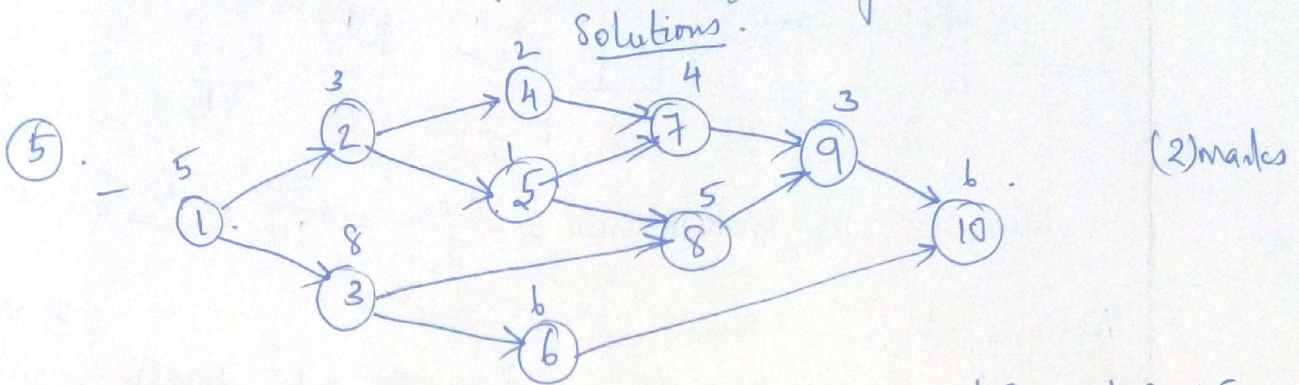


Internal Assessment Test I :-
Computer Integrated Manufacturing (CIM)

①



- Min no. of workstations = $\frac{T_{wc}}{T_c} = \frac{43}{10} = 4.3 \approx \underline{\underline{5}}$. (2 marks)

- RPW Table

Element	RPW value
1	43
2	24
3	28
4	15
5	19
6	12
7	13
8	14
9	9
10	6

(2 marks)

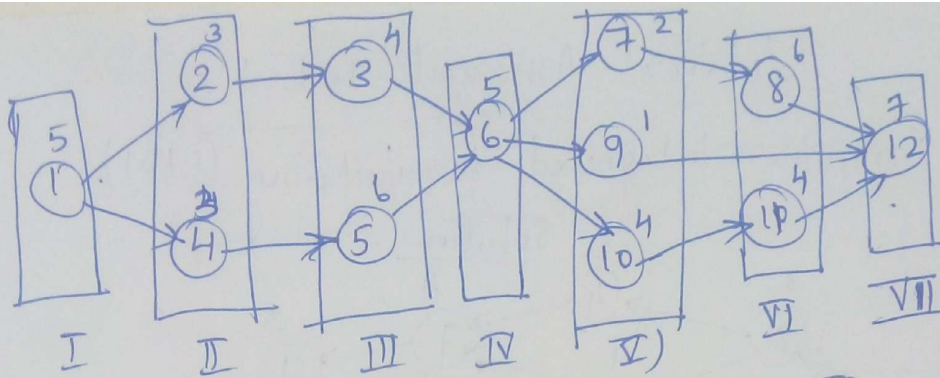
- Assignment

No. of W.S.	Element assigned Workstation	Station Time	Station delay	Activity available to allocation
1	1	5	5	1
	1+2	8	2	2, 3
	1+2+5	9	1	4, 5, 3
2	3	8	2	3, 4
	3+4	10	0	4, 6
	8	5	5	6, 7, 8
3	8	5	1	7, 6
	8+7	9	4	6, 9
4	6	6	1	9
	6+9	9	4	10
5	10	6	4	

(3 marks)

- Line efficiency $(E_b) = \frac{T_{wc}}{n \times T_{pc}} = \frac{43}{5 \times 10} = 86\%$.
 - Balance efficiency $(D) = 1 - E_b = 14\%$. (2 marks)

7.



(3 marks)

— Min. no. of workstations = $\frac{T_{we}}{T_c} = \frac{50}{10} = \underline{5}$. (1 mark)

Assignment:

(3 marks)

No. of W.S.	Work element assigned	Station time	Station Delay	Activity available for allocation
1	1	5	5	1
	1+2	8	2	2,4
2	4	3	7	3,4
	4+5	9	1	3,5
3	3	4	6	3,6
	3+6	9	1	6
4	10	4	6	7,9,10
	10+7	6	4	7,9,11
	10+7+9	7	3	8,11,9
5	8	6	4	8,11
	8+11	10	0	11
6	12	7	3	12

— line efficiency (E) = $\frac{T_{pc}}{T_c} = \frac{10}{10} = 100\%$

— line balancing Efficiency (E_b) = $\frac{50}{6 \times 10} = \frac{50}{60} = \underline{83.33\%}$

— Balance delay (D) = 16.67%

②. Automation:-

(2 marks)

The process of mechanisation of any process or operation to be done with the help of a machine and reduce the amount of human effort for the same is called automation. Automation does not eliminate the human interventions but minimises the human effort and but is still human controlled. It improves the product quality and consistency. but decreases the production cycle times.

- Types of Automation .

- Fixed Automation
- Flexible Automations
- Programmable Automations

Fixed Automations :-

- Least amount of variety
- Maximum amount production rate
- Lowest production cost.
- High investment & maintenance

Programmable Automations :-

- Maximum amount of variety but lower production rates
- Relatively higher production cost.
- Lower investment and maintenance.

Flexible Automations :-

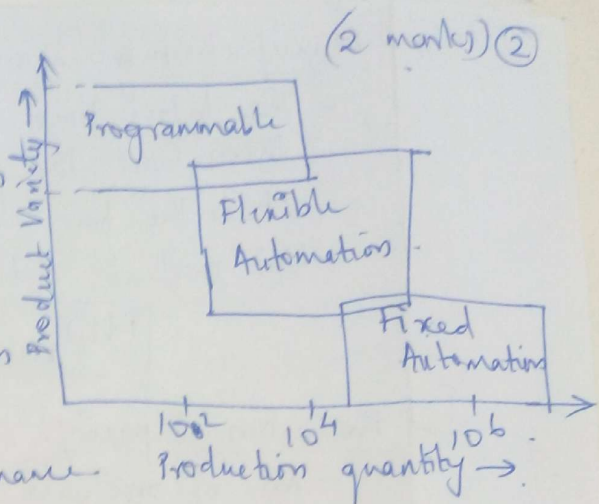
- It have higher variety and lower production rates.
- Average Moderate production cost.
- Moderate investment and maintenance

Advantages :-

- Increase in labour productivity
- Reduction of labour cost
- Mitigate the effects of labour shortages
- Reduce & eliminate routine manual & clerical tasks.
- Improved worker safety
- Improved product quality.
- Reduction in manufacturing lead time.
- Accomplish processes that can't be done manually.

Disadvantages :-

- Technology have its limitations. Not all process can be automated
- Economical limitations. and Financially ~~is not~~ not viable.
- Huge initial costs of investment.
- Maintenance cost are high
- Increase in unemployment due to dehumanisation..
- Complexity of operations make things not automatable.



③ (a) Manufacturing lead time (MLT) :- (2 marks)

- The total time required to process a given part throughout the plant.
- It is the time elapsed between the customer order and the product delivery.

$$\boxed{MLT_{(mass)} = n \cdot T_c}$$
 where n - no. of workstations
 T_c - cycle time.

(b) Production Capacity: (2 marks)

- No. of products that a production facility can produce under certain operating conditions.

$$\boxed{P.C = \frac{n \cdot S \cdot HR_p}{no}}$$

(c) Utilisation: (1)

- How best the resources are used in the plant.

$$u = \frac{Q}{PC} \times 100 \%$$

- Ratio of Actual Production with the Plant Capacity. (2 marks)

(d) Availability (A)

- Reliability of an equipment.
- Refers to how best the equipment can be maintained and serviced. How many hours of working time is actually available for operation.

$$A = \frac{MTBF - MTR}{MTBF} \times 100 = \frac{\text{Uptime}}{\text{Total time}}$$

(e) Work in Process (WIP) (2 marks)

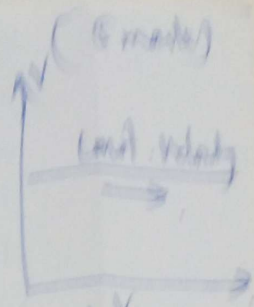
- Refers to no. of workparts which are located in the factory that are to be processed and workparts that are in between processing stations.
- Cost of inventory that is in the state of being transferred from raw material to finished inventory.

$$\boxed{WIP = \frac{A \cdot U \cdot P_c (MLT)}{S.H.}}$$

④ (a) Modes of Work part transportation :-

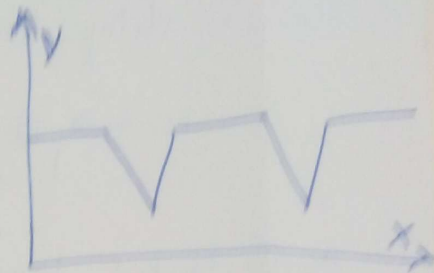
- Continuous transfer

- Transfer parts at constant velocity
- Work parts moves continuously
- Used in Manual production lines
- Very high production rates, minimum investment
- Easy to design but can't handle large parts



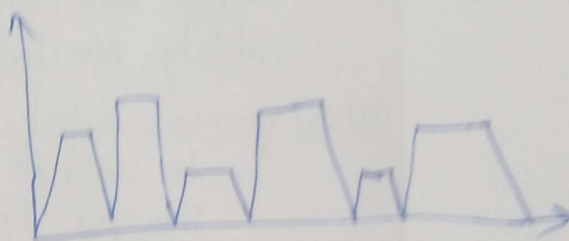
- Synchronous transfer :-

- Intermittent transport systems
- Commonly used in Automated assembly lines
- Line balancing have to be done
- The effectiveness is based on the efficiency of line balancing



- Asynchronous transfer :-

- Used when the parts will move to the workstation only when free.
- Ideal to move parts independently



- Accomodate huge storage buffers.
- Lower production rates

⑥ Walking beam

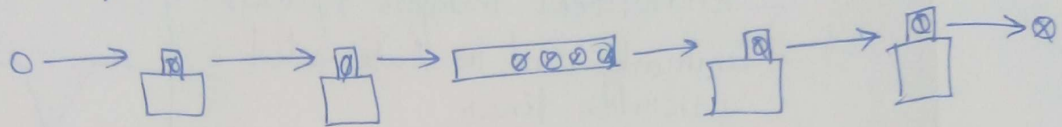
- A linear indexing mechanism
- Figure
- Lower space efficiency.
- Many workstations can be indexed successively.
- Continuous or intermittent motion
- Uses a transfer beam mechanism to alternatively transfer the parts from one position to other.

Geneva wheel

- A rotary indexing mechanism
- Figure
- Very high space efficiency.
- lower no. of workstations can be indexed.
- Rotary intermittent motion is achieved.
- Uses an intermittent gear to achieve the motion. The rotary indexing delay can be increased by increasing the driver circle.

⑥ (a) Buffer storage in a flow lines :- (5 marks)

- Act as a temporary storage before proceeding to subsequent workstations.
- It act as a bank of workparts.
- It helps to soaks the impact of individual breakdown of machines or workstations.
- Helps to reduce the ideal time or waiting time of operations.
- Can provide sufficient wiring time between operations.
- delay times can be minimised which reduces the M.L.T.



⑥ (b) Control functions :- (5 marks)

- Sequence Control.
- Safety ~~and~~ Monitoring
- Quality Monitoring

(a) Sequence Control :-

- to coordinate the sequence of activities performed on the transfer line.
- This is the basic function required in an automated transfer lines.
- ensures all activities on transfer lines must be performed with proper distribution of time.

(b) Safety Monitoring

- Protect human workers & equipment protection
- Incorporate safety measures as a part of system
- Eliminate unsafe conditions of operations
- Various sensors are used to monitor things in real time

(c) Quality Control :-

- Monitor the quality of workparts
- To detect and eliminate defective workpieces from production lines
- Once defects are encountered, 2 ways of actions:

(i) Instantaneous Control - Stop and correct immediately

(ii) Memory Control - No stoppage - simple elimination of defective