U .V Method

Ui ⟶

Vj ↓	7	8	1	7
0			1	
1	8	9	2	
-5		3		2

Cij = (ui + vj)

$C_{ij} = u_i + v_j$ **$C_{ij} = u_i + v_j$** **$C_{ij} = u_i + v_j$** **$C_{ij} = u_i + v_j$** **$C_{ij} = u_i + v_j$**

$1 = u_i + 0$ **$2 = 1 + v_j$** **$8 = u_i + 1$** **$9 = u_i + 1$** **$3 = 8 + v_j$**

$u_i = 1$ **$v_j = 1$** **$u_i = 7$** **$u_i = 8$** **$v_j = -5$**

$C_{ij} = u_i + v_j$

$2 = u_i - 5$

$u_i = 7$

Cij – (ui + vj) > 0

	7	8	1	7
0	6	4		5
1				7
-5	4		6	

6 – (7+0)

6–7 = -1 > 0
False
Negative

4 – (8 + 0)

4 – 8 = -4 > 0
False

Negative

5 – (7 + 0)

5 – 7 = -2 > 0
False
Negative

7 – (1 + 7)

7 – 8 = -1 > 0
False
Negative

4 – (-5 + 7)

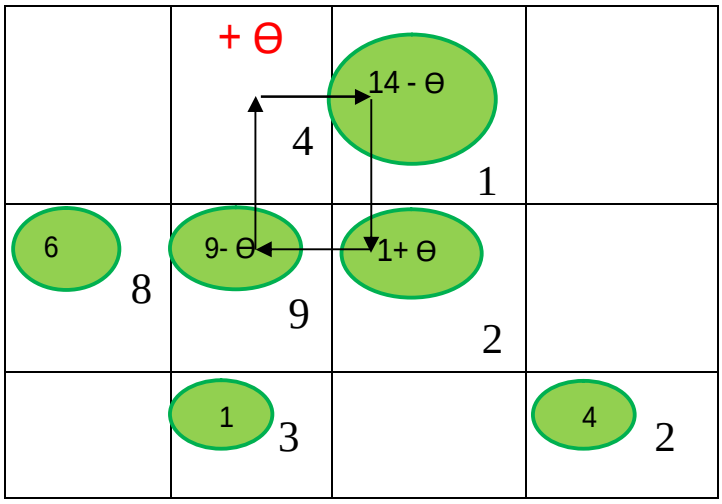
4 – (2) = 2 > 0

6 – (-5 + 1)

6 –(-4) = 6+4 =10 > 0

Modi Method

Choose Maximum Negative cell (Here 1st row second column)



$$\text{Min}\left\{14-\Theta,\ 9-\Theta\right\}$$

$9-\Theta=0$

$\Theta=9$

6	9 4	5 1	5
6 8	9	10 2	7
4	1 3	6	4 2

T.T.C = 9 * 4 + 5 * 1 + 6 * 8 + 10 * 2 + 1 * 3 + 4 * 2

= 36 + 5 + 48 + 20 + 3 + 8

= 120

UV method

6	9 4	5 1	5	14
6 8	9	10 2	7	16
4	1 3	6	4 2	5
6	10	15	4	

M + N – 1

3 + 4 – 1

= 6

Cij = ui + vj

Ui → / Vj ↓	7	4	1	3
0		4	1	
1	8		2	
-1		3		2

$C_{ij} = u_i + v_j$
4 = u_i + 0
u_i = 4

$C_{ij} = u_i + v_j$
1 = u_i + 0
v_j = 1

$C_{ij} = u_i + v_j$
2 = 1 + v_j
v_j = 1

$C_{ij} = u_i + v_j$
8 = u_i + 1
u_i = 7

$C_{ij} = u_i + v_j$
3 = 4 + v_j
v_j = - 1

$C_{ij} = u_i + v_j$
2 = u_i + (-1)
2 = u_i - 1
u_i = 3

	7	4	1	3
0	6			5
1		9		7
-1	4		6	

Cij – (ui + vj) > 0

6 – (0 + 7)
6 – 7 = - 1 > 0
False, Negative

5 – (3 + 0)

5 – 3 = 2 > 0

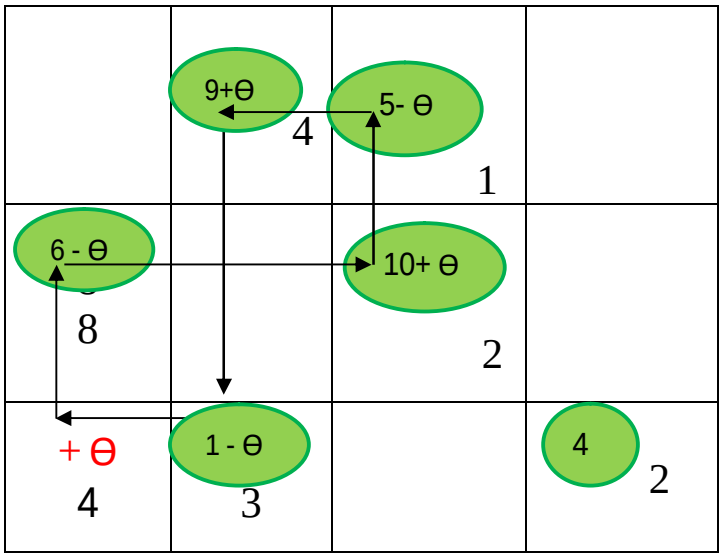
4 – (-1 + 7)
4 – 6 = - 2 > 0
False, Negative

9 – (4 + 1)
9 – 5 = 4 > 0

7 – (1 + 3)
7 – 4 = 3 > 0

6 – (-1 + 1)
= 6 > 0

Modi Method



Min $\{6-\Theta, 5-\Theta, 1-\Theta\}$

$1-\Theta = 0$

$\Theta = 1$

6	10 4	4 1	5	14
5 8	9	11 2	7	16
1 4	3	6	4 2	5
6	10	15	4	

T.T.C = 10 * 4 + 4 * 1 + 5 * 8 + 11 * 2 + 1 * 4 + 4 * 2

= 40 + 4 + 40 + 22 + 4 + 8

= 118

U V method

6	10 4	4 1	5	14
5 8	9	11 2	7	16
1 4	3	6	4 2	5
6	10	15	4	

M + N – 1

3 + 4 – 1

= 6

Ui → 7 4 1 5

Vj ↓

0		4	1	
1	8		2	
-3	4			2

Cij = (ui + vj)

$C_{ij} = u_i + v_j$
4 = u_i + 0
u_i = 4

$C_{ij} = u_i + v_j$
1 = u_i + 0
v_j = 1

$C_{ij} = u_i + v_j$
2 = 1 + v_j
v_j = 1

$C_{ij} = u_i + v_j$
8 = u_i + 1
u_i = 7

$C_{ij} = u_i + v_j$
4 = 7 + v_j
v_j = - 3

$C_{ij} = u_i + v_j$
2 = u_i + (-3)
2 = u_i - 3
u_i = 5

	7	4	1	5
0	6			5
1		9		7
-3		3	6	

6 – (0 + 7)
6 – 7 = - 1 > 0
False Negative

5 – (5 + 0)
5 – 5 = 0 > 0

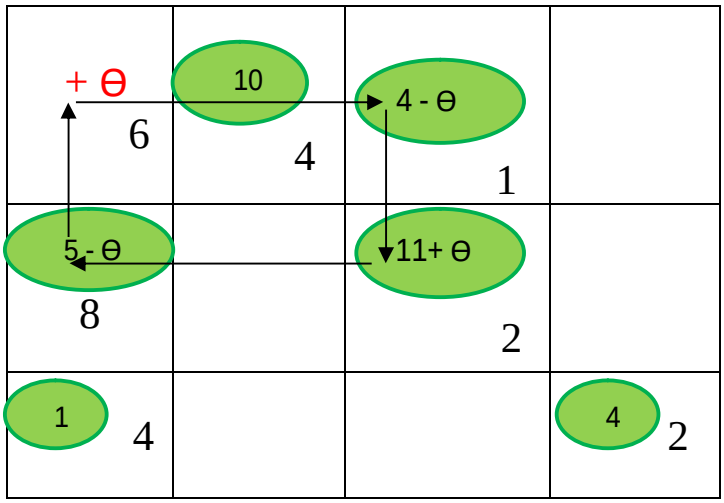
9 – (1 + 4)
9 – 5 = 4 > 0

7 – (1 + 5)
7 – 6 = 1 > 0

3 – (-3 + 4)
3 – (1) = 2 > 0

6 – (-3 + 1)
6 – (-2) = 8 > 0

Modi Method



$$\text{Min}\{\ 4-\Theta\ ,\ 5-\Theta\ \}$$

4 – Θ = 0

Θ = 4

4 6	10 4	1	5	14
1 8	9	15 2	7	16
1 4	3	6	4 2	5
6	10	15	4	

T.T.C = 4 * 6 + 10 * 4 + 1 * 8 + 15* 2 + 1 * 4 + 4 * 2

= 24 + 40 + 8 + 30 + 4 + 8

= 114

UV method

Ui ⟶ 6 4 0 4

Vj ↓

0	6	4		
2	8		2	
-2	4			2

M + N – 1

3 + 4 – 1

= 6

$C_{ij} = u_i + v_j$ **6= u_i + 0** **u_i = 6**

$C_{ij} = u_i + v_j$ **4 = u_i + 0** **v_j = 4**

$C_{ij} = u_i + v_j$ **8 = 6+ v_j** **v_j = 2**

$C_{ij} = u_i + v_j$ **2= u_i+2** **u_i = 0**

$C_{ij} = u_i + v_j$ **4 = 6+v_j** **v_j = - 2**

$C_{ij} = u_i + v_j$
2 = u_i +(-2)
u_i = 4

6 4 0 4

0			1	5
2		9		7
-2		3	6	

Cij – (ui + vj) > 0

1 – (0 + 0) **1 – 0 = 1 > 0**

5 – (0 + 4) **5 – 4 = 1 > 0**

9 – (2 + 4) **9 – 6 = 3 > 0**

7 – (2 + 4) **7 – 6 = 1 > 0**

3 – (-2 + 4) **3 – (2) = 1 > 0**

6 – (-2 + 0) **6 + 2 = 8 > 0**

All values are possitive, so answer obtain is optimal.

Answer 114

Transportation Problem – VAM Method

Voggel's Approximation Method[V.A.M]

Steps:

1) Calculating Penalty

It is an absolute difference between 2 Least cells in each Row and Column

2) Allot in the column / Row which is having highest penalty, in that allot the cell which is having least value

   (If the tie between penalty, then choose the cell where we can assign maximum units)

3) Re caluclate penalty before going to next allotment
4) Repeat step 1 to 3 untill supply and demand fullfill.

Production unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	1	5	**14**	
C. H. Nagar	8	9	2	7	**16**	
Mandya	4	3	6	2	**5**	
Demand	**6**	**10**	**15**	**4**		

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	1	5	**14**	3
C. H. Nagar	8	9	2	7	**16**	**5**
Mandya	4	3	6	2	**5**	1
Demand	**6**	**10**	**15**	**4**		
Penalty	2	1	1	3		

Transportation Problem – VAM Method

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	1	5	**14**	
C. H. Nagar	8	9	15 2	7	~~**16**~~ **1**	**5**
Mandya	4	3	6	2	**5**	
Demand	**6**	**10**	~~**15**~~ **0**	**4**		
Penalty						

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	X 1	5	**14**	1
C. H. Nagar	8	9	15 2	7	~~**16**~~ **1**	1
Mandya	4	3	X 6	2	**5**	1
Demand	**6**	**10**	~~**15**~~ **0**	**4**		
Penalty	2	1	X	3		

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	X 1	5	**14**	
C. H. Nagar	8	9	15 2	7	~~**16**~~ **1**	
Mandya	4	3	X 6	4 2	~~**5**~~ **1**	
Demand	**6**	**10**	~~**15**~~ **0**	~~**4**~~ **0**		
Penalty				**3**		

Transportation Problem – VAM Method

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	4	X 1	X 5	**14**	**2**
C. H. Nagar	8	9	15 2	X 7	~~**16**~~ **1**	1
Mandya	4	3	X 6	4 2	~~**5**~~ **1**	1
Demand	**6**	**10**	~~**15**~~ **0**	~~**4**~~ **0**		
Penalty	**2**	1	X	X		

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	10 4	X 1	X 5	~~**14**~~ **4**	**2**
C. H. Nagar	8	9	15 2	X 7	~~**16**~~ **1**	
Mandya	4	3	X 6	4 2	~~**5**~~ **1**	
Demand	**6**	~~**10**~~ **0**	~~**15**~~ **0**	~~**4**~~ **0**		
Penalty						

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	10 4	X 1	X 5	~~**14**~~ **4**	6
C. H. Nagar	8	X 9	15 2	X 7	~~**16**~~ **1**	**8**
Mandya	4	X 3	X 6	4 2	~~**5**~~ **1**	4
Demand	**6**	~~**10**~~ **0**	~~**15**~~ **0**	~~**4**~~ **0**		
Penalty	2	X	X	X		

Transportation Problem – VAM Method

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	10 4	X 1	X 5	~~14~~ 4	
C. H. Nagar	1 8	X 9	15 2	X 7	~~16~~ ~~1~~ 0	8
Mandya	4	X 3	X 6	4 2	~~5~~ ~~1~~ 0	
Demand	~~6~~ 5	~~10~~ 0	~~15~~ 0	~~4~~ 0		
Penalty						

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	6	10 4	X 1	X 5	~~14~~ 4	6
C. H. Nagar	1 8	X 9	15 2	X 7	~~16~~ ~~1~~ 0	X
Mandya	4	X 3	X 6	4 2	~~5~~ 1	4
Demand	~~6~~ 5	~~10~~ 0	~~15~~ 0	~~4~~ 0		
Penalty	2	X	X	X		

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	4 6	10 4	X 1	X 5	~~14~~ ~~4~~ 0	6
C. H. Nagar	1 8	X 9	15 2	X 7	~~16~~ ~~1~~ 0	
Mandya	4	X 3	X 6	4 2	~~5~~ 1	
Demand	6 ~~5~~ 1	~~10~~ 0	~~15~~ 0	~~4~~ 0		
Penalty						

Transportation Problem – VAM Method

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	4 6	10 4	X 1	X 5	~~14~~ ~~4~~ 0	X
C. H. Nagar	1 8	X 9	15 2	X 7	~~16~~ ~~1~~ 0	X
Mandya	4	X 3	X 6	4 2	~~5~~ 1	4
Demand	~~6~~ ~~5~~ 1	~~10~~ 0	~~15~~ 0	~~4~~ 0		
Penalty	**4**	X	X	X		

Production Unit	Maddur	K.R Nagar	N. Gudu	P. Pura	Available	Penalty
Mysuru	4 6	10 4	X 1	X 5	~~14~~ ~~4~~ 0	
C. H. Nagar	1 8	X 9	15 2	X 7	~~16~~ ~~1~~ 0	
Mandya	1 4	X 3	X 6	4 2	~~5~~ ~~1~~ 0	**4**
Demand	~~6~~ ~~5~~ ~~1~~ 0	~~10~~ 0	~~15~~ 0	~~4~~ 0		
Penalty	**4**					

Total transportation cost

4*6 + 10*4 + 1*8 + 15*2+ 1*4+ 4*2= 24 + 40 + 8 + 30 + 4 +8 = 114