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Total No. of Pages : 03

Total No. of Questions : 09

MCA (2012 & Onwards) (Sem.-3)
COMPUTER BASED OPTIMIZATION TECHNIQUES

Subject Code : MCA-302

Paper ID : [B1158]

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. SECTIONS-A, B, C & D contains TWO questions each carrying TWENTY marks each and students has to attempt any ONE question from each SECTION.
2. SECTION-E is COMPULSORY consisting of TEN questions carrying TWENTY marks in all.
3. Use of non-programmable scientific calculator is allowed.

SECTION-A

- 1) Consider the following linear program (LP) :

$$\text{Minimize } Z = 3x_1 + 2x_2$$

Subject to

$$x_1 + 2x_2 \leq 12$$

$$2x_1 + 3x_2 = 12$$

$$2x_1 + x_2 \geq 8$$

$$\text{and } x_1 \geq 0, \quad x_2 \geq 0$$

- a) Plot the feasible region
 - b) Determine all corner point feasible (CPF) solutions.
 - c) Determine all basic feasible (BF) solutions.
 - d) Determine all optimal solutions.
 - e) If Constraint (1) changed from $x_1 + 2x_2 \leq 12$ to $x_1 + 2x_2 \geq 12$, what is the optimal solution? (5×4=20)
- 2) Find the dual of the following primal linear programming problem and solve the primal from the solution of the dual problem:

$$\text{Minimize } Z = 3x_1 + 2x_2 + x_4$$

Subject to

$$2x_1 + x_2 + x_3 + 2x_4 \geq 7$$

$$x_2 + 3x_4 = 5$$

$$x_1, x_2 \geq 0, \quad x_3 \leq 0, \quad x_4 \text{ unrestricted.}$$

(20)

SECTION-B

- 3) Consider the transportation problem having the following parameter table :

	Destination			Supply
	1	2	3	
Source 1	13	16	15	18
Source 2	18	15	16	14
Demand	10	5	10	

- a) Use the Northwest corner rule to obtain an initial basic feasible solution and objective function value. (10)
- b) Use the transportation simplex method to find an optimal solution. Identify the optimal solution and the objective function value. (10)
- 4) Consider the problem of assigning four operators to four machines. The assignment costs in Rupees are given below. Operator 1 cannot be assigned to machine 3 and operator 3 cannot be assigned to machine 4. Find the optimal assignment using the 'Hungarian Assignment Method'.

	Machine			
	1	2	3	4
Operator 1	5	5	-	2
Operator 2	7	4	2	3
Operator 3	9	3	5	-
Operator 4	7	2	6	7

(20)

SECTION-C

- 5) What is dynamic programming? Differentiate between deterministic and probabilistic dynamic programming. Give applications of dynamic programming? (20)
- 6) a) Let A and B be events defined on some sample space, with $P(A) = 1/3$, $P(B) = 1/4$, and $P(A \cap B) = 1/6$. Find the probability that exactly one of the events A, B occur. (10)
- b) Among 35 students in a class, 17 earned "A" on the midterm, 14 earned "A" on final exam, and 11 did not earn "A" on either exam. What is the probability that a randomly selected student from this class earned "A" on both exams? (10)

SECTION-D

- 7) Solve the following LPP by the Gomory algorithm :

$$\text{Maximize } Z = 20x_1 + 22x_2 + 18x_3$$

Subject to the constraints

$$4x_1 + 6x_2 + x_3 \geq 54$$

$$4x_1 + 4x_2 + 6x_3 \geq 65$$

$$x_1, x_2, x_3 \geq 0, \text{ each } \leq 7 \text{ and integers.}$$

- 8) Solve the following integer LPP using branch-and-bound algorithm :

$$\text{Maximize } Z = 2x_1 + 10x_2 + x_3$$

Subject to constraints :

$$5x_1 + 2x_2 + x_3 \leq 15$$

$$2x_1 + x_2 + 7x_3 \leq 20$$

$$x_1 + 3x_2 + 2x_3 \leq 25$$

$$x_1, x_2, x_3 \geq 0, \text{ and integers.}$$

SECTION-E

- 9) **Write briefly :**

- Explain the main characteristic features of Operations Research.
- Name various OR models.
- What is linear programming? What are its major assumptions?
- What is meant by degeneracy in a linear programming problem?
- Explain how the assignment problem can be treated as a particular case of transportation problem.
- Explain the Role of Sensitivity Analysis in decision making.
- Discuss the economic interpretation of Dual Variables.
- What is unbalanced transportation problem? Explain.
- What is decision theory?
- Give definition of probability.