Do each of the following :

(a) Draw the precedence diagram.

(b) What is the shortest cycle time that will permit use of only two workstations? Is this cycle time feasible?

(c) What is the daily output under this arrangement?

(d) Determine the output rate that would be associated with the maximum cycle time.

OR iii. Consider four jobs A, B, C and D which have to be processed on three machines M_1, M2 and M_3. The processing times for each job on each of the three machines are given in the table below : **7**

Job	Processing Time (Minutes) On Machines		
	M_1	M_2	M_3
A	12	6	10
B	6	4	8
C	7	5	6
D	8	3	7

Using Johnson's rule, find the optimal sequence. Also draw the sequence of operation on Gantt Chart and compute the Cycle time.

Q.6 Attempt any two:

i. Define Benchmarking. What the types of benchmarking. Describe the process of benchmarking **5**

ii. Define TQM. List the principles of TQM. What are the Obstacles to implementing TQM **5**

iii. What do you understand by acceptance sampling and Operating Characteristic Curve? List the various sampling plans. **5**

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Enrollment No.....

Faculty of Management

End Sem (Even) Examination May-2018

MS5CO10 Operations Management

Programme: MBA Branch/Specialisation: Management

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. If inputs decrease while output remains constant, what will happen to productivity? **1**

(a) Increases (b) Decreases

(c) Remain Constant (d) Can't Say

ii. Operations can be classified according to their volume and variety of production as well as the degree of variation and visibility. Which of the following operations would be classified as high volume, low variety? **1**

(a) A Carpenter (b) A front office bank

(c) A fast food restaurant (d) All of these

iii. Product design may be accomplished more quickly through the use of cross-functional teams that work on various aspects of the design at the same time. This approach is known as **1**

(a) Simultaneous design.

(b) Concurrent engineering.

(c) The "throw it over the wall" approach.

(d) Robust Design

iv. A key advantage of a process layout is **1**

(a) High levels of inventory

(b) High degree of automation

(c) Flexible use of equipment and resources

(d) Smooth flow of materials

v. Quantitative methods of forecasting include **1**

(a) Exponential smoothing. (b) Sales force composite.

(c) Jury of executive opinion. (d) Consumer market survey.

vi. A list of all parts and materials needed to assemble one unit of a product is called: **1**
(a) A master schedule. (b) A kanban.
(c) A bill of materials. (d) None of these

vii. A major disadvantage of the EDD rule is: **1**
(a) It results in high in-process inventories.
(b) It does not take processing time into account.
(c) It tends to make long jobs wait.
(d) None of these.

viii. Which of the following dispatch rules tends to maximize the number of jobs completed on time? **1**
(a) LPT (b) SPT (c) EDD (d) FCFS

ix. In acceptance sampling, the producer's risk is the risk of having a **1**
(a) Bad lot accepted. (b) Bad lot Rejected
(c) Good lot rejected. (d) Good lot accepted.

x. Evaluating Self performance by comparing external sources which are at high level is known as **1**
(a) Benchmarking (b) Kaizen (c) Sampling (d) None of these

Q.2 i. Describe the functions of an operation manager? **3**

ii. Draw the volume variety graph of production system. What are the characteristics, advantages and limitations of job shop production? **7**

OR iii. Define productivity. List the various types of productivity. Discuss any four measurement techniques to improve the productivity of organization. **7**

Q.3 i. Define plant layout. What are the objectives of good plant layout? **4**

ii. Discuss the validity of location of most of the steel plant in Chattisgarh, Odisha and Jharkhand and Information Technology(IT) companies in Bangalore, Hyderabad. **6**

OR iii. Three potential locations A, B and C have the cost structure as shown in table below : **6**

Location	Fixed Cost/Year	Variable Cost/Unit
A	Rs. 2,00,000	Rs.10
B	Rs. 2,00,000	Rs.15
C	Rs. 2,00,000	Rs.20

(a) Plat the total cost curve for these locations on a single graph.
(b) Identify the range of output for which each alternative is superior.
(c) If the expected output at selected location is to be 9,000 units per year, which location would provide the lowest total cost?

Q.4 i. Define the aggregate planning and material requirement planning. **3**

ii. Define forecasting. And discuss the following method of forecasting : **7**
(a) Moving Average Method
(b) Exponential Smoothening Method
(c) Weighted Moving Average Method

OR iii. The owner of a small hardware store has noted a sales pattern for window locks that seems to parallel to the number of break ins reported each week in the news paper. The data are give in the table below :

Break-ins	9	3	3	5	4	7	2	6
Sales	46	18	20	24	27	34	14	30

(a) Obtain a regression equation for the data. **7**
(b) Estimate sales when the number of break-ins is 12 and 15.

Q.5 i. Describe the following single criterion sequencing rule : **3**
(a) FCFS (b) Least Slack (c) Earliest Due Date

ii. A large manufacturer of pencil Sharpeners is planning to add a new line of sharpeners. Following the details are given : **7**

Task	Task Time (minutes)	Immediate Follower
A	0.2	B
B	0.4	D
C	0.3	D
D	1.3	G
E	0.1	F
F	0.8	G
G	0.3	H
H	1.2	None

Marking Scheme
MS5CO10 Operations Management

Q.1 i. If inputs decrease while output remains constant, what will happen to productivity? **1**
(a) Increases

ii. Operations can be classified according to their volume and variety of production as well as the degree of variation and visibility. Which of the following operations would be classified as high volume, low variety? **1**
(b) A front office bank

iii. Product design may be accomplished more quickly through the use of cross-functional teams that work on various aspects of the design at the same time. This approach is known as **1**
(b) Concurrent engineering.

iv. A key advantage of a process layout is **1**
(c) Flexible equipment and resources

v. Quantitative methods of forecasting include **1**
(a) Exponential smoothing.

vi. A list of all parts and materials needed to assemble one unit of a product is called: **1**
(c) A bill of materials.

vii. A major disadvantage of the EDD rule is: **1**
(b) It does not take processing time into account.

viii. Which of the following dispatch rules tends to maximize the number of jobs completed on time? **1**
(b) SPT

ix. In acceptance sampling, the producer's risk is the risk of having a **1**
(c) Good lot rejected.

x. Evaluating Self performance by comparing external sources which are at high level , known as **1**
(a) Benchmarking

Q.2 i. Describe the functions of an operation manager? **3**
Any three functions each 1 mark (1 mark * 3)

ii. Draw the volume variety graph of production system. What are the characteristics, advantages and limitations of job shop production **7**
Drawing volume variety graph 1 mark
4 Characteristics (0.5 mark * 4) 2 marks
4 Advantages (0.5 mark * 4) 2 marks
4 Limitations (0.5 mark * 4) 2 marks

iii. Define productivity. List the various types of productivity. Discuss any four techniques to improve the productivity of organization. **7**
Definition of productivity 1 mark
Types of productivity 2 marks
Any four Techniques 1 mark each (1 mark *4) 4 marks

Q.3 i. Define plant layout. What are the objectives of good plant layout. **4**
Definition of plant layout 1 mark
6 objectives (0.5 mark * 6) 3 marks

ii. Discuss the validity of location of most of the steel plant in Chattisgarh, Odish and Jharkhand and Information Technology(IT) copanies in Bangalore, Hyderabad. **6**
Any four factors each 1.5 mark (1.5 mark *4)

OR iii. Three potential locations A, B and C have the cost structure as shown in table below : **6**
(a) Plat the total cost curve for these locations on a single graph. 2 marks
(b) Identify the range of output for which each alternative is superior. 2 marks
(c) If the expected output at selected location is to be 9,000 units per year , which location would provide the lowest total cost ? 2 marks

Q.4 i. Define the aggregate planning and material requirement planning. **3**
Aggregate planning 2 marks
Material Requirement planning 1 mark

ii. Define forecasting. And discuss the following method of forecasting : **7**
a) Moving Average Method b) Exponential Smoothening Method c) Weight Moving Average Method
Definition of forecasting 1 mark
Moving average method 2 marks
Exponential Smoothening method 2 marks
Weight moving Average method 2 marks

OR iii. The owner of a small hardware store has noted a sales pattern for window locks that seems to parallel the number of break ins reported each week in the news paper. The data are give in the table below :

Break-ins	9	3	3	5	4	7	2	6
Sales	46	18	20	24	27	34	14	30

a) Obtain a regression equation for the data **7**
b) Estimate sales when the number of break-ins is 12 and 15 .
Preparing the table 3 marks
Finding constant a and b and establishing equation of line y=a+bx 2 marks
Estimating sales at break-ins 12 and 15 2 marks

Q.5 i. Describe the following single criterion sequencing rule : **3**
a) FCFS b) Least Slack c) Earliest Due Date
Defining above terms each 1 mark (1 mark*3)

ii. A large manufacturer of pencil Sharpeners is planning to add a new line of sharpeners. Following the details are given : **7**
Do each of the following :
(a) Draw the precedence diagram 2 marks
(b) What is the shortest cycle time that will permit use of only two workstations? Is this cycle time feasible? 2 marks
(c) What is the daily output under this arrangement? 1 mark
(d) Determine the output rate that would be associated with the maximum cycle time. 2 marks

OR iii. Consider four jobs A, B, C and D which have to be processed on three machines M_1,M_2 and M_3. The processing times for each job on each of the three machines are given in the table below : **7**

Job	Processing Time (Minutes) On Machines		
	M_1	M_2	M_3
A	12	6	10
B	6	4	8
C	7	5	6
D	8	3	7

Using Johnson's rule , find the optimal sequence. Also draw the sequence of operation on Gantt Chart and compute the Cycle time.
Assign job to machine (sequencing) 3 marks
Preparing Gantt chart and computing cycle time 4 marks

Q.6 Attempt any two:

i. Define Benchmarking. What the types of benchmarking. Describe the process of benchmarking **5**
Definition of benchmarking 1 mark
Types of bench marking 1 mark
Process of benchmarking 3 marks

ii. Define TQM. List the principles of TQM. What are the Obstacles to implementing TQM **5**
Definition TQM 1 mark
Principles of TQM 1 mark
Obstacles to implementing TQM 3 marks

iii. What do you understand by acceptance sampling and Operating Characteristic Curve ? List the various sampling plans. **5**
Defining acceptance sampling 2 marks
Operating Characteristic cure 2 marks
Types of Sampling Plan 1 mark

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Operations Management

Q.3 (iii)

Location	Fixed cost/year	Variable cost/unit
A	2,00,000	Rs 10/-
B	2,00,000	Rs. 15/-
C	2,00,000	Rs 20/-

Sol

Total cost = Fixed cost + variable cost

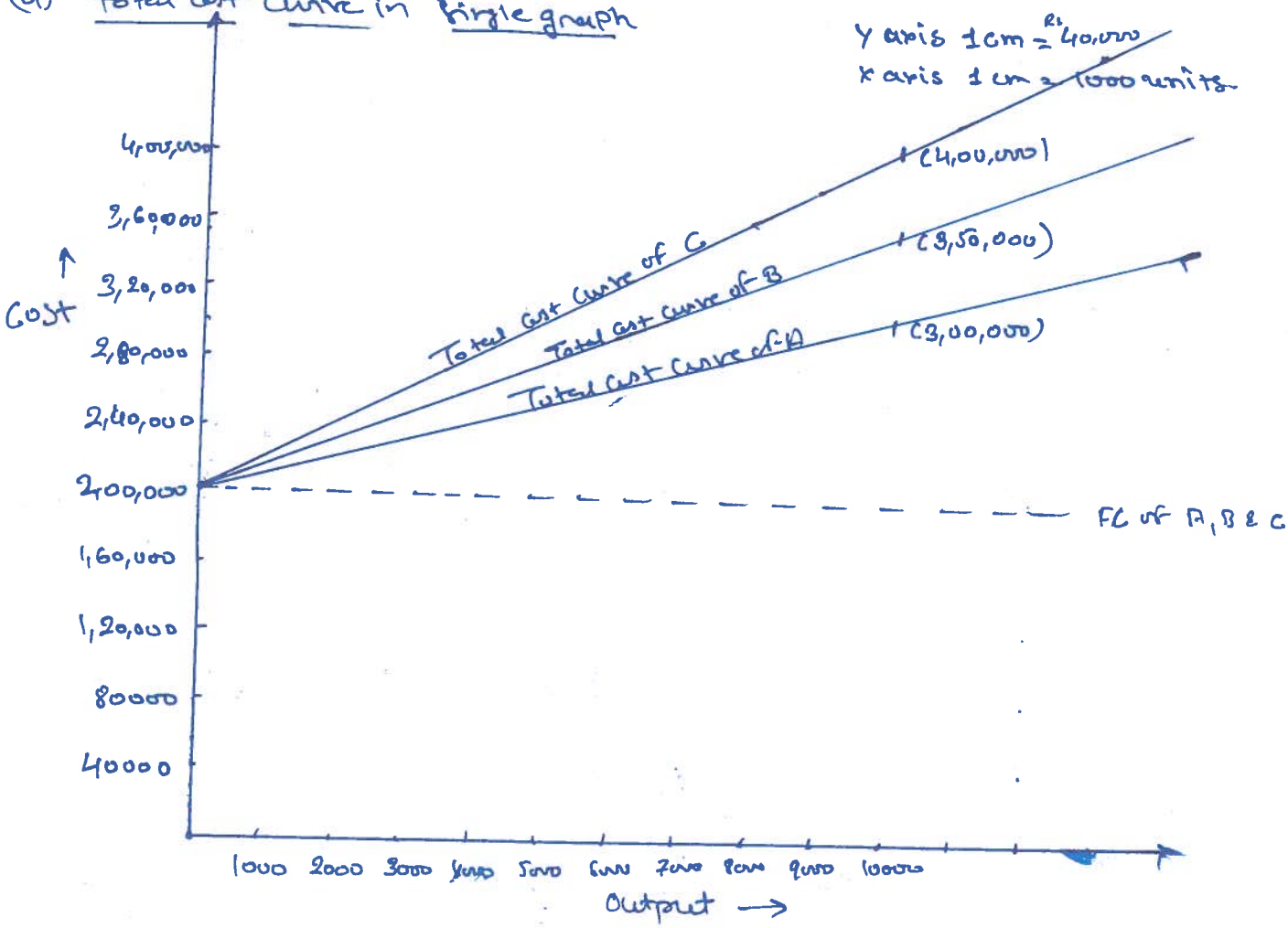
Assuming the annual production of 10,000 units.

Total cost of plant A = $2,00,000 + 10 \times 10000 = 3,00,000/-$

Total cost of plant B = $2,00,000 + 15 \times 10000 = 3,50,000/-$

Total cost of plant C = $2,00,000 + 20 \times 10000 = 4,00,000/-$

(a) total cost curve in single graph



(2) Identify the range of output for which each alternative is superior.

From the graph, when the output is 0 units, all location have the same fixed cost. But as there are different variable cost, from graph we see that total cost for location A is, less compare to others location inespective of output.

There fore for all range of out put, location A is superior.

(3) If the eppected output at selected location D to be 9000, units per year, location A will provide the lowest total cost.

Total cost = 2,00,000 + 9000 × 10

= 2,90,000/-

---x---+---x---x---x---x---

Q.4(iii) Computation for straight line curves

(x) Break-ins	(y) Sales	x^2	xy
9	46	81	414
3	18	9	54
3	20	9	60
5	24	25	120
4	27	16	108
7	34	49	238
2	14	04	28
6	30	36	180
$\Sigma x = 39$	$\Sigma y = 213$	$\Sigma x^2 = 229$	$\Sigma xy = 1202$

$$b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{8 \times 1202 - 39 \times 213}{8 \times 229 - (39)^2}$$

$$b = \frac{9616 - 8307}{1832 - 1521} = \frac{1309}{311} = 4.209$$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{213 - (4.209 \times 39)}{8}$$

$$a = \frac{48.849}{8} = 6.106$$

Thus equation is $y_x = a + bx$

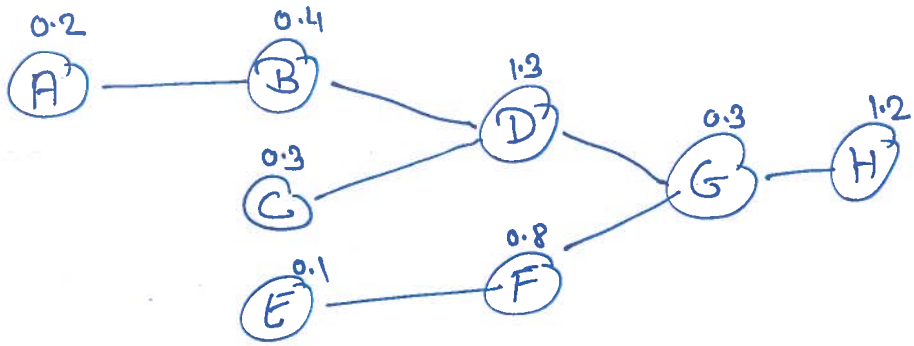
$$y_x = 6.106 + 4.209x$$

(ii) at break-ins 12, sales $y_{12} = 6.106 + 4.209 \times 12 = 56.61$

at break-ins 15, sales $y_{15} = 6.106 + 4.209 \times 15 = 69.24$

Q.5 (ii) A large manufacture- ——— ——— ——— -- given

(a) Draw the Precedence diagram:



(b) min cycle time :

min cycle time = longest task time (Bottleneck operation)
= 1.3 min

Max. cycle time = Σt = summation of all task time
= 0.2+0.4+0.3+0.1+1.3+0.8+0.3+1.2
= 4.6 min

Assuming 8 hr shift, & Available time = 480 min

~~Max & min output~~ :

Max & min output :

$$\text{Max. output} = \frac{\text{Available time}}{\text{min cycle time}} = \frac{480}{1.3} = 369.23 \simeq 369 \text{ units}$$

$$\text{min output} = \frac{\text{Available time}}{\text{max. cycle time}} = \frac{480}{4.6} = 104.34 \simeq 104 \text{ units}$$

The range of out put is 104 units to 369 units & range of the feasible cycle time is 1.3 min to 4.6 min

(b) The shortest cycle time that will permit use of only two work stations.

$$(\text{Workstation})\ N_{min} = \frac{\Sigma t}{\text{Cycle time}}$$

$$2 = \frac{4.6}{\text{Cycle time}}$$

$$\text{Cycle time} = \frac{4.6}{2} = 2.3 \text{ min}$$

Is this cycle time is feasible!

Yes, this cycle time is feasible, as it is in the range of min cycle time (1.9 min) & max cycle time (4.6 min).

(c) What is the daily output under this arrangement

$$\text{Cycle time} = \frac{\text{Available time}}{\text{Desired output}}$$

$$\text{Desired output} = \frac{\text{Available time}}{\text{Cycle time}}$$

$$= \frac{480}{2.3} = 208.69$$

$\simeq$ 208 units

(d) max. cycle time = Σt = 4.6 min

$$\text{Minimum output} = \frac{\text{Available time}}{\text{max. cycle time}}$$

$$= \frac{480}{4.6} = 104.31 \text{ units}$$

$\simeq$ 104 units

Q. 5(iii) Consider four jobs ---- ------- Cycle time.

<u>Sol:</u> <u>Step 1:</u> Convert the given Problem into n-jobs - 2 machine form. as below:

Job	Processing time in minutes	
	IM_1	IM_2
	M_1+M_2	M_2+M_3
A	12+6 = 18	6+10 = 16
B	6+4 = 10	4+8 = 12
C	7+5 = 12	5+6 = 11
D	8+3 = 11	3+7 = 10

<u>Now applying Johnson's Rule</u>:

<u>Step 2:</u> Find the shortest processing time on either m/c

The shortest processing time is 10 min for job B on m/c 1 & for job D on m/c 2.

Therefore, the job B should be placed first in the sequence & D at the last in the sequence.

B			D

After Removing the job B & D, Now the remaining jobs are

Job	Processing time in (minutes)	
	IM_1	IM_2
	M_1+M_2	M_2+M_3
A	12+6 = 18	6+10 = 16
C	7+5 = 12	5+6 = 11

Again, finding the shortest processing time for either m/c

The shortest processing time is 11 min for job C on m/c 2

There fore, arranging the job C, at the last in the sequence, for remaining positions.

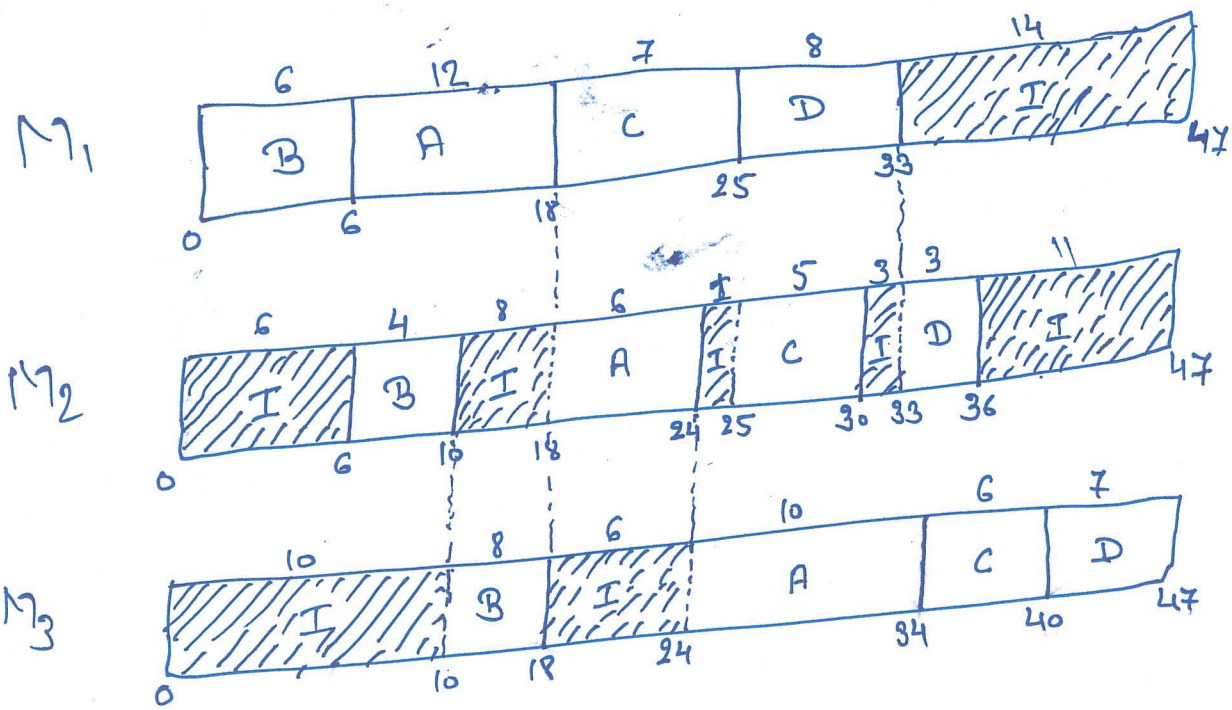
B		C	D

Now only job A ~~the the~~ remained, putting it in the sequence

The optimal sequence is

B	A	C	D

Cycle time : Using Gantt Chart



Total Flow time or cycle time = 47 min

Total operation time = operating time M_1 + operating time M_2 + operating time M_3

= 33 + 18 + 31 = 82 min

Total Idle time : Idle time on M_1 + Idle time on M_2 + Idle time M_3

= 14 + 29 + 16 = 59 min

Checks :

Total operation time + Total idle time = 3 × cycle time

82 + 59 = 3 × 47

141 = 141 min