Code No: 812AK **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
MCA II Semester Examinations, December - 2019
OPERATIONS RESEARCH

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

5 × 4 Marks = 20

1.a) What are the main characteristics of OR? Explain with suitable examples. [4]
b) Show that assignment model is a special case of transportation model. [4]
c) What are the various simplifying assumptions made while dealing with sequencing problems? [4]
d) Explain Saddle point, Value of the game, Two-person zero-sum game and strategy. [4]
e) Given average arrival rate = 8 /hour, average service time = 5 minutes,
calculate i) utilization factor ii) Idle time
iii) Probability that a customer arriving at the service counter will have to wait
iv) Probability that the number of customers in the system is 2. [4]

PART - B

5 × 8 Marks = 40

2.a) Solve the L.P.P. by the simplex method:
Maximize $Z = 40x_1 + 35x_2$
Subject to $2x_1 + 3x_2 \leq 60$,
$4x_1 + 5x_2 \leq 96$
$x_1, x_2 \geq 0$.

b) Use graphical method to solve
Maximize $Z = 6x_1 + 8x_2$
Subject to $5x_1 + 10x_2 \leq 60$
$4x_1 + 4x_2 \leq 40$
$x_1, x_2 \geq 0$. [4+4]

OR

3. Use the two-phase method to solve the problem:
Minimize $Z = x_1 - 2x_2 - 3x_3$,
Subject to $-2x_1 + x_2 + 3x_3 = 2$,
$2x_1 + 3x_2 + 4x_3 = 1$,
$x_1, x_2, x_3 \geq 0$. [8]

4.a) Write the procedure for U – V method.

b) A factory has three warehouses W1, W2 and W3 which supply to four stores S1, S2, S3 and S4. Monthly capacities of the warehouses are W1 = 100 units, W2 = 40 units and W3 = 60 units. Monthly demands at the stores are S1 = 30 units, S2 = 50 units, 3=65units and S4= 55 units. The shipping cost in terms of rupees from warehouses to stores is as given below:

	Stores			
Warehouses	**S1**	**S2**	**S3**	**S4**
W1	14	16	12	20
W2	12	14	10	8
W3	10	16	8	15

The problem here is to determine the optimum distribution for the factory to minimize shipping costs. [4+4]

OR

5.a) A department store has leased a new store and wishes to decide how to place four departments in four locations so as to maximize total profits. The table below gives the profits, in thousands of Rupees, when the departments are allocated to the various locations. Find the assignment that maximizes total profits.

		Location			
		1	2	3	4
	Shoes	20	16	22	18
Departments	Toys	25	22	18	28
	Auto	27	20	26	23
	House wares	24	22	23	22

b) A travelling salesman, named Rolling Stone plans to visit five cities 1, 2, 3, 4 & 5. The travel time (in hours) between these cities is shown below:

	To				
From	**1**	**2**	**3**	**4**	**5**
1	∞	5	8	4	5
2	5	∞	7	4	5
3	8	7	∞	8	6
4	4	4	8	∞	8
5	5	5	6	8	∞

How should Mr. Rolling Stone schedule his touring plan in order to **minimize** the total travel **time**, if he visits each city once a week? [4+4]

6.a) Shahi Export House has to process five items through two stages of production, viz, cutting & sewing. Processing times are given in the following table:

Items	Time In Hours	
	Cutting	**Sewing**
A	7	4
B	3	8
C	11	9
D	5	10
E	12	6

Determine an order in which these items should be processed so as to minimize the total processing time.

b) Two jobs are to be performed on five machines A, B, C, D, and E. Processing times are given in the following table. Use graphical method to obtain the total minimum elapsed time. [4+4]

			Machine				
Job 1	**Sequence**	:	A	B	C	D	E
	Time	:	4	5	3	7	3
Job 2	**Sequence**	:	B	C	A	D	E
	Time	:	6	5	4	3	7

OR

7. The failure rates of transistors in a computer are summarized in Table

Failure rates of Transistors in computers

End of the week	1	2	3	4	5	6	7
Probability of failure to date	0.07	0.18	0.30	0.48	0.68	0.89	1

The cost of replacing an individual failed transistor is Rs. 9. If all the transistors are replaced simultaneously, it would cost Rs. 3.00 per transistor. Any one of the following two options can be followed to replace the transistors:

a) Replace the transistors individually when they fail (individual replacement policy).

b) Replace all the transistors simultaneously at fixed intervals and replace the individual transistors as they fail in service during the fixed interval (group replacement policy).

Find out the optimal replacement policy, i.e. individual replacement policy or group replacement policy. If group replacement policy is optimal, then find at what equal intervals all the transistors should be replaced. [8]

8. Resolve the reliability problem for the following data. Total capital available c = 15.

Components

u_i	1		2		3		4	
	R	C	R	C	R	C	R	C
1	.70	4	.60	2	.90	3	.80	3
2	.75	5	.80	4	—	—	.80	5
3	.85	7	—	—	—	—	—	—

[8]

OR

9.a) Two firms are sompeting for business under the conditions such that one firm's gain is another firm's loss. Firm A's payoff matrix is given below. Suggest optimal strategies for the two firms and the net outcome thereof.

	Airline B: Does nothing	Airline B: Advertises special rates	Airline B: Advertises special features (i.e., movies, fine food)
Airline A: Advertises special rates	275	–50	–75
Airline A: Advertises special features (i.e., movies, fine food).	125	130	150

b) Solve the following game by reducing them to 2 × 2 games by graphical method [4+4]

		B			
A	3	4	0	1	2
	-1	5	-2	2	3

10.a) A textile mill boys its raw material from a vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs. 100 per order and the carrying cost is 20% of the purchase price per unit per month, where the rchase price per unit is Rs. 1. Find i) Economic order quantity ii) Total cost w.r.t. EOQ
iii) Number of orders per year iv) Time between consecutive two orders.

b) A company manufactures refrigeration units in batches. The estimated demand is 12,000 units/year. It costs Rs. 100 to setup the manufacturing process and the carrying cost is Rs. 0.75 per unit per year. Once the production process has been setup, 90 units can be manufactured daily. The demand during the production day has been 65 units per day. How many units should the company produce in each batch? How long will the production cycle last? [4+4]

OR

11. The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour.
i) What is the probability of having 0 customers in the system?
ii) What is the probability of having 5 customers in the system?
iii) What is the probability of having 10 customers in the system?
iv) Find L_q, L_s, W_q and W_s [8]