An Innovative Route to Acquire Least Cost in Transportation Problems

P.Sumathi, C.V.Sathiya Bama

***Abstract:** In Linear Programming Problem, Transportation Problem (TP) is a particular approach to reach the cost. Purpose of TP is to reduce the cost. Transportation model provides a great support to find out the best way to distribute supplies to client. An inventive hypothesis is discussed for getting optimal cost in transportation problem in this paper. The proposed work compared with also Vogel's Approximation and MODI methods. This approach is confirmed with various numerical illustrations.*

***Keywords:** Initial Basic Feasible Solution (IBFS), Optimal Cost, Vogel's Approximation Method (VAM), MODI, Transportation Problem (TP).*

***AMS classification:** 90 – 90B, 90C.*

I. INTRODUCTION

The application of quantitative study to work out the production problems in operation research, usually named as "Transportation Problem" (TP). It is used to minimize the cost for industries with the number of sources to the number of destinations whereas it satisfy the supply bound and demand necessity.

Because of the special structure of the Transportation Problem the Simplex Method of solving is unsuitable for the Transportation Problem. The model assumes that the distributing cost on a given route is directly proportional to the number of units distributed on that route. Generally, the transportation model can be extended to areas other than the direct transportation of a commodity, including among others, inventory control, employment scheduling, and personnel assignment.

For any product manufacturing company, it is critical that the raw materials being received from different parts across the locations. The cost associated with raw materials being transported needs to be well optimized, so that the profit can be increased. The finest known solution to increase the efficiency while reducing or minimizing the cost is utilizing the transportation model.

The main objective of transportation problem is to raise the gain and reduce the cost. Transportation model gives the finest way to issue supplies to client. Many authors analyzed about linear programming and transportation models in [2] [3] [4] [5] and [10] and several researchers projected new methods for transportation in [1] [6] [7] [8] [9] and [11].

Inventive idea for minimizing the cost in TP is proposed in this work, which is very clear and simple to apply. The proposed algorithm is presented in section 2 and section 3 deals with numerical illustrations. Comparative results were discussed in section 4 and 5 which concludes the work.

II. ALGORITHM

Step 1: Construct the transportation table from the given problem.

Step 2: If $\sum S_i = \sum D_j$, proceed to next step. If not add a dummy row or column.

Step 3: Find the total value of arg(C_{ij}) for every row and column and place it on the sides of the table

Step 4: Choose min arg(C_{ij}) corresponding to the min value of alongside placed values .

Step 5: Continue the procedure until all the cost values are occupied.

Step 6: Choose X_{ij} = min arg(C_{ij}) from unoccupied cells and $Y_{ij} = C_{ij}$ from maximum of occupied allocation cost.

Step 7: If the cost value of $X_{ij} < Y_{ij}$ then interchange the values of X_{ij} to Y_{ij}.

Step 8: If $X_{ij} \geq Y_{ij}$, choose the next max value which should satisfy $X_{ij} < Y_{ij}$. Find the transportation cost.

Step 9: Find the optimal solution by using optimality test.

III. NUMERICAL EXAMPLE

The raw materials such as glass, wood, iron rod required for the production of doors and windows from different sources to one destination depending on the demand of the production. The transportation requirements are listed in the following table. This procedure can be applied in any linear programming problem and this method is quite efficient. In order to increase the efficiency and minimizing the cost associated with the transportation.

Doors and windows		Glass	Iron rod	Wood
Tambaram	Total cost per trips	38	68	48
	Demand in trips	10	7	3
Medavakkam	Total cost per trips	30	70	50
	Demand in trips	8	5	2
Velachery	Total cost per trips	56	86	66
	Demand in trips	14	9	5

The raw materials details formulated by transportation model as given below

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	Velachery	Tambaram	Medavakkam	Supply
Glass	56	38	30	32
Iron rod	86	68	70	21
Wood	66	48	50	10
Demand	28	20	15	63

The proposed algorithm has been applied here

56	17 38	15 30	32	**124**	**94**	-
21 86	68	70	21	224	154	154
7 66	3 48	50	10	164	114	**114**
28	20	15				
208	154	150				
208	154	-				
152	116	-				

From occupied cell maximum allocation is 21 and corresponding cost value is 86. From unoccupied cell the minimum cost value is 50. It satisfies the condition 50<86. Therefore interchange the corresponding cost value.

56	17 38	15 30
21 50	68	70
7 66	3 48	86

Transportation cost = 17 × 38 + 15 × 30 + 21 × 50 + 7 × 66 + 3 × 48 = 2752

MODI method can be used to check the optimality and the optimal solution is 2752.

The optimal solution is 3508 by MODI method through VAM.

This problem can be solved by manual calculation from the actual transportation cost is 38 × 10 + 68 × 7 + 48 × 3 + 30 × 8 + 70 × 5 + 50 × 2 + 56 × 14 + 86 × 19 + 66 × 5 =3548. Comparing actual transportation cost and transportation model, the minimized optimal value reached by the proposed method.

IV. COMPARATIVE ANALYSIS & RESULTS

S.NO	Problem dimension		VAM	No. of Loops	Optimal solution	Proposed method	No. of Loops	Optimal solution
	M	n						
1.	3	4	779	1	743	667	1	651
2.	3	3	143	-	143	135	1	125
3.	3	5	1580	2	1400	960	1	950
4.	3	4	102	2	100	106	2	100
5.	3	4	480	1	460	450	-	450
6.	3	5	9360	1	9240	8880	1	8840
7.	4	3	80	1	76	69	1	67
8.	4	4	2245	1	1945	1010	-	1010
9.	3	4	476	1	412	444	-	444
10.	3	3	1745	2	1650	940	2	745
11.	3	5	2810	1	2700	2630	1	2550
12.	4	5	829	-	829	786	1	779
13.	3	4	2850	-	2850	2700	-	2700
14.	3	4	2920	-	2920	2260	1	2020
15.	3	4	12075	-	12075	12000	1	11625
16.	3	4	796	-	796	832	3	736
17.	3	4	104	-	104	102	-	102
18.	3	4	2221	-	2221	2688	2	2221
19.	3	4	960	1	920	880	-	880
20.	3	4	630	1	610	410	1	400

V. CONCLUSION

The most significant aim is to reduce the transportation cost. Using this new thought the cost is reduced with less time and computational work. And also various sizes of problems were compared with VAM method by optimality checking. The proposed technique concludes that the minimal cost is obtained, which is very less cost compared with others.

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