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10EE661

Sixth Semester B.E. Degree Examination, Aug./Sept. 2020
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Briefly explain the main characteristics of operation research. **(05 Marks)**

b. A farmer has 100 acre farm. He can sell all tomatoes, lettuce and radishes, he can raise. The price he can obtain is Rs.1.00 per kg for tomatoes, Rs.0.75 a head for lettuce and Rs.2.00 per kg for radishes. The average yield per acre is 2,000 kg of tomatoes, 3000 heads of lettuce and 1000kgs of radishes. Fertilizer is available at Rs. 0.50 per kg and the amount required per acre is 100kgs each for tomatoes and lettuce and 50kgs for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes, 6 man-days for lettuce. A total of 400 man-days of labour are available at Rs.20.00 per man-day. Formulate this problem as a Linear Programming model to maximize the farmer's total profit. **(08 Marks)**

c. Solve the following LPP by Graphical method :

$$\text{Max } Z = 3x_1 + 4x_2$$
$$\text{S.T.} \quad 5x_1 + 4x_2 \le 200$$
$$3x_1 + 5x_2 \le 150$$
$$5x_1 + 4x_2 \ge 100$$
$$8x_1 + 4x_2 \ge 80$$
$$\text{where } x_1, x_2 \ge 0.$$

(07 Marks)

2 a. Solve by two phase simplex method :

$$\text{Max } Z = 5x_1 - 4x_2 + 3x_3$$
$$\text{S.T} \quad 2x_1 + x_2 - 6x_3 = 20$$
$$6x_1 + 5x_2 + 10x_3 \le 76$$
$$8x_1 - 3x_2 + 6x_3 \le 50$$
$$\text{where } x_1, x_2\, x_3 \ge 0.$$

(10 Marks)

b. Give the procedure for Big-M method. **(05 Marks)**

c. Give the dual of the following LPP :

$$\text{Min } Z = 2x_1 + 3x_2 + 4x_3$$
$$\text{S.T.} \quad 2x_1 + 3x_2 + 5x_3 \ge 2$$
$$3x_1 + x_2 + 7x_3 = 3$$
$$x_1 + 4x_2 + 6x_3 \le 5$$
$$\text{where } x_1, x_2 \ge 0 \text{ and } x_3 \text{ is unrestricted.}$$

(05 Marks)

3 a. Define slack and surplus variables used in solving LPP. Explain degeneracy in LPP and explain how to solve it. **(10 Marks)**

b. Solve using deal simplex method :

$$\text{Max } Z = -3x_1 - 2x_2$$
$$\text{S.T.} \quad x_1 + x_2 \ge 1$$
$$x_1 + x_2 \le 7$$
$$x_1 + 2x_2 \ge 10$$
$$x_2 \le 3$$
$$\text{where } x_1, x_2 \ge 0.$$

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

4 a. What is an assignment problem? Describe the mathematical formulation of an assignment problem. **(08 Marks)**

b. A salesman estimates that the following would be the cost on his route, visiting the six cities as shown in the table below :

From city \ To city	1	2	3	4	5	6
1	∞	20	23	27	29	34
2	21	∞	19	26	31	24
3	26	28	∞	15	36	26
4	25	16	25	∞	23	18
5	23	40	23	31	∞	10
6	27	18	12	35	16	∞

The salesman can visit each of the cities once and only once. Determine the optimum sequence he should follow to minimize the total distance travelled. What is the total distance travelled? **(12 Marks)**

PART – B

5 a. With respect to transportation problems what is degeneracy and how it is tackled. **(08 Marks)**

b. A company has three plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. Unit transportation costs (in Rs.) are given below :

From \ To	D	E	F	G	H
A	5	8	6	6	3
B	4	7	7	6	5
C	8	4	6	6	4

Determine an optimum distribution for the company in order to minimize the total transportation cost. **(12 Marks)**

6 a. Define the following :

i) Two person zero sum game
ii) Optimal strategy
iii) Pay–off matrix
iv) Saddle point. **(04 Marks)**

b. Briefly explain the Max-min and Mini-max principle. **(06 Marks)**

c. Solve the following Game Graphically.

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}.$$

(10 Marks)