

Roll No. ....

## **BCA–304 (GE1)**

**B. C. A. (Third Semester)**

**EXAMINATION, 2023-24**

COMPUTER BASED OPTIMIZATION TECHNIQUES

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

*Maximum Marks : 60*

**Note :** Attempt all questions.

### **Section—A**

1. Multiple choice questions : 1 each
- (a) A feasible solution to an LPP ..... (CO1, BL-4)
- (i) Must satisfy all of the problem's constraints simultaneously
  - (ii) Must be a corner point of the feasible region.
  - (iii) Need not satisfy all of the constraints, only some of them
  - (iv) Must optimize the value of the objective function

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- (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) The transportation problem deals with the transportation of ..... (CO3, BL-2)
- (i) a single product from a source to several destinations

- (ii) a single product from several sources to several destinations
  - (iii) a single product from several sources to a destination
  - (iv) a multi-product from several sources to several destinations
- (e) The solution to a transportation problem with m-sources and n-destination is feasible, if the number of allocations are ..... (CO2, BL-3)
- (i)  $m + n - 1$
  - (ii)  $m + n + 1$
  - (iii)  $m + n$
  - (iv)  $m * n$
- (f) A mixed strategy game can be solved by ..... (CO5, BL-3)
- (i) Matrix method
  - (ii) Algebraic method
  - (iii) Graphical method
  - (iv) All of the above

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- (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 (a) and (b)
  - (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 of 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 (a) and (b)
  - (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

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2. Attempt all the questions : 3 each
- (a) Describe the mathematical formulation of transportation problem. (CO3, BL-3)
  - (b) Elaborate the difference between Assignment Problem and Transportation Problem. (CO4, BL-3)
  - (c) Briefly elaborate the procedure for mathematical formulation of an LPP. (CO1, BL-3)
  - (d) Elaborate the steps involved in the solution of an operation research problem. (CO1, BL-3)
  - (e) Discuss payoff matrix and types of strategy in game theory. (CO5, BL-3)

### **Section—B**

#### **(Short Answer Type Questions)**

3. Attempt all the questions : 6 each
- (a) A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate and 6 grains of codeine. It is found by users that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codein for providing immediate effect. It is required to determine the least number of pills of patient should take to get immediate relief. Formulate the problem as a standard LPP. (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)

		To City				
		A	B	C	D	E
From City	A	—	7	6	8	4
	B	7	—	8	5	6
	C	6	8	—	9	7
	D	8	5	9	—	8
	E	4	6	7	8	—

(d) —

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(e) 4. Answer any two from the following : 6 each

(a) Consider the payoff matrix Player A as shown below and solve it optimally using graphical method. (CO4, BL-4)

		Player B				
		1	2	3	4	5
Player A	1	3	6	8	4	4
	2	-7	4	2	10	2

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

	D1	D2	D3	D4	Supply
O1	3	3	4	1	100
O2	4	2	4	2	125
O3	1	5	3	2	75
Demand	120	80	75	25	300

(c) Obtain the dual problem of the following primal linear programming problem : (CO2, BL-4)

Minimize :

$$Z = x_1 - 3x_2 - 2x_3$$

Subject to the constraints :

$$3x_1 - x_2 + 2x_3 \leq 7;$$

$$2x_1 - 4x_2 \geq 12;$$

$$-4x_1 + 3x_2 + 8x_3 = 10$$

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$x_1, x_2 \geq 0$ ;  $x_3$  unrestricted in sign.

5. Answer any two from the following : 6 each

(a) Evaluate by graphical 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)

		<u>Player B</u>		
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
Player A	A <sub>1</sub>	1	3	1
	A <sub>2</sub>	0	-4	-3
	A <sub>3</sub>	1	5	-1

(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.

		<u>Employees</u>				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2

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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)

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