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Optimizing Transportation Problems using the Substitution Method and Zero-Cut Technique

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ABSTRACT

Objectives: To find the initial basic feasible solution of a transportation problem in real life problem.

Methods: We proposed a new method to find the initial basic feasible solution to get optimal solution.

Findings: This study introduce the zero-cut method for finding the initial basic feasible solution for transportation problem. The attractive feature of this method is that it requires very simple, so it is very easy to understand. Also, we find a minimum transportation cost.

Novelty: The numerical illustration demonstrates with an example for comparing the existing methods.

KEYWORDS: Initial Basic Feasible Solution (IBFS), Transportation (TP), Transportation Table (TT), optimal solution.

1. INTRODUCTION:

Transportation model is one of the most dominant applications of linear programming problem. To obtain best solution in a problem it's not only get a matter of maximization profit, but also cost must be minimized in optimization. Transportation problem deals with the determination of a minimum cost schedule for transporting a single commodity from a number of sources to a number of destination. This class of problem is basically a linear programming problem. In the transportation problem, the availability can be equal to the demand, the availability may be superior to the demand and the availability may be less than the demand. The basic transportation problem was originally stated by Hitchcock. The linear programming formulation and the associated systematic method for solution were first given in Dantzig. There are three well-known methods, North west corner Method, Least cost method, Vogel's Approximation method to find the initial basic feasible solution of a transportation problem. Several researchers have developed alternative methods for finding initial basic feasible solution. In general, some company for manufacturing products and some retail centers for distributing products which are called as sources and destinations in transportation model. For a transportation problem we consider m sources and n destinations where C_{ij} is the unit cost of i^{th} source to j^{th} destinations. The output of the transportation problem is x_{ij} means the amount of products transferred from i^{th} source to j^{th} destination, so that the total transportation cost will be minimized.

2. METHODOLOGY

Proposed Algorithm: (Zero Cut Method)

Step 1: Choose the smallest entry for each row of the transportation table and subtract it from the corresponding row wise.

Step 2: Choose the smallest entry for each column of the transportation table and subtract it from the corresponding column wise.

Step 3: In the reduced cost matrix, there will be at least one zero in each row and column.

Step 4: First mark all the zeros in respective row and column.

Step 5: Choose a zero with minimum supply or demand and then delete the row or column.

Step 6: If all the demand and supplies are satisfied then find the total transportation cost.

Step 7: The total transportation cost is the sum of the product of the cost and its corresponding allocated values of supply or demand.

Numerical Examples:

1. Consider the following cost minimizing transportation problem:

	D_1	D_2	D_3	D_4	Supply
S_1	7	5	9	11	30
S_2	4	3	8	6	25
S_3	3	8	10	5	20
S_4	2	6	7	3	15
Demand	30	30	20	10	

Solution:

Select the smallest entry for each row of the transportation table and subtract it from the corresponding row wise

2	0	4	6
1	0	5	3
0	5	7	2
0	4	5	1

Select the smallest entry for each column of the transportation table and subtract it from the corresponding column wise

2	0	0	5
1	0	1	2
0	5	3	1
0	4	1	0

The allocation cell values are given in the following transportation table is,

7	5 [10]	9 [20]	11
4 [5]	3 [20]	8	6
3 [20]	8	10	5
2 [5]	6	7	3 [10]

Total cost obtained by the proposed method is as follows,

Total minimum cost= (5×10) + (9×20) + (4× 5)+3× 20) + (3× 20) + (2× 5) + (3× 10)=410

2. Consider the following cost minimizing transportation problem:

	D_1	D_2	D_3	D_4	Supply
O_1	13	18	30	8	8
O_2	55	20	25	40	10
O_3	30	6	50	10	11
Demand	4	7	6	12	

Solution: Select the smallest entry for each row of the transportation table and subtract it from the corresponding row wise

5	10	22	0
35	0	5	20
24	0	44	4

Select the smallest entry for each column of the transportation table and subtract it from the corresponding column wise

0	10	17	0
30	0	0	20
19	0	39	4

The allocation cell values are given in the following transportation table is,

13 $\boxed{4}$	18	30	8 $\boxed{4}$
55	20 $\boxed{4}$	25 $\boxed{6}$	40
30	6 $\boxed{3}$	50	10 $\boxed{8}$

Total cost obtained by the proposed method is as follows,

Total minimum cost = (13× 4) + (8× 4) + (20× 4) + (25× 6) + (6× 3) + (10× 8)= 412

3. DISCUSSION

The comparison for the new proposed method(Zero Cut Method) with North west corner method, Least Cost Method, Vogel’s Approximation Method is listed below, its clearly understood that the optimal results.

Methods	Total Transportation Cost	
	Example 1	Example 2
NWCM	540	484
LCM	435	576
VAM	410	476
Proposed Method	410	412

4. CONCLUSION

In this paper, we have developed an improved algorithm, for obtaining the initial basic feasible solution of transportation problems. A comparison of proposed algorithm is made with existing method by considering two numerical examples. It is observed that the proposed algorithm yield more reliable results in contrast to the conventional methods.

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.DOI:10.37418/amsj.9.5.16.
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.DOI: https://doi.org/10.17762/turcomat.v12i1S.1827
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).