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10CS/IS661

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020

Operations Research

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO full questions from each part.

PART - A

- 1 a. Explain the phases of OR. (06 Marks)
 b. A manufacturer produces three models of a certain product. He uses two types of raw materials of which 4000 and 6000 units respectively are available. The raw material requirements per unit of the three models are given below:

Raw Material	Requirements per unit of given model		
	I	II	III
A	2	3	5
B	4	2	7

The labour time for each unit of model I is twice that of model II and three times of model III. The entire labour force of the factory can produce the equivalent of 2500 units of model I. A market survey indicates that the minimum demand of three models are 500, 500 and 375 units respectively. However, the ratios of the numbers of units produced must be 3:2:5. Assume that the profit per unit of models I, II and III are Rs.60, 40 and 100 respectively. Formulate the problem as a linear programming model in order to determine the number of units of each profit which will maximize profit. (10 Marks)

- c. What is the impact of OR on numerous organizations? (04 Marks)
- 2 a. Solve the following LP problem graphically:

$$\text{Maximize } Z = x_1 + \frac{x_2}{2}$$

$$\text{Subject to } 3x_1 + 2x_2 \leq 12$$

$$5x_1 \leq 10$$

$$x_1 + x_2 \leq 18$$

$$-x_1 + x_2 \geq 4 \quad \text{and} \quad x_1 \geq 0, \quad x_2 \geq 0$$

(10 Marks)

- b. Solve the following LPP by simplex method:

$$\text{Maximize } Z = 2x_1 + 4x_2 + 3x_3$$

$$\text{Subject to } 3x_1 + 4x_2 + 2x_3 \leq 60$$

$$2x_1 + x_2 + 2x_3 \leq 40$$

$$x_1 + 3x_2 + 2x_3 \leq 80 \quad \text{and} \quad x_1 \geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0$$

(10 Marks)

- 3 a. Solve the following LPP by Big M method:

$$\text{Maximize } Z = 3x_1 - x_2$$

$$\text{Subject to the constraints } 2x_1 + x_2 \geq 2$$

$$x_1 + 3x_2 \leq 3$$

$$x_2 \leq 4 \quad \text{and} \quad x_1, x_2 \geq 0$$

(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.

- b. Solve the following using Two phase method:

$$\text{Minimize } Z = 0.4x_1 + 0.5x_2$$

$$\text{Subject to } 0.3x_1 + 0.1x_2 \leq 2.7$$

$$0.5x_1 + 0.5x_2 = 6$$

$$0.6x_1 + 0.4x_2 \geq 6 \quad \text{and } x_1, x_2 \geq 0$$

(10 Marks)

- 4 a. Explain the procedure of computing for a basic feasible solution in revised simplex method.

(07 Marks)

- b. Convert the following problems in to its dual:

i) Minimize $Z = 2x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$$3x_1 + x_2 + 7x_3 \leq 3$$

$$x_1 + 4x_2 + 6x_3 \leq 5 \quad \text{and } x_1, x_2, x_3 \geq 0$$

ii) Minimize $Z = [3, 5] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

Subject to

$$\begin{bmatrix} 1 & 0 \\ 0 & 2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} 4 \\ 12 \\ 18 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \geq \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

(06 Marks)

- c. Explain:

i) Weak duality property

ii) Strong duality property

iii) Complementary solution property with example.

(07 Marks)

PART - B

- 5 a. In parametric linear programming explain

i) Systematic changes in the c_j parameters

ii) Systematic changes in the b_j parameters.

(06 Marks)

- b. Write the dual of the following LP problem and solve it

$$\text{Maximize } Z = 4x_1 + 2x_2$$

$$\text{Subject to } -x_1 - x_2 \leq -3$$

$$-x_1 + x_2 \leq -2 \quad \text{and } x_1, x_2 \geq 0$$

Hence or otherwise write down the solution of primal.

(10 Marks)

- c. Write in brief about economic interpretation of duality.

(04 Marks)

- 6 a. Find the initial basic feasible solution to the following transportation problem, using Vogel's approximation method.

		Destinations				
Sources	D ₁	D ₂	D ₃	D ₄	Supply	
S ₁	13	15	19	17	250	
S ₂	17	19	16	15	200	
S ₃	15	17	17	15	250	
Demand	100	150	250	100		

(08 Marks)

- b. Find the optimal solution to the given transportation problem. Use North-West corner rule to find the initial basic feasible solution. (12 Marks)

	Destinations			
Sources	6	3	5	4
	4	8	7	3
	3	4	3	2
	4	2	3	

- 7 a. Two competitors A and B are competing for the same product. Their different strategies are given in the following pay off matrix:

		Company B			
		I	II	III	IV
Company A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Use dominance principle to find optimal strategies. (10 Marks)

- b. Solve the following 2×4 game graphically:

		B			
		I	II	III	IV
A	I	2	2	3	-1
	II	4	3	2	6

(10 Marks)

- 8 Write a note on:
- Tabu search
 - Genetic algorithms
 - Algebra of simplex method
 - Post optimality analysis.

(20 Marks)
