An optimal solution for multi-objective linear transportation problem with different modes of transportation

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Abstract

In this work main aim is to proposed the most feasible solution to solve multi-objective linear and non-linear transportation problem with different mode of transport. A unique Maximum divide and minimum allotment (MDMA) method was proposed for a particular problem and calculate the feasible solution of given transportation problem. It also calculates the solution of given problem with the previously used different transportation methods and compare the solution with the MDMA methods. Through algorithm and solutions, it is found that the MDMA method give the feasible solution for the given transportation problem.

Keywords- Transportation problem, methods, linear, non-linear, comparison.

1. Introduction

Transportation issues are the most recommended and analysed aspects where there is always an effort to match supply and demand priorities weigh them. Adequate supply is required for every search maintain balance and create the best shipping solution. This an effective way is to provide a satisfactory shipping solution. Supply and demand at minimal cost. It makes sense to look for possible solutions to transportation problems. The proposed algorithm is the unique technique to achieve a possible solution (or) the best solution (for existing ones) without disturbing the state of attenuation. The previously listed methods (a) North West Corner Method, (b) Least Cost Method, (c) Vogel's approximation method, (d) zero deduction method and (e) origin max-min method like are also considered to find the feasible solutions of the given problem. In the paper an effective new unique maximum divide minimum allotment (MDMA) method was proposed for the particular problem and find the feasible solution for the problem. It also compares the feasible solution of MDMA with the pre-existing methods solutions. The transportation problem considered to solve in the paper is mention as

	D_1	D_2	D_3	D_4	D_5	Supply
S_1	12	4	9	5	9	55
S_2	8	1	6	6	7	45
S_3	1	12	4	7	7	30
S_4	10	15	6	9	1	50
Demand	40	20	50	30	40	180

We now present a new approach called the MDMA approach to find possible solutions to a transport problem. The algorithm of the MDMA method works as follows:

2. Algorithm:

Step 1: Express the Transportation Table (TT) for the assumed Pay Off Matrix (POM).

Step 2: Pick the element (ME) which is maximum from POM and then apply division to all elements with the help of the ME to get Constructed Transportation Table (CTT).

Step 3: Further supplying the demand to achieve minimum element recently CTT.

Step 4: Choose for the next maximum entry in the CTT and do the same procedure for other divisions.

3. MDMA method

Different steps that are included to solve the transportation problem with this method is included in the below section.

3.1 Step1: On the above Transportation Table (TT), we find the maximum element = 15. So as per MDMA method, we have to divide all elements of table by Maximum Element which is equal to 15 to get new table as below:

Table.1 Apply MDMA Method for Step-1

	D_1	**D_2**	**D_3**	**D_4**	**D_5**	**Supply**
S_1	12/15	4/15	9/15	5/15	9/15	55
S_2	8/15	1/15 (20)	6/15	6/15	7/15	45 (25)
S_3	1/15	12/15	4/15	7/15	7/15	30
S_4	10/15	15/15	6/15	9/15	1/15	50
Demand	40	20	50	30	40	180

Now, Selected the minimum element which is (1/15) appear in cell (2, 2) of S_2 x D_2 and searching for minimum demand vs supply. Then allotting the minimum demand = 20 and allot D (20, 45) = 20 units in the cell (2, 2) and apply cancellation of entire column.

3.2 Step 2:

On the above new Transportation Table (TT), we find the maximum element = 12/15. So as per MDMA method, we have to divide all elements of table by Maximum Element which is equal to 12/15 to get new table as below:

Table.2 Apply MDMA Method for Step-2

	D_1	**D_3**	**D_4**	**D_5**	**Supply**
S_1	1	9/12	5/12	9/12	55
S_2	8/12	6/12	6/12	7/12	25
S_3	1/12 (30)	4/12	7/12	7/12	30
S_4	10/12	6/12	9/12	1/12	50
Demand	40 (10)	50	30	40	160

Now, Selected the minimum element which is (1/12) appear in cell (3,1) of S_3 x D_1 and searching for minimum demand vs supply. Then allotting the minimum demand = 30 and allot D (30 ,40) =30 units in the cell (3,1) and apply cancellation of entire row.

3.3 Step 3:

Here, we find the maximum element = 10/12. So as per MDMA method, we have to apply division to all elements of table by Maximum Element which is equal to 10/12 to get new table as below:

Table.3 Apply MDMA Method for Step-3

	D_1	**D_3**	**D_4**	**D_5**	**Supply**
S_1	12/10	9/10	5/10	9/10	55
S_2	8/10	6/10	6/10	7/10	25
S_4	1	6/10	9/10	1/10 (40)	50 (10)
Demand	10	50	30	40	130

Now, Selected the minimum element which is (1/10) appear in cell (3,4) of S_4 x D_5 and searching for minimum demand vs supply. Then allotting the minimum demand = 40 and allot D (40 ,50) =40 units in the cell (3,4) and apply cancellation of entire column.

3.4 Step4:

Here, we find the maximum element = 12/10. So as per MDMA method, we have to apply division to all elements of table by Maximum Element which is equal to 12/10 to get new table as below:

Table.4 Apply MDMA Method for Step-4

	D_1	**D_3**	**D_4**	**Supply**
S_1	1	9/12	5/12 (30)	55 (25)
S_2	8/12	6/12	6/12	25
S_4	10/12	6/12	9/12	10
Demand	10	50	30	90

Now, Selected the minimum element which is (5/12) appear in cell (1,3) of S_1 x D_4 and searching for minimum demand vs supply. Then allotting the minimum demand = 30 and allot D (30 ,55) =30 units in the cell (3,4) and apply cancellation of entire column.

3.5 Step 5:

Here, we find the maximum element = 10/12 and apply division to all elements of table by Maximum Element which is equal to 10/12 to get new table as below:

Table.5 Apply MDMA Method for Step-5

	D_1	**D_3**	**Supply**
S_1	12/10	9/10	25
S_2	8/10	6/10	25
S_4	1	6/10 (10)	10
Demand	10	50 (40)	60

Now, Selected the minimum element which is (6/10) appear in cell (3,2) of S_4 x D_3 and searching for minimum demand vs supply. Then allotting the minimum demand = 10 and allot D (50, 10) =10 units in the cell (3,2) and apply cancellation of entire row.

3.6 Step 6:

Here, we find the maximum element = 12/10 and apply division to all elements of table by Maximum Element which is equal to 12/10 to get new table as below:

Table.6 Apply MDMA Method for Step-6

	D_1	**D_3**	**Supply**
S_1	1	9/12	25
S_2	8/12	6/12 (25)	25
Demand	10	40 (15)	50

Now, Selected the minimum element which is (6/12) appear in cell (2,2) of S_2 x D_3 and searching for minimum demand vs supply. Then allotting the minimum demand = 25 and allot D (40 ,25) =25 units in the cell (2,2) and apply cancellation of entire row.

Now, allotting 10 unit in the cell (1,1) of above matrix S_1 x $D_1$and 15 unit in the remaining cell (1,2) to get final optimal allotment table.

Table.7 MDMA Method Optimal Allotment Table

	D_1	**D_2**	**D_3**	**D_4**	**D_5**	**Supply**
S_1	12 (10)	4	9 (15)	5 (30)	9	55
S_2	8	1 (20)	6 (25)	6	7	45
S_3	1 (30)	12	4	7	7	30
S_4	10	15	6 (10)	9	1 (40)	50
Demand	40	20	50	30	40	180

Further, aim is to attain a basic feasible solution is below:

S_1—D_1 = units cost 12 x 10 = 120

S_1—D_3 = units cost 9 x 15 = 135

S_1—D_4 = units cost 5 x 30 = 150

S_2—D_2 = units cost 1 x 20 = 20

S_2—D_3 = units cost 6 x 25 = 150

S_3—D_1 = units cost 1 x 30 = 30

S_4—D_3 = units cost 6 x 10 = 60

S_4—D_5 = units cost 1 x 40 = 40

Total cost = Rs 705

In this way, the MDMA method provides a possible value of the target function for the transport problem. The proposed algorithm has a systematic procedure and is easy to comprehend. It can be extended to solve problems and issues with traveling traders to get the best optimal solution. Explanatory methods provide tools for decision makers as they address different types of logistics in real time.

4. Comparative Study on Various Method in Transportation Problem

After find the transportation solution from MDMA method, same problem was also solved with the previously existing different methods and compare the solution of each methods. Here comparative study of various method discussed and after analysis we have concluded the following result table:

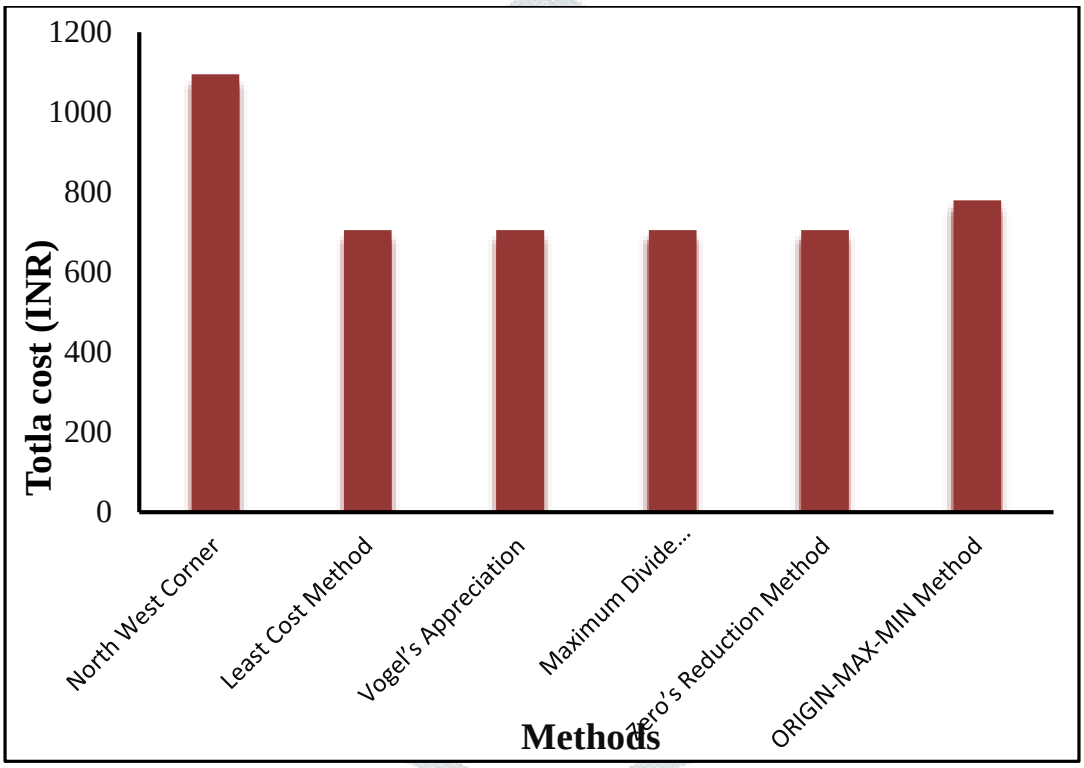

Figure 4.1 Comparison of value of total cost of transportation calculated through different methods

5. Conclusion

In this way, the MDMA method provides a possible value of the target function for the transport problem. The proposed algorithm has a systematic procedure and is easy to comprehend. It can be extended to solve difficulties and issues with traveling traders to get the best solution. The proposed method is a vital tool for decision makers when there are different logistics issues to make effective decisions and from the MDMA comparison leads to the optimal solution of all methods. Comparative analysis with the best solution of the problems given by the methods defined here compares and summarizes the results of different methods. These methods are an vital tool for decision makers when tackling different types of logistics to make the best decisions.

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