

GUJARAT TECHNOLOGICAL UNIVERSITY
BE –SEMESTER 7 (NEW SYLLABUS) EXAMINATION- SUMMER 2018

Subject Code: 2171901

Date: 03-05-2018

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.
4. Use of normal distribution table is allowed.

	MARKS
Q.1 (a) Discuss various areas for the application of operations research techniques.	03
(b) Briefly explain the steps involved in the solution of an operations research problem.	04
(c) An electronic company is engaged in the production of two components A and B used in radio sets. Each units of A cost the company Rs. 5 in material and Rs. 5 in wages, while each of B cost the company Rs. 25 in wages and Rs. 15 in material. The company sells both products on period credit terms but the company's labor and material expenses must be paid in cash. The selling price of A is Rs. 30 per units and of B is Rs. 70 per unit. It is assumed that the company can sell as many units as it produces. The company's production capacity is however is limited by two considerations. First, at the beginning, the company has initial balance of Rs. 4000 (cash plus bank credit plus collection from past credit sales). Second, the company has available 2000 hours of machine time and 1400 hours of assembly time. The production of each unit of A requires 3 hours of machine time and 2 hours of assembly time whereas the production of B requires 2 hours of machine time and 3 hours of assembly time. Formulate this problem as a LP model so as to maximize the total profit of the company.	07
Q.2 (a) Graphically represent following cases in linear programming. (1) Un-bounded solution (2) Multiple optimal solution	03
(b) Write dual of the following LPP. Min $Z = X_1 - 3X_2 - 2X_3$ Subject to, $3X_1 - X_2 + 2X_3 \leq 7,$ $2X_1 - 4X_2 \geq 12,$ $-4X_1 + 3X_2 + 8X_3 = 10,$ $X_1, X_2 \geq 0; X_3$ unrestricted in sign.	04
(c) Solve following LPP. Is problem has multiple optimal solution? Verify. Max $Z = 6X_1 + 4X_2$ Subject to, $2X_1 + 3X_2 \leq 30,$ $3X_1 + 2X_2 \leq 24,$ $X_1 + X_2 \geq 3,$ $X_1, X_2 \geq 0$	07

OR

- (c)

Solve following LPP.
Max $Z = 3X_1 + 5X_2 + 4X_3$
Subject to,
 $2X_1 + 3X_2 \leq 8,$
 $2X_2 + 5X_3 \leq 10,$
 $3X_1 + 2X_2 + 4X_3 \leq 15$
 $X_1, X_2, X_3 \geq 0$

07

- Q.3

(a) What is replacement? Describe some important replacement situations.

03
- (b) How would you deal with assignment problems, where (a) the objective function is to be maximized? (b) some assignments are prohibited?

04
- (c) Five jobs are to be assigned to five machines with an objective to minimize total man-hours. The time (in hours) that each man takes to perform each job is given below. Find the optimum assignment.

07

Employees						
Jobs		I	II	III	IV	V
	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

OR

- Q.3

(a) Discuss group replacement policy with suitable example.

03
- (b) Discuss the difference between decision-making under certainty, under uncertainty and under risk.

04
- (c) The running cost per year and resale price of the equipment is given below. The purchase price is Rs. 2,00,000. What is the optimum period of replacement?

07

Year	1	2	3	4	5	6	7
Running Cost (Rs.)	30,000	38,000	46,000	58,000	72,000	90,000	1,10,000
Resale value (Rs.)	1,00,000	50,000	25,000	12,000	8,000	8,000	8,000

- Q.4

(a) With suitable example, explain various possible errors in the construction of a network diagram.

03
- (b) What is transshipment problem? Explain how it can be formulated and solved as a transportation problem?

04
- (c) A small project involves 7 activities, and their time estimates are listed in the following table.

07

Activity	Estimated Duration (weeks)		
	Optimistic	Most likely	Pessimistic
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

- (a)

Draw the network diagram of the activities in the project.
- (b)

Find the expected duration and variance for each activity. What is the expected project length?
- (c)

What is the probability that the project will be completed at least 4 weeks earlier than expected time?

OR

- Q.4 (a)** What is “Strategy”? Explain the difference between pure strategy and mixed strategy. **03**
- (b)** Payoff matrix of a game is given below. It game has a saddle Point? If no, **04**
Reduce the size of the game using dominance rule.

		Player B			
		B1	B2	B3	B4
Player A	A1	3	2	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

- (c)** A manufacturer wants to ship 22 loads of his product as shown below. The **07**
matrix gives the kilometers from sources to destinations. What shipping
schedule should be used to minimize the total distance to be travelled?

		Destination					Supply
Source		D ₁	D ₂	D ₃	D ₄	D ₅	
	S ₁	5	8	6	6	3	8
	S ₂	4	7	7	6	5	5
	S ₃	8	4	6	6	4	9
Demand		4	4	5	4	8	

- Q.5 (a)** Discuss various costs involved in an Inventory model. **03**
- (b)** What are various performance measures of a queuing system? Discuss in brief. **04**
- (c)** A contractor has to supply 10,000 bearings per day to an automobile **07**
manufacturer. He finds that when he starts production run, he can produce
25,000 bearings per day. The cost of holding a bearing in stock for a year is Rs.
200 per year. The set-up cost of a production run is Rs. 1,800. How frequently
should production run be made? Assume 300 working days per year.

OR

- Q.5 (a)** Write a short-note on “ABC analysis” of inventory control technique. **03**
- (b)** Derive the EOQ formula when the rate of demand is constant. Clearly mention **04**
the assumptions made.
- (c)** In a bank counter, customers arrive at a rate of 30 customers per day. Assuming **07**
that the interarrival time follows an exponential distribution and service time
distribution is also exponential with an average of 36 minutes. Calculate:
(a) Expected queue size
(b) Probability that the queue size exceeds 10
