© 2017 IJSRSET | Volume 3 | Issue 6 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Solving Transportation Problem Using Maximization Case in Vogel's Approximation Method

M. Roohini, P. Murugan
Department of Mathematics, Dr.SNS Rajalakshmi College of Arts and Science,(Autonomous)Coimbatore, Tamilnadu, India

ABSTRACT

The transportation problem can be represented as a linear programming model in the operation research (OR). The optimization processes in mathematics, computer science and economics are solving effectively by choosing the best element from set of available alternatives elements. Find the transportation pattern that will minimize the total of the transportation cost. In this study, we used the VAM, since it generally produces better starting solution than other solving methods. We proposed a new solving method for transportation problem by using maximization case in Vogel's Approximation Method.
Keywords: Linear Programming, Maximization Case In Transportation Problem, Operation Research, Optimization Problems, Transportation Model, Vogel's Approximation Method.

I. INTRODUCTION

Transportation problem is concerned with the optimal pattern of the product unit's distribution from several original points to several destinations. All linear programming problems can be solved by simplex method, but certain special problems lend themselves to easy solution by the other methods. One such case in that of transportation problems. The objective is to minimize the cost associated with such transportation from place of supply to places of demand within given constraints of availability and level of demand.

$Assume\ that \sum_{i=1}^{m} a_i = \sum_{i=1}^{n} b_j \ \ldots..(1)$

It is the case when demand is fully met from the origin. the problem can be stated as LP problem in the following manner.

Min(total cost)Z $= \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij}\, x_{ij} \ \ldots..(2)$

$$Subject\ to \sum_{j=1}^{n} x_{ij} = a_i; i = 1, \ldots.m$$

Mathematically, the transportation problem can be represented as a linear programming model. Since the objective function in the problem is to minimize the total transportation cost as given by equation (3)

$$Z = c_{11}x_{11}c_{12}x_{12} + \cdots + c_{mn}x_{mn} \ \ldots..(3)$$

Equation(3) is a mathematical formulation of a transportation problem that can adopt the linear programming(LP)technique with the equality constraints LP technique can be used in different product areas such as oil plum industry (1).the transportation solution problem can be found with a good success in the improving the service quality of the public transport system.

II. METHODS AND MATERIAL

Transportation Model

In a transportation problem the points may represent factories to produce items, and to supply a required quantity of the products to a certain number of destinations.

$\sum_{i=1}^{m} x_{ij} = b_j\ for\ j = 1,2,3 \ldots..n$ and

$$x_{ij} \geq 0\ for\ all\ i = 1,2,3 \ldots..m$$
$$j = 1,2,3 \ldots..n$$

This can be represented as a matrix of the dimensions $m \times n$. One matrix is the unit cost matrix which represents the unit transportation cost for each of the possible transportation routes. Superimposed on the matrix in which each cell contains a transportation variable, i.e., the number of units shipped from the row-designated origin to the column designated destination. The amount of supplies a_i available at source i and amount demended b_j at each destination j i.e.,a_i's and b_j's represent supply and demand constraint. Find the transportation pattern that will minimize the total of the transportation cost (see table 1).

Table 1: The model of the transportation problem.

Origins (factories)	Destinations (warehouse)			Available
	1,2….n			
1	c_{11}	$c_{1,2}$	c_{1n}	a_1
2	c_{21}	c_{22}	c_{2n}	a_2
…..	…..	…..	…..	…..
m	c_{m1}	c_{m2}	c_{mn}	a_m
Required	b_1	b_2	b_n	

STEPS IN TRANSPORTATION METHOD:

The solution of the transportation problem has the following algorithm

Step 1: formulate the problem and establish the transportation matrix or table, the cells indicating the parameters value for various combinations i.e., cost, profit, time, distance etc.

Step 2: Obtain an initial basic solution. This can be done in three different ways i.e., North-west corner rule, least cost method or the Vogel's approximation method.

The initial basic solution from any of the methods named above should satisfy the following conditions.

(i) The solution must be feasible, satisfying allocation all supply requirement in to demand position.

(ii) The number of positive allocations must be equal to m+n-1,otherwise the solution will become degenerate.

Step 3: Test the initial solution for optimality-this is done either by stepping stone method or by MODI method.

Step 4: Update the solution i.e., applying step 3 till optimal feasible solution is obtained.

VOGEL'S APPROXIMATION METHOD (VAM):

This is a preferred method over other two methods due to its solution being either optimal or very near optimal. This may reduce the time for optimal calculations.

1. Consider each row of the cost matrix individually and find the difference between two least cost cells in it. Then repeat the exercise for each of the columns. Identify the column or row with the largest value difference. In case of tie, select any one (it is wise to select the row or column to give allocation at minimum cost cell). Now consider the cell with the minimum cost in the column (or row, as the case may be) and assign the maximum units possible, considering the demand and supply position corresponding to that cell. Assign only one cell at a time.
2. Delete the column/row, which has been satisfied.
3. Again, find out the differences of least cost cells and proceed in the same way. Continue until all units have been assigned.

The Vogel's approximation method is also called the penalty method because the cost differences that it uses are nothing but the penalties of not using the least cost route. Since the objective function is the minimization of the transportation cost, in each iteration that route is selected which involves the maximum penalty of not being used.

STEP IN MAXIMIZATION CASE TRANSPORTATION:

Maximization case transportation process includes three steps, these steps are shown as follows:

Step 1: If we have a transportation problem where the objective to maximize the total profit.

Step 2: first we have to convert the maximization problem in to **a** minimization problem by subtracting all the entries from the highest entry in a given transportation table.

Step 3: To modify minimization problem can be solve in the usual procedure.

III. PROPOSED METHOD

In this study, we proposed a new solving method for transportation problem by using maximization case. the proposed method must operate the as following:

Step 1: we must check the matrix balance, if the total supply is equal to the total demand, then the matrix is balanced and also apply step 2. if the total supply is not equal to the total demand, then the add a dummy row or column as needed to make supply is equal to the demand. So the transportation costs in this row or column will be assigned to zero.

Step 2: applying maximization case in transportation problem. Two determine the first we have to convert the maximization problem in to a minimization problem by subtracting all the entries from the highest entry in a given transportation table.

Step 3: Identify the row or the column that includes the largest penalty. As much as possible, the lowest cost row/column (cell) in the row or column should be allocated with the highest difference.

Step 4: Elect the next modify minimization problem can be solving step 3 in VAM method in until all row or column is exhausted.

MAXIMIZATION CASE IN TRANSPORTATION PROBLEM:

If we have a transportation problem where the objective to maximization the total profit, first we have to convert the maximization problem in to a minimization problem by subtracting all the entries from the highest entry in a given transportation table. The modify minimization problem can be solve in the usual procedure.

Problem: Find the optimal cost the problem assigning five jobs persons to take maximizes case in transportation problem.

Solution:

Step 1: In this problem, the matrix is unbalanced, where the total of supply in not equal to the total of demand (table 2). Here we add a dummy row to make supply is equal to the demand, so the transportation costs in the row will be assigned zero (tables).

Table 2: the proposed method-process 1

plant	D_1	D_2	D_3	D_4	supply	
S_1	10	30	25	15	14	
S_2	20	15	20	10	10	
S_3	10	30	20	20	15	
S_4	30	40	35	45	12	
Demand	10	15	12	15	52	51

Table 3: the proposed method-process 2

Plant	D_1	D_2	D_3	D_4	Supply	
S_1	10	30	25	15	14	
S_2	20	15	20	10	10	
S_3	10	30	20	20	15	
S_4	30	40	35	45	12	
S_5	0	0	0	0	1	
Demand	10	15	12	15	52	52

Step 2: We convert this in to a minimization type by subtracting the values from the highest values.

Since $\sum a_i = 51$, $\sum b_j = 52$

Table 4 : the proposed method-process 3

Plant	D_1	D_2	D_3	D_4	Supply	
S_1	35	15	20	30	14	
S_2	25	30	25	35	10	
S_3	35	15	25	25	15	
S_4	15	5	10	0	12	
S_5	0	0	0	0	1	
Demand	10	15	12	15	52	52

Step 3: By using VAM take must identity the row or column with largest penalty. If a occurs, break the die arbitrarily choose the cell with smallest cost in that selected row or column and allocate us much as possible to this cells and cross out the satisfied row or column.

Table 5: the proposed method-process 4

Plant	D_1	D_2	D_3	D_4	Supply
S_1	35	15	20	30	14
S_2	25	30	25	35	10
S_3	35	15 15	25	25	0
S_4	15	5	10	0	12
S_5	0	0	0	0	1
Demand	10	0	12	15	52 52

Step 4: we elect the next VAM from the chosen combination and repeat step 3 until all columns and rows are exhausted (Table 6).

Table 6: the proposed method-process 5

Plant	D_1	D_2	D_3	D_4	Supply
S_1	35	15	12 20	2 30	0
S_2	9 25	30	25	1 35	0
S_3	35	15 15	25	25	0
S_4	15	5	10	12 0	0
S_5	0	0	0	0	0
Demand	1 0	0	0	0	52 52

We found that the result by using VAM as:

$$12 \times 20 + 2 \times 30 + 9 \times 25 + 1 \times 35 + 15 \times 15 + 12 \times 0 + 1 \times 0 = \mathbf{785}$$

IV. RESULTS AND DISCUSSION

The transportation case associated with VAM is least and comparatively in row difference and column difference for least cost method in comparison maximization case in transportation problem. We analyze that VAM yields the best starting solution and maximization case in transportation problem yields the convert worst result though it is easier to apply.

V. CONCLUSION

Since Vogel's approximation method result in the most economical maximization case solution, we shall use this method for all transportation problems.

VI. REFERENCES

[1]. Abdallah A.HIayel, Mohammad A.Alia 2012 Solving Transportation problems using the Best Candidates Method CSEIJ International Journal of Computer Science and Engineering, Vol.2, No.5.

[2]. Taghrid, I, Mohamed G, I man S., 2009. Solving Transportation Problem Using Object-Oriented Model.IJCSNS International Journal of Computer Science and Network Security, Vol.9, No.2.

[3]. Er. Prem Kumar Gupta & Dr. D.S. Hira, 2014. Operation Research: Seventh Revised Edition ISBN: 81-219-0281-9.

[4]. Jamal Lmariouh, Nizar EI Hachemi, Driss Bouami, 2012. Transportation problems with plant closure relocation of machines. IJCSI International Journal of Computer Science Issues, Vol.9, Issue 5, No 2, September 2012.