Location D	(680,370)	1200	816000	444000
Location E	(470,120)	2500	1175000s	300000
Total		12800	3977500	5121000

Locate the five places in a graph using the x and y coordinates and then locate the centre of gravity point P. We will calculate the x and y coordinates of the central location (P) such that the cost of shipment from such central location gives the minimum cost in the following way:

$$C_X = \frac{\sum L_i X_i}{SL_i} \qquad C_Y = \frac{\sum L_i Y_i}{SL_i}$$

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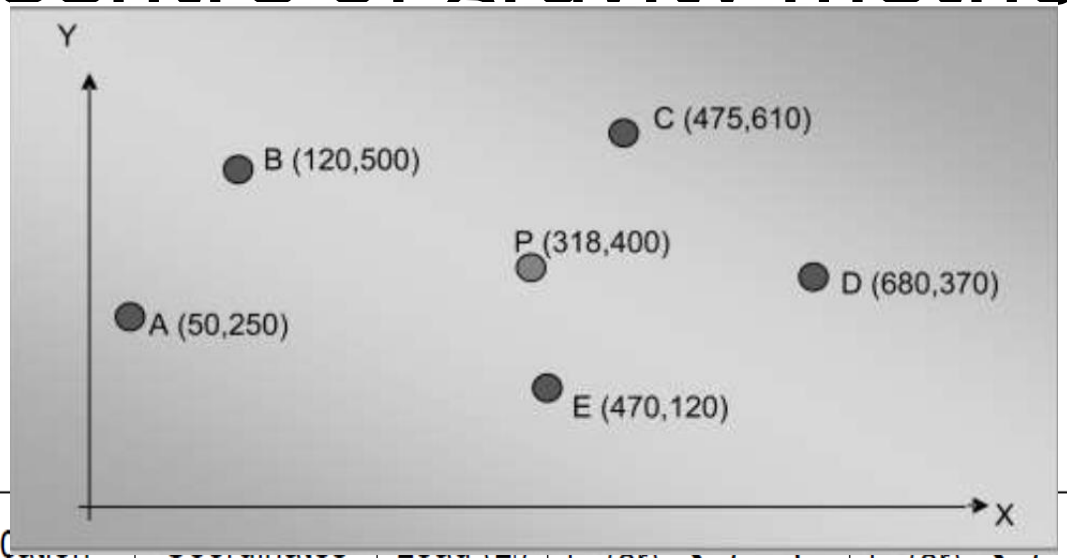
$$C_X = \frac{3977500}{12800} = 318 \qquad C_Y = \frac{5121000}{12800} = 400$$

Centre of gravity method



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Centre of gravity method - Qs

A new facility is going to be established in Bangalore. Customers will travel from the seven locations to the new facility when they need service. The co-ordinates for the centre of each location, along with the projected populations, measured in thousands are given here. Table depicts the details of the seven centres and co-ordinate distances along with the population for each centre. Find the target area's centre of gravity for the new facility.

Sl. No	Centres	Co-ordinate distances (x_i, y_i)	Population (L)
1	A	(3, 4.5)	6
2	B	(2.2, 5)	5
3	C	(10,4.5)	2
4	D	(5,2)	14
5	E	(6, 6)	8
6	F	(9, 3)	18
7	G	(9,4)	15

Centre of gravity method - Qs

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Sl. No.	Centres	(x, y)	Population (L)	L_x	L_y
1	A	(3, 4.5)	6	18	27
2	B	(2.2, 5)	10	22	50
3	C	(10,4.5)	2	20	9
4	D	(5, 2)	14	70	28
5	E	(6, 6)	8	48	48
6	F	(9, 3)	18	162	54
7	G	(9, 4)	15	135	60
Total			**73**	**475**	**276**

$$C_X = \frac{\sum L_i \; X_i}{SL_i}$$

$$C_X = \frac{475}{73} = 6.5$$

$$C_Y = \frac{\sum L_i \; Y_i}{SL_i}$$

$$C_Y = \frac{276}{73} = 3.78$$

The centre of gravity calculated is (6.5, 3.78). Managers can now search in the vicinity for the optimal location using the centre of gravity as starting point.

PLANT LAYOUT

- A layout refers to the arrangement of facilities connected with production, support, customer service, and other activities
- It involves the physical arrangement of work centers, storage, space for material handling and movement, utility areas and other essential spaces required for production and operations.
- Organization of a company's physical facilities to promote the efficient use of equipment, material, people and energy

- **How does a layout differ from a floor plan?**

Objectives of a Good Plant Layout

- Reduced risk to health and safety of employees
- Improved morale and worker satisfaction
- Increased output
- Fewer production delays
- Savings in floor space - production, storage, and service
- Reduced material handling
- Greater utilization of machinery, manpower, and service
- Reduced inventory-in-process
- Utilize labor effectively
- Avoid unnecessary capital investment

Objectives of a Good Plant Layout

- Shorter manufacturing time
- Reduced clerical work and indirect labour
- Easier and better supervision
- Less congestion and confusion
- Easier adjustment to changing conditions
- Facilitate the overall production process.
- Minimize material handling costs
- Increase production throughout
- Effective utilization of available space
- Provide flexibility

Classification of Facilities

- Production facilities
  - Workshops, tool room, machine shop, assembly, heat treatment, painting, testing and inspection.
- Support facilities
  - Storage, packing, administrative, library, service centre, reception.
- Employee utilities
  - Vehicles' parking, canteen, healthcare, rest room.
- Additional facilities
  - Conference hall, board room, customer service, training hall.

Classify the Type of Facility

- In an airport the layout consists of:
- Runways for landing and take-off
- Parking area for employees and passengers
- · Cargo area
- · Baggage collection and retrieval
- · Counters
- · Security check area
- · Canteens
- · Administrative offices
- · Storage area
- · Health care
- · Restrooms

Classify the Type of Facility

In an airport the layout

Runways for landing and take-off – Production / Service Facility

- · Parking area for employees and passengers – Employee Utility & Passenger Support
- · Cargo area – Support / Service Facility
- · Baggage collection and retrieval – Support Facility
- · Counters – Support Facility
- · Security check area - Support Facility
- · Canteens – Employee / Passenger Utility
- · Administrative offices - Support Facility
- · Storage area Support Facility

- · Health care Employee / Passenger Utility

- · Restrooms Employee / Passenger Utility

Basis for Types of Layouts

- · **Type of product**

  – Different products and services require different areas for various processes and support functions.

  - For example, an electronic product manufacturing layout is smaller and simpler compared to a tractor manufacturing unit.

- **Types of production processes**

  - Different production processes require different size of areas for operations.
  - For example, a machining process for an automobile component requires a larger area compared to a sheet punching for a utensil.

- · **Volume of production**

  – The space requirements are directly proportional to the volume of production.

Why Layout Decisions is Important

- · They require substantial investments of both money and effort
- · They involve long term commitments which make mistakes difficult to overcome
- · They have a significant impact on the cost and efficiency of short-term operations
- Further layout once set, may be difficult to change

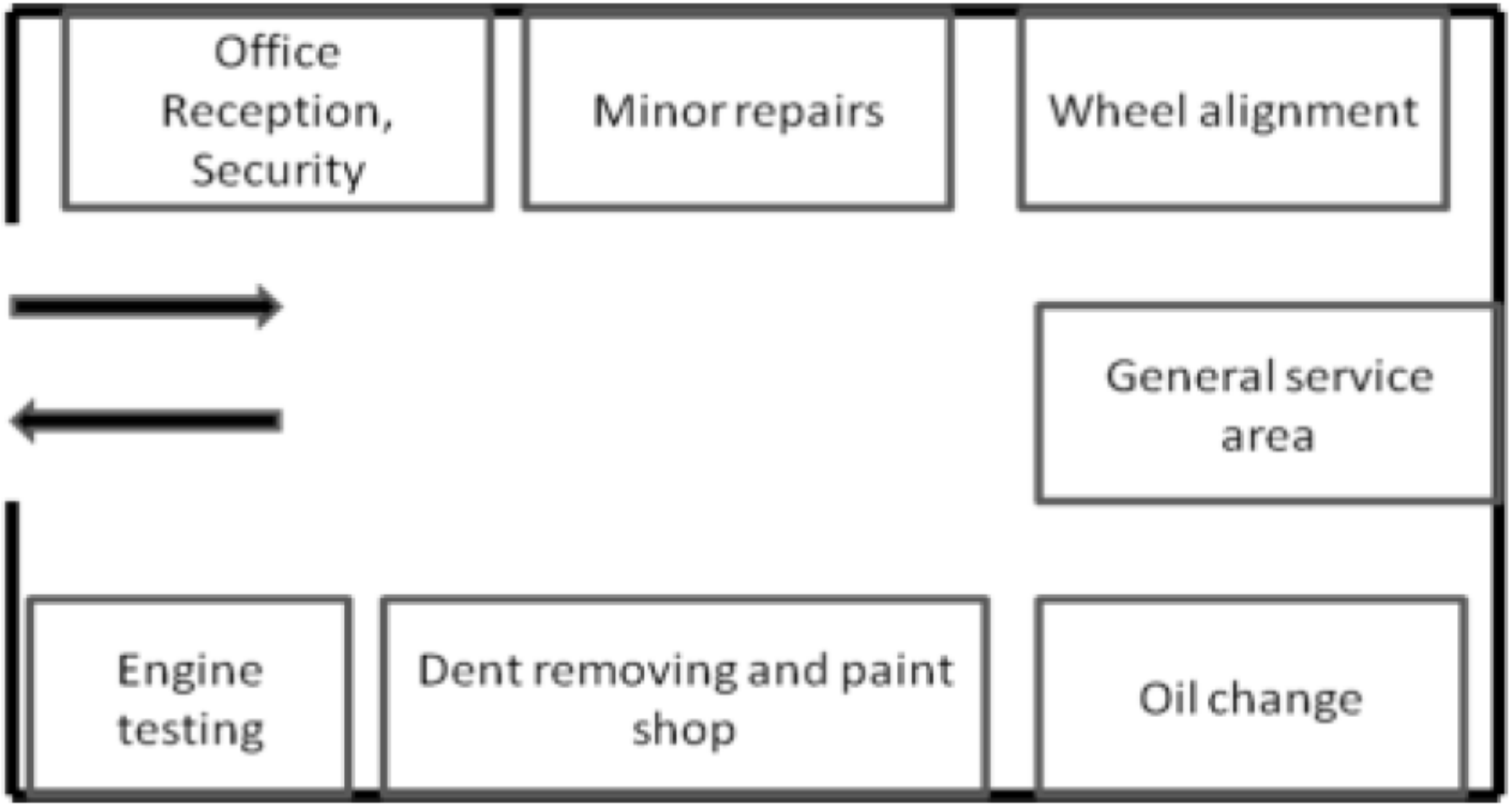
Nature of Layout Problems

- *Planning a complete new plant*
- *Expanding or moving to an existing plant*
- *Rearranging a present layout*
- *Minor adjustments in existing layouts*

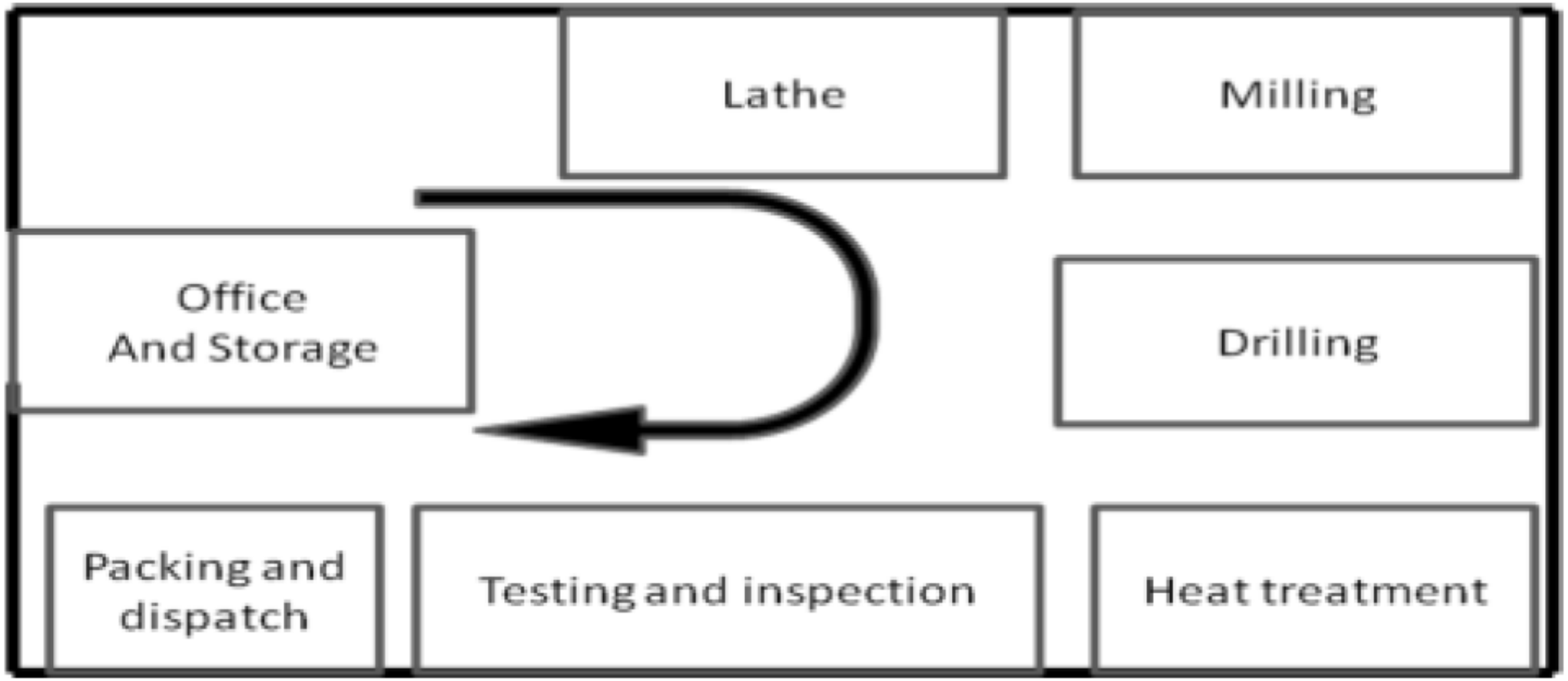
Types of Layout

- Process layout
- Product layout
- Group technology layout
- Fixed position layout

Process Layout - EXAMPLE OF A CAR SERVICE CENTRE



PRODUCT LAYOUT / Line Layout
- Example of a Component Manufacturing



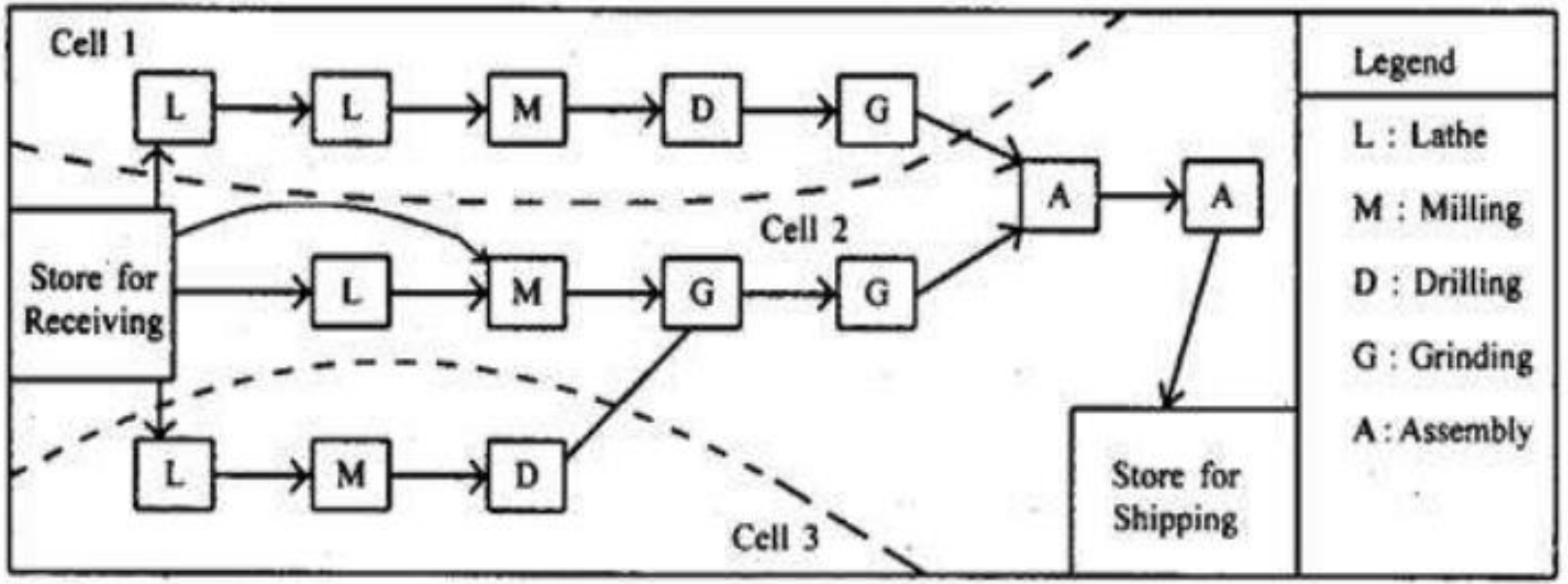
Qs

An LPG Cylinder Manufacturing Plant has the following stages during its production

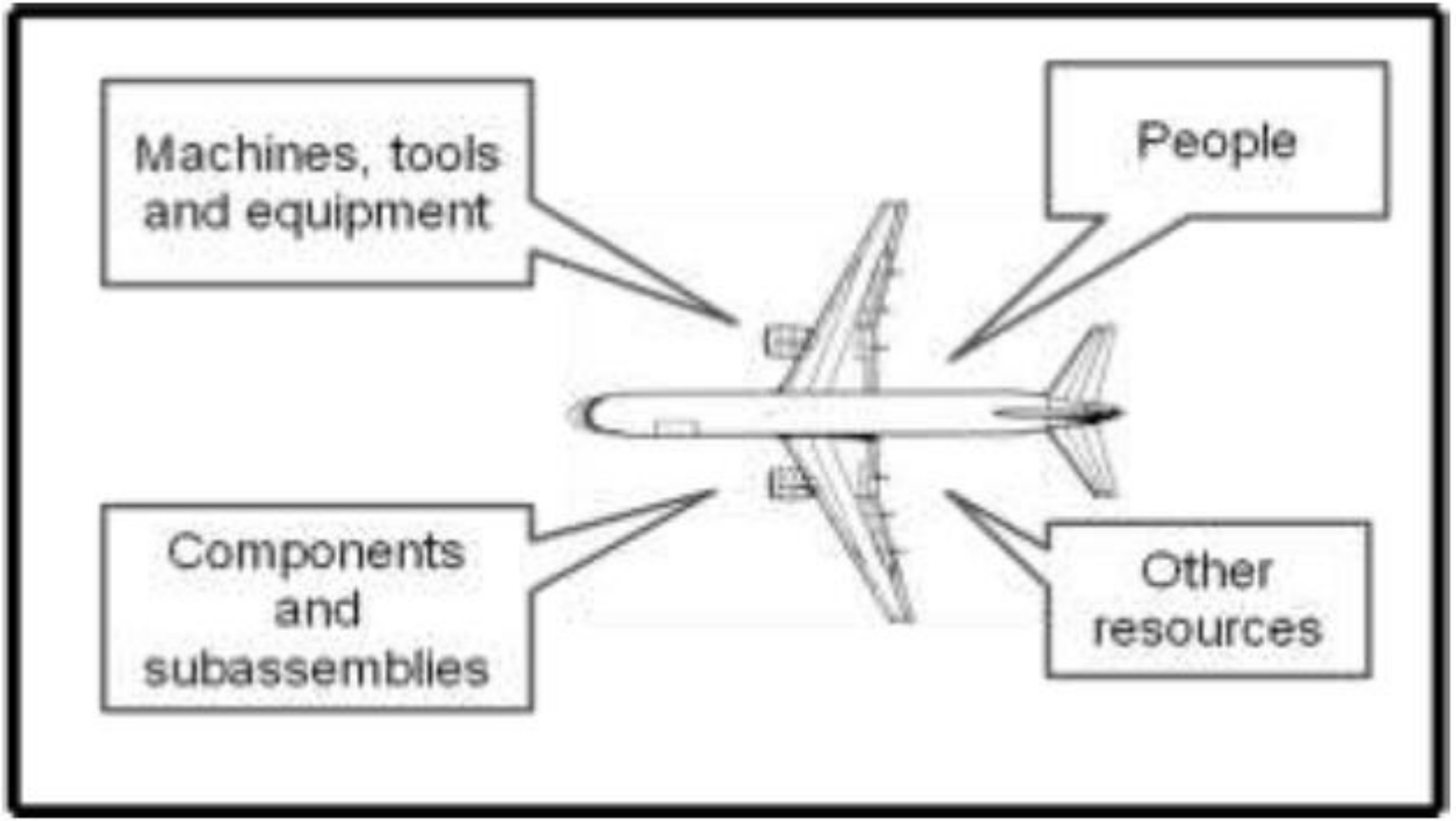
1. Cutting of Sheet Metal
2. Pressing to Capsules
3. Cutting of Different Components
4. Welding - 1 of Capsules
5. Welding – 2of All Components
6. Heat Treatment
7. Stress Test
8. Leak Test
9. Painting
10. Valve Fitting

Draw the most suitable Layout for the above

GROUP TECHNOLOGY LAYOUT



FIXED POSITION LAYOUT



Systematic Layout Planning (SLP)

- Muther R.
- **Site layout –** shows how the building should be located
- **Block layout –** shows the sizes of departments in buildings and their relative location
- **Detailed layout –** shows the arrangements of machines and workstations in the departments
- **Workstation layout –** shows locations of every part of the workstation

2 Different Approaches to SLP

1. The departments or functional areas to be located adjacent or non-adjacent are identified, using a **closeness rating**

2. The total distance travelled becomes the focal point, and the departments are organised essentially to minimise the total distance travelled by materials and or by people**.**

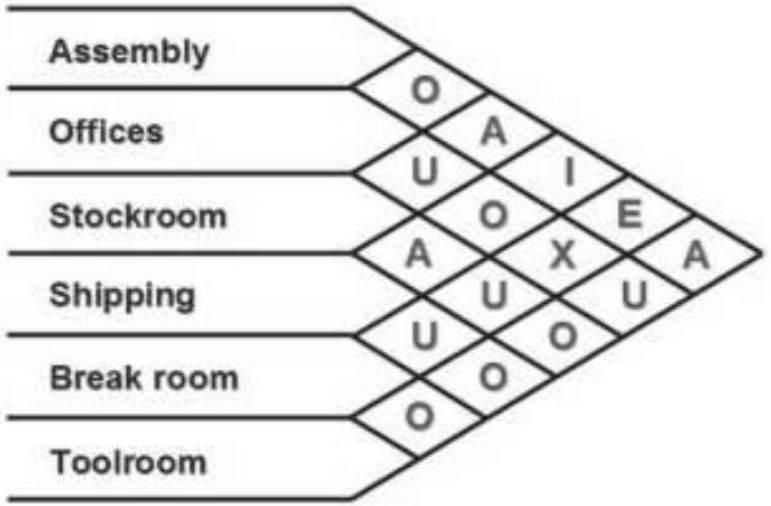
Closeness Rating

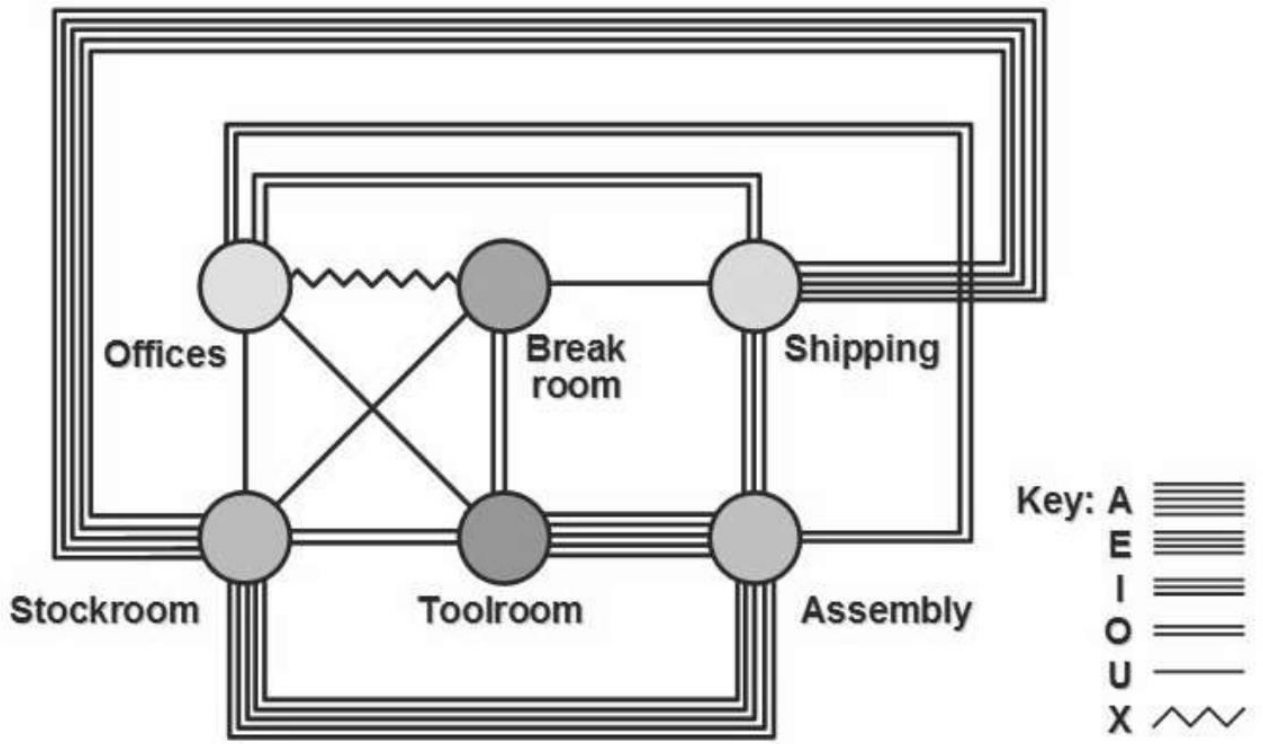
- The “closeness rating” is expressed using a letter code and later converted to a number to simplify the calculations.

The letter codes stated here help to express the degree of closeness between two departments taken as a pair:

- A – Absolutely necessary = 16
- E – Essential or especially important = 8
- I – Important = 4
- O – Ordinarily important or okay = 1
- U – Unimportant = 0
- X – Undesirable = -80

Present REL Chart





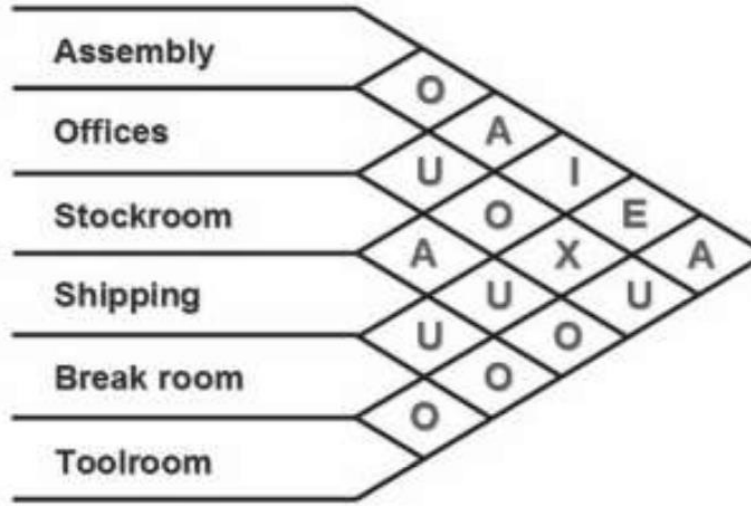
PRESENT LAYOUT DIAGRAM

Current Layout

	Assembly	Offices	Stockroom	Shipping	Break room	Tool room
Assembly	-	O	A	I	E	A
Offices		-	U	O	X	U
Stockroom			-	A	U	O
Shipping				-	U	O
Break room					-	O

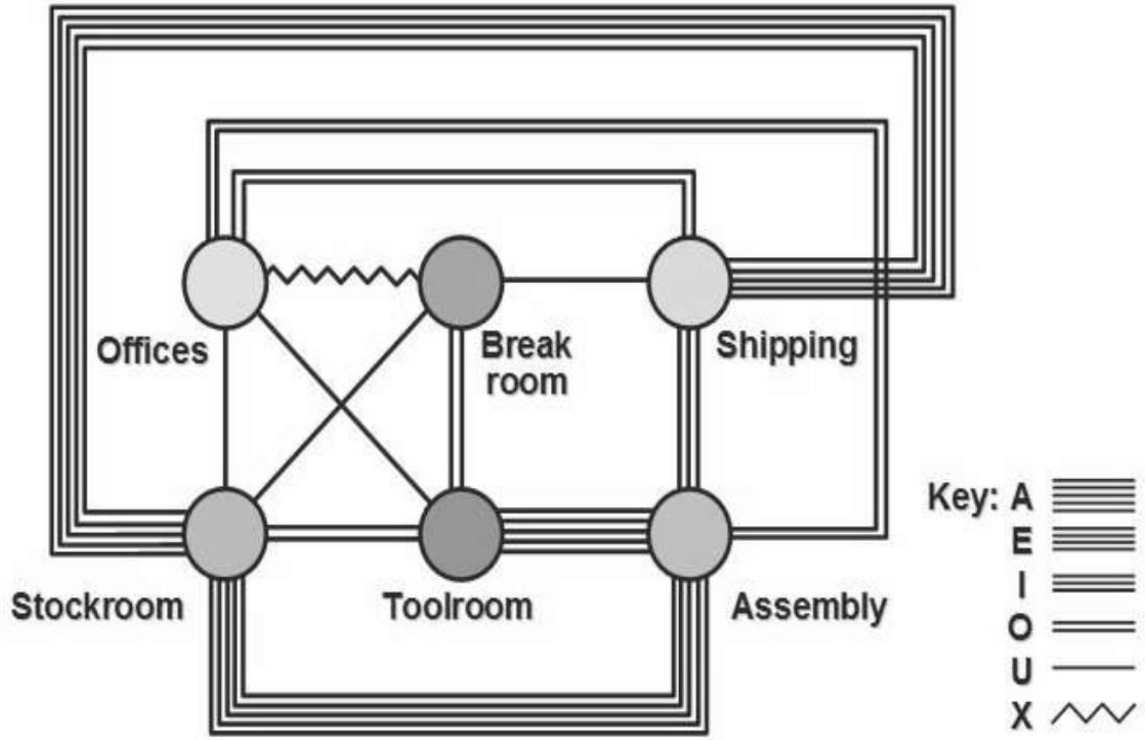
Proposed Layout

	Assembly	Offices	Stockroom	Shipping	Break room	Tool room
Assembly		O	A	E	A	A
Offices			U	O		U
Stockroom				A		O
Shipping					U	O
Break room						O



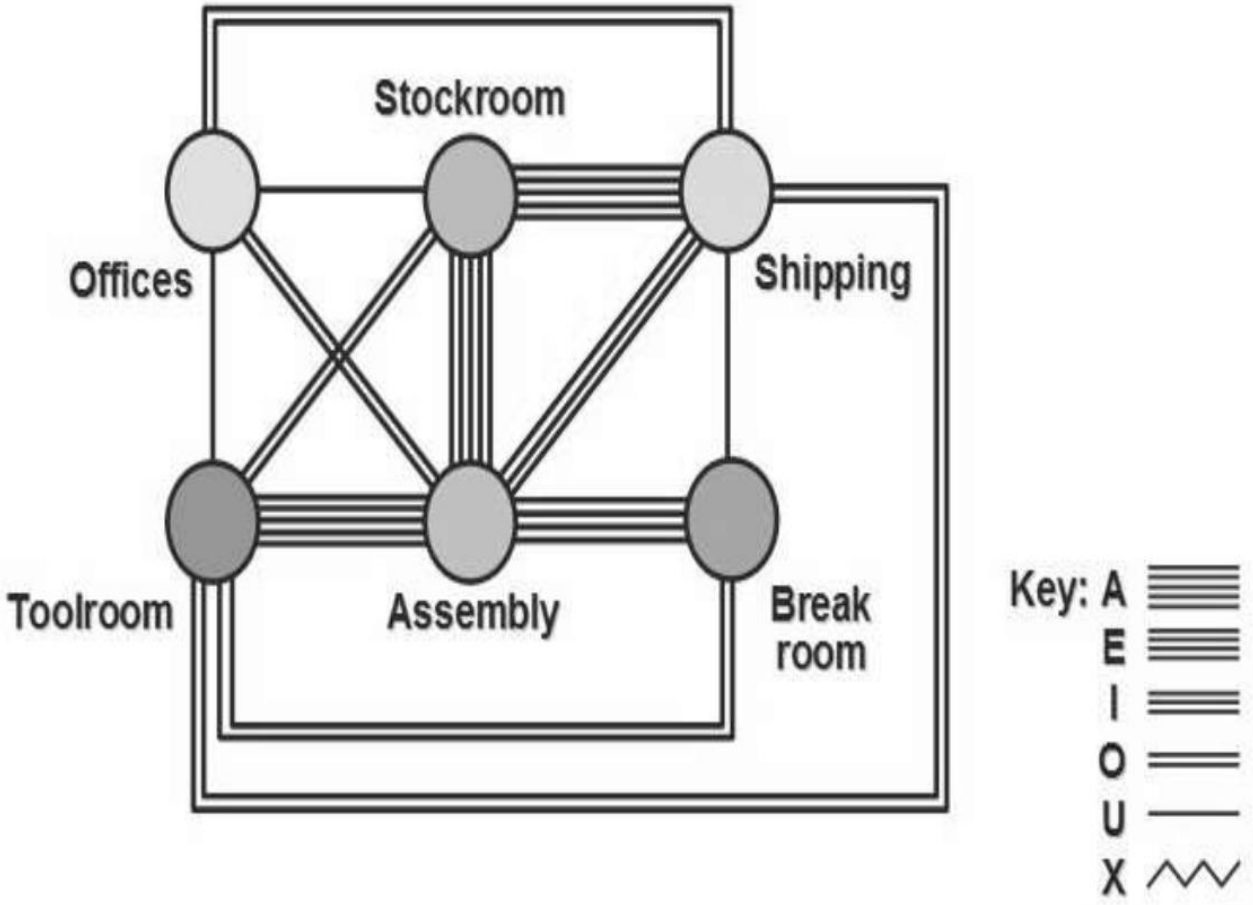
	Assembly	Offices	Stockroom	Shipping	Break room	Tool room	Total
Assembly		1	16	4	8	16	45
Offices			0	1	-80	0	-79
Stockroom				16	0	1	17
Shipping					0	1	1
Break room						1	1
							-15

	Assembly	Offices	Stockroom	Shipping	Break room	Tool room	Total
Assembly		1	16	8	16	16	57
Offices			0	1		0	1
Stockroom				16		1	17
Shipping					0	1	1
Break room						1	1
							77



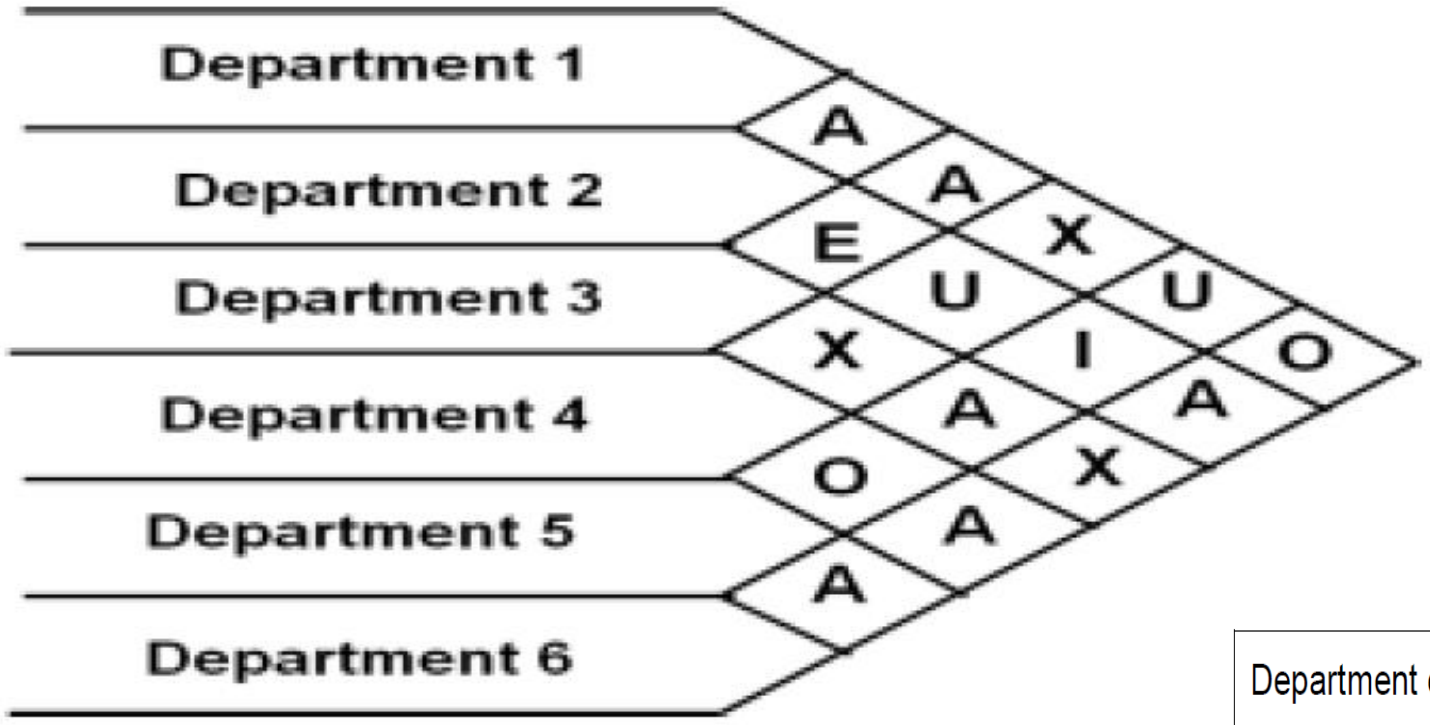
PRESENT LAYOUT

PROPOSED LAYOUT



Qs

Consider six departments numbered 1 to 6 and the closeness rating as depicted in Figure



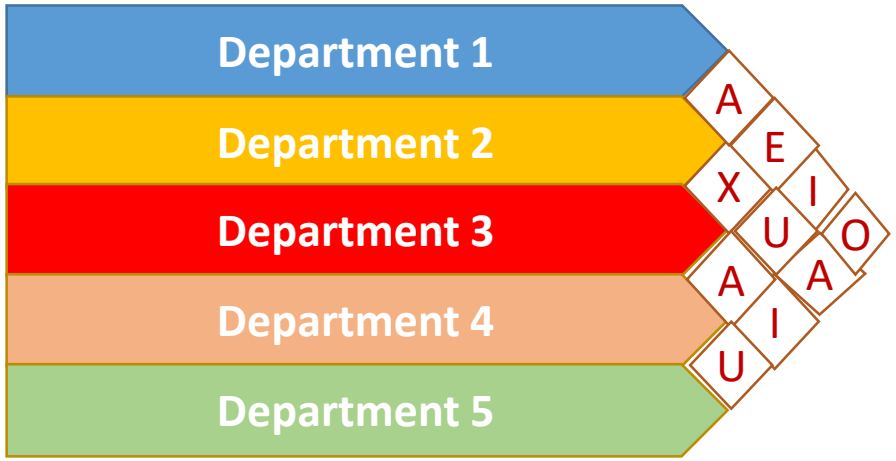
"A" rating: 1-2, 1-3, 2-6, 3-5, 4-6, 5-6
"X" rating: 1-4, 3-4, 3-6

Assuming a 2 (rows) by 3 (columns) grid for the department configuration, the following solution is generated as depicted in table

Department configuration			Solution		
			1	2	6
			3	5	4

Qs

Consider six departments numbered 1 to 6 and the closeness rating as depicted in Figure



"A" rating: 1-2, 1-3, 2-6, 3-5, 4-6, 5-6
"X" rating: 1-4, 3-4, 3-6

1. Draw Present Layout
2. Evaluate Closeness Rating and Propose Better Relationship Score (If Any)
3. Draw New Layout

EVALUATING PLANT LAYOUTS

- Techniques for evaluating layout may be generally classified as:
  - Systematic
  - Optimising

- One common technique that is helpful in determining the magnitude of product flow is the materials handling between departments. The tool is called the travel chart or the load-distance matrix, which assists in designing a new layout and valuating a layout.

Travel Chart

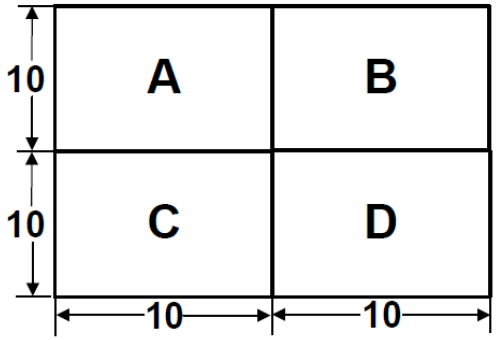
To: / From	A	B	C	D	E
A		15	20	6	
B	3		12		14
C	20			10	6
D	18		4		12
E		14		18	

A typical travel chart will show; how many items or how much material is being transported or how many people are moving between departments, and it is necessary to find out what is the corresponding total time or distance. This is usually done by multiplying the load by the distance traveled and is used as a measure to evaluate the layout. Typically called as the load x distance analysis, it also helps to find busy routes and also indicates how much of backward movement or reverse flow takes place in the given layout

All diagonal elements will be zero indicating nothing can go to a department from the same department. For example from A to A it is zero units transported. The values above the diagonal indicate the movement in the forward direction, and the values below the diagonal represent possible back tracking and attempt should be made to eliminate or minimise this. The units or numbers used in the travel chart represent an amount of material handling for example, pallet loads per day, frequency of trips, etc.

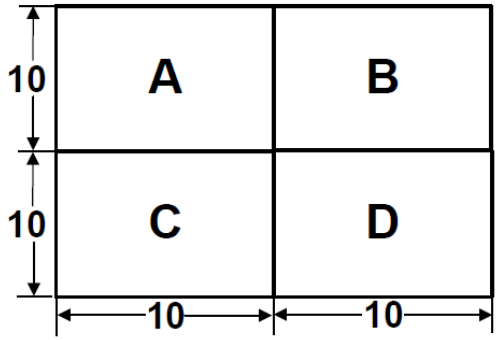
Qs

A small workshop has four departments A, B, C, and D, each measuring 10 metres by 10 metres. The initial layout is depicted in figure. The number of trips between each pair of departments is: A and B = 50, A and C = 20, A and D = 30, B and C = 10, B and D = 25, and C and D = 40



1. Determine the total load distance in the given layout ?

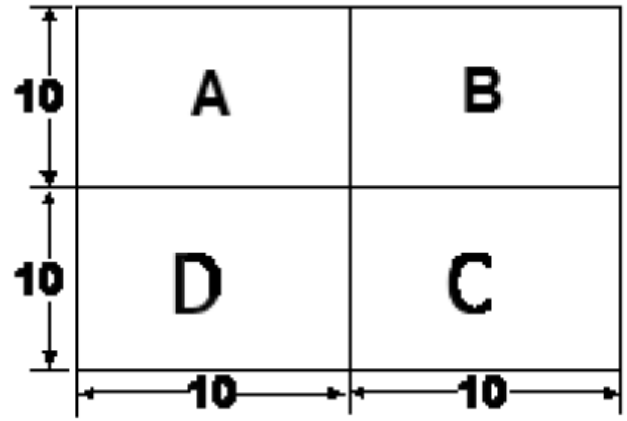
2. Suggest one improved layout, which is the total load distance for this layout should be less than the total load distance of the original layout ?



The number of trips between each pair of departments is: A and B = 50, A and C = 20, A and D = 30, B and C = 10, B and D = 25, and C and D = 40

Between	Load	Distance	Load X Distance
A and B	50	10	500
A and C	20	10	200
A and D	30	20	600
B and C	15	20	300
B and D	20	10	200
C and D	40	10	400
Total			2200

From the calculations it is clear that two major values namely 600 and 500 are between A and C, and A and D. A and C are adjacent and hence, C and D will be interchanged to make A and D adjacent to each other



Between	Load	Distance	Load X Distance
A and B	50	10	500
A and C	20	20	400
A and D	30	10	300
B and C	15	10	150
B and D	20	20	400
C and D	40	10	400
Total			2150

We notice that the total load distance has decreased from 2200 to 2150 and hence, this change is justifiable

Assignment

Four departments A, B, C, and D are to be located in four rooms marked 1, 2, 3, and 4 as depicted in the figure

The centre to centre distance between adjacent rooms is 20 feet. The flows between the departments are as depicted in the table

To → From ↓	A	B	C	D
A	-	25	30	20
B	-	-	15	25
C	35	-	-	50
D	40	-	-	-

The supervisor, Mr. Jeff wants department B to be in Room 2 only. Obtain the layout satisfying this condition and find the total cost of movement?

Suppose Mr. Jeff agrees to give up his choice and wants a layout with the minimum total cost of movement, what will be the new layout and its total movement cost? What improvement do you see?

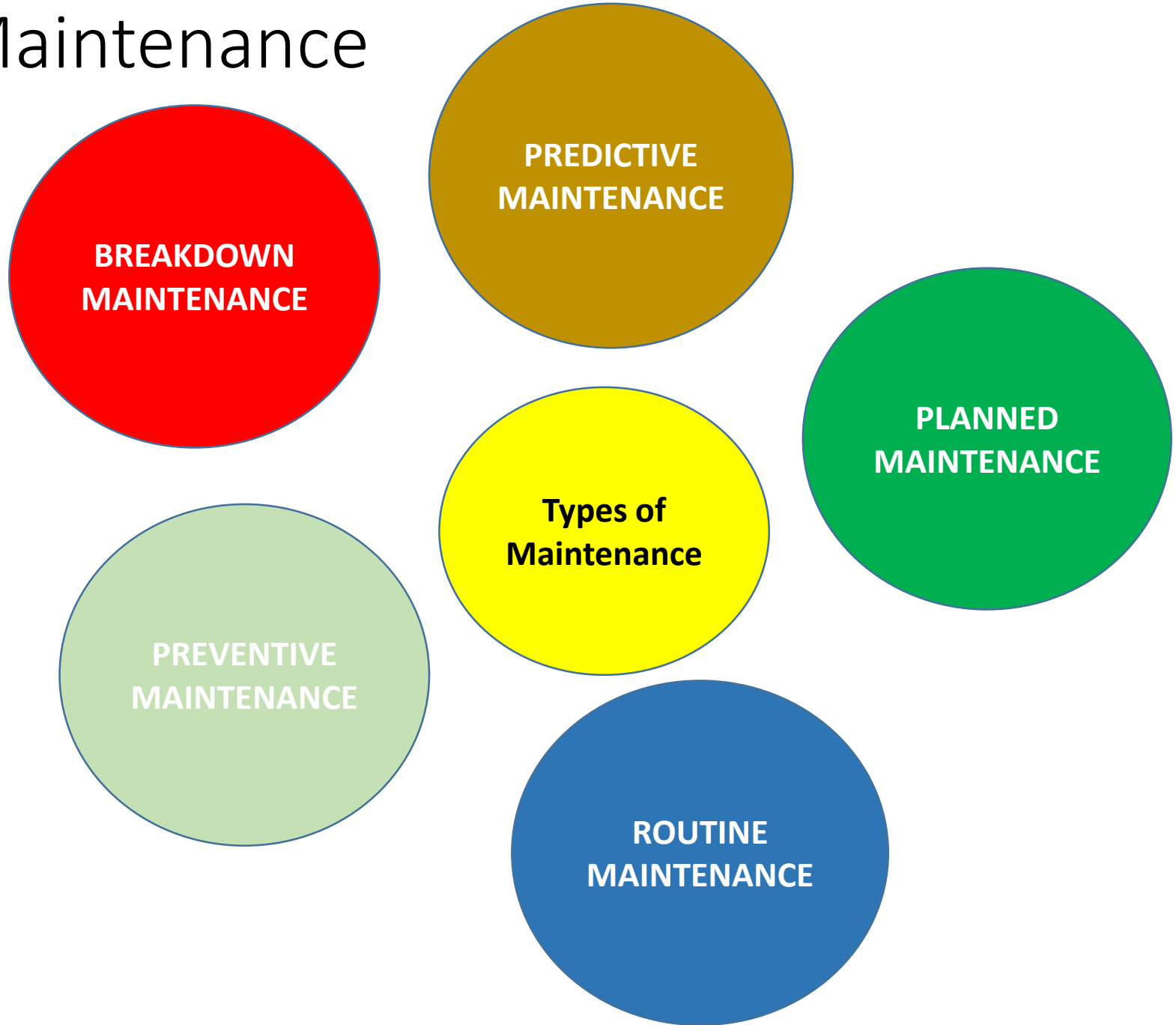
Assignment Qs

Six departments marked A, B, C, D, E, and F are to be located in six production areas marked 1, 2, 3, 4, 5 and 6. The quantity moved between the departments is depicted in the table

From – To	A	B	C	D	E	F
A		50	100			20
B			30	50	10	
C				20		100
D					50	
E						
F						

1	**2**	**3**
4	**5**	**6**

Plant Maintenance



Stores Management

- Provide uninterrupted service to the manufacturing divisions.
- Functions of Stores

- ✓To receive raw materials, components, tools, equipment's and other items
- ✓To provide adequate and proper storage and preservation
- ✓To meet the demands of the consuming departments
- ✓To minimize obsolescence, surplus and scrap through proper **codification**, preservation and handling.
- ✓To highlight stock accumulation, discrepancies and abnormal consumption and effect control measures
- ✓To ensure good house keeping so that material handling, material preservation, stocking, receipt and issue can be done adequately
- ✓To assist in verification and provide supporting information for effective purchase action.

Industrial Safety

- Industrial Hazard -> Any physical or chemical situation which can result in the injury of an individual or can cause any kind of harm to the health of a person is termed as a hazard
- Hazards can result in some types of dangers or threats.
- Industrial accidents may cause either the death or momentary or permanent disability of worker

Importance of Industrial Safety?

- **Accident Avoidance**
- **Cost Prevention**
- **Improved Employee Satisfaction and Commitment**
- **Legal Compliance**
- **Better Industrial Relations**

Causes of Industrial Accidents

- **Unsafe Conditions (Work-Related Causes):** *Improperly guarded equipment , Defective equipment., Hazardous arrangement or procedure in and or around, machines or equipment. Unsafe storage; congestion, overloading, Inadequate safety devices.,. Wrong and faulty lay-out, and bad location , Improper illumination — glare, insufficient light, . Improper ventilation — insufficient air charge, impure air source. , Poor house-keeping*.

- **Unsafe Acts** *Operating without authority, Failing to secure equipment or warning other employees of possible danger., Failing to use safe attire or personal protective equipment, Throwing materials on the floor carelessly, Operating or working at unsafe levels of speed, either too fast or too slow,. Making safety devices inoperative by removing, adjusting, disconnecting them, Using unsafe equipment or using equipment unsafely, Using unsafe procedures in loading, placing, mixing, combining, aking unsafe positions, under suspended loads. , Lifting improperly, Cleaning, adjusting, oiling, repairing, etc. or moving a dangerous equipment. Distracting, teasing, abusing, startling, quarreling, day-dreaming, horseplay.*

- ***Other Causes:*** These causes arise out of unsafe situational and climate conditions and variations — such as bad working conditions, rough and slippery floors, excessive glare, heat, humidity, dust

Safety Programs

- A safety programme is a continuous process and tries to be decrease the influence of personal and environmental factors which cause accidents.
- Normally a safety programme consists of providing safety equipment's and special training to workmen or employees.

- *Indian standards Institute has done commendable job in this context and lays down as follows:*

  - (i) Safety precautions to be taken during manifesting operations.
  - (ii) Standards for proper lighting, ventilation and proper layout of the industrial unit.
  - (iii) Standards and specifications of safe industrial operations and practices etc.
  - (iv) Requirements for effective maintenance of tools and equipment's.
  - (v) Guidance on safe cutting and welding processes.
  - (vi) Guidance on use of powered industrial trucks, belt conveyors and fire protection equipment's.
  - (vii) Safety requirements for personal protective equipment's.
  - (viii) Classification of hazardous chemicals and provision of accident provision tags.
  - (ix) Markings for handling and lebelling of dangerous items/ goods.
  - (x) Standards for safety:
    - (a) In industrial building
    - (b) Safety procedures to be followed in electrical work
    - (c) in use of electrical appliances in hazardous area and explosive atmosphere.
- (xi) Specifications for protective clothing, safety helmets face shields and safety equipment for eyes ears lags hands and feet etc

Production Planning and Control

- Production planning is required for scheduling, dispatch, inspection, quality management, inventory management, supply management and equipment management.
- Production control ensures that production team can achieve required production target, optimum utilization of resources, quality management and cost savings.
- Essential to integrate the production planning and control system
  - It ensures that optimum utilization of production capacity is achieved, by proper scheduling of the machine items which reduces the idle time as well as over use
  - It ensures that **inventory level are maintained at optimum** levels at all time, i.e. there is no over-stocking or under-stocking.
  - It also ensures that production time is kept at optimum level and thereby increasing the turnover time.
  - Since it overlooks all aspects of production, quality of final product is always maintained.