Mathematics Presentation

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Simplex method

Introduction :

- Simplex Method is a more general method suitable for solving LPP with a large number of variables.

- This method was developed by **George Dantzig** in 1947 and was made available

Basic Terms

1) **Slack variables :** The $\leq$ type inequations can be transformed into equations by the addition of non-negative variables, say s_1, s_2 etc, known as Slack variables.

2) **Surplus variables :** The $\geq$ type inequality, subtracted from the left hand side constraint to convert the constraint into equally is called Surplus variables.

3) **Artificial variables** : If x_1 *and* x_2 are set equal to zero, s_1 *and* s_2 turns out to be negative violating the non-negative restriction. Therefore, to overcome this, we introduce another similar device of artificial variables represented by A_1, A_2 .

Question

Ques. : Solve the LP Problem using simplex method.

Maximize Z = $5x_1 + 3x_2$

Subject to constraints

$3x_1 + 5x_2 \leq 15$

$5x_1 + 2x_2 \leq 10$

$x_1, x_2 \geq 0$ (Non-negativity constraint)

Solution:

Max. Z = $5x_1 + 3x_2 + 0S_1 + 0S_2$

Subject to constraints

$$3x_1+5x_2+s_1+0s_2=15$$
$$5x_1+2x_2+0s_1+s_2=10$$

where x_1, x_2 and $s_1, s_2 \geq 0$

		C_j	5	3	0	0	
Basic	C_B	x_b	x_1	x_2	s_1	s_2	Min. ratio
s_1	0	15	3	5	1	0	5
s_2	0	10	5 (5)	2	0	1	2 → (Key row)
		z_j	0	0	0	0	
		$C_j - z_j$	5	3	0	0	

↑ (key column)

Key element = 5

Incoming variable = x_1

Outgoing variable = s_2

		C_j	5	3	0	0	
Basic	C_B	x_b	x_1	x_2	s_1	s_2	Min. ratio
s_1	0	9	0	19/5	1	-3/5	45/19 (key row)
x_1	5	2	1	2/5	0	1/5	5
		z_j	5	2	0	1	
		$C_j - z_j$	0	1	0	-1	

(key column)

Key element = 19/5

Incoming variable = x_2

Outgoing variable = s_1

		C_j	5	3	0	0	
Basic	C_B	x_b	x_1	x_2	s_1	s_2	Min. ratio
x_2	3	45/19	0	1	5/19	-3/19	
x_1	5	20/19	1	0	-2/19	25/19	
		z_j	5	3	5/19	16/19	
		$C_j - z_j$	0	0	-5/19	-16/19	

Since all the $C_j - z_j$ are negative or zero, so we get the optimum solution

$$x_1 = 20/19$$
$$x_2 = 45/19$$

max Z = 235/19.