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BS (SE)
Semester 4th
Section (A)

Operations Research

Questions:-

Use vogel's Approximation Method to obtain the intial feasible solution of :-

Origin	Destination 1	2	3	4	Supply
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Demand	60	40	30	110	240

Balanced transportation problem

Demand = Supply

Origin	1	2	3	4	Supply
1	20	[40] 22	17	[80] 4	120 80 0
2	[10] 24	37	[30] 9	7	70 40 10 0
3	[50] 32	37	20	15	50 0

origin	1	2	3	4	Supply				
1	[10]	[40]		[80]	0	13	(13)	-	-
2	[10]		[30]	[30]	0	2	2	2	(17)
3	[50]				0	5	5	5	17

Demand ~~60~~ ~~40~~ ~~30~~ ~~110~~

~~50~~ 0 0 0 ~~30~~ 0

4 (15) 80 3

4 - 8 3

8 - (11) 8

8 - - 8

Total of cost :- 40(22) + 80(4) + 10(24) + 30(9) + 30(7) + 50(32).

⇒ 3520

Question:- There are total five machines and five employments are to releegated and the related cost network is per the following

	A	B	C	D	E
1	6	12	3	11	15
2	4	2	7	1	10
3	8	11	10	7	11
4	16	19	122	23	21
5	9	5	7	6	10

Solution :-

Step 1 => Row operation -
Finding Smallest number in each row and Subtracting it from each element in that row :-

	A	B	C	D	E
1	3	9	0	8	12
2	3	1	6	0	9
3	1	4	3	0	4
4	0	3	106	7	5
5	4	0	2	1	5

step 2 :- Column operation
Same as Row operation but in columns it take place.

	A	B	C	D	E
1	3	9	0	8	8
2	3	1	6	0	5
3	1	4	3	0	0
4	0	3	106	7	1
5	4	0	2	1	1

Step :- Cross out the zero's in the matrix

	A	B	C	D	E
1	3	9	0	8	8
2	3	1	6	0	5
3	1	4	3	0	0
4	0	3	106	7	1
5	4	0	2	1	1

step :- make the assigment

5=5 condition satisfied
optimal Solution

Jobs	machines	Time
1	3	3
2	4	1
3	5	11
4	1	16
5	2	5
Total =>		36

Question:-

Solve following linear programming problem

Min $Z = 2x_1 + 3x_2$

Subject to:-

$$\frac{1}{2}x_1 + \frac{1}{4}x_2 <= 4$$

$$x_1 + 3x_2 >= 20$$

$$x_1 + x_2 = 10$$

Solution:-

Standard form:-

$$\frac{1}{2}x_1 + \frac{1}{4}x_2 <= 4$$

$$(-1)x_1 + 3x_2 >= -20$$

$$x_1 + x_2 <= 10$$

$$Z = 4x_1 - 20x_2 + 10x_3$$

$$\frac{1}{2}x_1 - x_2 + x_3 <= 2$$

$$\frac{1}{4}x_1 - 3x_2 + x_3 <= 3$$

step(1) Using slack variable

$\frac{1}{2}x_1 - x_2 + x_3 + S_1 = 2$

$\frac{1}{4}x_1 - 3x_2 + x_3 + S_2 = 3$

step(2) objective function = zero -

$-4x_1 + 20x_2 - 10x_3 + Z = 0$

step(3)

	x_1	x_2	x_3	S_1	S_2	Z	
S_1	$1/2$	-1	1	1	0	0	2
S_2	$1/4$	-3	1	0	1	0	3
S_3	-4	20	-10	0	0	1	0

step(4) pivot column -

x_1	x_2	x_3	S_1	S_2	Z	
$1/2$	-1	1	1	0	0	2
$1/4$	-3	1	0	1	0	3
-4	20	-10	0	0	1	0

step (5) Pivot Row

x_1	x_2	x_3	S_1	S_2	Z	?
1/2	-1	1	1	0	0	2
1/4	-3	1	0	1	0	3
-4	20	10	0	0	1	0

step (6) pivot value

x_1	x_2	x_3	S_1	S_2	Z	
1/2	-1	1	1	0	0	2
1/4	-3	1	0	1	0	3
-4	20	-10	0	0	1	0

step (7)

x_1	x_2	x_3	S_1	S_2	Z	
1/2	-1	1	1	0	0	2
1/4	-3	1	0	1	0	3
-4	20	-10	0	0	1	0

$R_2 \Rightarrow -R_1 + R_2$

x_1	x_2	x_3	S_1	S_2	Z	
$1/2$	-1	1	1	0	0	2
$-1/4$	-2	0	-1	1	0	1
-4	20	-10	0	0	1	0

$R_3 \Rightarrow 10R_1 + R_3$

x_1	x_2	x_3	S_1	S_2	Z	
$\frac{1}{2}$	-1	1	1	0	0	2
$-1/4$	-2	0	-1	1	0	1
1	10	0	10	0	1	20

Now $x_3 = 2$, $S_2 = 1$

$Z = 20$, $x_1 = 0$, $x_2 = 0$, $S_1 = 0$

putting the values in objective function for checking :-

$Z = 4x_1 - 20x_2 + 10x_3$

$Z = 4(0) - 20(0) + 10(2)$

$Z = 20$

L.H.S = R.H.S

$20 = 20$

X ~~~~~~~~~~ X