Operational Research

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Q:1

Maximize to :-

$$Z = x_1 + 3x_2 + 3x_3$$
$$3x_1 + x_2 + 2x_3 \leq 7$$
$$-2x_1 - 4x_2 \leq 12$$
$$-4x_1 + 3x_2 \leq 10.$$

Solution :-

$$3x_1 + x_2 + 2x_3 + S_1 = 7$$
$$-2x_1 - 4x_2 + 0.S_1 + S_2 = 12$$
$$-4x_1 + 3x_2 + 0.S_1 + 0.S_2 + S_3 = 10$$

Initial Simplex Method

C_j		1	3	3	0	0	0		
C_B	Basis	x_1	x_2	x_3	S_1	S_2	S_3	B	θ
0	S_1	2	1	2	1	0	0	7	
0	S_2	-2	4	0	0	1	0	12	
0	S_3	-4	3	0	0	0	1	10	

Key column, Key Row, key Element.

C_j		1	3	3	0	0	0		
C_B	Basis	x_1	x_2	x_3	S_1	S_2	S_3	B	θ
0	S_1	3	1	2	1	0	0	7	7/2
0	S_2	-2	-4	0	0	1	0	12	12/0
0	S_3	-4	3	0	0	0	1	10	10/0

Key Column

Qno.2

Minimization:-

$$Z = 5x_1 + 3x_2$$

Subject to:-

$$x_2 \leq 2$$
$$5x_1 + 2x_2 \leq 10$$
$$3x_1 \leq 12$$

Solution:-

$$Z = 5x_1 + 3x_2$$

$$0x_1 + x_2 + S_1 = 2$$
$$5x_1 + 2x_2 + 0.S_1 + S_2 = 10$$
$$3x_1 + 0x_2 + 0.S_1 + 0.S_2 + S_3 = 12$$

Initial Simplex Method

Cj		5	3	0	0	0	13	13	θ
CB	Basis	X_1	X_2	S_1	S_2	S_3			
0	S_1	0	1	1	0	0	2	2	4/12
0	S_2	2	2	0	1	0	10	10	4/2
0	S_3	3	0	0	0	1	12	12	12 → key row
	Z_j	3	0	0	0	0	0	0	
	C_j-Z_j	0	3	0	0	0			

$$\Downarrow$$

Key column

$C_j \gg 0$ for minimization function

As there is no negative value in C_j. So, it satisfies the equation.

$x_1 \geq 0 \qquad\qquad x_2 \geq 0$

Optimal Solution:-

$$Z = 5x_1 + 3x_2$$
$$= 5(0) + 3(0)$$
$$Z = 0 \,(min)$$