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Q1 :- There are total 5 Machines and 5 employments are to be relegated and the related cost network is as per the following. locate the best possible test.

Machines

Jobs	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	12	23	21
5	9	5	7	6	10

machines = jobs 5 = 5

So no need for dummy machine or dummy jobs.

~~A D~~

Now start the row reduction operation means (subtract the smallest elements of in each ROW.

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Q1

Machines

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

Smallest value subtract from each element

Machin

	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 III Column operation / reduction mean subtract the smallest value in column of each value of that column

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Q.

machine

	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
	0	0	0	0	4

Smallest value

Smallest value Subtract from each column

machine

	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

Steps experimental assignment

1) Scan all the Row or Colum one by one

if Single zero in the

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Q1

Now then make a Square and cross over the other zero present in that column and if single zero in that column then make a Squar and cross the other zero present and that column

machine

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

So No of ROW = No of assignment

4 = 4

steteps:

Calculate the minimum time

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Q1

⇒

1 - C = 3

2 - D = 1

3 - E = 11

4 - A = 16

5 - B = 5

Total Minimum cost = 36

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Q:2 Solve the following linear programming problem?

Min $Z = 2x_1 + 3x_2$

Subject to:

$\frac{1}{2}x_1 + \frac{1}{4}x_2 <= 4$ —(i)

$x_1 + 3x_2 >= 20$ —(ii)

$x_1 + x_2 = 10$ —(iii)

$x_1, x_2 >= 0$

=> 1st convert into standerd form.

$\frac{1}{2}x_1 + \frac{1}{4}x_2 <= 4$ —(i)

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

$-x_1 - 3x_2 <= -20$ —(ii)

$x_1 + x_2 <= 10$ —(iii)

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Q2

Max Z / Min $Z = 2x_1 + 3x_2$

Now Convert into Dual Problem:

Object ⟷ Constraint

Dual:

Min:

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

and column convert into Row

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

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

Now

Step 1: Convert the System of inequalities to Equation using slack variables.

$$\frac{1}{2}x_1 - x_2 + x_3 + S_1 = 2 \quad \text{---(1)}$$

$$\frac{1}{4}x_1 - 3x_2 + x_3 + S_2 = 3 \quad \text{---(1)}$$

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Step(ii) Set the objective function equal to zero

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

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

Step(iii)

Create a simple table put the co-efficient

	x_1	x_2	x_3	S_1	S_2	Z	
S_1	$\frac{1}{2}$	-1	1	1	0	0	2
S_2	$\frac{1}{4}$	-3	1	0	1	0	3
Z	-4	20	-10	0	0	1	0

Step(iv)

Select the pivot column

pivot column →

x_1	x_2	x_3	S_1	S_2	Z	
$\frac{1}{2}$	-1	1	1	0	0	2
$\frac{1}{4}$	-3	1	0	1	0	3
-4	20	-10	0	0	1	0

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Q2

Step (V) Select pivot Row:

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

Step (VI) Pivot value

x_1	x_2	x_3 (pivot value)	S_1	S_2	Z	Row
1/2	-1	1	1	0	0	2
1/4	-3	1	0	1	0	3
-4	20	-10	0	0	1	0

colum

Step (VII)

Perform row operation to do the pivot value equal to 1 and the other value of pivot column equal to zero.

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

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Q2

Need $\frac{1}{2}$ $\frac{1}{4}$

$-\frac{1}{2}+\frac{1}{4}=\frac{-2+1}{4}=-\frac{1}{4}$

$(-1)(\frac{1}{2})-4$

$R_2 \Rightarrow -R_1+R_2$

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

Now $x_3 = 2$

$S_2 = 1$

$\boxed{Z = 20}$ — Maximum

$x_1 = 0$

$x_2 = 0$

$S_1 = 0$

Now for checking the answer

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Q2

Put value in objective function:-

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

Put values

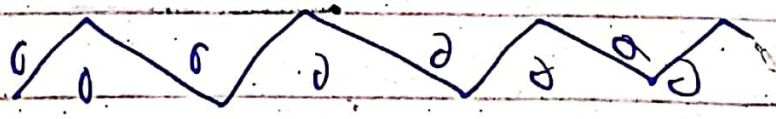
$$Z = 4(0) - 20(0) + 10(2)$$

$$Z = 20$$

So L.H.S = R.H.S

$$20 = 20$$

End Question 2:-



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Q3 use vogel's approximation method to obtein the intial feesible solution of.

Origin \ Distination	1	2	3	4	supply
1	70	22	17	4	70
2	24	37	9	7	50
3	32	37	20	15	120
Demand	60	40	30	110	240/240

Supply = Demand

So no need for adding Dummy column or Row

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Q3

Origan \ Distination	1	2	3	4	Supply	Row different			
1	20 ✗	22 (40)	17 ✗	4 (80)	120 80 0	13	(13)	—	—
2	24 (40)	37 ✗	39 (30)	7 ✗	70 40 0	2	2	2	17
3	32 (20)	37 ✗	20 ✗	15 (30)	80 20 0	5	5	5	(17)
Demand	60 20 0	40 0	80 0	110 300 240 240					
	4	(15)	8	3					
	4	—	8	3					
	8	—	(11)	8					
	8	—	—	8					

Column different

Total cost of transpotion:

⇒ 40(22) + 80(4) + 24(40)
+ 30(9) + 32(20) + 15(30)

Total cost = 3520

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