CSE - 2018

Q: An agricultural firm has - - - - - - [10m]

Solution → Let we prepare $9x$ ton of 3:3:4 mixture and $8y$ ton of 2:4:2 mixture.

Therefore profit $= 1500 \times 9x + 1200 \times 8y$

let profit = Z, $\boxed{Z = 13500x + 9600y}$

Since in 3:3:4 there will be $3x$ ton nitrogen, $3x$ ton phosphate and $4x$ ~~ton~~ potash. out of total $9x$ ton

and in 2:4:2 there will be $2y$ ~~ton~~ nitrogen, $4y$ ton phosphate and $2y$ ton potash out of total $8y$ potash.

Now due to availability restrictions, there will be :→

$3x + 2y \leq 180$ (availibility of nitrogen)

$3x + 4y \leq 250$ (" " phosphate)

$4x + 2y \leq 220$ (" " potash)

$x, y \geq 0$ (non-negative restrictions, since quantity cannot be negative)

Therefore the L.P.P form of the given Problem is :→

$$\left.\begin{aligned} \max \quad & Z = 13500x + 9600y \\ \text{Subject to} \quad & 3x + 2y \leq 180 \\ & 3x + 4y \leq 250 \\ & 4x + 2y \leq 220 \\ & x, y \geq 0 \end{aligned}\right\} \quad \text{— (1)}$$

where $9x$ ton is quantity of 1st mixture (3:3:4) and $8y$ ton is quantity of 2nd mixture (2:4:2).

Q: Solve the following LPP by Big-m method - - - [20m]

Ans→ Write the given L.P.P in standard form as below:→

$$\max z'(=-z) = -3x_1 - 5x_2 + 0S_1 + 0S_2 + 0S_3 - MA_1 - MA_2$$

where m is very large penalty (positive large value)

Subject to

$$x_1 + 2x_2 - S_1 + A_1 + 0S_2 + 0A_2 + 0S_3 = 8$$
$$3x_1 + 2x_2 + 0S_1 + 0A_1 - S_2 + A_2 + 0S_3 = 12 \quad (1)$$
$$5x_1 + 6x_2 + 0S_1 + 0A_1 + 0S_2 + 0A_2 + S_3 = 60$$
$$x_1, x_2, S_1, S_2, S_3, A_1, A_2 \geq 0$$

Now we proceeds with simplex method (Big-m) as below:→

Since I.B.F.S is $\boxed{A_1 = 8, A_2 = 12, S_3 = 60}$

Simplex Table

C_{Bi}	C_j / Basis	x_1 (−3)	x_2 (−5)	S_1 (0)	S_2 (0)	S_3 (0)	A_1 (−M)	A_2 (−M)	Solution b_i	Ratio (θ)
−M	A_1	1	2	−1	0	0	1	0	8	8
−M	A_2	(3)	2	0	−1	0	0	1	12	4 →
0	S_3	5	6	0	0	1	0	0	60	12
	Z_j	−4m	−4m	m	m	0	−m	−m	$\boxed{z' = -20m}$	
	$C_j - Z_j$	4m−3 ↑	4m−5	−m	−m	0	0	0		
−M	A_1	0	(4/3)	−1	1/3	0	1	−1/3	4	3 →
−3	x_1	1	2/3	0	−1/3	0	0	1/3	4	6
0	S_3	0	8/3	0	−5/3	1	0	−5/3	40	15
	Z_j	−3	$-\frac{4m}{3}$−2	m	−m+1	0	−m	$\frac{m}{3}$−1	$\boxed{z' = -4m-12}$	
	$C_j - Z_j$	0	$\frac{4m}{3}$−3 ↑	−m	m−1	0	0	$-\frac{4m}{3}$+1		
−5	x_2	0	1	−3/4	1/4	0	3/4	−1/4	3	~~4 →~~
−3	x_1	+1	0	+1/2	−1/2	0	−1/2	+1/2	2	—
0	S_3	0	0	2	+1	1	−2	−1	32	—
	Z_j	−3	−5	9/4	+1/4	0	−1/4	−1/4	$\boxed{z' = -21}$	
	$C_j - Z_j$	0	0	−9/4	−1/4	0	9/4−m	1/4−m		

Hence $\boxed{\min z = 21}$

Solution (2, 3)

Q: How many basic - - - [15m]

Solutions :→ $^4C_2 = \boxed{6}$ Possibilities

$(-,-,0,0)$, $(\frac{18}{7}, 0, \frac{2}{7}, 0)$, $(0, \frac{-36}{7}, \frac{2}{7}, 0)$, $(-,0,0,-)$,

$(0,-,0,-)$, $(0,0,\frac{2}{7},\frac{36}{7})$

only 3 basic solutions, 2 are ~~basic~~ feasible Solution.

Q: In a factory - - - - - - [15m]

(no. of lines = ~~rows~~ no. of rows in ~~given matrix~~ given cost matrix.

Solution ⇒ we Assign a very large cost ~~to~~ let say ~~∞~~ to restricted combination, then proceed with Hungarian method as below:→

Cost matrix

24	29	18	32	29
17	26	34	22	∞
27	16	∞	17	25
22	18	28	30	24
28	16	31	24	27

Row Reduction

6	11	0	14	1
0	9	17	5	∞
11	0	∞	1	9
4	0	10	12	6
12	0	15	8	11

Column Reduction

6	11	0	13	0
0	9	17	4	∞
11	0	∞	0	8
4	0	10	11	5
12	0	15	7	10

Updated matrix - I

6	15	0	13	0
0	9	17	4	∞
11	4	∞	0	8
0	0	6	7	5
8	0	11	3	10

updated - 2

		$\boxed{0}$		~~0~~
$\boxed{0}$			0	
			$\boxed{0}$	
~~0~~	~~0~~			$\boxed{0}$
	$\boxed{0}$			

18
+ 17
+ 17
+ 24
+ 16

$\boxed{92}$

optimal Assignment table → make