[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4947 **H**

Unique Paper Code : 2362571201

Name of the Paper : DSC- A2: Advanced Linear Programming

Name of the Course : **B.A. (Prog.) / B.Sc. (Physical Sciences / Mathematical Sciences) with Operational Research as one of the Core Disciplines**

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.

P.T.O.

1. (a) Define the dual of the Linear Programming Problem and show that the dual of dual is primal. (10)

(b) Write the Dual of the following Linear Programming Problem :

Maximum $Z = 3x_1 + x_2 + 4x_3 + x_4 + 9x_5$

subject to $4x_1 - 5x_2 - 9x_3 + x_4 - 2x_5 \leq 6$

$2x_1 + 3x_2 + 4x_3 - 5x_4 + x_5 \leq 9$

$x_1 + x_2 - 5x_3 - 7x_4 - 11x_5 \leq 10$

$x_1, x_2, x_3, x_4, x_5 \geq 0.$ (8)

2. (a) State and prove Weak duality theorem. (8)

(b) Solve the following Linear Programming Problem using Dual Simplex method.

Maximize $Z = -2x_1 - 2x_2 - 4x_3$

subject to $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 \leq 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

$x_1, x_2, x_3 \geq 0$ (10)

3. Consider the following Linear Programming Problem :

Maximize $Z = 2x_1 + x_2 + 4x_3 - x_4$

subject to $x_1 + 2x_2 + x_3 - 3x_4 \leq 8$

$-x_2 + x_3 + 2x_4 \leq 0$

$2x_1 + 7x_2 - 5x_3 - 10x_4 \leq 21$

$x_1, x_2, x_3, x_4 \geq 0.$

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

C_B	Y_B	X_B	x_1	x_2	x_3	x_4	s_1	s_2	s_3
2	x_1	8	1	0	3	1	1	2	0
1	x_2	0	0	1	-1	-2	0	-1	0
0	s_3	5	0	0	-4	2	-2	3	1
		z(= 16)	0	0	1	1	2	3	0

Using the discrete parameter changes listed below, make the necessary corrections in the optimum table and solve the resulting problem :

(a) Change c_1 to 1.

(b) Change b_2 to 11.

(c) Change b to (3, –2, 4).

(d) Change C to (1,2,3,4). (18)

4. (a) Explain in brief (i) Vogel's Approximation method, (ii) Least Cost method and (iii) North-West Corner rule. (8)

(b) Find the optimal Transportation cost using the following cost minimization matrix. (10)

	P	Q	R	S	Supply
A	19	30	50	12	7
B	70	30	40	60	10
C	40	10	60	20	18
Demand	5	8	7	15	

5. (a) Define Transhipment Problem. Write the differences between Transportation and Transhipment Problems. (8)

(b) Solve the following Transportation Problem in order to maximize profit and give criteria for optimality. (10)

	F_1	F_2	F_3	F_4	Supply
W_1	40	25	22	33	100
W_2	44	35	30	30	30
W_3	38	38	28	30	70
Demand	40	20	60	30	

6. (a) Explain the Assignment Problem. Write the differences between the Transportation Problem and the Assignment Problem. (8)

(b) Solve the following Assignment Problem. (10)

	I	II	III	IV	V
A	32	38	40	28	40
B	40	24	28	21	36
C	41	27	33	30	37
D	22	38	41	36	36
E	29	33	40	35	39

7. (a) What is Travelling Salesman Problem? (8)

(b) Solve the following Travelling Salesmen Problem so as to minimize the distance travelled by him if he has to visit each city exactly once and return back to home city. (10)

	A	B	C	D	E
A	-	2	5	7	1
B	6	-	3	8	2
C	8	7	-	4	7
D	12	4	6	-	5
E	1	3	2	8	-