Roll No. ……..

BSCIT/BCA–304(GE1)

B. Sc. (IT)/B. C. A. (Third Semester)
EXAMINATION, 2024-25

COMPUTER BASED OPTIMIZATION TECHNIQUES

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

Maximum Marks : 60

Note : All questions are compulsory.

Section—A

1. Multiple choice questions. 1 each

   (i) Consider the following statements regarding linear programming : (CO1, BL-4)

   (I) The graphical method cannot solve a linear programming problem with three variables and two constraints.

P. T. O.

(II) When one constraint line comes parallel to the objective function line, LPP will have a degenerate solution.

Which of the given statements are correct ?

(a) Only (i) is true.

(b) Both (i) and (ii) are true.

(c) Only (ii) is true.

(d) Both (i) and (ii) are false.

(ii) Which of the following methods is used for obtaining an initial basic feasible solution to the transportation problem ? (CO3, BL-3)

(a) North-West Corner Method

(b) Vogel's Approximation Method

(c) Least Cost Method

(d) All of the above

(iii) In a transportation problem with 4 supply points and 5 demand points, how many numbers of constraints are required in its formulation ? (CO3, BL-3)

(a) 20

(b) 1

(c) 0

(d) 9

(iv) Any linear programming model must have all of the following properties except :

(CO1, BL-3)

(a) the model must have structural constraints

(b) the relationship between variables and constraints must be non-linear

(c) the model must have an objective function

(d) the model must have non-negativity constraint

(v) If the *i*th constraint of a primal (maximization) is equality, then the dual (minimization) variable ' y_i ' is : (CO2, BL-3)

(a) ≥ 0

(b) ≤ 0

(c) Unrestricted in sign

(d) None of the above

(vi) If there are *m* sources and *n* destinations in a transportation matrix, the total number of basic variables in a basic feasible solution is :

(CO3, BL-3)

(a) $m + n$

(c) $m + n + 1$

(b) $m + n - 1$

(d) m

(vii) The supply at three sources is 80, 30, and 40 units respectively while the demand at the four destinations is 30, 20, 25, and 55 units. In solving this transportation problem :

(CO3, BL-3)

(a) a dummy source of capacity 20 units is needed with unit transportation cost one.

(b) a dummy destination of capacity 20 units is needed with unit transportation cost zero.

(c) a dummy source of capacity 20 units is needed with unit transportation cost zero.

(d) a dummy destination of capacity 20 units is needed with unit transportation cost one.

(viii) In a Linear Programming Problem, the linear relations of the variables which are either to be maximized or minimized is called ..... .

(CO1, BL-3)

(a) the decisions variables

(b) the constraints functions

(c) the variable function

(d) the objective function

(ix) If two constraints do not intersect in the positive quadrant of the graph, then :

(CO1, BL-3)

(a) the problem is infeasible

(b) the solution is unbounded

(c) one of the constraints is redundant

(d) None of the above

(x) The method used for solving an assignment problem is called : (CO4, BL-3)

(a) reduced matrix method

(b) MODI method

(c) Hungarian method

(d) None of the above

(xi) What happens when maximin and minimax values of the game are same ? (CO5, BL-3)

(a) no solution exists

(b) solution is mixed

(c) saddle point exists

(d) None of the above

(xii) In graphical method the restriction on number of variables is ..... . (CO1, BL-3)

(a) 2

(b) 3

(c) not more than 3

(d) None of the above

2. Attempt any *four* questions (Short Answer Type questions) : 3 each

(a) Illustrate the principle of duality in linear programming. Explain its advantages.

(CO2, BL-3)

(b) Illustrate the difference between Assignment Problem and Transportation Problem.

(CO3, BL-3)

(c) Discuss the following : (CO5, BL-3)

(i) pure and mixed strategies

(ii) saddle point

(iii) two-person zero-sum game problem.

(d) Briefly elaborate the assignment problems in OR and applications of assignment in OR.

(CO4, BL-3)

(e) Elaborate the steps involved in the solution of an operation research problem. (CO1; BL-3)

Section—B

3. Answer any *two* from the following : 6 each

(a) A company produces two types of leather belts, A and B. Belt A is of a superior quality and B is of an inferior quality. The profits from the two are 40 and 30 paise per belt, respectively. Each belt of type A requires twice as much time as required by a belt of type B. If all the belts were of type B, the company could produce 1,000 belts per day. But the supply of leather is sufficient only for 800 belts per day. Belt A requires a fancy buckle and only 400 of them are available per day. For belt B only 700 buckles are available per day. Formulate this problem as an LP model to maximize profit. Solve this problem to determine how many units of the two types of belts the company should manufacture in order to have the maximum overall profit ?

(CO1, BL-6)

(b) Apply the graphical method to solve the following LP problem : (CO2, BL-4)

Maximize :

$$Z = 15x_1 + 10x_2$$

subject to the constraints

$$4x_1 + 6x_2 \leq 360,$$

$$3x_1 \leq 180,$$

$$5x_2 \leq 200,$$

and $x_1, x_2 \geq 0.$

(c) A travelling salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The travelling cost (in '000 ₹) of each city from a particular city is given below :

(CO4, BL-5)

		To City				
		A	B	C	D	E
From City	A	∞	2	5	7	1
	B	6	∞	3	8	2
	C	8	7	∞	4	7
	D	12	4	6	∞	5
	E	1	3	2	8	∞

4. Answer any *two* from the following : 6 each

(a) Obtain the strategies for both players and the value of the game for two-person zero-sum game whose payoff matrix is given as follows : (CO5, BL-4)

	Player B		
Player A	B_1	B_2	B_3
A_1	1	3	11
A_2	8	5	2

(b) A steel company has three open hearth furnaces and five rolling mills. The transportation costs (rupees per quintal) for shipping steel from furnaces to rolling mills are given in the following table : (CO3, BL-4)

	M_1	M_2	M_3	M_4	M_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

Find the optimal transportation routes.

(c) A book binder has one printing press, one binding machine and manuscripts of 7 different books. The times required for performing printing and binding operations for different books are shown below :

Book	Printing time (hours)	Binding time (hours)
1	20	25
2	90	60
3	80	75
4	20	30
5	120	90
6	15	35
7	65	50

Decide the optimum sequence of processing of books in order to minimize the total time required to bring out all the books.

(CO4, BL-5)

5. Answer any *two* from the following : 6 each

(a) Write the dual of the following primal LP problem : (CO2, BL-4)

Maximize :

$$Z = 2x_1 + 3x_2 - 5x_3$$

Subject to :

$$2x_1 + 3x_2 - x_3 \leq 2,$$

$$3x_1 + x_2 - 4x_3 \leq 3,$$

$$5x_1 + 7x_2 - 6x_3 = 4,$$

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

(b) Solve the game whose payoff matrix is given below : (CO5, BL-4)

	Player B			
Player A	B_1	B_2	B_3	B_4
A_1	3	2	4	0
A_2	3	4	2	4
A_3	4	2	4	0
A_4	0	4	0	8

(c) Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and is given in the following table :

		Jobs				
		I	II	III	IV	V
Men	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find out how men should be assigned the jobs in way that will minimize the total time taken.

(CO4, BL-5)