PC-1004/MR

F-3/2050

LINEAR PROGRAMMING-364

(Semester–VI)

Time : Two Hours] [Maximum Marks : 30

Note : Attempt any *four* questions. All questions carry equal marks.

I. Solve Using two phase method

Maximize $z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to the constraints:

$$x_1 + 2x_2 + 3x_3 = 15$$
$$2x_1 + x_2 + 5x_3 = 20$$
$$x_1 + 2x_2 + x_3 + x_4 = 10$$
$$x_1, x_2, x_3, x_4 \geq 0.$$

II. A company has two grades of inspectors 1 and 2 who are to be assigned to a quality inspection work. It is required that at least 1800 pieces are inspected per 8-hour day. Grade 1 inspectors can check pieces at the rate of 25 per hour with an accuracy of 98% .Grade 2 inspectors can check at the rate of 15 pieces per hour with an accuracy of 95%. The wage rate for grade 1 inspector is Rs. 40 per hour while that the grade 2 is Rs. 30 per hour. Each time an

error is caused by the inspector the cost to the company is Rs. 20. The company has eight grade 1 and ten grade 2 inspectors. The company wants to determine the optimal assignment of inspector to minimize total inspection cost. Formulate it as LPP and solve using graphical method.

III. Prove that dual of dual is the primal. Also State and prove week duality theorem.

IV. Use artificial constraint,
solve the following LPP by dual simplex method.
Maximize $z = 2x_3$
Subject to the constraints:
$-x_1 + 2x_2 - 2x_3 \geq 8, -x_1 + x_2 + x_3 \leq 4,$
$2x_1 - x_2 + 4x_3 \leq 10; \quad x_1, x_2, x_3 \geq 0.$

V. Suppose that we are given the LPP

Minimize $x_0 = 2x_1 + 3x_2 + 4x_3$
Subject to the constraints:

$x_1 + 2x_2 + 3x_3 \leq 11, 2x_1 + 3x_2 + 2x_3 \leq 10, x_1, x_2, x_3 \geq 0.$
With its optimal table as

Table

BV	x_1	x_2	x_3	S_1	S_2	solution
x_0	0	1/2	0	1	1/2	16
x_3	0	1/4	1	1/2	–1/4	3
x_1	1	5/4	0	–1/2	3/4	2

(a) Within what range the cost of x_1 varies so that the optimality remains unaffected.

(b) Within what range the cost of x_2 varies so that the optimal solution remains unaffected.

(c) Discuss the effect of changing the cost 2, 3, 4 of the decision variable x_1, x_2, x_3 to 1, 2, 2.

VI. Find the starting solution in the following transportation problem by Vogel's approximation method. Also obtain the optimum solution:

	D_1	D_2	D_3	D_4	Supply
S_1	6	1	9	3	70
S_2	11	5	2	8	55
S_3	10	12	4	7	90
Demand	85	35	50	45	

VII. Consider the LPP

Minimize $x_0 = 3x_1 + 2x_2 + 5x_3$

Subject to the constraints:

$x_1 + 2x_2 + x_3 \leq 43$, $3x_1 + 2x_3 \leq 46$, $x_1 + 4x_2 \leq 42$,

$x_1, x_2, x_3 \geq 0$ With its optimal table as

Table

BV	x_1	x_2	x_3	S_1	S_2	S_3	Solution
x_0	4	0	0	1	2	0	135
x_2	–1/4	1	0	½	–1/4	0	10
x_3	3/2	0	1	0	1/2	0	23
S_3	2	0	0	–2	1	1	2

Find the optimal solution when following modifications are proposed in the above LPP.

(a) $b = (43, 46, 42)^T$ is changed to $b' = (60, 64, 59)^T$.

(b) $b = (43, 46, 42)^T$ is changed to $b' = (45, 46, 40)^T$.

VIII. Solve the following assignment problem using Hungarian method. The matrix entries are processing times in hour :

		Operation				
		O_1	O_2	O_3	O_4	O_5
Job	J_1	65	40	90	80	90
	J_2	60	35	100	85	85
	J_3	60	38	105	90	95
	J_4	70	45	120	90	100
	J_5	65	40	105	87	90

IX. Attempt all questions.

(a) Old hens can be bought for Rs. 2.00 each and young ones cost Rs. 5.00 each. The old hens lay 3 eggs per week and the young ones 5 eggs per week, each worth 30 paise. A hen costs Rs. 1.00 per week to feed. If I have only Rs. 80.00 to spend for hens, how many of each kind should I buy to give a profit of more than Rs. 6.00 per week, assuming that I cannot house more than 20 hens? Write a mathematical model of the problem.

(b) Use graphical method to solve the following LPP.

Maximize $z = x_1 + x_2$

Subject to the constraints:

$x_1 + x_2 \leq 1$, $-3x_1 + x_2 \geq 3$ and $x_1, x_2 \geq 0$

(c) Define Improved basic feasible solution and Optimum basic feasible solution.

(d) Formulate dual of the following LPP.

Maximize $z = 2000x_1 + 3000x_2$

Subject to the constraints :

$6x_1 + 9x_2 \leq 100$; $2x_1 + x_2 \leq 20$ and $x_1, x_2 \geq 0$

(e) Define transportation problem.

(f) Write down the steps of Least cost method to find the initial basic feasible solution.

(g) What is Assignment problem?