

**B.Tech. SEM -VII Production 2014 Course (CBCS) : SUMMER - 2019**

**SUBJECT: OPERATIONS RESEARCH**

Day : Thursday  
Date : 09/05/2019

**S-2019-2843**

Time : 02.30 PM TO 05.30 PM  
Max. Marks : 60

**N. B. :**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable calculator is **ALLOWED**.
- 4) Assume suitable data, if necessary.

**Q.1 a)** Describe the scope, objectives, advantages and limitations of operation research. **(05)**

**b)** Explain in detail Big M method of Linear programming. **(05)**

**OR**

Solve the following Linear programming problem by Simplex method: **(10)**

$$\begin{aligned} \text{Max} \quad & Z = x_1 + x_2 + x_3 \\ \text{subject to} \quad & 4x_1 + 5x_2 + 3x_3 \leq 15 \\ & 10x_1 + 7x_2 + x_3 \leq 12 \\ \text{and} \quad & x_1, x_2, x_3 \geq 0 \end{aligned}$$

**Q.2** A captain of a cricket team has to allot five middle order batting positions to five batsmen. The average runs scored by each batsman at these positions are given in the table: **(10)**

**Batting position**

	III	IV	V	VI	VII	
Batsman	A	40	40	35	25	50
	B	42	30	16	25	27
	C	50	48	40	60	50
	D	20	19	20	18	25
	E	58	60	59	55	53

Make the assignment so that the expected total average runs scored by these batsmen are maximum.

**OR**

Figures in the table below are proportional to the cost of transportation of the tone of food grain from the port: **(10)**

Ports	Delhi	Hyderabad	Mysore	Nagpur	Stock (thousand tonnes)
Bombay	9	5	8	5	225
Calcutta	9	10	13	7	75
Madras	14	5	3	7	100
Requirement (thousand tonnes)	125	80	95	100	400

Plan the transportation scheme satisfying the requirements of each destination and at the same time optimizing the transportation cost.

**P. T. O.**

- Q. 3** a) Describe production lot size model with shortage. (05)
- b) A manufacturer has to supply his customer with 600 units of the product per year. Shortages are not allowed and the storage cost amounts to Rs. 0.60 per unit per year. The set-up cost per run is Rs. 80.00. Find the optimum run size and the minimum average yearly cost. (05)

**OR**

A shopkeeper estimates the annual requirement of an item as 2,000 units. He buys it from his supplier at a cost of Rs. 10 per item and the cost of ordering is Rs. 50 each time he orders. If the stockholding costs are 25 per cent per year of stock value, how frequently should be replenish his stocks? Further, suppose the supplier offers a 10 percent discount on orders between 400 and 699 items, and a 20 percent discount on orders exceeding or equal to 700. Can the shopkeeper reduce his costs by taking advantage of either of these discounts? (10)

- Q. 4** In a machine shop, 8 different products are being manufactured each requiring time on two machines A and B as given below: (10)

Job	1	2	3	4	5	6	7	8
m/c A	30	45	15	20	80	120	65	10
m/c B	20	30	50	35	36	40	50	20

- i) Determine the optimum sequence of processing.  
 ii) Total minimum elapsed time.  
 iii) Idle time for machine A and B.

**OR**

Assume that at a Bank teller window the customers arrive in their cars at the average rate of 20 per hour according to Poisson's distribution. Assume that the bank teller spends an average of 2 minutes per customer to complete a service and service time is exponentially distributed. Customers, who arrive from an infinite population are served on first – come – first – served basis. (10)

- i) What is the expected waiting time in the system per customer?  
 ii) What is the mean number of customers waiting in the system?  
 iii) What is the probability of zero customers in the system?  
 iv) What is the utilization factor?

- Q. 5** a) Explain the replacement policy where equipment deteriorates with time. (03)
- b) Determine the optimal strategies and the value of the game: (07)

$$\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$$

**OR**

- a) Explain Two Person Zero Sum Game and MiniMax and MaxiMin principle (03)
- b) A truck owner finds, from his past records, that the maintenance costs per year of a truck whose purchase price is Rs. 8,000 are as given below: (07)

Year	1	2	3	4	5	6	7	8
Maintenance cost (RS.)	1000	1300	1700	2000	2900	3800	4800	6000
Resale value (RS.)	4000	2000	1200	600	500	400	400	400

Determine what time would it be profitable to replace the truck.

Q. 6

(10)

Activity	Duration (days)		
	to	tm	tp
1-2	2	5	14
1-6	2	5	8
2-3	5	11	29
2-4	1	4	7
3-5	5	11	17
4-5	2	5	14
6-7	3	9	27
5-8	2	2	8
7-8	7	13	31

- i) For this PERT network find the expected task durations and variances of the tasks.
- ii) Draw the network for this project and find critical path. What is the expected length of the critical path? What is the variance of the critical path?
- iii) What is the probability that the length of the critical path does not exceed 30 days?

OR

The following maintenance job has to be performed periodically on the heat exchangers in a refinery: (10)

Task	Immediate predecessors	Time (days)
A	–	14
B	A	22
C	B	10
D	B	16
E	B	12
F	C	10
G	C	6
H	F, G	8
I	D, E, H	24
J	I	16

- i) Draw a network diagram of activities for the project.
- ii) Identify the critical path, what is its length?
- iii) Find the total float and free float for each task.

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