GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (OLD) EXAMINATION – WINTER 2018

Subject Code: 171901   **Date: 06/12/2018**

Subject Name: Operation 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)**	**(i)** Describe the various objectives of OR? Write any two merits of OR.	**04**
		(ii) What is degeneracy in transportation? How it resolve?	**03**
	(b)	Using Graphical method, Find the maximum value of	**07**

$$Z = 2X_1 + X_2$$

$$\textit{Subjected to,} \quad X_1 + 2X_2 \leq 10,$$
$$X_1 + X_2 \leq 6,$$
$$X_1 - 2X_2 \leq 1,$$
$$X_1 - X_2 \leq 2,$$
$$X_1, X_2 \geq 0$$

Q.2 **(a)** Find initial feasible solution by VAM and check optimality by MODI, where cell **07** entries are unit costs.

	D_1	D_2	D_3	D_4	D_5	Available
O_1	68	35	4	74	15	18
O_2	57	88	91	3	8	17
O_3	91	60	75	45	60	19
O_4	52	53	24	7	82	13
O_5	51	18	82	13	7	15
Required	16	18	20	14	14	

(b) Using Simplex method, **07**

$$\textit{Maximize,} \quad Z = 3X_1 - X_2$$
$$\textit{Subjected to,} \quad 2X_1 + X_2 \leq 2,$$
$$X_1 + 3X_2 \geq 3,$$
$$X_2 \leq 4,$$
$$X_1, X_2 \geq 0$$

OR

(b) Formulate the LPP and prepare initial table, if An Air Force is experimenting **07** with three types of bombs P, Q and R in which three kinds of explosives, viz. A, B and C will be used. Taking the various factors into account, it has been decided to use the maximum 600 kg of explosive A. at least 480 kg of explosive B and exactly 540 kg of explosive C. Bomb P requires 3, 2, 2 kg, Bomb Q requires 1, 4, 3 kg and Bomb R requires 4, 2, 3 kg of explosives A, B and C respectively. Bomb P is estimated to give the equivalent of a 2 ton explosive, bomb Q, a 3 ton

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Q.3 **(a)** Four different jobs can be done on four different machines. The set-up and take-down time costs are assumed to be prohibitively high for changeovers. The matrix below gives the cost in rupees of producing jobs i on machine j. **07**

	M_1	M_2	M_3	M_4
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

How should the jobs be assigned to the various machines so that the total cost is minimized?

(b) Explain Kendall's notation for queuing system. Also explain the term: Balking and Jockeying. **07**

OR

Q.3 **(a)** Five wagons are available at stations 1, 2, 3, 4 and 5. These are required at five stations I, II, III, IV and V. The mileages between various stations are given by the table below. How should the wagons be transported so as to minimize the total mileage covered? **07**

	I	II	III	IV	V
1	10	5	9	18	11
2	13	9	6	12	14
3	3	2	4	4	5
4	18	9	12	17	15
5	11	6	14	19	10

(b) A company uses Rs. 10,000 worth of an item during the year. The ordering costs are Rs. 25 per order and carrying charges are 12.5% of the average inventory value. Find the economic order quantity, number of orders per year, time period per order and the total cost. **07**

Q.4 **(a)** The maintenance cost and resale value per year of a machine whose purchase price is Rs. 7000 is given below. **07**

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	900	1200	1600	2100	2800	3700	4700	5900
Resale value in Rs.	4000	2000	1200	600	500	400	400	400

When should the machine be replaced?

(b) A company currently involved in negotiation with its union on the upcoming wage contract. Positive sign in below table represents wage increase while negative sign represents wage reduction. What are the optimal strategies for the company as well as the union? What is the game value? **07**

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Conditional costs to the company (Rs. In lakhs)

Union Strategies

		U_1	U_2	U_3	U_4
Company	C_1	+0.25	+0.27	+0.35	-0.02
	C_2	+0.20	+0.16	+0.08	+0.08
Strategies	C_3	+0.14	+0.12	+0.15	+0.13
	C_4	+0.30	+0.14	+0.19	+0.00

OR

Q.4 **(a)** A Hand Drill Machine costs Rs. 9000. Annual operating costs are Rs. 200 for the first year, and then increase by Rs. 2000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? Assume that the machine has no resale value when replaced and that future costs are not discounted. **07**

(b) Explain the following: **(i)** Minimax and Maximin principles **(ii)** Pure and mixed strategies **(iii)** Two-person zero-sum game. **07**

Q.5 **(a)** Estimated times for the jobs of a project are given below: **07**

Job:	A	B	C	D	E	F	G	H	I	J	K	L
Time (weeks)	13	5	8	10	9	7	7	12	8	9	4	17

The constraints governing the jobs are as follows:
A and B are start jobs; A controls C, D and E; B controls F and J; G depends upon C; H depends on D; E and F control I and L; K follows J; L is also controlled by K; G, H, I and L are the last jobs. Draw the network, determine float for each activity, project duration and the critical path.

(b) Explain Monte Carlo method and give the situations where these methods are useful. **07**

OR

Q.5 **(a)** What do you mean by floats? Explain how to calculate each type of floats with respect to CPM? **07**

(b) Explain the Bellman's principle of optimality with illustrative example. **07**

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