PC-1024/MJ

F-9/2051

LINEAR PROGRAMMING–364

(Semester–VI)

Time : Three Hours] [Maximum Marks : 30

Note : Attempt *two* questions each from Section A and B. Section C will be compulsory.

SECTION – A

(Attempt any *two*)

I. A farm is engaged is breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (call them X, Y and Z), it is necessary to buy two additional products, say A and B. One unit of product A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of product B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A cost Rs. 20 per unit and product B cost Rs. 40 per unit.

Formulate the above as a linear programming problem to minimize the total cost, and solve the problem by using graphic method.

II. Solve Using Big M method

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

subject to the constraints :

$$x_1 + 2x_2 + 3x_3 = 15.$$

$$2x_1 + x_2 + 5x_3 = 20.$$

$$x_1 + 2x_2 + x_3 + x_4 = 10.$$

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

III. Use duality to solve the L.P.P.

Minimize $z = 2x_1 - x_2 + x_3 + 5x_4 - 3x_5.$

subject to the constraints :

$$4x_1 + 2x_2 + x_3 + x_4 = 3,$$

$$2x_1 + 2x_2 + x_3 + x_5 = 2,$$

$$x_1,\ x_2,\ x_3,\ x_4,\ x_5 \geq 0.$$

IV. Use dual simplex method to solve the L.P.P.

Minimize $z = x_1 + x_2$

subject to the constraints :

$$2x_1 + x_2 \geq 4,$$

$$x_1 + 7x_2 \geq 7,$$

$$x_1,\ x_2 \geq 0.$$ (2×4=8)

SECTION – B

(Attempt any *two*)

V. 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	3	7	6	4	5
S_2	2	4	3	2	2
S_3	4	3	8	5	3
Demand	3	3	2	2	

VI. 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.

VII. 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
	J_1	20	22	35	22	18
Job	J_2	4	26	24	24	7
	J_3	23	14	17	19	19
	J_4	17	15	16	18	15
	J_5	16	19	21	19	25

VIII. 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	1/2	–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 $b' = (45, 46, 40)^T$.

(2×4=8)

SECTION – C

(Compulsory Question)

IX. Attempt all questions.

(a) A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 garin of codeine. Size B contains 1 grain of aspirin, 8 grain of bicarbonate and 6 grain of codeine. It is found by users that it requires at lest 12 grain of aspirin, 74 grain of bicarbonate and 24 grain of codeine for providing immediate effect. It is

required to determine the least number of pills should take to get immediate relief. Formulate the problem as a standard LPP.

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

Maximize $z = 6x_1 + x_2$ subject to the constraints :

$2x_1 + x_2 \geq 3,\ x_2 - x_1 \geq 0$ and $x_1, x_2 \geq 0$.

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

(d) Formulate dual of the following LPP.

Maximize $z = 4x_1 + 2x_2$ subject to the constraints :

$x_1 + x_2 \geq 3,\ x_1 - x_2 \geq 2$ and $x_1, x_2 \geq 0$.

(e) Write down the steps of North-West corner method to find the initial basic feasible solution.

(f) What is Assignment problem?

(g) Defined term degeneracy in transportation problem.

(7×2=14)