

M. Tech First Semester Regular/ Back Examination – 2015-16 Decision Modelling-I

Full Marks – 70

Time : 3 hours

Q.Code:T1036

Answer Question No. 1 which is compulsory and any **five** from the rest

1. (a) What is artificial variable and how it is different from slack/surplus variable?
- (b) What is the meaning of basic feasible solution?
- (c) Explain the meaning of shadow price of a resource.
- (d) What is the function of minimum ratio rule in the Simplex method?
- (e) Explain the concept of degeneracy in transportation problem.
- (f) What will happen if Assignment problem is solved using Transportation algorithm?
- (g) Explain under what conditions rounding off continuous solutions is a good strategy for obtaining integer values?
- (h) Explain the difference between the shortest route problem and the minimal spanning tree problem?
- (i) What do you mean by dominance in Game theory?
- (j) What is the importance of sensitivity analysis? 2x10

2. Use graphical method to solve the following:

$$\text{Maximize: } Z = 2X_1 + X_2$$

$$\text{Subject to: } X_1 + 2X_2 \leq 10$$

$$X_1 + X_2 \leq 6$$

$$X_1 - X_2 \leq 2$$

$$X_1 - 2X_2 \leq 1$$

$$X_1, X_2 \geq 0$$

/10

3. Solve the following Linear Programming problem by Simplex method:

$$\text{Minimize: } Z = 3X_1 + 4X_2$$

$$\text{Subject to: } 4X_1 + X_2 \geq 30$$

$$-X_1 - X_2 \leq -18$$

$$X_1 + 3X_2 \geq 28$$

$$X_1, X_2 \geq 0$$

/10

4. A City has 3 water reservoirs 1, 2 and 3 which have to supply water to 4 different areas A, B, C and D. The reservoir supply capacities are 15, 20 and 25 million liters/day respectively. The demand rates for different areas are 8, 10, 12 and 15 million liters/day respectively. Excess water can be disposed off at zero cost and the cost of pumping per million liters from reservoirs to different areas is given in the matrix below:

Areas

Reservoirs	A	B	C	D
1	2	3	4	5
2	3	2	5	2
3	4	1	2	3

Use the transportation algorithm to determine the cheapest pumping schedule.

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5. A company is faced with the problem of assigning five different jobs to five different machines. The following matrix shows the return in thousands of rupees for assigning different machines to different jobs. Find the optimal assignment to maximize return.

		Jobs				
		1	2	3	4	5
Machine	1	5	11	10	12	4
	2	2	4	6	3	5
	3	3	12	5	14	6
	4	6	14	4	11	7
	5	7	9	8	12	5

/10

6. Reduce the following game by method of dominance and find the game value along with optimal Strategies:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

/10

7. A company manufactures three products A, B and C requiring two raw materials - labor and material – wants to determine the optimal production schedule that maximizes the total profit. The following linear program was formulated to answer this:

$$\begin{aligned} \text{Maximize: } & Z = 3X_1 + X_2 + 5X_3 \\ \text{Subject to: } & 6X_1 + 3X_2 + 5X_3 \leq 45(\text{labour}) \\ & 3X_1 + 4X_2 + 5X_3 \leq 30(\text{material}) \\ & X_1, X_2, X_3 \geq 0 \end{aligned}$$

Where X_1 , X_2 and X_3 are the amount of products A, B and C. The Computer prints out the following optimal table, where X_4 , X_5 are the slacks

Cb	Cj	3	1	5	0	0	Constants
		X_1	X_2	X_3	X_4	X_5	
3	X_1	1	-1/3	0	1/3	-1/3	5
5	X_3	0	1	1	-1/5	2/5	3
C row		0	-3	0	0	-1	Z=30

Answer the following with respect to the above optimal table:

- Find the range on the unit profit of product A.
- Suppose an additional 15 units of material may be obtained at a cost of 10. Is it profitable to do so?
- Find the optimal solution when available material is increased to 60 units.

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8. Write notes on any TWO

- Minimal Spanning Tree Algorithm
- Algorithms to solve Integer programming problem
- Explain the Trans-shipment problem

/5x2