To Study VAM for Transportation Problem and Optimality by using MODI Method

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***Abstract*:** The goal of the paper is to get an optimal result of Transportation programming problem. The study presented here is done with VAM and to find an optimal solution for this Transportation Programming Problem ,the MODI method is applied. The suggested process is exceptional and the outcome with an elaborate illustration proves that the technique offered here is operative optimal test of the transportation cost.

Key words: Transportation problem, VAM, MODI Method, optimality.

I. INTRODUCTION

The problem of Transportation is a customary function of the LPP. Transportation model provides a greater impact on the management of transport [5]. The remarkable Transportation problem was initially proposed by Hitch Cock [3][6]. It is a remarkable optimization problem, categorized as Transportation problem[1].TP deals with an significant part in the management of demand & supply chain to maximize profit and to minimize the losses[4].The problem is basically concerned to resolve optimum ways to minimize TP of specific product from a number of sources to a number of destination. It goals to discover the best method to accomplish n-demand points by using the m-supply points [7] by applying the renowned method i.e., Vogel's Approximation Method (VAM) and check its optimality by applying Modified Distribution (MODI) test method.

II. PROCEDURE OF VAM

Step 1: Verify whether the all out supply levels with all out demand. On the off chance that it isn't in this way, at that point set up a spurious row or column.

Step 2: Identify lowest and second lowest cost of transportation in each row or column and determine the difference which is called Penalty by the relating next column or row.

Step 3: Now select the row or column with maximum penalty and mark maximum allocation to the cell having minimum transportation cost in that particular row or column. If two or more penalties are equal, then choose any one of them arbitrarily.

Step 4: Modify the supply and demand and remove the satisfied row or column. If a row and column are satisfied at the same time, remove any of them and the corresponding one is given a zero value. Any row or column with zero supply or demand cannot be used in further calculation of penalties[8].

Step 5: Repeat the procedure till all the supply and demand are satisfied.

III. ILLUSTRATION

To / From	F_1	F_2	F_3	F_4	SUPPLY
W_1	2	3	11	7	**6**
W_2	1	0	6	1	**1**
W_3	5	8	15	9	**10**
DEMAND	**7**	**5**	**3**	**2**	**34 / 34**

Table 1

Solution: On applying VAM:

To / From	F_1	F_2	F_3	F_4	SUPPLY	Penalty
W_1	2	3	11	7	**6**	**[1]**
W_2	1	0	6	1(1)	**1 0**	**[1]**
W_3	5	8	15	9	**10**	**[3]**
DEMAND	**7**	**5**	**3**	**2 1**	**34** **34**	
Penalty	**[1]**	**[3]**	**[5]**	**[6]**		

(Maximum Penalty)

Table 2

To / From	D_1	D_2	D_3	D_4	SUPPLY	Penalty
W_1	2	3(5)	11	7	**6 1**	**[1]**
W_3	5	8	15	9	**10**	**[3]**
DEMAND	**7**	**5 0**	**3**	**1**		
Penalty	**[3]**	**[5]**	**[4]**	**[2]**		

(Maximum Penalty)

Table 3

To / From	D_1	D_3	D_4	SUPPLY	Penalty
W_1	2(1)	11	7	**1 0**	**[5]**
W_3	5	15	9	**10**	**[4]**
DEMAND	**7 6**	**3**	**1**		
Penalty	**[3]**	**[4]**	**[2]**		

Table 4

To / From	D_1	D_3	D_4	SUPPLY	Penalty
W_3	5	15(3)	9	**10 7**	**[4]**
DEMAND	**6**	**3 0**	**1**		
Penalty	**[5]**	**[15]**	**[9]**		

(Maximum Penalty)

Table 5

To / From	D_1	D_4	SUPPLY	Penalty
W_3	5	9(1)	~~7~~ 6	[4]
DEMAND	6	~~1~~ 0		
Penalty	[5]	[9]		

(Maximum Penalty)

Table 6

To / From	D_1	SUPPLY	Penalty
W_3	5(6)	~~6~~ 0	[5]
DEMAND	~~6~~ 0		
Penalty	[5]		

(Maximum Penalty)
Table 7

From this table, it can be seen that the no. of independent allocations is

(m + n - 1) = (3 + 4 -1) = 6
The TC is : (1x1 + 3x5 + 2x1 + 15x3 + 9x1 + 5x6) = Rs.102

ASSESSING THE SOLUTION FOR OPTIMALITY THROUGH MODI METHOD (Modified Distribution Method)

To verify whether the obtained feasible solution is optimal or not, MODI (Modified Distribution method) test is performed. In the modified distribution method, cell evaluations of all the unoccupied cells are calculated simultaneously and only one closed path for the most negative cell is traced.
Step-1:.Set-up a cost matrix with only occupied cells .

To / From	D_1	D_2	D_3	D_4
W_1	2	3		
W_2				1
W_3	5		15	9

Step-2: Set v_j (1,2,3,….,n) for the column corresponding to demand constraints and set u_j(1,2,3,….,m) for the row corresponding to supply constraints. Then determine a set of u_i's and v_j's such that for each occupied cell, $u_i + v_j = c_{ij}$.[2]

$$u_1 + v_1 = 2$$
$$u_1 + v_2 = 3$$
$$u_2 + v_4 = 1$$
$$u_3 + v_1 = 5$$
$$u_3 + v_3 = 15$$
$$u_3 + v_4 = 9$$

Step-3: Assign a value zero to one of the u_i's or v_j's for which the corresponding row or column have the maximum no. of allocations. Let v_1 = 0,Therefore

$$u_1 = 2, v_2 = 1, u_3 = 5, v_3 = 10, v_4 = 4, u_2 = -3$$

Step-4: Write the sums of u_i *and* v_j in the vacant boxes **.** Therefore the matrix may be written as **u_i**

		12	6	2
-3	-2	7		1
	6			5

v_j **0** **1** **10** **4**

Step-5: Then calculate $d_{ij} = c_{ij} - (u_i + v_j)$ for each unoccupied cell, where c_{ij} = original cost matrix.

		11-12 = -1	7-6 = 1
1 + 3 = 4	0+2= 2	6-7 = -1	
	8-6 = 2		

Step-6: If all the d_{ij}'s are non-negative, then the basic feasible solution is called optimal. And, if anyone of d_{ij} is –ve, then the particular solution is not optimal.

Step-7: Select the largest negative value of d_{ij} (In case of tie in the cell evaluation , the cell wherein allocation can be made is selected. Then draw a closed loop , starting with the largest negative value of d_{ij} with the occupied cells. **:** Mark the identified cell as positive and each occupied cell at the corners of the path alternatively negative , positive , negative .

− 1	5	+		**6**
			1	**1**
+ 6		3 −	1	**10**
7	**5**	**3**	**2**	

Mark a new allocation in the identified cell by entering the smallest allocation on the path that has been assigned a negative sign. Add and subtract this new allocation from the cells at the corners of the path, maintaining the row and coloumn requirements. This causes the one basic cell to become zero and other cells remain non negative.

1 − 1	5	+1		**6**
			1	**1**
6 + 1		3 −1	1	**10**
7	**5**	**3**	**2**	

↓

	5	1		**6**
			1	**1**
7		2	1	**10**
7	**5**	**3**	**2**	

The total TC for the second feasible solution is

= Rs.(3 x 5 + 11 x 1 + 1 x 1 + 7 x 5 + 2 x 15 + 1 x 9 = 101,

Which is less than for the first feasible solution by Rs. 100.

Step-10: Repeat the entire technique till the optimum solution is attained.

CONCLUSION

The approach of Vogel's Approximation Method is simple in calculation and easy to comprehend and apply. The method deliberated gives us an IBF of a balanced transportation problem in minimization cost .The method developed here gives the optimal solution.

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