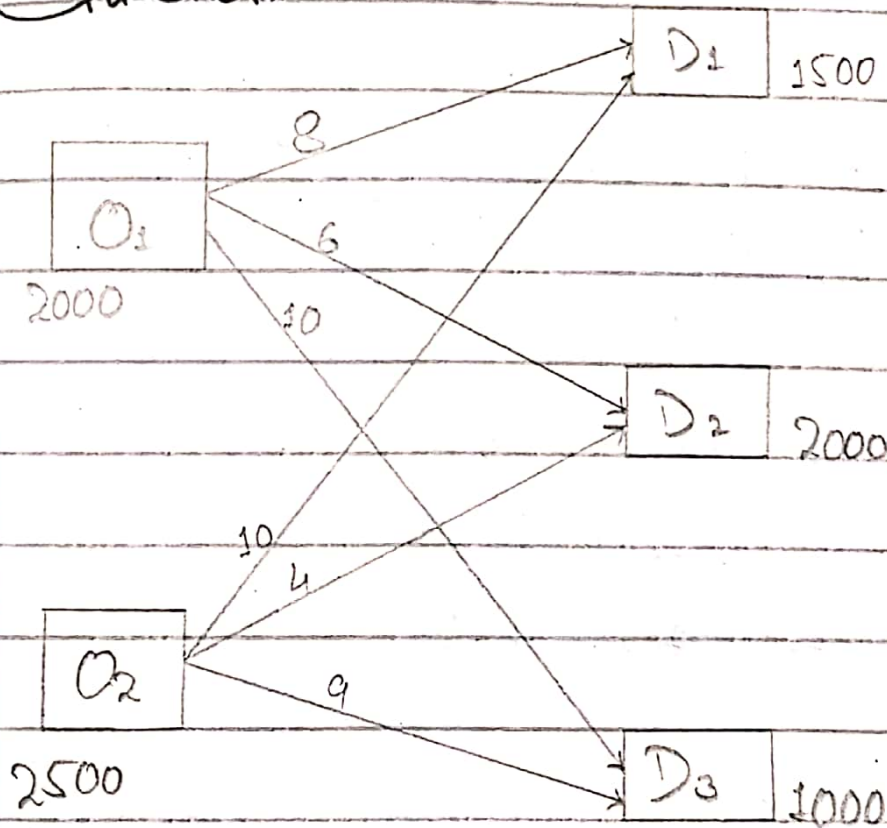# Operation Research

Quiz # 3

Question:-

To Calculate:-

a) LPP equation for the above graph.

b) Apply Hungarian Assignment Model.

a) Solution:-

$$Min = 8x_{11} + 6x_{12} + 10x_{13} + 10x_{21} + 4x_{22} + 9x_{23}$$

Subject to:-

$$x_{11} + x_{12} + x_{13} = 2000$$

$$x_{21} + x_{22} + x_{23} = 2500$$

$$x_{11} + x_{21} = 1500$$

$$x_{12} + x_{22} = 2000$$

$$x_{13} + x_{23} = 1000$$

$$x_{ij} \geq 0$$

	D_1	D_2	D_3	Supply
O_1	8	6	10	2000
O_2	10	4	9	2500
Demand	1500	2000	1000	4500

b) Hungarian Method:-

	D_1	D_2	D_3
O_1	8	6	10
O_2	10	4	9

It is unbalanced.

By adding row to get balanced.

	D_1	D_2	D_3
O_1	8	6	10
O_2	10	4	9
O_3	0	0	0

Phase I:-
Rows and Column Reduction.

Rows:

	D_1	D_2	D_3	Row Minimization
O_1	8	6	10	6
O_2	10	4	9	4
O_3	0	0	0	0

Subtract the minimum value from the entries of that row.

	D_1	D_2	D_3
O_1	2	0	4
O_2	6	0	5
O_3	0	0	0

Column:-

	D_1	D_2	D_3
O_1	2	0	4
O_2	6	0	5
O_3	0	0	0
Column Minimum	0	0	0

Subtract the minimum value from the entries of the column.

	D_1	D_2	D_3
O_1	2	0	4
O_2	6	0	5
O_3	0	0	0

It does'nt effect any value of table because all values are subtracted from zero.

Phase II:-
Optimization of Problem:

Step 1:-
Row and Column Scanning

	D_1	D_2	D_3
O_1	2	[0]	4
O_2	6	0	5
O_3	[0]	0	0

Step 2:-
Number of squares = 2

It is not equal to the number of rows.

Step 3:-

Minimum value of un-deleted cell values is 2:.

Now, subtract it from all un-deleted values.

	D_1	D_2	D_3
O_1	0	0	2
O_2	4	0	3
O_3	0	0	0

Step 4:-

Rows and Columns Scanning:

	D_1	D_2	D_3
O_1	0	0	2
O_2	4	0	3
O_3	0	0	0

Highlighted zero is equal to the number of rows.

$$3 = 3$$

Step 5 :-

Optimal Solution:-

Factories	City	Cost
O_1	D_1	8
O_2	D_2	4
O_3	D_3	0

Total = 12 cost.