

Mathematics

Presentation

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 equality 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.

$$\text{Maximize } Z = 5x_1 + 3x_2$$

Subject to constraints

$$3x_1 + 5x_2 \leq 15$$

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

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

Solution:

$$\text{Max. } Z = 5x_1 + 3x_2 + 0S_1 + 0S_2$$

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	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

$$x_1 = 20/19$$

$$x_2 = 45/19$$

$$\max Z = 235/19.$$

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