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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
   $$2x_1 + 3x_2 \le 1500,$$
   $$3x_1 + 2x_2 \le 1500,$$
   $$x_2 \le 450$$
   and $x_1, x_2 \ge 0$ **(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
   $$2x_1 + x_2 \le 12$$
   $$x_1 + 3x_2 \le 15$$
   and $x_1, x_2 \ge 0$ **(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
   $$2x_1 + x_2 - 6x_3 = 20$$
   $$6x_1 + 5x_2 + 10x_3 \le 76$$
   $$8x_1 - 3x_2 + 6x_3 \le 50$$
   and $x_1, x_2, x_3 \ge 0$ **(10 Marks)**

b. Use Big-M method to solve the following LPP:
   Minimize $Z = 2x_1 + x_2$
   Subject to the constraints
   $$3x_1 + x_2 = 3,$$
   $$4x_1 + 3x_2 \ge 6,$$
   $$x_1 + 2x_2 \le 4$$
   and $x_1, x_2 \ge 0$ **(10 Marks)**

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:
      Maximize $Z = 3x_1 + 2x_2 + 5x_3$
      Subject to the constraints
      $$x_1 + 2x_2 + x_3 \leq 430$$
      $$3x_1 + 2x_2 \leq 460$$
      $$x_1 + 4x_2 \leq 420$$
      and $x_1, x_2, x_3 \geq 0$ **(10 Marks)**

5 a. Solve the following LPP by using dual Simplex method
      Minimize $Z = 2x_1 + x_2 + 3x_3$
      Subject to the constraint
      $$x_1 - 2x_2 + x_3 \geq 4$$
      $$2x_1 - x_2 + x_3 \leq 8$$
      $$x_1 - x_3 \geq 0$$
      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
	I	3	2	4	0
	II	3	4	2	4
A	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)**

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