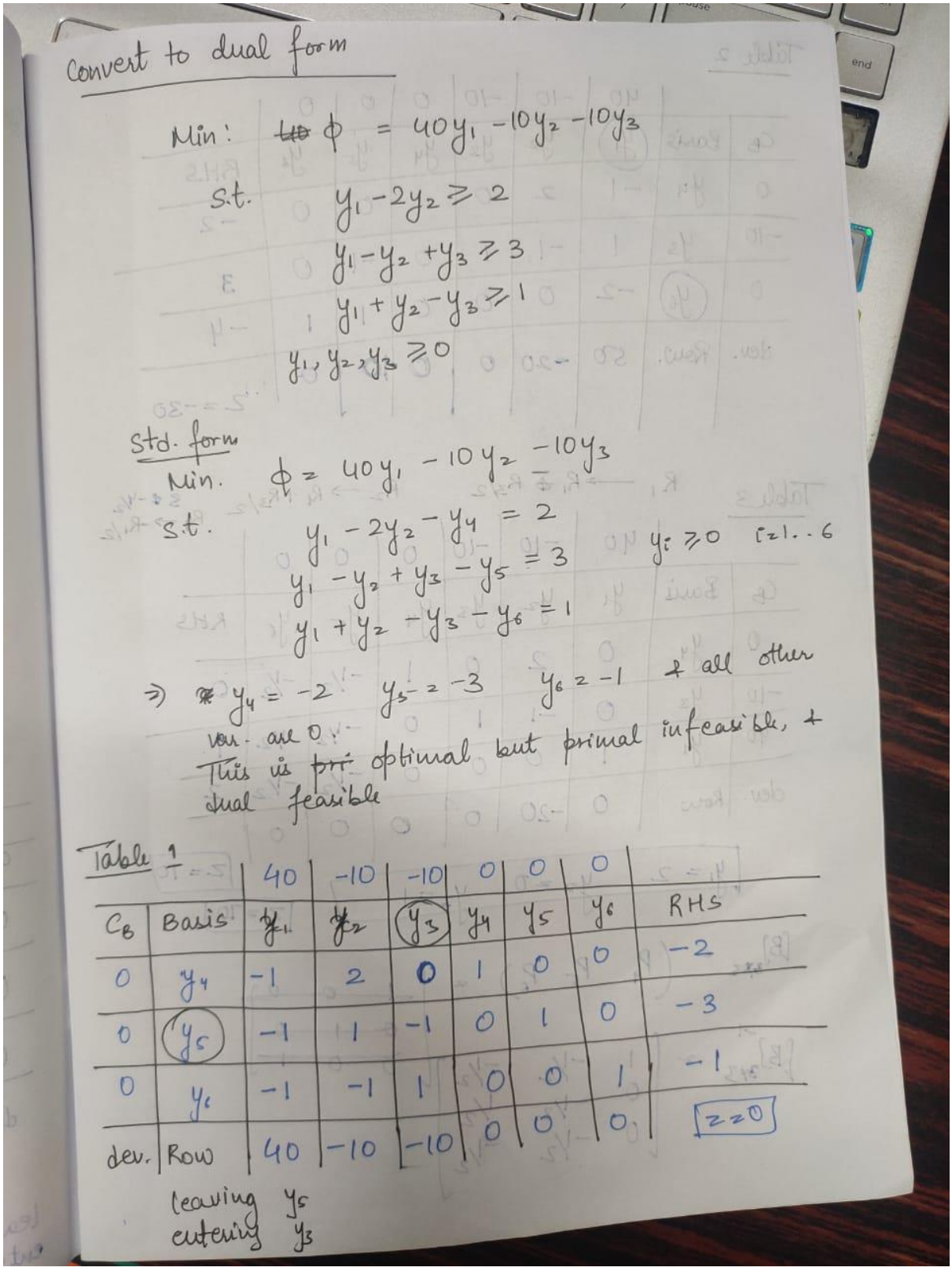
OR LAB

Assignment 6

Nikita 18AE30029

Q1)



Convert to dual form

Min: $\phi = 40y_1 - 10y_2 - 10y_3$

s.t. $y_1 - 2y_2 \geq 2$

$y_1 - y_2 + y_3 \geq 3$

$y_1 + y_2 - y_3 \geq 1$

$y_1, y_2, y_3 \geq 0$

Std. form

Min. $\phi = 40y_1 - 10y_2 - 10y_3$

s.t. $y_1 - 2y_2 - y_4 = 2$

$y_1 - y_2 + y_3 - y_5 = 3$ $\quad y_i \geq 0 \quad i = 1..6$

$y_1 + y_2 - y_3 - y_6 = 1$

$\Rightarrow y_4 = -2 \quad y_5 = -3 \quad y_6 = -1$ & all other var. are 0.

This is optimal but primal infeasible, & dual feasible

Table 1

		40	-10	-10	0	0	0	
C_B	Basis	y_1	y_2	y_3	y_4	y_5	y_6	RHS
0	y_4	-1	2	0	1	0	0	-2
0	y_5	-1	1	-1	0	1	0	-3
0	y_6	-1	-1	1	0	0	1	-1
dev.	Row	40	-10	-10	0	0	0	$z = 0$

leaving y_5

entering y_3

Table 2

		40	-10	-10	0	0	0	
C_B	Basis	y_1	y_2	y_3	y_4	y_5	y_6	RHS
0	y_4	-1	2	0	1	0	0	-2
-10	y_3	1	-1	1	0	-1	0	3
0	y_6	-2	0	0	0	1	1	-4
dev.	Row.	50	-20	0	0	10	0	$Z = -30$

$R_1 \longrightarrow R_1 - R_3/2$ $\quad R_2 \longrightarrow R_1 + R_3/2$ $\quad S \leftarrow -\frac{1}{2}$ $\quad R_4 \rightarrow R_4/2$

Table 3

		40	-10	-10	0	0	0	
C_B	Basis	y_1	y_2	y_3	y_4	y_5	y_6	RHS
0	y_4	0	2	0	1	-1/2	-1/2	0
-10	y_3	0	-1	1	0	-1/2	1/2	1
40	y_1	1	0	0	0	-1/2	-1/2	2
dev.	Row	0	-20	0	0	0	0	

$y_1 = 2 \quad y_2 = 0 \quad y_3 = 1$ $\quad Z = 70$

$Z = 70$

$$[B]_{3\times3} = (P_4 \quad P_5 \quad P_6) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$[B]^{-1}_{3\times3} = \begin{bmatrix} 1 & -1/2 & -1/2 \\ 0 & -1/2 & 1/2 \\ 0 & -1/2 & -1/2 \end{bmatrix}$$

$$b = \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$$

$$\bar{b} = B^{-1}b = \begin{bmatrix} 1 & -1/2 & -1/2 \\ 0 & -1/2 & 1/2 \\ 0 & -1/2 & -1/2 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix}$$

$$\bar{b} = \begin{bmatrix} -1/2 - 1 \\ -1/2 + 1 \\ -1/2 - 1 \end{bmatrix} = \begin{bmatrix} -3/2 \\ 1/2 \\ -3/2 \end{bmatrix}$$

$$C_B B^{-1} = \begin{pmatrix} 0 & -10 & 40 \end{pmatrix} \begin{bmatrix} 1 & -1/2 & -1/2 \\ 0 & -1/2 & 1/2 \\ 0 & -1/2 & -1/2 \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ \frac{10}{2} - \frac{40}{2} \\ \frac{-10}{2} - \frac{40}{2} \end{bmatrix} = \begin{bmatrix} 0 \\ -15 \\ -25 \end{bmatrix}$$

This is the solution of the dual

Q2)

```
The coeeficient matrix:
1 1 1 1 0 0 40
-2 -1 1 -0 1 -0 -10
-0 1 -1 -0 -0 1 -10
The cost function:
2 3 1 0 0 0

The Simplex tableau:
0 5 1 1 1 1 0 0 40
0 6 -2 -1 1 -0 1 -0 -10
0 7 -0 1 -1 -0 -0 1 -10


Beginning Dual Simplex method!!


Iteration: 0
The Tableau:
0 5 1 1 1 1 0 0 40
0 6 -2 -1 1 -0 1 -0 -10
0 7 -0 1 -1 -0 -0 1 -10
Deviations: 2 3 1 0 0 0
Outgoing variable: x5
INFEASIBLE!! {Since we could not find valid incoming variable}

Now converting into dual form and solving

cost_fn_size: 6
n: 6
After: The coeeficient matrix:
-1 -2 -0 1 -0 -0 -2
1 1 -1 0 1 0 3
1 -1 1 0 0 1 1
After: The cost function:
-40 -10 -10 -0 -0 -0



Beginning Dual Simplex method!!
```

```
Beginning Dual Simplex method!!


Iteration: 0
The Tableau:
0 5 -1 -2 -0 1 -0 -0 -2
0 6 1 1 -1 0 1 0 3
0 7 1 -1 1 0 0 1 1
Deviations: -40 -10 -10 -0 -0 -0
Outgoing variable: x4
Incoming variable: x2
The Value of the Optimization Fucntion is: 0


Iteration: 1
The Tableau:
-10 3 0.5 1 0 -0.5 0 0 1
0 6 0.5 0 -1 0.5 1 0 2
0 7 1.5 0 1 -0.5 0 1 2
Reached the termination state since all RHS values are positive

The Optimisation function is optimised at the point : x2 = 1, x5 = 2, x6 = 2, Rest all xis=0
The value of the cost function at this point is : 10
```