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10CS/IS661

Sixth Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Define Operations Research. List and explain the various phases of an Operations Research study. (08 Marks)
- b. Food X contains 6 units of vitamin A/gram and 7 units of vitamin B/gram and costs 20 paise/gram Food Y contains 8 units of vitamin A/gram and 12 units of vitamin B/gram and costs 30 paise/gram. The daily minimum requirement of vitamin A and B are 100 units and 120 units respectively. Formulate the problem as an LPP. (06 Marks)
- c. Use the graphical method to solve the following LPP:
Z maximize = $20x_1 + 24x_2$
Subject to the constraint
 $2x_1 + 3x_2 \leq 1500,$
 $3x_1 + 2x_2 \leq 1500,$
 $x_2 \leq 450$
and $x_1, x_2 \geq 0$ (06 Marks)
- 2 a. Define slack variable and surplus variable with example. (04 Marks)
- b. Explain the following:
i) A standard form of the LPP
ii) Basic solution of a LPP
iii) Degeneracy and unbounded solution with respect to simplex method. (06 Marks)
- c. Solve the following LPP by Simplex method
Maximize $Z = 2x_1 + 3x_2$
Subject to the constraints
 $2x_1 + x_2 \leq 12$
 $x_1 + 3x_2 \leq 15$
and $x_1, x_2 \geq 0$ (10 Marks)
- 3 a. Solve the following LPP by two-phase Simplex method:
Maximize $Z = 5x_1 - 4x_2 + 3x_3$
Subject to the constraints
 $2x_1 + x_2 - 6x_3 = 20$
 $6x_1 + 5x_2 + 10x_3 \leq 76$
 $8x_1 - 3x_2 + 6x_3 \leq 50$
and $x_1, x_2, x_3 \geq 0$ (10 Marks)
- b. Use Big-M method to solve the following LPP:
Minimize $Z = 2x_1 + x_2$
Subject to the constraints
 $3x_1 + x_2 = 3,$
 $4x_1 + 3x_2 \geq 6,$
 $x_1 + 2x_2 \leq 4$
and $x_1, x_2 \geq 0$ (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.

- 4 a. Explain the computational procedure of revised Simplex method in standard form. (10 Marks)
 b. Apply revised Simplex method to solve the following problem:

$$\text{Maximize } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to the constraints

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_2 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

(10 Marks)

- 5 a. Solve the following LPP by using dual Simplex method

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

Subject to the constraint

$$x_1 - 2x_2 + x_3 \geq 4$$

$$2x_1 - x_2 + x_3 \leq 8$$

$$x_1 - x_3 \geq 0$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

(10 Marks)

- b. Explain the role of duality theory in sensitivity analysis. (05 Marks)

- c. Explain primal-dual relationship with an example. (05 Marks)

- 6 a. Solve the following transportation problem by using,
 i) North-West corner method ii) Vogel's approximation method.

| | D ₁ | D ₂ | D ₃ | D ₄ | |
|----------------|----------------|----------------|----------------|----------------|----|
| O ₁ | 5 | 2 | 4 | 3 | 22 |
| O ₂ | 4 | 8 | 1 | 6 | 15 |
| O ₃ | 4 | 6 | 7 | 5 | 8 |
| | 7 | 12 | 17 | 19 | |

(10 Marks)

- b. A car company has one car at each of the 5 depots (A, B, C, D and E). A customer requires a car in each town namely (P, Q, R, S and T) distance between depots and towns (in kilometers) are given in the following matrix. How the cars should be assigned to the customer to minimize the distance travelled. (10 Marks)

| | A | B | C | D | E |
|---|-----|-----|-----|-----|-----|
| P | 160 | 130 | 175 | 190 | 200 |
| Q | 135 | 130 | 130 | 160 | 175 |
| R | 140 | 110 | 155 | 170 | 185 |
| S | 50 | 50 | 180 | 80 | 110 |
| T | 55 | 35 | 70 | 80 | 105 |

- 7 a. With reference to game theory define the following: i) Saddle point ii) Pay off matrix
 iii) Two person zero-sum game iv) Mixed strategy v) Pure strategy. (10 Marks)
 b. Solve the following game by using the concept of dominance. (10 Marks)

| | | B | | | |
|---|-----|---|----|-----|----|
| | | I | II | III | IV |
| A | I | 3 | 2 | 4 | 0 |
| | II | 3 | 4 | 2 | 4 |
| | III | 4 | 2 | 4 | 0 |
| | IV | 0 | 4 | 0 | 8 |

- 8 a. Give a note on basic simulated annealing algorithm. (05 Marks)
 b. Write an outline of a basic genetic algorithm. (05 Marks)
 c. Explain tabu search algorithm. (05 Marks)
 d. Explain briefly Metaheuristics. (05 Marks)
