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2611N881

Candidate's Seat No :_____

IMSc (CSF) (NEP) Sem.-5 Examination

SEC-ICSF-356

Data Analysis

November-2025

Time : 1-00 Hour] **[Max. Marks : 25**

Instructions:

1. Use of non-Programmable Scientific Calculator is allowed.

Q.1 **(a)** Define Sensitivity Analysis in LPP. **(05)**

Maximize $Z = 3x_1 + 5x_2$

Subject to the constraints

$x_1 + x_2 \leq 1$

$2x_1 + 3x_2 \leq 1$

$x_1, x_2 \geq 0$

Determine variations in $c_j, j = 1,2$ which are permitted without changing the optimal solution. What is the range of c_1 & c_2 so that optimal solution remains unchanged.

(b) Formulate the Linear Programming Problem. **(05)**

A company manufactures two products, Product A and Product B. Each unit of Product A requires 2 hours of labor and 3 units of raw material. Each unit of Product B requires 4 hours of labor and 2 units of raw material. The company has 100 hours of labor and 90 units of raw material available. The profit from each unit of Product A is Rs.30, and from each unit of Product B is Rs.40. How many units of each product should the company produce to maximize its profit?

OR

(a) Solve the LPP by using Simplex method **(05)**

Maximize $Z = 4x_1 + 3x_2$

Subject to the constraints

$x_1 + x_2 \leq 8$

$2x_1 + x_2 \leq 10$

$x_1, x_2 \geq 0$

(b) Solve the LPP by using Graphical method **(05)**

Maximize $Z = 3x_1 + 5x_2$

Subject to the constraints

$2x_1 + 3x_2 \leq 8$

$x_1 + 2x_2 \leq 5$

$x_1, x_2 \geq 0$

P.T.O

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Q.2 **(a)** A security analyst must scan 5 critical network nodes (servers) in a network, where the cost between nodes is the network latency in milliseconds (ms). The goal is to visit every server exactly once, starting and ending at the control server (A), and minimize the total network latency by using Hungarian method. **(05)**
The cost (latency in ms) matrix is as follows:

	A	**B**	**C**	**D**	**E**
A	∞	10	15	20	25
B	10	∞	35	25	17
C	15	35	∞	30	28
D	20	25	30	∞	23
E	25	17	28	23	∞

(b) A production company needs to ship goods from three warehouses to four destinations. The cost per unit between each warehouse and destination is given. **(05)**

Warehouses	Destinations				Supply
	D1	D2	D3	D4	
W1	9	7	10	8	14
W2	8	11	9	11	27
W3	13	10	12	10	14
Demand	15	19	11	10	55

Use the Least Cost Method to determine the initial basic feasible solution.

OR

(a) A security operations center (SOC) manages several data centers. The SOC must distribute threat intelligence updates from central servers (Suppliers) to various regional security hubs (Consumers). The goal is to transport updates with minimal cost while satisfying supply and demand by using North-West Corner Method. **(05)**
The cost matrix (Data Transfer Cost in Rs. Per GB):

	Hub 1	Hub 2	Hub 3	Supply (GB)
Central 1	4	6	8	70
Central 2	5	3	7	50
Central 3	6	4	5	30
Demand (GB)	50	80	20	

(b) What is Operations Research and why is it considered a crucial tool in decision making? **(05)**

Q.3 Attempt any **FIVE** out of **SIX:** **(05)**

(1) The Hungarian Method is used for solving:

A. Transportation problems
B. Assignment problems
C. Linear programming problems
D. None of the above

(2) Which of the following statements is correct?

A. Every LP problem has at least one optimal solution.
B. Every LP problem has a unique solution.
C. If an LP problem has two optimal solutions, then it has infinitely many solutions.
D. If a feasible region is unbounded then LP problem has no solution

(3) Which method is used to find the initial feasible solution in transportation problems?

A. Simplex Method
B. Hungarian Method
C. Vogel's Approximation Method
D. Nash Equilibrium

(4) In the transportation model, a degenerate solution occurs when:

A. Number of allocations is less than required
B. Supply is greater than demand
C. Demand is greater than supply
D. All variables are allocated

(5) The optimal value of the objective function is attained at the points

A. given by intersection of lines representing inequations with axes only
B. given by intersection of lines representing inequations with X-axis only
C. given by corner points of the feasible region
D. at the origin

(6) The minimum number of lines required to cover all zeros in the Hungarian method's cost matrix represents:

A. The initial feasible solution
B. The optimal assignment solution
C. The degeneracy solution
D. None of the above

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