Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA Integrated – SEMESTER – IV • EXAMINATION – SUMMER 2018

Subject Code: 4440602   **Date: 04-May-2018**

Subject Name: Operations Research (OR)

Time: 10.30 am to 1.00 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)** What is Operations Research (OR)? What are the significant features of OR? State any four application of OR.   **07**

(b) A person wants to decide the constituents of a diet which will fulfill his daily requirements of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in the following table. Formulate linear programming model for the problem.   **07**

Food Type	Yield per unit			Cost per unit
	Proteins	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum Requirements	800	200	700	

Q.2 **(a)** Solve the following problem using graphical method: **07**

Maximize $Z = 40x_1 + 100x_2$

$12x_1 + 6x_2 \leq 3000, 4x_1 + 10x_2 \leq 2000, 2x_1 + 3x_2 \leq 900, x_1, x_2 \geq 0$

(b) Use simplex method to solve following problem: **07**

Maximize $Z = 2x_1 + 5x_2$

Subject to $x_1 + 4x_2 \leq 24$, $3x_1 + x_2 \leq 21$, $x_1 + x_2 \leq 9$, $x_1, x_2 \geq 0$

OR

(b) Use Big-M Method to solve following problem: **07**

Minimize $Z = 12x_1 + 20x_2$

Subject to $6x_1 + 8x_2 \geq 100, 7x_1 + 12x_2 \geq 120, x_1, x_2 \geq 0$

Q.3 **(a)** Solve the following using least cost method and North West Corner Method.   **07**

	P	Q	R	Supply
A	2	7	4	5
B	3	3	1	8
C	5	4	7	7
D	1	6	2	14
Demand	7	9	18	

(b) Solve the following assignment problem.   **07**

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	P	Q	R	S	T
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	13

OR

Q.3 **(a)** Define: Two- person zero- sum game, Saddle point. For the game with payoff matrix: **07**

Player A	Player B			
	B_1	B_2	B_3	B_4
A_1	3	−5	0	6
A_2	−4	−2	1	2
A_3	5	4	2	3

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

(b) Find optimal solution of the following transportation problem.   **07**

	P	Q	R	S	Supply
A	10	8	7	12	500
B	12	13	6	10	600
C	8	10	12	14	900
Demand	700	550	450	300	

Q.4 **(a)** Describe the characteristics of calling population (input source) of a queuing system. What do you understand by Queue discipline?   **07**

(b) There are 7 jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as follow. Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B.   **07**

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

OR

Q.4 **(a)** What is simulation? Explain Monte-Carlo simulation along with all the necessary steps.   **07**

(b) A self service store employs one cashier as its counter. 9 customers arrive on at average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming passion distribution for arrival rate and exponential distribution for service time, find   **07**
1. Average number of customers in the system.
2. Average number of customers in the queue or average queue length.
3. Average time a customer spends in the system.
4. Average time a customer waits before being served.

Q.5 **(a)** Explain the difference between PERT and CPM.   **07**

(b) The cost of a machine is Rs. 6100 and its scrap value is Rs. 100. The maintenance costs found as follows. When should the machine be replaced?   **07**

Year	1	2	3	4	5	6	7	8

Maintenance cost	100	250	400	600	900	1200	1600	2000

OR

Q.5 **(a)** A project has the following characteristics: **07**

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time	4	1	1	1	6	5	4	8	1	2	5	7

(1) Draw PERT Diagram.
(2) Compute E and L for each event.
(3) Find the critical path.

(b) A particular item has a demand of 9000 units/year. The cost of one procurement **07**
is Rs. 100 and the holding cost per unit is Rs. 2.40 per year. The replacement is
instantaneous and no shortages are allowed. Determine
(1) The economic lot size.
(2) The number of orders per year.
(3) The time between orders.
(4) The total cost per year if the cost of one unit is Rs. 1.

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