Roll No. ……..

BCA–C-304

B. C. A. (Third Semester)

EXAMINATION, 2022-23

COMPUTER BASED OPTIMIZATION TECHNIQUES

Time : $2\frac{1}{2}$ Hours

Maximum Marks : 60

Note : All questions have to attempted.

Section—A

1. Choice the correct options : 1 each

   (a) Identify the non-relevance characteristic of linear programming : (CO1, BL-4)

   (i) resources must be limited

   (ii) only one objective function

   (iii) parameters value remains constant during the planning period

   (iv) the problem must be of minimization type

(b) Non-negativity condition is an important component of LP model because : (CO3, BL-3)

(i) variables value should remain under the control of the decision-maker

(ii) value of variables make sense and correspond to real-world problems

(iii) variables are interrelated in terms of limited resources

(iv) None of the above

(c) While plotting constraints on a graph paper, terminal points on both the axes are connected by a straight line because : (CO3, BL-3)

(i) The resources are limited in supply

(ii) The objective function is a linear function

(iii) The constraints are linear equations or inequalities

(iv) All of the above

(d) For maximization LP model, the simplex method is terminated when all values : (CO3, BL-2)

(i) $cj - zj \leq 0$

(ii) $cj - zj \geq 0$

(iii) $cj - zj = 0$

(iv) $zj \leq 0$

(e) A variable which does not appear in the basic variable (B) column of simplex table is : (CO1, BL-3)

(i) Never equal to zero

(ii) Always equal to zero

(iii) Called a basic variable

(iv) None of the above

(f) If an artificial variable is present in the 'basic variable' column of optimal simplex table, then the solution is : (CO2, BL-3)

(i) Infeasible

(ii) Unbounded

(iii) Degenerate

(iv) None of the above

(g) The dual of the primal maximization LP problem having m constraints and n non-negative variables should : (CO3, BL-3)

(i) Have n constraints and m non-negative variables

(ii) Be a minimization LP problem

(iii) Both (i) and (ii)

(iv) None of the above

(h) Select the method used for solving an assignment problem is called : (CO4, BL-4)

(i) Reduced matrix method

(ii) MODI method

(iii) Hungarian method

(iv) None of the above

(i) Identify the aim of a dummy row or column in an assignment problem : (CO4, BL-4)

(i) To obtain balance between total activities and total resources

(ii) To prevent a solution from becoming degenerate

(iii) To provide a means or representing a dummy problem

(iv) None of the above

(j) When the total supply is not equal to total demand in a transportation problem then it is called : (CO2, BL-3)

(i) Balanced

(ii) Unbalanced

(iii) Degenerate

(iv) None of the above

(k) Two person zero-sum game means that the : (CO5, BL-3)

(i) Sum of losses to one player is equal to the sum of gains to other

(ii) Sum of losses to one player is not equal to the sum of gains to other

(iii) Both (i) and (ii)

(iv) None of the above

(l) When maximin and minimax values of the game are same, then : (CO2, BL-3)

(i) no solution exists

(ii) solution is mixed

(iii) saddle point exists

(iv) None of the above

2. Attempt any *four* of the following : 3 each

(a) Illustrate the dual of a linear programming problem. Elaborate the functional properties of duality. (CO3, BL-3)

(b) Elaborate the difference between Assignment Problem and Transportation Problem. (CO4, BL-3)

(c) Discuss slack, surplus and artificial variables in a linear programming problem. (CO1, BL-3)

(d) Briefly elaborate the assignment problems in OR and applications of assignment in OR. (CO4, BL-3)

(e) Discuss payoff matrix and types of strategy in game theory. (CO5, BL-3)

Section—B

3. Attempt any *two* of the following : 6 each

(a) A company sells two different products A and B, making a profit of ` 40 and ` 30 per unit, respectively. They are both produced with the help of a common production process and are sold in two different markets. The production process has a total capacity of 30,000 man-hours. It takes three hours to produce a unit of A and one hour to produce a unit of B. The market has been surveyed and company officials feel that the maximum number of units of A that can be sold is 8,000 units and that of B is 12,000 units. Subject to these limitations, products can be sold in any combination. Formulate this problem as an LP model to maximize profit. (CO3, BL-6)

(b) Apply the graphical method to solve the following LP problem : (CO3, BL-4)

Minimize :

$$z = 3x_1 + 2x_2$$

subject to the constraints

$$5x_1 + x_2 \geq 10,$$

$$x_1 + x_2 \geq 6,$$

$$x_1 + 4x_2 \geq 12$$

and $x_1, x_2 \geq 0$.

(c) Consider the following traveling salesman problem. Design a tour to five cities to the salesman such that minimize the total distance. Distance between cities is shown in the following matrix : (CO5, BL-5)

	1	2	3	4	5
1	–	10	3	6	9
2	5	–	5	4	2
3	4	9	–	7	8
4	7	1	3	–	4
5	3	2	6	5	–

4. Attempt any *two* of the following : 6 each

(a) Apply the simplex method to solve : (CO3, BL-4)

Max. :

$$z = 3x_1 + 5x_2 + 4x_3$$

Subject to :

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0 .$$

(b) Three sugar factories X, Y and Z located at different places of the country produce 6, 4 and 5 lakh tones of sugar respectively. Under the directive of the central government, they are to be distributed to 3 States A, B and C as 5, 3 and 7

lakh tones respectively. The transportation cost per tones in rupees is given below :

	A	B	C
X	11	17	16
Y	15	12	14
Z	20	12	15

Evaluate the suitable transportation pattern at minimum cost by North West Corner method and Vogel's Approximation method. (CO2, BL-4)

(c) There are nine jobs, each of which must go through two machines P and Q in the order PQ, the processing times (in hours) are given below :

Machine	**Job(s)**								
	A	B	C	D	E	F	G	H	I
P	2	5	4	9	6	8	7	5	4
Q	6	8	7	4	3	9	3	8	11

Find the sequence that minimizes the total elapsed time T. Also calculate the total idle time for the machines in this period. (CO5, BL-4)

5. Attempt any *two* of the following : 6 each

(a) Evaluate by Big M simplex method :

(CO3, BL-4)

Minimize :

$$Z = x_1 + x_2$$

Subject to :

$$2x_1 + x_2 \geq 4,$$

$$x_1 + 7x_2 \geq 7,$$

$$x_1, x_2 \geq 0.$$

(b) Determine the value of the game : (CO3, BL-4)

		Player B			
		I	II	III	IV
Player A	1	4	2	3	6
	2	3	4	7	5
	3	6	3	5	4

(c) A department of a company has five employees with five jobs to be performed. The time (in hour) that each employee takes to perform each job is given in the effectiveness matrix :

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours ?

(CO4, BL-5)