Cluster Innovation Centre, University of Delhi
B.Tech (Information Technology and Mathematical Innovations)
End Term Examination: 2019-2020, Semester- VI
Paper Code: 911610
VI.1: Linear Construction of Actions: Engineering through Linear Programming and Game Theory

Max Time: 2 Hours; **Max Marks: 75**

Attempt any 4 questions, each question carries equal marks.

1. Solve the following problem using dual-simplex method

$$\text{Max}\{-x_1 + 5x_2\}$$

Subject to

$$\begin{aligned} 2x_1 - 3x_2 &\geq 1 \\ x_1 + x_2 &\leq 3 \\ x_1, x_2, &\geq 0 \end{aligned}$$

2. Verify that $x_0 = (0,5\frac{2}{3},8\frac{1}{3},\frac{1}{3})^T$ is an optimal point to

$$\text{Min}\{7x_1 + 11x_2 - 3x_3 - x_4\}$$

subject to

$$\begin{aligned} 2x_1 + 2x_2 - x_3 - 3x_4 &\geq 2 \\ -x_1 + 5x_2 - 2x_3 + x_4 &\geq 12 \\ x_1 - 4x_2 + 3x_3 + 5x_4 &\geq 4 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

and $y_0 = (3\frac{1}{2},2,1\frac{1}{2})^T$ is an optimal point of dual.

3. JoShop wants to assign four different categories of machines to five types of tasks. Machine category J3 cannot be assigned to task type T1 and Machine category J2 cannot be assigned to task type T3 . Table provides the unit cost (in dollars) of assigning a machine category to a task type. The objective of the problem is to determine the optimum number of machines in each category to be assigned to each task type. Solve the problem and interpret the solution.

		T1	T2	T3	T4	T5
	J1	4	6	10	5	6
	J2	7	4	-	5	4
Machines	J3	-	6	9	6	2
	J4	9	3	7	2	3

4. Suppose given table is a payoff matrix for player A of a two person zero sum game. Reduce the following game to a linear programming problem and solve by Simplex Method

		Player B	
	6	-1	5
Player A	4	0	-4
	1	7	10

5. Three refineries with daily capacities of 40, 60, and 50 million gallons, respectively, supply four distribution areas with daily demands of 20, 30, 50 and 50 million gallons, respectively. Gasoline is transported to the four distribution areas through a network of pipelines. The transportation cost is 10 cents per 1000 gallons per pipeline mile. Table gives the mileage between the refineries and the distribution areas. Construct the associated transportation model and determine the initial feasible solution using Vogal Approximation Method .

		Distribution area		
	D1	D2	D3	D4
Refinery 1	4	6	8	8
Refinery 2	6	8	6	7
Refinery 3	5	7	6	8

6. A company produces two types of overcoats. Both Type 1 and Type 2 coats manufactured in two departments cutting and sewing. The company has received firm orders for its products. The profit is $8 per Type 1 hat and $5 per Type 2 overcoat. Determine the number of overcoats of each type that maximizes profit based on the following data:

		Time per hour	
Department	Type 1	Type 2	Capacity (hr)
Cutting	1	1	5
Sewing	3	2	12
Unit Profit	$8	$5	