

# **Assignment Problem**

## **Hungarian Method**

# Balanced Assignment Problem: Hungarian Method

(No. of rows = NO. of Column)

## Phase 1: Row and Column Reduction.

Find the minimum value row wise and subtract from each elements of row.

Find the minimum value column wise and subtract from element of column

Operators /Jobs	1	2	3	4	5	Row Redution
1	9/2/2	11/4/4	14/7/7	11/4/2	7/0/0	7
2	6/0/0	15/9/9	13/7/7	13/7/5	10/4/4	6
3	12/6/6	13/7/7	6/0/0	8/2/0	8/2/2	6
4	11/2/2	9/0/0	10/1/1	12/3/1	9/0/0	9
5	7/0/0	12/5/5	14/7/7	10/3/1	14/7/7	7
Column Reduction	0	0	0	2	0	

Step 2: Next row wise identify single 0 (Zero) and draw vertical lines to delete the column

- If row has more than one 0 values ignore
- Then column wise identify single 0 (Zero) and draw horizontal lines to delete the row.
- If row has more than one 0 values ignore

	1	2	3	4	5
1	2	4	7	2	0
2	0	9	7	5	4
3	6	7	0	0	2
4	2	0	1	1	0
5	0	5	7	1	7

- No. of rows =5                      No. of squared zero = 4
- The solution is not optimal

## Phase 2: Optimization

1. Draw minimum lines to cover all zeros of matrix
  1. Row scanning
  2. Column scanning
2. Add minimum value from undeleted cells to intersecting cells
3. Subtract minimum values from remaining cells to undeleted cell values

	1	2	3	4	5
1	2	4	7-1	2-1	0
2	0	9	7-1	5-1	4
3	6+1	7+1	0	0	2+1
4	2	0	1-1	1-1	0
5	0	5	7-1	1-1	7

New Matrix is shown next slide

## New Matrix

	1	2	3	4	5
1	2	4	6	1	0
2	0	9	6	4	4
3	7	8	0	0	3
4	2	0	0	0	0
5	0	5	6	0	7

Now perform row and column scanning on new matrix

Perform row scan and column scan on the new matrix

	1	2	3	4	5
1	2	4	6	1	0
2	0	9	6	4	4
3	7	8	0	0	3
4	2	0	0	0	0
5	0	5	6	0	7

All zeroes are now covered the solution is optimal  
Solution: Job 1: 5; Job 2: 1; Job 3: 3; Job 4: 2; Job 5: 4.