**Task#9: Solve the assignment problem using Hungarian-method. The matrix entries are processing time of man in hours.**

**Men**

**1 2 3 4 5**

**I** 20 15 18 20 25

**II** 18 20 12 14 15

**(JOBS) III** 21 23 25 27 25

**IV** 17 18 21 23 20

**V** 18 18 16 19 20

1. **Step-1: As matrix is a square matrix so no need to add imaginary row/column.**
2. **Step-2: Row Reduction:**

1st row: smallest element=15

20-15= 5

15-15= 0

18-15= 3

20-15= 5

25-15= 10

2nd row: smallest element=12

18-12= 6

20-12= 8

12-12= 0

14-12= 2

15-12= 3

3rd row: smallest element=21

21-21= 0

23-21= 2

25-21= 4

27-21= 6

25-21= 4

4th row: smallest element=17

17-17= 0

18-17= 1

21-17= 4

23-17= 6

20-17= 3

5th row: smallest element=16

18-16= 2

18-16= 2

16-16= 0

19-16= 3

20-16= 4

**New Cost matrix:-**

5 0 3 5 10

6 8 0 2 3

0 2 4 6 4

1. 1 4 6 3

2 2 0 3 4

**3. Step-3: Column Reduction:**

1st column:- smallest element=0

=>As It is zero so no need to subtract.

5

6

0

0

2

2nd column:- smallest element=0

=>As It is zero so no need to subtract.

0

8

2

1

2

3rd column:- smallest element=0

=>As It is zero so no need to subtract.

3

0

4

4

0

4th column:- smallest element=2

5-2= 3

2-2= 0

6-2= 4

6-2= 4

3-2= 1

5th column:- smallest element=3

10-3= 7

3-3= 0

4-3= 1

3-3= 0

4-3= 1

**New Cost matrix:-**

5 0 3 3 7

6 8 0 0 0

0 2 4 4 1

0 1 4 4 0

2 2 0 1 1

**4. Step-4: Drawing lines to cover zeros:-**

5 0 3 3 7

6 8 0 0 0

0 2 4 4 1

0 1 4 4 0

2 2 0 1 1

**5. Step-5: Checking if matrix is reduced:-**

As we see that

No of lines=order of matrix => i.e. 5

Hence matrix is reduced so we will now directly move to that **Step-8**.

**6. Step-8: Select row that has single zero and assign that task to corresponding operator:-**

**1 2 3 4 5**

**I** 5 0 3 3 7

**II** 6 8 0 0 0

**III** 0 2 4 4 1

**IV** 0 1 4 4 0

**V** 2 2 0 1 1

Task -> Possible operator(s)

I -> 2

II -> 3,4,5

III -> 1

IV -> 1,5

V -> 3

=>Assign Task-I to operator-2.

=>Assign Task-III to operator-1.

=>Assign Task-V to operator-3.

=>Assign Task-IV to operator-5.

=>Assign Task-II to operator-4.

**Now from Original Cost Matrix:**

**1 2 3 4 5**

**I** 20 15 18 20 25

**II** 18 20 12 14 15

**(JOBS) III** 21 23 25 27 25

**IV** 17 18 21 23 20

**V** 18 18 16 19 20

**Total Cost is:-**

Assigned Task-Operator Cost

I-2 15

III-1 21

V-3 16

IV-5 20

II-4 14

+

Total Cost = Rs. $86.00