

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2171901

Date:23/11/2016

Subject Name: Operation Research

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 linear programming problem? Discuss the scope and role of LPP in solving management problems. **07**

(b) A 24 hour supermarket has the following minimal requirements for cashiers: **07**

Period	1	2	3	4	5	6
Time of the day (24 hour clock)	3-7	7-11	11-15	15-19	19-23	23-3
Minimum number required	7	20	14	20	10	5

Period 1 follows immediately after period 6. A cashier works eight consecutive hours, starting at the beginning of one of the six time periods. Determine a daily employee worksheet which satisfies the requirements with the least number of personnel. Formulate the problem as an LPP.

Q.2 (a) Maximize $Z = 10x_1 + 15x_2$ **07**

Subject to constraints,

$$2x_1 + x_2 \leq 26,$$

$$2x_1 + 4x_2 \leq 56,$$

$$x_1 - x_2 \geq -5,$$

$$x_1, x_2 \geq 0$$

(b) Maximize $Z = 40x_1 + 35x_2$ **07**

Subject to constraints,

$$2x_1 + 3x_2 \leq 60,$$

$$4x_1 + 3x_2 \leq 96,$$

$$x_1, x_2 \geq 0$$

OR

(b) Obtain the dual of the LPP given here: **07**

Maximize $Z = 8x_1 + 10x_2 + 5x_3$

Subject to constraints,

$$x_1 - x_3 \leq 4, \quad 2x_1 + 4x_2 \leq 12,$$

$$x_1 + x_2 + x_3 \geq 0, \quad 3x_1 + 2x_2 - x_3 = 8,$$

$$x_1, x_2, x_3 \geq 0$$

Q.3 (a) As new automobile vehicle costs Rs. 10000 and it can be sold at the end of any year with the selling price as shown. The operating and maintenance cost are given year wise in following table. Find when the automobile vehicle needs to be replaced because of wear and tear. **07**

Year	1	2	3	4	5	6
Selling price (Rs)	7000	5000	3000	2000	1000	500
Operating & Maintenance cost (Rs)	1000	1600	1800	2500	3000	3500

(b) Following are the records of demand of an item for the past one month. 07

Demand	100	110	120	130	140
Probability	0.05	0.25	0.40	0.26	0.04

1. Calculate the expected demand
2. The item cost price of an item is Rs. 25 and selling price is Rs. 30. If at the end of the day any surplus has to be disposed of at Rs. 20 per item. What is optimum output?

OR

Q.3 (a) What is an assignment problem? Why it is called as a special case of the transportation problem? 07

(b) The captain of a cricket team has to allot five middle order batting positions to 5 batsmen available for selection. The average runs scored by each batsmen at these positions are summarized in a table below. 07

Batsman	Batting positions				
	I	II	III	IV	V
A	40	46	48	36	48
B	48	32	36	29	44
C	49	35	41	38	45
D	30	46	49	44	44
E	37	41	48	43	47

Using Assignment model, determine the assignment of batsmen to positions which would give maximum runs in favor of team.

Q.4 (a) The details of activity and duration are shown below: 07

Activity	A	B	C	D	E	F	G
Depends on	-	A	A	A	B,C	C,D	E,F
Time, Days	10	5	4	7	6	4	7

Find:

1. Draw a network diagram
2. Find the critical path
3. Project duration

(b) Solve the following pay-off matrix for player A. Also find out the optimal strategy and value of the game using arithmetic method. 07

		Player B		
		B1	B2	B3
Player A	A1	1	3	11
	A2	8	5	2

OR

Q.4 (a) What is degeneracy? How does the problem of degeneracy arise in a transportation problem? How can we deal with this problem? 07

(b) Company has factories A1, A2 & A3 which supply to warehouses at W1, W2 & W3. Weekly factory capacities are 240, 200 & 130 units respectively. Weekly warehouses requirements are 190, 150 & 110 units respectively. Unit transportation costs in Rs. is given in the table. Find initial basic feasible solution using VAM method & Optimum solution by MODI method. 07

Company\Warehouse	W1	W2	W3	Supply
A1	16	20	12	240
A2	14	8	18	200
A3	26	24	16	130
Demand	190	150	110	450

- Q.5 (a)** The annual demand of a product is 10,000 units. Each unit costs Rs. 40 if the orders are placed in quantities below 140 units. The order of 180 or above, the unit price is Rs. 40. Assume inventory holding cost as 10 % of the value of the item and the ordering cost is Rs. 2 per order. Find the economic lot size. **07**
- (b)** Write a short note on ABC analysis. **07**

OR

- Q.5 (a)** Explain Kendall's notation for queuing system. Also explain the terms: balking and jockeying. **07**
- (b)** At barber's shop, the customers arrive at the average interval of 6 minutes and the barber takes on an average 5 minutes for serving the person. Calculate: **07**
- i. Counter utilization level
 - ii. Average no. of customers in service
 - iii. Average no. of customers in queue
 - iv. Average waiting time of the customers in the system
 - v. Expected average waiting time in the queue
 - vi. Probability that the barber is idle
 - vii. Probability of finding more than 3 customers in the system
