→ used to get integer solutions

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(Opp of primal simplex method)

Dual Simplex Method → used to solve problems without using artificial variables

$1:5$

min: $z = 8x_1 + 4x_2$

wrt $x_1 + x_2 \geq 40, \quad 5x_1 + x_2 \geq 60, \quad x_1, x_2 \geq 0$ → convert all constraints to $\leq$ type

$-x_1 - x_2 \leq -40, \quad -5x_1 - 5x_2 \leq -60, \quad x_1, x_2 \geq 0$

⟹ convert to max problem, with atleast 1 -ve RHS value for constraints

max: $-z = -8x_1 - 4x_2 + 0s_1 + 0s_2$

wrt

$-x_1 - x_2 + s_1 = -40$ $\qquad x_1, x_2, \underbrace{s_1, s_2}_{\text{slack variables}} \geq 0$

$-5x - x_2 + s_2 = -60$

Table 1.

coeff	Basic	x_1 (coeff → -8, non basic →)	x_2 (-4)	x_B
0	s_1	-1	-1	-40
$i' \to$ 0	s_2	-5^*	-1	-60
		8	4	0

$(0\times-1)+(0\times-5)-(-8)$
$=8$

Conditions#

- ~~Atleast 1~~ ~~All~~ BV's has -ve values
- no -ve variable in the last row

→ As s_2 is most -ve variable, s_2 is departing variable and its row is row i'

→ ~~as $\frac{8}{-5}$ = ... $\frac{z_i}{a_{i'j}}$ is smaller the~~

→ we divide final row elements with corespond i' row elements

As $\left|\frac{8}{-5}\right|$ is ~~most negative~~ smallest value, -5 is pivot & x_1 is entering variable

→ The exchange of variables & creation of new table is same as simplex method.

→ For this step N^r has to be ≥ 0 & D^r has to be < 0, choose only pivot that is < 0

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Table 2

		0	-4	
		s_2	x_2	
0	s_1	$-1/5$	$-4/5$*	-28
-8	x_1	$-1/5$	$1/5$	12
		$8/5$	$12/5$	-96

→ pivotal row divided by pivot

new pivot $= \frac{1}{\text{pivot}}$

pivotal column divided by (-pivot)

for other elements

pivot q r s

$$s' = \frac{(\text{pivot} \times s) - qr}{\text{pivot}}$$

Conditions are satisfied. hence we repeat

Table 3

		0	0	
		s_1	s_2	
-4	x_2	$1/4$	$-5/4$	35
-8	x_1	$-1/4$	$1/4$	5
		1	3	-180

Conditions NOT satisfied, hence optimal solution reached

$x_2 = 35$, $x_1 = 5$, $-Z^* = -180$, $Z^* = 180$