Vol (02) _Issue (04)
ISSN: 2456-9348
Impact Factor: 4.520

iJETRM

International Journal of Engineering Technology Research & Management

A VAM AND MODI METHOD TO SOLVE THE OPTIMALITY FOR THE TRANSPORTATION PROBLEM

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Abstract:
In this paper, an optimal solution of Transportation programming problem has been considered. To obtain initial basic feasible solution (IBFS), the work shown here is donewith Vogel's approximation method (VAM). The MODI method is applied for finding an optimal solution for this T.P.P. The proposed method is unique and the result with an elaborate illustration demonstrates that the method presented here is effective optimal test of the transportation cost.

Keywords:
Transportation problem (T.P.), VAM, MODI Method, Initial basic feasible solution (IBFS), optimal test

INTRODUCTION

The Transportation problem is one of the traditional function of the L.P.P.Transportation model provides a greater impact on the management of transport [5]. The basic Transportation problem was initially proposed by Hitch Cock [3][6]. It is a special kind of the network optimization problems. It has defined data structure in solution, characterized as a Transportation group[1].It plays an important role in logistics & supply chain management for reducing cost & improving service[4].The problem mainly deals with the determination of optimum routes to minimize transporting cost of particular product from a number of sources to a number of destination.Network model of the transportation programming problem is shown in figure 1. It aims to find the best method to fulfill the demand of n-demand points using the capacities of m-supply points[7]by applying the renownedmethod i.e., Vogel's Approximation Method (VAM) and check its optimality by applying Modified Distribution (MODI) test method.

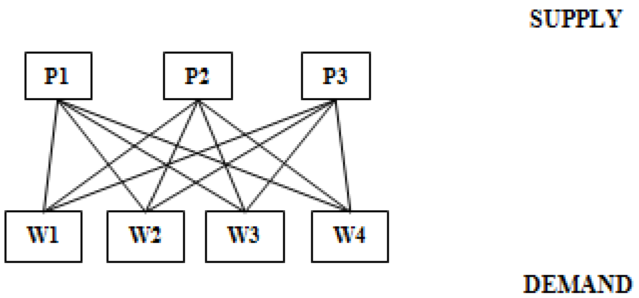

Figure: 1 - Network Model of T.P.P.

ALGORITHM OF VOGEL'S APPROXIMATION METHOD

Step 1: Verify whether the total supply equals total demand. Ifit is not so then set up a dummy row or column.
Step 2: Identify least and second least transportation cost in each row or column and write the difference (penalty) beside the corresponding row or column.
Step 3: Now select the row or column with maximum penalty and make maximum allotment to the boxhaving minimum cost of transportation in that row or column. If the penalties of two or more rows or columns are equal, then choose any one of them.
Step 4: Adjust the supply and demand and eliminate the satisfied row or column. If a row and column are satisfied simultaneously, only of them is eliminated and the other one is assigned a nil value. Any row or column having nilsupply or demand cannot be used in calculating future penalties. [8]
Step 5: Repeat the process until all the supply sources and demand destinations are satisfied.

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ILLUSTRATION

To / From	D_1	D_2	D_3	SUPPLY
S_1	2	7	4	5
S_2	3	3	1	8
S_3	5	4	7	7
S_4	1	6	2	14
DEMAND	7	9	18	34 / 34

Table 1

Solution: By Using VAM Method

To / From	D_1	D_2	D_3	SUPPLY	PENALTY (P_1)	P2	P3	P4	P5
S_1	2 [5]	7	4	~~5~~	2	.....	.....	....	....
S_2	3	3	1 [8]	~~8~~	2	2	.....	....	....
S_3	5	4 [7]	7	~~7~~	1	1	1	1	4
S_4	1 [2]	6 [2]	[10]	~~14~~ ~~4~~ ~~2~~	1	1	1	5	6
DEMAND	~~7~~ ~~2~~	~~9~~ ~~7~~	~~18~~ ~~10~~	34 / 34					
PENALTY (P1)	1	1	1						
P2	2	1	1						
P3	4	2	5						
P4	4	2	....						
P5	....	2	....						

Table 2

From this table, it can be seen that the number of non-negative independent allocations is

(m+n-1) = (4+3 -1) = 6. [5]

Hence the solution is non-degenerate basic feasible.

The initial transportation cost: 5*2 + 2*1 + 7*4 + 2*6 + 8*1 + 10*2 = Rs.80

ISSN: 2456-9348
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TEST THE SOLUTION FOR OPTIMALITY

By Modified Distribution Method (MODI Method) or u-v Method:

To verify whether the feasible solution obtained minimizes the total transportation cost or not .To find optimal solution of transportation problem we apply MODI (Modified Distribution method) test as follows:

Step-1: Determine an initial basic feasible solution as we derived in the above problem by Vogel Approximation Method. Then take the costs only of the occupied cells.

Step-2: Set v1, v2, v3…etc.against the corresponding column and set u1, u2, u3…etc. against the corresponding row.Then determine a set of uiandvjs.t. for each occupied cell, using ui+ vj = cij.[2]

Step-3:Assign 0 to one of the ui's or vj' s for which the corresponding row or column have the maximum number of individual allocations.
Step-4: Then find the cell evaluations (Subtract the above matrix's cells from the corresponding cells of original matrix) ui+vj for each unoccupied cell and enter at the upper right corner of the corresponding unoccupied cell.
Step-5:Thenwe calculate dij(difference of each occupied cell) by the dij= Cij– (ui+vj) for each unoccupied cell and enter at the lower right corner of the corresponding unoccupied cell.
Step-6:If all the dij is non-negative, then the basic feasible solution is optimal. On the other hand, if anyone of dij is –ve, then the basic feasible solution is not optimal.
Step-7: Select the largest negative value of dij. If there have more than one equal cell, then any one can be chosen. Then draw a closed loop for the unoccupied cell. Starting the closed loop with the largest negative value of dijand draw a closed loop with the occupied cells only.
Step-8: Mark the identified cell as +ve and each occupied cell at the corners of the path alternatively –ve , +ve , -ve and so on.
Step-9: check all the negative position and consider the smallest transportation costthat has been assigned a –vesign. Now, + and –demand and supply values of all the positions of + and -.
Step-10: Repeat the whole procedure until the optimum solution is obtained.

Solution:

To / From	D_1	D_2	D_3	a_j
S_1	2 [5]	7	4	5
S_2	3	3	1 [8]	8
S_3	5	4 [7]	7	7
S_4	1 [2]	6 [2]	2 [10]	14
b_j	7	9	18	

Table 3

Now we determine a set of uiand vjs.t. for each occupied cell, cij=ui+vj
For this we choose u4= 0(since row 4 contains maximum no. of allocations).
Since C41= u4+v1 = 1 therefore, v1= c41-u4 = 1

$C_{42}=u_4+v_2 = 6$ $v_2= c_{42}-u_4 = 6$
$C_{43}=u_4+v_3 = 2$ $v_3= c_{43}-u_4 = 2$
$C_{11}= u_1+v_1 = 2$ $u_1= c_{11}-v_1 = 1$
$C_{23}= u_2+v_3 = 1$ $u_2= c_{23}-v_3 = -1$
$C_{32}=u_3+v_2 = 4$ $u_3= c_{32}-v_2 = -2$

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Then we find the cell evaluations ui+ vj for each unoccupied cell by dij = cij – (ui+vj)

(2) 5	(7) (7) (0)	(4) (3) (1)	**1**
(3) (0) (3)	(3) (5) (-2)*	(1) **8**	**-1**
(5) (-1) (6)	(4) **7**	(7) (0) (7)	**-2**
(1) **2**	(6) **2**	(2) **10**	**0**

- Since cell evaluation d22 = -2 < 0, so the solution under test is not optimal.
- Since d22 has the largest negative value, so making a closed path with the help of this.
- Starting the closed loop with the largest negative value of dij and making a closed loop with the occupied cell only.

5		
	+Θ	**8 - Θ**
	7	
2	**2-Θ**	**10 + Θ**

- Since minimum allocation containing -Θ is 2- Θ
  Taking 2- Θ = 0, we get Θ = 2
- The new B.F.S. thus obtained is shown in the following table :
  aj

(2) **5**	(7)	(4)	**5**
(5)	(3) **2**	(1) **6**	**8**
(5)	(4) **7**	(7)	**7**
(1) **2**	(6)	(2) **12**	**14**

Table 6

- Now the new transportation cost = 5*2+2*1+2*3+7*4+6*1+12*2 = Rs. 76
- Now set u1, u2, u3, u4 and v1, v2, v3again.
  u_i

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(2) **5**	(7) (5) (2)	(4) (3) (1)	**1**
(3) (0) (3)	(3) **2**	(1) **6**	**-1**
(5) (1) (4)	(4) **7**	(7) (2) (5)	**0**
(1) **2**	(6) (4) (2)	(2) **12**	**0**

Table 7

- Since all dij> 0. Hence, the B.F.S. shown by table is an optimum solution which is also unique.

CONCLUSION

The approach of VAM is simple in calculation and easy to understand and apply. The method discussed gives us an initial basic feasible solution of a balanced transportation problem in minimization cost .The method developed here gives the optimal solution.

REFERENCES

[1] Gass, SI (1990). On solving the Ttransportation problem. Journal of Operational Research Society, 41(4), 291 -297.

[2] HasanMohammad kamrul, (2012), “Direct Methods for Finding Optimal Solution of a Transportation Problem are not alwaysreliable”, International Refereed Journal of Engineering and Science, 1(2), 46-52.

[3] Hitchcock, F. L. 1941. The distribution of a product from several sources to numerous localities, Journal of Mathematical Physics, 20, 224-230.

[4] S.Priya, S.Rekha, B.Srividhya. “Solving Transportation Problems Using ICMM Method”, International Journal of Advanced Research, vol.4,issue 2, (2016).

[5] S.Rekha, B.Srividhya & S.Vidya “Transportation Cost Minimization: Max Min Penalty Approach”,IOSR Journal of Mathematics, vol.10, issue 2, (2014).

[6] Sharma, Gaurav; Abbas, S. H.; Gupta, Vijay “Solving Transportation Problem With The Various Method Of Linear Programming Problem”, Asian Journal Of Current Engineering And Maths, vol. 1, No. 3, (2012)

[7] Singh, Shweta; Dubey, G.C.; Shrivastava, Rajesh “A Various Method To Solve The Optimality For The Transportation Problem”,International Journal of Mathematical Engineering and Science,vol.1,issue 4,(2012)

[8] Sood Smita; Jain Keerti “The maximum difference method to find initial basic feasible solution for transportation problem, Asian Journal of Management Sciences, 03 (07),(2015)