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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:

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

Subject to $3x_1 + 2x_2 \le 12$

$5x_1 \le 10$

$x_1 + x_2 \le 18$

$-x_1 + x_2 \ge 4$ and $x_1 \ge 0$, $x_2 \ge 0$ **(10 Marks)**

b. Solve the following LPP by simplex method:

Maximize $Z = 2x_1 + 4x_2 + 3x_3$

Subject to $3x_1 + 4x_2 + 2x_3 \le 60$

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

$x_1 + 3x_2 + 2x_3 \le 80$ and $x_1 \ge 0, x_2 \ge 0, x_3 \ge 0$ **(10 Marks)**

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

Maximize $Z = 3x_1 - x_2$

Subject to the constraints $2x_1 + x_2 \ge 2$

$x_1 + 3x_2 \le 3$

$x_2 \le 4$ and $x_1, x_2 \ge 0$ **(10 Marks)**

b. Solve the following using Two phase method:
Minimize $Z = 0.4x_1 + 0.5x_2$
Subject to $0.3x_1 + 0.1x_2 \leq 2.7$
$0.5x_1 + 0.5x_2 = 6$
$0.6x_1 + 0.4x_2 \geq 6$ 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 $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 \leq 3$
$x_1 + 4x_2 + 6x_3 \leq 5$ and $x_1, x_2, x_3 \geq 0$

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

Subject to

$$\begin{bmatrix} 1 & 0 \\ 0 & 2 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} 4 \\ 12 \\ 18 \end{bmatrix} \text{ and } \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \geq \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$ **(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 cj parameters
ii) Systematic changes in the bj parameters. **(06 Marks)**

b. Write the dual of the following LP problem and solve it
Maximize $Z = 4x_1 + 2x_2$
Subject to $-x_1 - x_2 \leq -3$
$-x_1 + x_2 \leq -2$ 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 (columns); Sources (rows)

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 (columns); Company A (rows)

	I	II	III	IV
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 (columns); A (rows)

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

(10 Marks)

8 Write a note on:

a. Tabu search
b. Genetic algorithms
c. Algebra of simplex method
d. Post optimality analysis. **(20 Marks)**

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