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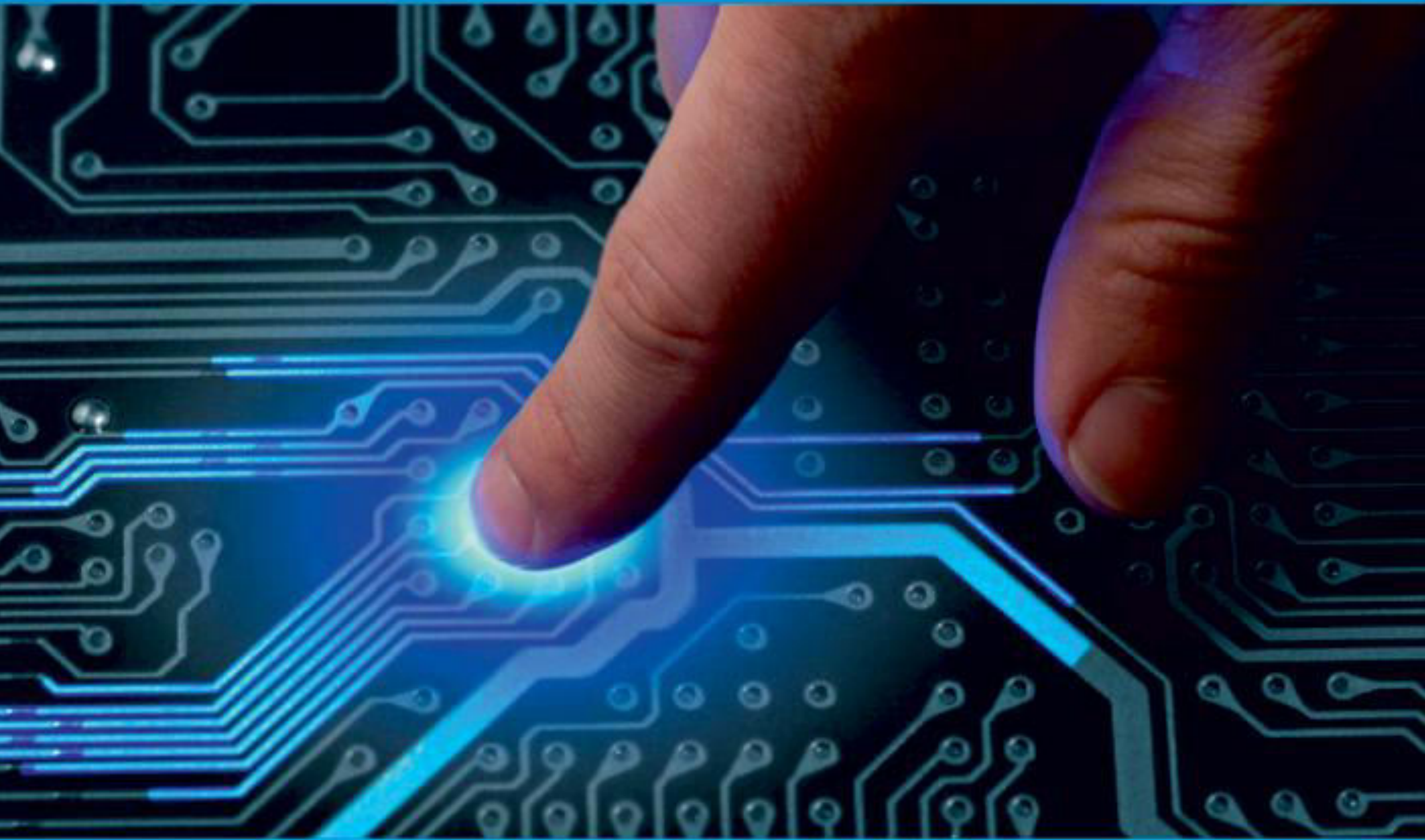

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Computer Based Solution to Solution of transportation Problem Coded in PHP

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ABSTRACT: In this paper, an algorithm and its computer oriented program have been developed for solving transportation problem (TP) more difficult and time-consuming if it is done manually By using the computer program the solution can be found in a shorter time. It will be shown that a TP with a large number of variables can be solved in few seconds by using this method. A number of numerical examples are presented to demonstrate the method developed in this research.

KEYWORDS: Transportation Problem, summation method ,VAM , Apache server

I. INTRODUCTION

One of the most important and successful applications of quantitative analysis to solving business problems has been in the physical distribution of products, commonly referred to as transportation problems. Basically, the purpose is to minimize the cost of shipping goods from one location to another so that the needs of each arrival area are met and every shipping location operates within its capacity.
TP is a type of Linear Programming Problem (LPP) that may be solved by using simplex technique called transportation method. It includes major application in solving problems involving several product sources and several destinations of products, this type of problem is frequently called the TP.

The two common objectives of such problems areeither
(1) Minimize the cost of shipping m units to n destinations(or)
(2) Maximize the profit of shipping m units to ndestinations.

The aim of this study is to determine the minimum transportation cost in an easy and efficient mannerVogel's method gives approximate solution while MODI and Stepping Stone (SS) method are considered as a standard technique for obtaining to optimal solution. Since decade these two methods are being used for solving TP. Goyal (1984) improving VAM for the Unbalanced TP, Ramakrishnan (1988) discussed some improvement to Goyal's Modified VAM for Unbalanced TP. Moreover Sultan and Goyal (1988) studied initial Goyal (1984) basic feasible solution and resolution of degeneracy inTP.

Several extensions of transportation model and methods have been subsequently developed. TP is based on supply and demand of commodities transported from several sources to the different destinations. The sources from which we need to transport refer the supply while the destination where commodities arrive referred the demand. It has been seen that on many occasion, the decision problem can also be formatting as TP. In general we try to minimize total transportation cost for the commodities transporting from source todestination.

However, the study on alternate optimal solutions is clearly limited in the literature of transportation with the exception of A. Sridhar and R.S.suganthi (2019) who suggested a new approach for finding an optimal solution for TPs,. A. Sridhar and R. Allah Pitchai (2018) discussed Unbalanced Transportation Problems Using Vogels Approximation Method A. Sridhar and R. Allah Pitchai, (2018) discussed Unbalanced Transportation Problems Using Least cost Method without using dummy row and dummy column.

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II. SUMMATION METHOD

It is observed that this method produces better IBFS for all TP. The solution procedure of this method is described step by step in below.

1. If the given TP is Unbalanced then convert the given TP into a balanced TP using dummy row and dummy column with zero transportationcost.
2. Obtain the sum of each row and each column store the results in an array namely Row-Sum (RS) and Column-Sum(CS).
3. Identify the row or column with the highest sum. Allocate as much as possible quantity to the variable with the lowest unit cost in the selected row or column. Adjust the supply and demand and cross out the row or column that is already satisfied. If both the row and column are satisfied simultaneously, cross out both of them. If tie occurs in the summation give the priority to the variable which has the maximum possible allocationquantity.
4. Calculate the fresh sum costs for the remaining sub-matrix as in Step- 2 and follows the procedure of Steps 3. Continue the process until all rows and columns are satisfied.
5. Finally calculate the total transportation cost which is the sum of the product of cost and corresponding allocatedvalue.

III. NUMERICALEXAMPLES

Example 3.1: Consider the following transportation

	D1	D2	D3	D4	Supply
O1	9	8	5	7	12
O2	4	6	8	7	14
03	5	8	9	5	16
demand	8	18	13	3	

Initial solution by presentmethod

	D1	D2	D3	D4	Supply
O1	9	8	5(12)	7	12
O2	4	6(13)	8(1)	7	14
O3	5(8)	8(5)	9	5(3)	16
demand	8	18	13	3	

Initial transportation cost is equalto
12 x 5 +13 x 6 +1 x 8 + 8 x 5+8 x 5 + 3 x 5 = 241

Coding for the above problem is as follows

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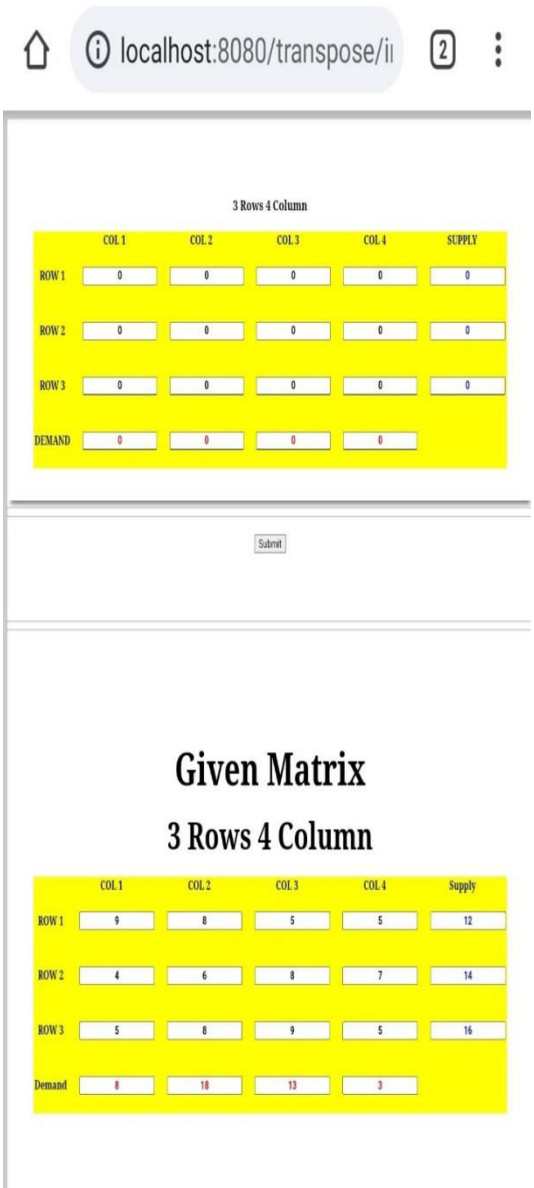


localhost:8080/transpose/i

3 Rows 4 Column

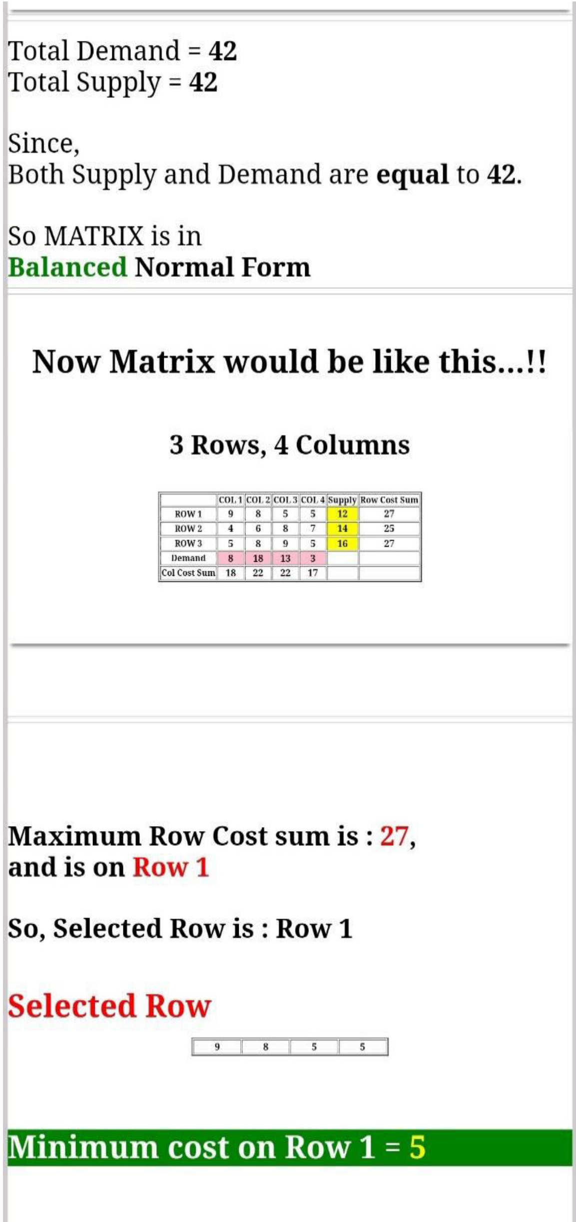
	COL 1	COL 2	COL 3	COL 4	SUPPLY
ROW 1	0	0	0	0	0
ROW 2	0	0	0	0	0
ROW 3	0	0	0	0	0
DEMAND	0	0	0	0	

Submit

Given Matrix

3 Rows 4 Column

	COL 1	COL 2	COL 3	COL 4	Supply
ROW 1	9	8	5	5	12
ROW 2	4	6	8	7	14
ROW 3	5	8	9	5	16
Demand	8	18	13	3	



Total Demand = **42**
Total Supply = **42**

Since,
Both Supply and Demand are **equal** to **42**.

So MATRIX is in
Balanced Normal Form

Now Matrix would be like this...!!

3 Rows, 4 Columns

	COL 1	COL 2	COL 3	COL 4	Supply	Row Cost Sum
ROW 1	9	8	5	5	12	27
ROW 2	4	6	8	7	14	25
ROW 3	5	8	9	5	16	27
Demand	8	18	13	3		
Col Cost Sum	18	22	22	17		

Maximum Row Cost sum is : 27,
and is on Row 1

So, Selected Row is : Row 1

Selected Row

9	8	5	5

Minimum cost on Row 1 = 5

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Check whether Minimum Cost " 5 "
has duplicates??

```
Array
(
    [0] => 2
    [1] => 3
)
```

Yes, Minimum cost 5 has duplicates

Minumum cost 5 has maximum allocation occurs at column Position : 3 , 4 ,

Minimum cost 5 has maximum allocation value of 13 on demand column COL : 3

Minimum cost 5 is found in Row : 1 Col : 3 , and its corresponding Supply=12 & Demand= 13

13 > 12 so,we are going to delete a row

Now cells to be deleted is in RED COLOR
3 Rows , 4 Columns

	COL 1	COL 2	COL 3	COL 4	Supply	Row Cost Sum
ROW 1	9	8	5	5	12	27
ROW 2	4	6	8	7	14	25
ROW 3	5	8	9	5	16	27
Demand	8	18	13	3		
Col Cost Sum	18	22	22	17		

Partial Solution

Minimum cost on Row: 1 Col: 3 = 5

Product = 12

Row to be deleted is:

9	8	5	5

SUPPLY IS DELETED and is Now as :

Supply

14
16

LOOP COUNT=1

Now Matrix would be like this...!!

2 Rows, 4 Columns

	COL 1	COL 2	COL 3	COL 4	Supply	Row Cost Sum
ROW 1	4	6	8	7	14	25
ROW 2	5	8	9	5	16	27
Demand	8	18	1	3		
Col Cost Sum	9	14	17	12		

Maximum Row Cost sum is : 27,
and is on Row 2

So, Selected Row is : Row 2

Selected Row

5	8	9	5

Minimum cost on Row 2 = 5

Check whether Minimum Cost " 5 "
has duplicates??

```
Array
(
    [0] => 0
    [1] => 3
)
```

Yes, Minimum cost 5 has duplicates

Minumum cost 5 has maximum allocat occurs at column Position : 1 , 4 ,

Minimum cost 5 has maximum allocati value of 8 on demand column COL : 1

Minimum cost 5 is found in Row : 2 Col : 1 , and its corresponding Supply=16 & Demand= 8

16 > 8 so,we are going to delete a colum

Now cells to be deleted is in RED COI
2 Rows , 4 Columns

	COL 1	COL 2	COL 3	COL 4	Supply	Row Cost Sum
ROW 1	4	6	8	7	14	25
ROW 2	5	8	9	5	16	27
Demand	8	18	1	3		
Col Cost Sum	9	14	17	12		

Partial Solution

Minimum cost on Row: 2 Col: 1 = 5

Product = 8

Column to be deleted is :

4
5

DEMAND IS DELETED and is Now as :

18	1	3

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LOOP COUNT=2

Now Matrix would be like this...!!

2 Rows, 3 Columns

	COL 1	COL 2	COL 3	Supply	Row Cost Sum
ROW 1	6	8	7	14	21
ROW 2	8	9	5	8	22
Demand	18	1	3		
Col Cost Sum	14	17	12		

Maximum Row Cost sum is : 22,
and is on Row 2

So, Selected Row is : Row 2

Selected Row

8	9	5

Minimum cost on Row 2 = 5

Check whether Minimum Cost " 5 " has duplicates??

```
Array
(
    [0] => 2
)
```

Minimum cost 5 has No duplicates

Minimum cost 5 is found in
Row : 2 Col : 3 , and its corresponding
Supply=8 & Demand= 3

8 > 3 so,we are going to delete a column

Now cells to be deleted is in RED COLOR
2 Rows , 3 Columns

	COL 1	COL 2	COL 3	Supply	Row Cost Sum
ROW 1	6	8	7	14	21
ROW 2	8	9	5	8	22
Demand	18	1	3		
Col Cost Sum	14	17	12		

Minimum cost on Row: 2 Col: 3 = 5

Product = 3

Column to be deleted is :

7
5

DEMAND IS DELETED and is Now as :

18	1

LOOP COUNT=3

Now Matrix would be like this...!!

2 Rows, 2 Columns

	COL 1	COL 2	Supply	Row Cost Sum
ROW 1	6	8	14	14
ROW 2	8	9	5	17
Demand	18	1		
Col Cost Sum	14	17		

Maximum Row Cost sum is : 17,
and is on Row 2

So, Selected Row is : Row 2

Selected Row

8	9

Minimum cost on Row 2 = 8

Check whether Minimum Cost " 8 " has duplicates??

```
Array
(
    [0] => 0
)
```

Minimum cost 8 has No duplicates

Minimum cost 8 is found in
Row : 2 Col : 1 , and its corresponding
Supply=5 & Demand= 18

18 > 5 so,we are going to delete a row

Now cells to be deleted is in RED COLOR
2 Rows , 2 Columns

	COL 1	COL 2	Supply	Row Cost Sum
ROW 1	6	8	14	14
ROW 2	8	9	5	17
Demand	18	1		
Col Cost Sum	14	17		

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Partial Solution

Minimum cost on Row: 2 Col: 1 = 8

Product = 5

Row to be deleted is:

8	9

SUPPLY IS DELETED and is Now as :

Supply

14

LOOP COUNT=4

Now Matrix would be like this...!!

1 Rows, 2 Columns

	COL 1	COL 2	Supply	Row Cost Sum
ROW 1	6	8	14	14
Demand	13	1		
Col Cost Sum	6	8		

Maximum Row Cost sum is : 14,
and is on Row 1

So, Selected Row is : Row 1

Selected Row

6	8

Minimum cost on Row 1 = 6

Check whether Minimum Cost " 6 " has duplicates??

```
Array
(
    [0] => 0
)
```

Minimum cost 6 has No duplicates

Minimum cost 6 is found in
Row : 1 Col : 1 , and its corresponding
Supply=14 & Demand= 13

14 > 13 so,we are going to delete a column

Now cells to be deleted is in RED COLOR
1 Rows , 2 Columns

	COL 1	COL 2	Supply	Row Cost Sum
ROW 1	6	8	14	14
Demand	13	1		
Col Cost Sum	6	8		

Partial Solution

Minimum cost on Row: 1 Col: 1 = 6

Product = 13

Column to be deleted is :

6

DEMAND IS DELETED and is Now as :

1

LOOP COUNT=5

Now Matrix would be like this...!!

1 Rows, 1 Columns

	COL 1	Supply	Row Cost Sum
ROW 1	8	1	8
Demand	1		
Col Cost Sum	8		

Maximum Row Cost sum is : 8,
and is on Row 1

So, Selected Row is : Row 1

Selected Row

8

Minimum cost on Row 1 = 8

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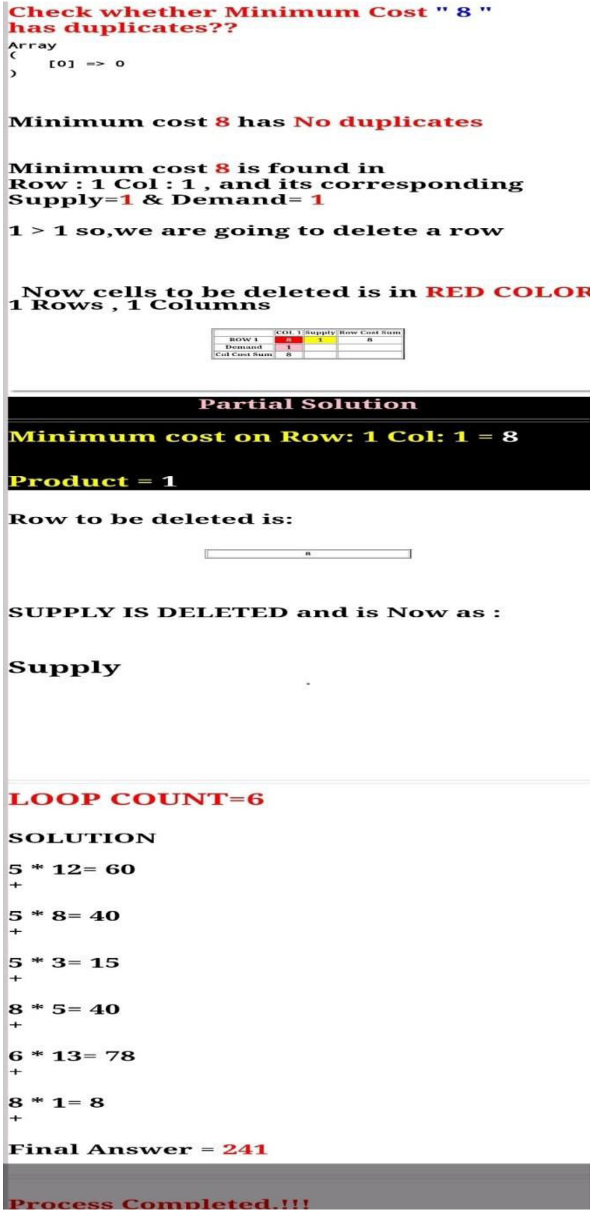

Check whether Minimum Cost " 8 " has duplicates??

```
Array
(
    [0] => 0
)
```

Minimum cost 8 has No duplicates

Minimum cost 8 is found in
Row : 1 Col : 1 , and its corresponding
Supply=1 & Demand= 1

1 > 1 so,we are going to delete a row

Now cells to be deleted is in RED COLOR
1 Rows , 1 Columns

	COL 1	Supply	Row Cost Sum
ROW 1	8	1	8
Demand	1		
Col Cost Sum	8		

Partial Solution

Minimum cost on Row: 1 Col: 1 = 8

Product = 1

Row to be deleted is:

SUPPLY IS DELETED and is Now as :

Supply

LOOP COUNT=6

SOLUTION

5 * 12= 60
+
5 * 8= 40
+
5 * 3= 15
+
8 * 5= 40
+
6 * 13= 78
+
8 * 1= 8
+
Final Answer = 241

Process Completed.!!!

Example 3.2

Similarly we can solve any type of TP using this coding For example

	D1	D2	D3	D4	D5	D6	D7	D8	Supply
O1	10	22	25	54	36	24	25	85	2440
O2	24	25	42	78	54	22	51	60	1000
O3	14	41	52	12	54	10	11	85	8024
O4	58	2	56	45	89	91	92	58	8965
O5	6	14	24	85	54	52	62	32	2436
O6	70	12	12	12	42	52	58	56	2546
O7	25	52	25	14	25	35	68	9	2540
O8	36	87	21	98	87	74	75	56	2350
O9	89	89	20	61	25	35	54	56	2354
O10	54	90	65	85	68	69	78	74	1256
Demand	8510	5632	4512	1254	1263	1258	5368	2569	

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LOOP COUNT=18

SOLUTION

12 * 1254= 15048
+
11 * 5368= 59048
+
9 * 2540= 22860
+
32 * 29= 928
+
25 * 1263= 31575
+
10 * 1258= 12580
+
2 * 5632= 11264
+
6 * 2407= 14442
+
10 * 2440= 24400
+
14 * 1398= 19572
+
24 * 1000= 24000
+
36 * 1265= 45540
+
12 * 1292= 15504
+
20 * 1091= 21820
+
21 * 1085= 22785
+
56 * 1044= 58464
+
0 * 2289= 0
+
0 * 1256= 0
+
Final Answer = 399830

Process Completed.!!!

IV. CONCLUSION

The present method provides very easy and better initial feasible solution than others which are very close to optimal solution and sometimes it is equal to optimal solution. All the times this method provides least feasible solution but most of the times it gives better approach

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