### UTTARANCHAL UNIVERSITY, DEHRADUN
### UTTARANCHAL SCHOOL OF COMPUTING SCIENCES
### MID TERM EXAMINATION
Odd Semester 2024-25

BCA | 3<sup>rd</sup> semester |

**COMPUTER BASED OPTIMIZATION TECHNIQUES | BCA –304 (GE1)**

Time: 1:15 Hour                                                                 Max. Marks: **30**

*Note: All questions are compulsory.*

**Q.1- Answer the following questions.**                    **(1 x 6 = 6 Marks)**

**Multiple Choice Questions**

a) Mathematical model of linear programming problem is important because _____.                    (CO-1, BL-5)

    a. it helps in converting the verbal description and numerical data into mathematical expression

    b. decision makers prefer to work with formal models

    c. it captures the relevant relationship among decision factors

    d. it enables the use of algebraic technique

b) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are          (CO-3, BL-4)

    a.  $m + n$                               b. $m * n$

    c.  $m+n-1$                           d. $m+n+1$

c) All equality constraints can be replaced equivalently by _____ inequalities.                    (CO-2, BL-3)

    a. 1                                         b. 2

    c. 0                                         d. they can't be replaced

**State True/ False**

d) Graphical method of a linear programming is useful when the number of decision variables are 2.                    (CO-1, BL-3)

e) The dual of the dual is primal.                    (CO-2, BL-5)

f) Transportation problems are a special type of linear programming problems.                    (CO-3, BL-5)

**Q.2-Write short note on any two (up to 70 words)**          **(2 x 3 = 6 Marks)**

a) Definition and historical development of Operations Research.
                    (CO-1, BL-2)

b) Concept of duality and its advantages?                    (CO-2, BL-2)

c) Definition, application and limitation of Operations Research.
                    (CO-1, BL-2)

**Q.3-Attempt any one of the following (1 x 6 = 6 Marks)**

a) A dietician has to develop a special diet using two foods P and Q. Each packet of food P contains 12 units of calcium, 4 units of iron,

6 units of cholesterol and 6 units of vitamin A. Each packet of food Q contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of vitamin A. The diet requires at least 240 units of calcium, at least 460 units of iron and at most 300 units of cholesterol. How many packets of each food should be used to minimize the amount of vitamin A in the diet? (CO-1, BL-6)

<div align="center">OR</div>

b) Use the graphical method to solve the following linear programming problem: (CO-1, BL-4)

Maximize $Z = 2x_1 + 3x_2$

Subject to the constraints

$x_1 + x_2 \leq 30, x_2 \geq 3, 0 \leq x_2 \leq 12, 0 \leq x_1 \leq 20, x_1 \geq x_2$

**Q.4- Attempt any one of the following.**     (1 x 6 = 6 Marks)

a) Obtain the dual problem of the following primal linear programming problem. (CO-2, BL-4)

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

Subject to the constraints

$3x_1 - x_2 + 2x_3 \leq 7, 3x_1 - 4x_2 \geq 12, -4x_1 + 3x_2 + 8 \overset{x3}{=} 10, x_1,$

$x_2, x_3 \geq 0.$

<div align="center">OR</div>

b) Obtain the dual problem of the following primal linear programming problem. (CO-2, BL-5)

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

Subject to the constraints $3x_1 - x_2 + 2x_3 \leq 7, 3x_1 - 4x_2 \leq 12,$
$-4x_1 + 3x_2 + 8 \geq 10, x_1, x_2 \geq$

$0; x_3$ unrestricted in sign

**Q.5- Attempt any one of the following.**     (1 x 6 = 6 Marks)

a) Solve the transportation problem.     (CO-3, BL-6)

| Plant | W1 | W2 | W3 | Supply |
|-------|----|----|----|--------|
| | | Warehouse | | |
| P1 | 49 | 150 | 70 | 30 |
| P2 | 80 | 70 | 90 | 70 |
| P3 | 15 | 87 | 79 | 40 |
| Demand | 20 | 70 | 50 | |

b) Solve the transportation problem.     (CO-3, BL-6)

| Plant | M1 | M2 | M3 | M4 | M5 | Supply |
|-------|----|----|----|----|----|--------|
| | | | Warehouse | | | |
| P1 | 4 | 2 | 3 | 2 | 6 | 8 |
| P2 | 5 | 4 | 5 | 2 | 1 | 12  -34 |
| P3 | 6 | 5 | 4 | 7 | 7 | 14 |
| Demand | 4 | 4 | 6 | 8 | 8 | |

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