[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1444 **F**

Unique Paper Code : 2362571201

Name of the Paper : DSC-4 : Advanced Linear Programming

Name of the Course : **B.A. (Program)**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all.
3. **All** questions carry equal marks.

1. (a) State and prove Weak Duality Theorem. (8)

(b) Use Dual Simplex Method to solve the following Linear Programming Problem :

Maximize $Z = 3x_1 - 2x_2$

subject to $x_1 + x_2 \leq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \leq 3$

$x_1, x_2 \geq 0.$ (10)

2. (a) Show that Dual of Dual is Primal. (6)

(b) Use Principle of Duality to solve the following Linear Programming problem and verify Strong Duality Theorem.

Maximize $Z = 2x_x + x_2$

subject to $3x_1 + 5x_2 \leq 15$

$6x_1 + 2x_2 \leq 24$

$x_1, x_2 \geq 0$ (12)

3. Consider the following Linear Programming Problem:

Maximize $Z = 4x_1 + 6x_2 + 2x_3$

subject to $x_1 + x_2 + x_3 \leq 3$

$x_1 + 4x_2 + 7x_3 \leq 9$

$x_1, x_2, x_3 \geq 0.$

The optimum solution to the above Linear Programming Problem is displayed in the following simplex table :

C_B	V_B	X_B	x_1	x_2	x_3	s_1	s_2
4	x_1	1	1	0	-1	4/3	-1/3
6	x_2	2	0	1	2	-1/3	1/3
		$z(=16)$	0	0	6	10/3	2/3

(a) Discuss the effect of discrete changes in the availability of resources from [3,9] to [9,3].

(b) Which resource should be increased (or decreased) to get best marginal increase in the value of the objective function?

(c) What will be the effect on optimal solution if c_1 is increased from 4 to 8?

(d) What will be the effect on optimal solution if c_2 is decreased from 6 to 3?

(e) Let the variable x_3 be deleted from the problem then, obtain optimum solution to the resulting LPP. (18)

4. (a) Define Travelling Salesman Problem. Solve the following Travelling Salesman Problem using Branch and Bound Method. (12)

	A	B	C	D	E
A	--	8	7	6	4
B	9	--	5	3	8
C	8	10	--	5	6
D	7	8	4	--	1
E	2	3	5	2	--

(b) Write short notes on any **two** of the following : (6)

(i) Simplex method vs dual simplex method

(ii) Sensitivity analysis

(iii) Complementary Slackness Theorem

5. (a) Formulate the following Transportation Problem as a Linear Programming Problem and define the notations used. (6)

Factory	Transportation Cost (Rs) per unit				Supply
	1	2	3	4	
A	12	18	6	25	200
B	8	7	10	18	500
C	14	3	11	20	300
Demand	180	320	100	400	

(b) Solve the following minimization Transportation Problem :

Factory	Destinations					Supply
	A	B	C	D	E	
1	4	7	8	8	2	4
2	1	4	-	3	8	7
3	7	2	7	7	7	9
4	4	7	4	4	-	2
Demand	8	3	2	4	5	

It is given that it is not possible to transport any quantity from factory 2 to destination C and factory 4 to destination E. (12)

P.T.O.

6. (a) Formulate cost minimization Assignment Problem as a Linear Programming Problem. (6)

(b) Mr. Sharma's four children want to earn some money to take care of personal expenses during a school trip to the local zoo. Mr. Sharma has chosen four chores for his children: mowing the lawn, painting the garage door, cleaning the rooms and washing the family cars. To avoid anticipated sibling competition, he asks them to submit bids for what they feel is fair pay for each of the four chores. The understanding is that all four children will abide by their father's decision as to who gets which chore. The following table summarizes the bids received. Based on this information, how should Mr. Sharma assign the chores?

		Chore			
		I	II	III	IV
Child	1	1	4	6	3
	2	9	7	10	9
	3	4	5	11	7
		8	7	8	5

Find the optimal assignment to minimize Mr. Sharma's total expenditure using Hungarian method. (12)

7. (a) Obtain the initial basic feasible solution of the following cost minimizing Transportation Problem by Vogel's Approximation Method and Least Cost Method. (6)

	D_1	D_2	D_3	D_4	Availability
O_1	5	5	4	7	5
O_2	6	4	1	2	5
O_3	5	9	1	4	6
O_4	8	3	2	4	4
O_5	6	5	3	1	6
Requirement	5	8	3	10	

(b) The following network gives the shipping routes from nodes 1 and 2 to nodes 5 and 6 via nodes 3 and 4. The unit shipping costs are shown on

the respective arcs. Identify pure supply nodes, pure demand nodes, transhipment nodes and buffer amount. Also, find the optimal shipping schedule. (12)