Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– IV EXAMINATION – WINTER 2019

Subject Code: 2640003 Date: 15/11/2019

Subject Name: Operations Research

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define Operations Research. List out the applications of Operations Research. **07**

(b) Obtain an optimal solution for the following transportation problem: **07**

	D1	**D2**	**D3**	**D4**	**Supply**
S1	19	30	50	10	**7**
S2	70	30	40	60	**9**
S3	40	8	70	20	**18**
Demand	**5**	**8**	**7**	**14**	**34**

Q.2 **(a)** Machine A costs Rs 45,000 and its operating costs are estimated to be Rs 1,000 for the first year, increasing by Rs 10,000 per year in the second and subsequent years. Machine B costs Rs 50,000 and operating costs are Rs 2,000 for the first year, increasing by Rs 4,000 in the second and subsequent years. If at present we have a machine of type A, should we replace it with B? If so when? Assume that both machines have no resale value and their future costs are not discounted. **07**

(b) Explain reasons for carrying inventory in detail. **07**

OR

(b) A company uses rivets at a rate of 5,000 kg per year, rivets costing Rs. 2 per kg. It costs Rs. 20 to place an order and the carrying cost of inventory is 10% per annum. How frequently should order for rivets be placed and how much? **07**

Q.3 **(a)** **(1)** Define Strategy. Explain its types in detail. **03**

(2) Define the terms: Maximin Principle, Minimax Principle **04**

(b) The arrival rate of a customer at a service window of a cinema hall follows a probability distribution with a mean rate of 45 per hour. The service rate of the clerk follows Poisson distribution with a mean of 60 per hour. **07**

(a) What is the probability of having no customers in the system?
(b) What is the probability of having five customers in the system?
(c) Finds Ls, Lq, Ws and Wq.

OR

Q.3 **(a)** For the game with payoff matrix: **07**

	Player B		
Player A	**B_1**	**B_2**	**B_3**
A_1	-1	2	-2
A_2	6	4	-6

Determine the optimal strategies for players A and B. Also determine the value of the game. Is this game (i) fair? (ii) strictly determinable?

(b) Define Simulation. Explain types of simulation in detail. **07**

Q.4 **(a)** An established company has decided to add a new product to its line. It will buy the product from a manufacturing concern, package it, and sell it to a number of distributors that have been selected on a geographical basis. Market research has already indicated the volume expected and the size of sales force required. The steps shown in the following table are to be planned. **07**

Activity	Description	Predecessors	Duration (days)
A	Organize sales office	-	6
B	Hire Salesman	A	4
C	Train salesman	B	7
D	Select advertising agency	A	2
E	Plan advertising campaign	D	4
F	Conduct advertising campaign	E	10
G	Design package	-	2
H	Setup packaging facilities	G	10
I	Package initial stocks	J, H	6
J	Order stock from manufacturer	-	13
K	Select distributors	A	9
L	Sell to distributors	C, K	3
M	Ship stocks to distributors	I, L	5

(a) Draw an arrow diagram for this project.
(b) Indicate the critical path.
(c) For each non – critical activity, find the total and free float.

(b) Solve the following sequencing problem, giving an optimal solution when passing is not allowed. **07**

Machine	Job				
	A	**B**	**C**	**D**	**E**
M1	11	13	9	16	17
M2	4	3	5	2	6
M3	6	7	5	8	4
M4	15	8	13	9	11

OR

Q.4 **(a)** A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing times on A and B are given in the following table. Find the optimum sequence, the total minimum elapsed time and idle time for each machine. **07**

Job Number	No. of Units of Each Job	Processing Time (hours)	
		Machine A	**Machine B**
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

(b) Construct a network diagram for the following project activities : **07**

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Predecessors Activity	-	A	A	C	B	C	D, E	G	H	F	I, J	K	L	J	M, N

Q.5 **(a)** **(1)** Explain components of LP Model in detail. **03**

(2) Discuss assumptions of an LP Model in detail. **04**

(b) Use the graphical method to solve the following LP problem: **07**

Maximize $Z = 6x_1 - 4x_2$

Subject to the constraints

(i) $2x_1 + 4x_2 \leq 4$ (ii) $4x_1 + 8x_2 \geq 16$

and $x_1, x_2 \geq 0$

OR

Q.5 **(a)** Solve the following LP problem using simplex method: **07**

Maximize $Z = 3x_1 + 9x_2$

Subject to the constraints

(i) $x_1 + 4x_2 \leq 8$ (ii) $x_1 + 2x_2 \leq 4$

and $x_1, x_2 \geq 0$

(b) Obtain the dual of the following primal LP problem: **07**

Maximize $Z_x = x_1 - 2x_2 + 3x_3$

Subject to the constraints

(i) $-2x_1 + x_2 + 3x_3 = 2$ (ii) $2x_1 + 3x_2 + 4x_3 = 1$

and $x_1, x_2, x_3 \geq 0$

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