Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 171901 **Date: 11/05/2017**

Subject Name: Operation Research

Time: 02:30 PM to 05:00 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)** Discuss the scope or operation research. Also state its limitations. **07**

(b) Solve the following LPP by graphical method **07**

Minimize $Z = 20x_1 + 10x_2$

Subject to

$$x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \geq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_1, x_2 \geq 0$$

Q.2 **(a)** Obtain the dual of the primal problems **07**

(i) Maximize $Z = 3x_1 + 17x_2 + 9x_3$

Subject to

$$x_1 - x_2 + x_3 \geq 3$$
$$-3x_1 + 2x_3 \leq 1$$
$$x_1, x_2, x_3 \geq 0$$

(ii) Maximize $Z = 2x_1 + x_2 + x_3$

Subject to

$$x_1 + x_2 + x_3 \geq 6$$
$$3x_1 - 2x_2 + 3x_3 = 3$$
$$-4x_1 + 3x_2 - 6x_3 = 1$$
$$x_1, x_2, x_3 \geq 0$$

(b) Solve by Simplex method the following L.P. problem **07**

Minimize $Z = x_1 - 3x_2 + 3x_3$

Subject to

$$3x_1 - x_2 + 2x_3 \leq 7$$
$$-2x_1 - 4x_2 \leq 12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0$$

OR

(b) Solve using Big-M method **07**

Maximize $Z = 3x_1 - x_2$

Subject to

$$2x_1 + x_2 \leq 2$$
$$x_1 + 3x_2 \geq 3$$
$$x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

Q.3 **(a)** Explain degeneracy in simplex method and in transportation problem. **07**

(b) Solve the game using graphical method after reducing it using dominance rule. **07**

		B			
		y_1	y_2	y_3	y_4
A	x_1	19	6	7	5
	x_2	7	3	14	6
	x_3	12	8	18	4
	x_4	8	7	13	-1

OR

Q.3 **(a)** A company manufacturing air coolers has two plants located in Mumbai and Kolkata with a capacity of 200 units and 100 units per week respectively. The company supplies the air coolers to its four show rooms situated at Ranchi, Delhi, Lucknow and Kanpur which have a maximum demand of 75, 100, 100 and 30 units respectively. Due to the differences in raw material cost and transportation cost, the profit per unit in rupees differs which is shown in the table below. **07**

	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	110
Kolkata	50	70	130	85

Plan the production programme so as to maximize the profit. Obtain initial basic feasible solution by Vogel's method and optimal solution by MODI method.

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

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

Q.4 **(a)** A machine costs Rs. 500. Operation and maintenance costs are zero for the first year and increase by Rs. 100 every year. If money is worth 5 % every year, determine the best age at which the machine should be replaced. The resale value of the machine is negligibly small. What is the weighted average cost of owning and operating the machine ? **07**

(b) Write a note on ABC analysis. **07**

OR

Q.4 **(a)** Find the cost per period of individual replacement policy of an installation of 300 light bulbs, given the following : **07**

(i) Cost of replacing an individual bulb is Rs.2

(ii) Conditional probability of failure is given below :

Week no.	0	1	2	3	4
Conditional probability of failure	0	0.1	0.3	0.7	1.0

Also calculate the number of light bulbs that would fail during each of the four weeks.

(b) (i) Write a note on Kendall's notation as related to queuing theory. **04**

(ii) Define the following terms : balking, reneging and jockeying. **03**

Q.5 **(a)** Write a note on crashing of network. **07**

(b) Define dynamic programming and explain Bellman's principle of optimality. **07**

OR

Q.5 **(a)** The time estimates (in weeks) for the activities of a PERT network are given below : **07**

Activity	t_o	t_m	t_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(i) Determine the expected project length.

(ii) Calculate the standard deviation and variance of the project length.

(iii) What is the probability that the project will be completed

(I) Atleast 4 weeks earlier than expected time ?

(II) No more than 4 weeks later than the expected time ?

(iv) If the project due date is 19 weeks, what is the probability of not meeting the due date ?

Use the following data :

Z	-1.33	0.667	1.33
Probability	0.0918	0.7486	0.9082

(b) Write a note on Monte Carlo simulation. **07**

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