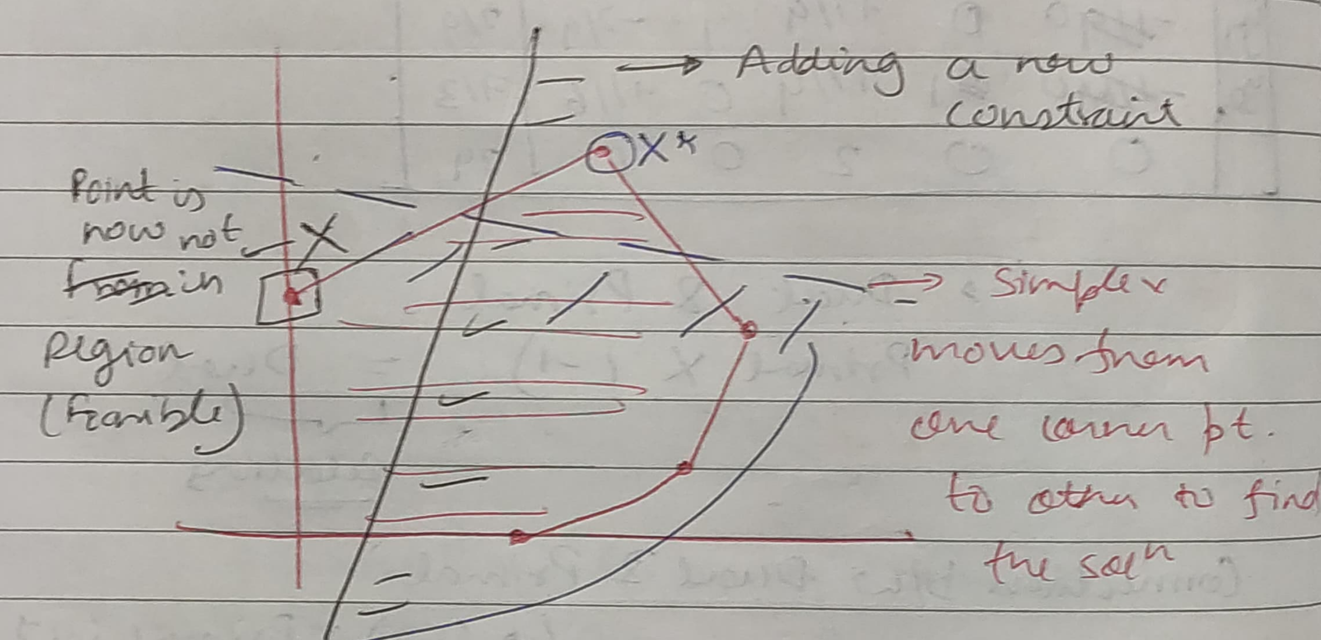
18 February, 2021

Change In Obj. fn
Add A Variable
Change in R.H.S value
} Analysis

Adding a constraint

Let X^* be optimal soln for a LP model.
Now, add a ~~co~~ new constraint.



If X^* satisfies new constraint } soln will remain same

Now this new constraint removes X^* from feasible region. ∴ We need to find the new optimal point

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1) If X^* satisfies new constraint } X^* is solⁿ
2) If X^* doesn't " " " } solⁿ is changed

- X^* is still optimal ⇒ Z^* remains same
- If X^* not satisfies new constraint ⇒ Z^* changes

Ex: Continuing previous example:
We add constraint in final tableau
Writing final tableau as constraints

$$-2x_1 + 5x_3 + x_4 + 2x_5 - x_6 = 6 \quad \text{— (1)}$$
$$11x_1 + x_2 - 18x_3 \quad - 7x_5 + 4x_6 = 4 \quad \text{— (2)}$$
$$3x_1 + \quad 2x_3 \quad + 2x_5 + 1x_6 = 106 \quad \text{— (3)}$$

↳ Z eqⁿ

$Z_{max} = 106$ at $X^* (0, 4, 0, 6, 0, 0)$

(1) Add $3x_1 + x_2 + 3x_4 \leq 20$
Checking If X^* satisfies above constraint
$0 + 4 + 18 = 22 \leq 20$ → false
Not Satisfying

X^* is not optimal

$$3x_1 + x_2 + 3x_4 \quad + x_7 = 20 \quad \text{— (N)}$$

Our Model is already in canonical form, so we convert this in canonical form
Replacing x_2 in above from (2) & x_4 from (1)
That gives us

$$\Rightarrow -2x_1 + 3x_3 + 1x_5 - x_6 + x_7 = -2 \quad \text{— (N)}$$
$$-2x_1 + 5x_3 + x_4 + 2x_5 - x_6 = 6$$
$$11x_1 + x_2 - 18x_3 - 7x_5 + x_6 = 4$$

-ve b

Then optimal Solⁿ ← First feasible Soln ← Dual Simplex

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LPP

Solving the above ~~eq~~ LPP in LP Assistant.
Starting with Dual simplex.

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	b
x_4	-2	0	5	1	2	-1	0	6
x_2	11	1	-18	0	-7	4	0	4
x_7	-2	0	3	0	1	-1 ↑	1	-2
	3	0	2	0	2	1	0	106
x_4	0	0	2	1	1	0	-1	8
x_2	3	1	-6 ↑	0	-3	0	4	-4
x_6	2	0	-3	0	-1	1	-1	2
	1	0	5	0	3	0	1	104
x_4	1	$1/3$	0	1	0	0	$1/3$	$20/3$
x_3	$-1/2$	$-1/6$	1	0	$1/2$	0	$-2/3$	$2/3$
x_6	$1/2$	$-1/2$	0	0	$1/2$	1	-3	4
	$7/2$	$5/6$	0	0	$1/2$	0	$13/3$	$302/3$

Zmin as no -ve value

New optimal Point is ← No Entering Variable
$y^* = (0, 0, 2/3, 20/3, 0, 4, 0)$

$Z^* = 302/3$

(2) Add a constraint $4x_1 + x_2 + 4x_4 \geq 29$
Sol^n was $(0, 4, 0, 6)$
Checking If Sol^n is satisfying $28 \geq 29 \rightarrow$ false
Now, Pivoting & finding the new optimal sol^n

$\Rightarrow 4x_1 + x_2 + 4x_4 - x_7 = 29$

$\Rightarrow -4x_1 - x_2 - 4x_4 + x_7 = -29$

Turning this in canonical form
{Same as above}

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	x_1	x_2	x_3	x_4	x_5	x_6	x_7	b
x_4	-2	0	5	1	2	-1	0	6
x_2	11	1	-18	0	-7	4	0	4
x_7	-1	0	2	0	1	0	1	-1
	3	0	2	0	2	1	0	106
x_4	0	0	1	1	0	-1	-2	8
x_2	0	1	4	0	4	4	11	-7
x_1	1	0	-2	0	-1	0	-1	1
	0	0	8	0	5	1	3	103

Can't Remove this -ve

No -ve value in Row

Unbounded Soln
or Not feasible Soln

③ Add a constraint $x_1 + 3x_3 + x_4 - 4x_5 - x_6 = -18$
Soln is $(0, 4, 0, 6)$
checking: If Soln is satisfying $-6 = -18$, false
$X^* \rightarrow$ Not satisfying this constraint
After solving this, we get
$Z_{min} = 96$ at $(0, 24, 0, 0, 4, 2)$

TRANSPORTATION PROBLEM OR MODEL

Suppose we have some products at a warehouse.

It There is a origin & we have to distribute the products to different locations

from Inventories $\longrightarrow$ Transport to different locations (3 in this case)

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There are diffrent limits in the locations

e.g. School Bus → takes route for less petrol & more students reach home → less distance Route.

Origin : School   Destination : Homes

Limit on Origin → No. of Students which can sit in bus

Limits on Destinations → 10 students on that destination D_1, 5 on D_2, 6 on D_3 etc.

Total Student which Hop In on Origin = Total Student which get down on diffrnt destinations

Supply = Demand

Optimization : Cost (Fuel), Time (Acc. to problem)
∴ Will take a route where these will be minimized.

So, the bus driver has to move in such a way such that the demands is also fulfilled & cost is also optimized.

O_i = location of Good $\xrightarrow[\text{to}]{\text{Transport}}$ D_j (Destination)

Cost from O_i to D_j is given

Goal : Need to find a solⁿ to minimize the cost

Balance Transportation Problem
Supply = Demand & $O_i = D_j$