



MODIFIED MINIMUM ALLOCATION METHOD - AN OPTIMAL SOLUTION FOR TRANSPORTATION PROBLEM

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ABSTRACT:

A special case of LPP known as TP arises frequently in real life situations. Traditionally we solve the transportation problem in two stages, firstly we use any of the existing methods for obtaining IBFS and second stage, and we apply MODI method for obtaining IBFS. Alternating stepping stone method proposed by charnels et.al (1953) may also be used instead of MODI (Modified Distribution approach) method. But this traditional practice involves lengthy mathematical calculations for obtaining the optimal solution of TP. To minimize the effort of mathematical calculations Dr. R. Murugasan proposed a method named MODA which tests the optimality of a solution and also optimizes the solution if it is not optimal. In this research article we have proposed an innovative method MODI-MAM, this also tests the optimality solution. We have found very easy and less iteration to solve the problem.

Key words: TP, optimal solution, IBFS, Zero Cost value Method, MODI Method, MODA Method.

INTRODUCTION:

The TP is a subset of the LPP that appears often in real-world circumstances. Traditionally, we address the TP in two stages: first, we utilize any of the current methods to acquire an IBFS, and then we use the MODI approach to obtain an OS based on the first BFS. Instead of the MODI approach, the stepping stone method described by the author et al. (1953) may be utilized. However, this old technique entails long mathematical computations in order to achieve the ideal answer to the TP. Hitchcock first stated the basic transportation dilemma. Dantzig was the first to present the LPF and the associated systematic approach to solving it. To discover the IBFS of a TP, three well-known methods are used: NWCM, LCM, and VAM. Several scholars have created various ways of determining the IBFS. To minimize the effort of mathematical calculations The Author proposed MODA, which tests the optimal solution. We have found it very easy and requires less iteration to solve the problem.

This paper deals with the innovative method for finding the OS of a TP. This method is iterative and can be used to test the optimality of an IBFS and also optimize the solution.

In this method, the way to improve the optimal solution is based on the currently allocated cell with the smallest unit transportation cost to another unallocated cell and its reallocations. The proposed algorithm consists of the following steps:

MODI-MAM (Modified Minimum Allocation Method)

Step 1: For the given transportation matrix, first find an IBFS using the zero cost value method in TP and also find the TTC.

Step 2: Make sure that the number of occupied cells in the transportation matrix is exactly equal to the sum of the number of rows and the number of columns minus one.

Step 3: Find out which occupied cell (basic cell) has the smallest unit transportation cost.

Step 4: Beginning with the occupied cell, trace a closed path passing through only one non-basic cell. In this closed loop, using the direct route through at least three occupied cells

Step 5: In the closed path assign '+' sign and '-' sign alternatively on each corner cell, starting with the plus sign at non-basic cell to be evaluated.

Step 6: Calculating an improvement index by adding the unit cost figure found in each square containing a plus sign and subtracting the unit cost in each square is called the net change cost. Check the sign for the NCC.

Step 7:

- (i) If all the NCC is positive, then the optimal solution has been reached, and hence the current solution is optimal. This improved solution is the minimum total transportation cost. Next, we go to step 3 to identify the occupied cell having the minimum unit TC.
- (ii) If the NCC for an identified occupied cell is negative, then the solution is not optimal, and the solution can be improved by adding the corresponding closed path to the negative NCC to the exact loop.
- (iii) If the net change cost of an occupied cell is zero, then the solution is optimal.

Step 8: Select the occupied cell having the most negative NCC value and determine the minimum number of units that can be assigned to a cell marked with a minus sign on the closed path corresponding to this cell. Add this number to the non-basic cell and to all other cells on the marked path with a plus sign. Subtract this number from the closed path with a minus sign.

Step 9: Repeat the method until we find the best solution.

Example:

Consider the following transportation costs for an air cooler from different factories to different warehouses: they are given below.

	D1	D2	D3	D4	Supply
S1	6	1	9	3	70
S2	11	5	2	8	55
S3	10	12	4	7	90
Demand	85	35	50	45	

Solution:

The given transportation table is

	D1	D2	D3	D4	Supply
S1	6	1	9	3	70
S2	11	5	2	8	55
S3	10	12	4	7	90
Demand	85	35	50	45	

Table: 1 Transportation Table

First, we have to solve the given balanced transportation problem by using the zero cost-value method and obtain the near-optimal solution shown below.

The allocated cell values are in the following transportation table:

6		1	35	9		3	35
11	5	5		2	50	8	
10	80	12		4		7	10

Table: 2 Zero Cost Value Method – Allotment Table

Obtaining a basic, feasible solution is

$$S1 \rightarrow D2 \Rightarrow 1 \times 35 = 35 \text{ Units}$$

$$S1 \rightarrow D4 \Rightarrow 3 \times 35 = 105 \text{ Units}$$

$$S2 \rightarrow D1 \Rightarrow 11 \times 5 = 55 \text{ Units}$$

$$S2 \rightarrow D3 \Rightarrow 2 \times 50 = 100 \text{ Units}$$

$$S3 \rightarrow D1 \Rightarrow 10 \times 80 = 800 \text{ Units}$$

$$S3 \rightarrow D4 \Rightarrow 7 \times 10 = 70 \text{ Units}$$

Total Transportation Cost = 1165 Units.

In Step 2, Here is the number of occupied cells = $m+n-1$

$$6 = 4+3-1$$

By Step 3, the occupied cell (S1, D2) that has the smallest unit transportation cost.

By Step 4, trace all closed paths passing through only one unoccupied cell.

Test the optimality:

As the improvement index for the identified occupied cell (S1, D2) is negative, the current initial basic feasible solution is not optimal.

By implementing the loop, we obtain the modified allocation table.

		30			40
6	1		9		3
		5		50	
11	5		2		8
		85			5
10	12		4		7

Table: 3 MODI - MAM

$$S2 \rightarrow D2 \Rightarrow 1 \times 30 = 30 \text{ Units}$$

$$S1 \rightarrow D4 \Rightarrow 3 \times 40 = 120 \text{ Units}$$

$$S2 \rightarrow D2 \Rightarrow 5 \times 5 = 25 \text{ Units}$$

$$S2 \rightarrow D3 \Rightarrow 2 \times 50 = 100 \text{ Units}$$

$$S3 \rightarrow D1 \Rightarrow 10 \times 85 = 850 \text{ Units}$$

$$S3 \rightarrow D4 \Rightarrow 7 \times 5 = 35 \text{ Units}$$

Improved Total Transportation Cost = 1160 Units.

SECOND ITERATION:

In step 2, the number of occupied cell = $6 = m+n-1$

By Step 3, the occupied cell (S1, D2) that has the smallest unit transportation cost.

By Step 4, trace all the closed paths passing through only one un-occupied cell.

Test the Optimality:

As the improvement Index for the identified occupied cell (S1, D2) shows that all the changes in costs are positive, by the implementation of the corresponding closed path, there will be no changes in total transportation cost value. Therefore, we go to step 3 to consider the next occupied cell where the unit transportation cost is greater than one.

The next occupied cell is (S2, D3), and the unit transportation cost is two. Trace all possible closed paths, passing through only one unoccupied cell.

Test the Optimality:

As the improvement Index for the identified occupied cell (S2, D3) shows that all the changes in costs are positive, by the implementation of the corresponding closed path, there will be no changes in total transportation cost value. Therefore, we go to step 3 to consider the next occupied cell where the unit transportation cost is greater than one.

The next occupied cell is (S1, D4), and the unit transportation cost is three. Trace all possible closed paths, passing through only one unoccupied cell.

Test the Optimality:

As the improvement Index for the identified occupied cell (S1, D4), shows that all the change in costs are positive, by the implementation of the corresponding closed path, there will be no changes in total transportation cost value.

Therefore, we go to step 3 to consider the next occupied cell where the unit transportation cost is greater than one.

The next occupied cell is (S2, D2), and the unit transportation cost is five. Trace all possible closed paths, passing through only one unoccupied cell.

Test the Optimality:

As the improvement Index for the identified occupied cell (S2, D2) shows that all the changes in costs are positive, by the implementation of the corresponding closed path, there will be no changes in total transportation cost value. Therefore, we go to step 3 to consider the next occupied cell where the unit transportation cost is greater than one.

The next occupied cell is (S3, D4), and the unit transportation cost is seven. Trace all possible closed paths, passing through only one unoccupied cell.

Test the Optimality:

As the improvement Index for the identified occupied cell (S3, D4) shows that all the changes in costs are positive, by the implementation of the corresponding closed path, there will be no changes in total transportation cost value. Therefore, we go to step 3 to consider the next occupied cell where the unit transportation cost is greater than one.

The next occupied cell is (S3, D1), and the unit transportation cost is five. Trace all possible closed paths, passing through only one unoccupied cell.

Hence, improvement is not possible by implementing the corresponding closed path.

Also, we can see that the improved index of each occupied cell is positive.

Therefore, we stopped the improvement process.

The Optimal transportation cost is \$160.

CONCLUSION:

On the basis of the present study, it can be concluded that MODI-MAM is a novel iterative method for finding optimal solutions in TPs. To find the best IBFS to TP, the MODI-MMAM was evaluated on a number of optimal solutions achieved using the zero cost value method. In addition, the suggested method provides alternate optimal solutions to a given transportation problem, if such solutions exist.

REFERENCES:

- [1] G. Padma Karthiyayini, Dr. S. Ananthalakshmi and Dr. R. Usha Parameswari, "An Innovative Method to solve Transportation Problem Based on a Statistical Tool", "Advances in Mathematics: Scientific Journal 9(2020), no.5, 2533-2539, ISSN: 1857-8365.
- [2] Vrushabh Vora, Mamta Choudhary, Nishant Ahirrao, Mahendra Chodhary, "An Efficient Heuristic for Obtaining a Better Initial Basic Feasible Solution in a Transportation Problem", IOSR Journal Of Mathematics, e-ISSN:2278-5728,p-ISSN:2319-765X. Volume 17,Issue 4 Ser.III (2021),PP 53-69.
- [3] G. Padma Karthiyayini, Dr. S. Ananthalakshmi and Dr. R. Usha Parameswari, "A New Approach to Determine the initial Basic Feasible Solution by using SDP method", in the proceedings of, ISBN: 978-93-94293-01-4(2022).
- [4] G. Padma Karthiyayini, Dr. S. Ananthalakshmi and Dr. R. Usha Parameswari, "A Modern Approach For Finding Minimization Cost In Transportation Problem", " Turkish Journal of Computer and Mathematics Education", Vol.12. No.IS (2021), 319-322.
- [5] G. Padma Karthiyayini, Dr. S. Ananthalakshmi and Dr. R. Usha Parameswari, "An Algorithmic Approach to find a Feasible Solution of Transportation Problems by Using the Half Width- Value Method", in the proceedings of, ISBN: 978-81-948552-93(2022).
- [6] Dr.R.Murugesan,"MODA – An Innovative Method For Optimality Testing and Optimizing a Solution In Transportation Problems", Global Journal of Pure and Applied Mathematics, ISSN 0973-1768 Vol 18, Number 2 (2022), pp. 479-499

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