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Q.1
→ The standard Form of the given LPP can be write as maximize $Z = 3x_1 + 2x_2 + 5x_3$
sujeect to $x_1 + 2x_2 + 3 + s_1 = 430$
$3x_1 + 2x_3 + s_2 = 460$
$x_1 + 4x_2 + s_3 = 420$
$x_1, x_2, x_3, s_1, s_2, s_3 \geq 0$

C_i		3	2	5	0	0	0		
C_B	x_B	x_1	x_2	x_3	s_1	s_2	s_3	b	Θmin
0	s_1	1	2	1	1	0	0	430	430
0	s_2	3	2	2	0	1	0	460	230→
0	s_3	1	4	0	0	0	1	420	-

x_3 enters Z_j 0 0 0 0 0 0 0
s_2 leaves $C_j - Z_j$ 3 2 5↑ 0 0 0 0

0	s_1	-0.5	2 →	0	1	-0.5	0	200 100→
5	x_3	1.5	0	1	0	0.5	0	230 —
0	s_3	1	4	0	0	0	1	420 105

x_2 enters Z_j 7.5 0 5 0 2.5 1150
s_1 leaves $C_j - Z_j$ -4.5 2↑ 0 0 0 -2.5

Q.2

→ The standard form of the given LPP can be written as.

Maximize $z = 10x_1 + 6x_2 + 4x_3$

Subjected to $x_1 + x_2 + x_3 + s_1 = 100$

$10x_1 + 4x_2 + 5x_3 + s_2 = 600$

$2x_1 + 2x_2 + 6x_3 + s_3 = 300$

$x_1, x_2, x_3, s_1, s_2, s_3 \geq 0$

	C_j	10	6	4	0	0	0		
C_B	x_B	x_1	x_2	x_3	s_1	s_2	s_3	b	θ_{min}
0	s_1	1	1	1	1	0	0	100	100
0	s_2	10	4	5	0	1	0	600	60 →
0	s_3	2	2	6	0	0	1	300	150
x_1 enters	z_j	0	0	0	0	0	0	0	
s_2 leaves	$C_j - z_j$	10↑	6	4	0	0	0		

0	s_1	0	0.6	0.5	1	-0.1	0	40	66.67 →
10	x_1	1	0.4	0.5	0	0.1	0	60	150
0	s_3	0	1.2	5	0	-0.2	1	180	150
s_1 leaves	z_j	10	4	5	0	1	0	600	
x_2 enters	$C_j - z_j$	0	2↑	-1	0	-1	0		

6	x_2	0	1	0.83	1.66	-0.16	0	66.67 = x_2
10	x_1	2.5	0	0.42	1.66	0.41	0	83.33 = x_1
0	s_3	0	0	11.24	5	-1.42	0	100
	z_j	25	6	9.2	7	3	0	1233
	$C_j - z_j$	-15	0	-5.2	-7	-3	0	

optimal

Optimal Solution Max $z = 1233$, $x_1 = 83.33$, $x_2 = 66.67$

$x_3 = 0$

FOR EDUCATIONAL USE

Q.3

=> The standard form of given LPP can be written as.

Maximum $z = -x_1 + 3x_2 - 2x_3$

Subject to: $3x_1 - x_2 + 3x_3 \le 7$

$-2x_1 + 4x_2 + S_3 = 12$

$-4x_1 + 3x_2 + 8x_3 + S_3 = 10$

$x_1, x_2, x_3, S_1, S_2, S_3 \ge 0$

	C_j	-1	3	-2	0	0	0	0	Ratio
CB	XB	X1	X2	X3	S1	S2	S3	b	
0	S1	3	-1	3	1	0	0	7	-7
0	S2	-2	4	0	0	1	0	12	3
0	S3	4	3	8	0	0	1	10	3.33

X2 enters	Z_j	0	0	0	0	0	0	0	
S2 leaves	$C_j - Z_j$	-1	3	-2	0	0	0		
0	S1	2.5	0	3	1	0.25	0	10	4
3	X2	-0.5	1	0	0	0.25	0	3	-6
0	S3	2.5	0	8	0	0.15	1	1	-0.4
x_1 enters	Z_j	-1.5	3	0	0	0.75	0	9	
S1 leaves	$C_j - Z_j$	0.5	0	-2	0	-0.75	0		
-1	X1	1	0	1.2	0.4	10	0	4	
3	X2	0	1	1.2	0.4	6.5	0	10	
0	S2	0	0	4.0	0.4	90	0.4	44	
Z_j		-1	6	2.4	0.8	21.5	0	26	

Optimal Solution Min $Z = -26$, $x_1 = 4$, Optimal

$x_2 = 100$, $x_3 = 0$

Q.4 maximize $z = 28x_1 + 30x_2$
subject to $6x_1 + 3x_2 \le 18$
$3x_1 + x_2 \le 8$
$4x_1 + 5x_2 \le 30$
$x_1, x_2 \ge 0$

→ The standard form of given L.P.P can be written as:

maximize $z = 28x_1 + 30x_2$
subject to $6x_1 + 3x_2 + s_1 = 18$
$3x_1 + x_2 + s_2 = 8$
$4x_1 + 5x_2 + s_3 = 30$
$x_1, x_2, x_3, \cancel{s_1}, \cancel{s_2}, s_3 \ge 0$

	C_j	28	30	0	0	0		
C_B	x_B	x_1	x_2	s_1	s_2	s_3	b	θ min
0	s_1	6	3	1	0	0	18	6
0	s_2	3	1	0	1	0	8	8
0	s_3	4	5 →	0	0	1	30	6 →

x_2 enters Z_j 0 0 0 0 0 0
s_3 leaves $C_j - Z_j$ 28 30↑ 0 0 0

Since value of variables s_1, s_3 are same is indicates a degeneracy in the situation.

To resolve this.

	s_1	s_2	s_3
s_1	1	0	0
s_2	0	1	0
s_3	0	0	1

	s_1	s_2	s_3
s_1	1/3	0	0
s_2	0	1	0
s_3	0	0	1/5

Here the minimum ratio occurs for the first row hence s_1 will leave the basis.

	C_j	24	30	0	0	0	b	θ min
CB	XB	x_1	x_2	s_1	s_2	s_3	b	
0	s_1	3.6	0	1	0	-0.6	6	6
0	s_2	2.2	0	0	1	-0.2	2	0.41
30	x_2	0.8	1	0	0	0.2	6	7.5
x_1 enter	z_j	24	30	0	0	6		
s_1 leave	C_j-z_j	48	0	0	0	6		

24	s_1	1	0	0.28	0	-1/6	0	$= x_1$
0	s_2	0	0	-0.6	1	-0.28	4.4	
30	x_2	0	1.25	-0.23	0	5/12	7.5	$= x_2$
	z_j	24	37.5	0.54	0	2.83	225	
	C_j-z_j	0	-7.5	-0.54	0	-2.83		

optimal solution

Optimal Solution : max $z = 225$, $x_1 0$, x_2 7.5

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Q5 The standard form of the given LPP can be
→ given as maximize $z = -3x_1 + -4x_2 - MA_1 - MA_2$
subject to $2x_1 + 3x_2 - S_1 + A_1 = 90$
$4x_1 + 3x_2 - S_2 + A_2 = 120$
$S_1, S_2, x_1, x_2, A_1, A_2 \geq 0$

C_j		-3	-4	0	0	-M	-M		
CB	xB	x_1	x_2	S_1	S_2	A_1	A_2	b	θ min
-M	A_1	2	3	-1	0	1	0	90	45
-M	A_2	4 →	3	0	-1	0	-1	120	30 →

x_1 enters	z_j	-6M	-6M	M	M	-M	-M
A_2 leaves	$C_j - z_j$	6M-3 ↑	6M	-M	-M	0	0

-M	A_1	0	6/4 →	-1	1/2	1	-1/2	30	20 →
-3	x_1	1	3/4 →	0	-1/4	0	1/4	30	40 →

x_2 enters z_j -3 -6M/4 M -M/2 -M M/2 -30M
$C_j - z_j$ -9/4 3/4 -3/4 -90

A_1 leaves $C_j - z_j$ 0 6M/4 -M M/2 0 -3M/2
-7/4 ↑ -3/4 3/4

∴	x_2	0	1	-4/6	1/3	4/6	-1/3	$20 = x_2$	
-3	x_1	1	0	1/2	-1/2	-4/6	1/2	$15 = x_1$	
	z_j	-3	-4	7/6	1/6	-4/6	-125		
	$C_j - z_j$	0	0	-7/6	-1/6	-M/6	-M/6		

Optimal

Optimal sol ∴ min $z = 125$, $x_3 = 15$, $x_2 = 30$

FOR EDUCATIONAL USE

Q6

→ Standard form of the LPP is given by:

Max = 107x + x2 + 2x3 + 0x4 + 0S2 + 0S3

Subject to = 14/3 x1 + 1/3 x2 - 2x3 + x4 + 0S + ...

6x1 + 1/2 x2 + 6x3 + 0x4 + 0S2 + 0S3 = 5

3x - x2 - x3 + 0x4 + 0S2 + S3 = 0

x1, x2, x3, x4, S2, S3 ≥ 0

	Cj	107	1	2	0	0	0		
CB	xj	x1	x2	x3	x4	S2	S3	b	θ min
0	x4	14/3	1/3	-2	1	0	0	7/3	1/2
0	x2	16	1/2	0	0	1	0	5	5/16
0	x3	0	-1	+1	0	0	1	0	0 →
	zj	0	0	0	0	0	0		

	Cj - zj	107	1	2	0	0	0	0		
x1 - 14/2	0	x4	0	18/9	$\boxed{-4/4}$	1	0	-14/9	4/3	–
x - 16y	0	S2	0	65/6	$\boxed{34/3}$	0	1	-16/3	5	15/34
y x	107	x1	1	-1/3	$\boxed{-1/3}$	0	0	1/3	0	–
	zj	107	-107/3	-107/3	0	0	107/3	0		

	Cj - zj	0	110/3	43/37	0	0	-107/3	
S2 x, 4/4 0	x4	0	$\boxed{36/17}$	0	0	1	2/51	-30/17
				1	0	3/24	40/17	~~48/46~~
y	2	x3	0	$\boxed{35/68}$	0	0	1/21	-8/17
				$\boxed{-11/61}$				3/17
	zj	= 107	-1103/68	2	0	113/34	305/17	568/29

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x^2 enters	$C_j \cdot Z_j$	0	1102/60P	0	0	-110/37	-305/17	
$x_1, x_4 0$ g	x_4	0	0	-17/12	1	-37/105	6/25	5/7
	x_2	0	1	68/35	0	6/35	-32/35	6/7
$x + 11 s y$	x_1	1	0	11/35	0	2/35	0	2/35 2/7
	Z_j	102	1	249/7	0	44/7	15/7	
	$C_j - Z_j$	0	6	-285/7	0	-44/7	20/7 -15/7	

Since all $C_j - Z_j$ are negative or zero, the sol obtained is optimal.

The optimal sol max $Z = \frac{220}{7} = 31.43$

$x_1 = \frac{2}{7}$, $x_2 = \frac{6}{7}$, $x = 0$