OR Classtest - 1

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Solution: Minimize $Z = 10x_1 + 6x_2 + 2x_3$

Subject to : ~~$3x_1 + 2x_2$~~

$$-x_1 + x_2 + x_3 \geq 1,$$
$$3x_1 + x_2 - x_3 \geq 2,$$
$$x_1, x_2, x_3 \geq 0$$

Initial basic feasible solution,

$x_1 = x_2 = x_3 = 0$,

$S_1 = -1$ and $S_2 = -2$

			C_j	-10	-6	-2	0	0
C_B	B	X_B	b	a_1	a_2	a_3	S_1	S_2
0	a_1	S_1	-1	-1	-1	-1	1	0
0	a_3	S_2	-2	-3	-1	1	0	1
			Z_j	0	0	0	0	0
			$Z_j - C_j$	10	6	2	0	0

$$\theta = \text{Max}\left[\frac{-10}{3}, -6\right]$$

$\therefore a_1$ replaces S_2

$$R_2' \leftarrow R_2 \times \left(\frac{-1}{3}\right)$$

$$R_1' \leftarrow R_1 - R_2'$$

		C_j	-10	-6	-2	0	0
B	X_B	b	a_1	a_2	a_3	S_1	S_2
a_3	S_1	5/3	0	-9/3	2/3	1	1/3
a_1	X_1	2/3	1	1/3	-1/3	0	-1/3
		$Z_j - C_j$	0	8/3	16/3	0	10/3

$$\text{Max} = [-, -2, -1/8, -, -]$$

$$R_1' \leftarrow R_1 \times \left(\frac{-3}{2}\right)$$

$$R_2' \leftarrow R_1 + \frac{1}{3} \times R_2'$$

		C_j	-10	-6	-2	0	0
C_B	B	X_B	b	a_1	a_2	a_3	S_1	S_2
-2	a_3	X_3	5/2	0	2	1	-3/2	-1/2
-10	a_1	X_1	3/2	1	1	0	-1/2	-1/2
		$Z_j - C_j$	0	-8	0	8	6

$$a_2 \rightarrow a_1$$

$$R_1' \leftarrow R_1 - 2R_2$$

		C_j	-10	-6	-2	0	0
C_B	B	X_B	b	a_1	a_2	a_3	S_1	S_2
-2	a_3	x_3	-1/2	-2	0	1	-1/2	1/2
-6	a_2	x_2	3/2	1	1	0	-1/2	-1/2
		$Z_j - C_j$	8	0	0	3	2

$$\theta = \text{Max}[-4, -, -, -, -6, -]$$

$R_1' \leftarrow R_1 \times (-1/2)$

$R_2' \leftarrow R_2 - R_1'$

a_1 replaces a_3

			C_j	-10	-6	-2	0	0
C_B	B	X_b	b	a_1	a_2	a_3	S_1	S_2
-10	a_1	x_1	1/4	1	0	-1/2	1/4	-1/4
-6	a_2	x_2	5/4	0	1	1/2	-3/4	-1/4
			$Z_j - C_j$	0	0	4	2	4

$\therefore$ $x_1 = 1/4$

$x_2 = 5/4$

$x_3 = 0.$

Solution 2.

	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

from

Subtracting row minimum from Row :-

	A	B	C	D	E
A	∞	1	4	6	0
B	4	∞	1	6	0
C	4	3	∞	0	3
D	8	0	2	∞	1
E	0	2	1	7	∞

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Subtracting column minimum from column

	A	B	C	D	E
A	∞	1	3	6	0
B	4	∞	0	6	0
C	4	3	∞	0	3
D	8	0	1	∞	1
E	0	2	0	7	∞

	A	B	C	D	E
A	∞	1	3	6	0
B	4	∞	0	6	0
C	4	3	∞	0	3
D	8	0	1	∞	1
E	0	2	0	7	∞

no of Lines = N

From		To
A	→	E
B	→	C
C	→	D
D	→	B
E	→	A

Solution 3). Let x units of fodder 1 and y units of fodder 2 be included in the food ration of an animal.

The cost of fodder 1 is ₹3 per unit and that of fodder 2 is ₹2 per unit.

$\therefore$ Total cost = ₹ $(3x + 2y)$

The minimum requirement of nutrients A, B, C for an animal are 14, 22 and 1 unit respectively.

$\therefore$ We construct given table with minimum requirement column as follows:-

Nutrient \ Fodder	Fodder 1	Fodder 2	Minimum requirement
Nutrient A	2	1	14
Nutrient B	2	3	22
Nutrient C	1	1	1

from table, the food ration of an animal must contain $(2x + y)$ units of nutrient A, $(2x + 3y)$ units of B and $(x + y)$ units of C.

$\therefore$ The constraints are :-

$$2x + y \geq 14,$$
$$2x + 3y \geq 22,$$
$$x + y \geq 1$$

Since x and y cannot be negative, we have $x \geq 0$, $y \geq 0$.

∴ Given problem can be formulated as follows:

Minimize $Z = 3x + 2y$

Subject to $2x + y \geq 14$, $2x + 3y \geq 22$,

$x + y \geq 1$, $x \geq 0$, $y \geq 0$.

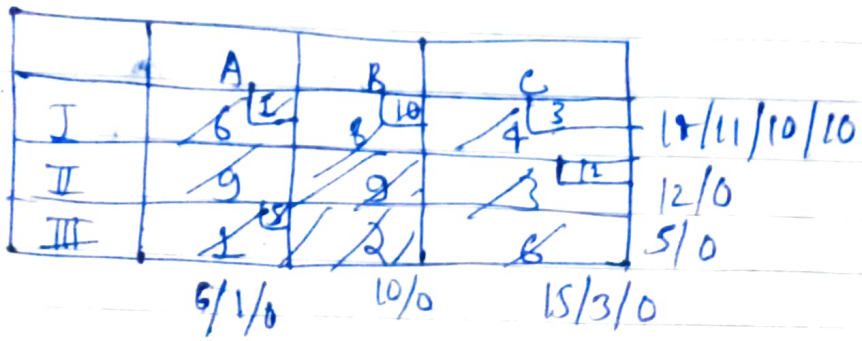
(Solution:)

	A	B	C	Demand
I	6	8	4	14
II	9	9	3	12
III	1	2	6	5
Supply	6	10	15	31 31

Since Σ supply $= \Sigma$ Demand

This is balanced table

	A	B	C	
I	6	8	4	14
II	9	9	3 [12]	12/0
III	1	2	6	3
	6	10	15/3	



	A	B	C	Demand
I	6 [1]	8 [10]	4 [3]	14
II	9	9	3 [12]	12
III	1 [5]	2	6	5
Supply	6.	10.	15	

Total cost = $6 \times 1 + 8 \times 10 + 4 \times 3 + 3 \times 12 + 1 \times 5$

$= 6 + 80 + 12 + 36 + 5$

$= 139.$