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New Approach to Find Initial Basic Feasible Solution (IBFS) for Optimal Solution in Transportation Problem

Shubham Raval

Department of Industrial Engineering, University of New Haven, West Haven, USA
Email: srava4@unh.newhaven.edu

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Abstract

Minimizing transportation time and getting optimal solutions are always considered as important factors while solving transportation problem. This paper shows a new approach for finding initial basic solution for transportation problem which reduces cost of transportation more than any transportation method such as LCM, northwest, Vogel's approximation and so on. This method has been illustrated by taking an example; afterwards, it compares basic initial feasible solution with other methods IBF and optimal dictate solutions such as MODI and Steppingstone method.

Keywords

Transportation Problem, New Approach for Transportation Problem, Initial Basic Feasible Solution, Minimizing, Transportation Time

1. Introduction

Transportation problem is a special linear programming problem which concerned with minimization of cost and time. Moreover, transportation problem deals with fulfillment of demand by an obstruction of supply accordingly. Transportation problems for minimizing cost have been studied for a long [1] [2].

There are many methods for solving transportation problems such as LCM, Vogel's approximation, Russell's approximation, northwest corner method, row minima, column minima and so on [3].

More than that there are various ways to make transportation cost even more optimal such as MODI method and stepping stone which is known as optimality test.

The application of Transportation problem solution is not applicable for only medical, food storage and public sector, it also deals with military operations, rescue equipment and operation with deals with limited time. In these all applications more reduction of Transportation time is appreciated as it deals with either emergency or human safety. What if there is a way to reduce the transportation time more efficiently than other transportation methods like Northwest corner method, LCM, Rusell's approximation and Vogel's approximation Furthermore, it compares final solution (minimized cost) with others initial basic feasible solution and optimal solution which can be achieved by MODI and steppingstone method.

This paper also verifies this new method by the number of basic variables (M + N − 1). And number of demands should be equal to number of supplies.

2. Proposed Procedure of Finding an Initial Basic Feasible Solution

This paper has assumed that readers are well known with Transportation problems. Moreover, for the recognition this paper assigned a name of this new approach as a Raval's approximation for finding an initial basic feasible solution for minimum cost of transportation is mentioned as below:

Step-1: The number of supply and demand should be equal, and metric should have same number of row and column, if it is not then adding dummy column or row in it.

Step-2: find the number of basic variables by M + N − 1 and select lowest number in the cell accordingly.

Step-3: After selecting a number of basic variables (M + N − 1) and multiply the lowest element from the demand or supply to the corresponding cell.

Step-4: For balancing the demand and supply, whatever we multiply with the cells that should be substitute with corresponding demand or supply. Further, select the second lowest element from the demand or supply and the process continues further.

Step-5: The operation continues until we do not reach the number of basic variables and utilization of all demand and supply.

Step-6: There should not be any negative elements in cells, demand, and supply, or it violates the basic rule of transportation model.

Step-7: Multiplication and submission of cells with corresponding demands and supply forgetting initial basic feasible solution

3. Illustrative: Example

Table 1 shows the time required to transport industrial products from origin to destination. Further it requires to find out optimal solution.

4. Initial Basic Feasible Solution

Step 1: ensuring table is balanced, number of demands is equal to amount of supply. In this case, it is equal hence, table is balanced.

Table 1. Data of example 1. (a) Selection of lowest element from the table; (b) utilization of demand and supply accordingly; (c) selection of second lowest element from the table; (d) utilization of all supply and demand.

Origins	Destinations				Supply
	D1	D2	D3	D4	
A	6	3	5	4	22
B	5	9	2	7	15
C	5	7	8	6	8
Demand	7	12	17	9	45/45

(a)

Origins	Destinations				Supply
	D1	D2	D 3	D4	
A	6	3	5	4	22
B	5	9	2	7	15
C	5	7	8	6	8
Demand	7	12	17	9	45/45

(b)

Origins	Destinations				Supply	
	D1	D2	D3	D4		
A	6	3	5	4	22	
B	5	9	2	7	15	8 − 7 = 1
C	5(7)	7	8	6	8	
Demand	7	12	17	9	45/45	
	7 − 7 = 0					

(c)

Origins	Destinations				Supply	
	D1	D2	D 3	D4		
A	6	3	5	4	22	
B	5	9	2	7	15	
C	5(7)	7	8	6	8	8 − 7 = 1
Demand	7	12	17	9	45/45	
	7 − 7 = 0					

(d)

Origins	Destinations				Supply	
	D1	D2	D3	D4		
A	6	3(12)	5(2)	4(8)	22	22 − 20 = 8
B	5	9	2(15)	7	15	15 − 15 = 0
C	5(7)	7	8	6(1)	8	8 − 7 = 1
Demand	7	12	17	9	45/45	
	7 − 7 = 0	12 − 12 = 0	17 − 15 = 2	9 − 8 = 1		
	0	0	2 − 2 = 0			

Step 2: selecting lowest number from the cells (from top to bottom by m + n − 1).

Where, m = number of rows and n = number of columns. In this case, it is 6 that we must select, number of cells.

Step 3: now, the lowest element from the demand and supply is number 7, moreover, which is the lowest destination which corresponds to demand 7. However, there are two origins which have a number 5, because of that, lowest number of supplies should be selected for getting the lowest number as per optimal solution.

Step 4: selecting second lowest element from demand and supply and repeat the process so on.

Step 5: Operation continues until we do not reach the number of basic variables and utilization of all demand and supply.

Step 6 and step 7: From the table, there is no negative number or elements which violate the basic rule of transportation model. Now, multiplication of the demand/ apply with cells respectively, for getting initial basic feasible solution.

Initial basic feasible solution:

3(12) + 5(2) + 4(8) + 2(15) + 5(7) + 6(1) = 149

In this method, the optimal solution as per IBFS is 149, now this paper's going to compare other transportation method with this solution further this paper also going to compare this initial basic feasible solution of Raval's approximation with optimality test of other transportation method, for proving efficiency of this new method.

5. Result and Discussion

As a result, this paper compares IBFS of Raval's approximation to other transportation methods such as northwest corner method, least cost method, Vogel's approximation method, row minima method, column minima method and Rusell's approximation. Not only it compares the initial basic feasible solution of other methods but it also, compare optimal solution of other method with initial basic feasible solution of Raval's approximation steel result is more efficient than optimal solution of other methods.

Table 2. Comparison of different methods.

METHODS	IBFS	OPTIMALITYTEST (MODI/STEPPING STONE)
LCM	150	149
NWCM	176	149
ROW MINIMA	149	149
COLUMN MINIMA	150	149
RUSELL'S APPROXIMATION	189	149
VOGEL APPROXIMATION	149	149
RAVAL'S APPROXIMATION	149	149

6. Comparative Study

As can be seen from Table 2 that IBFS of other traditional methods varies from 189 to 149. indeed , methods like row minima and Vogel's approximation has 149 as IBFS which is lowest number can be achieve from the table however these two method are lengthy while solving. On the other side as can be observe that Raval's approximation is getting 149 as an IBFS which can be seen in optimality test of others' methods. Moreover, this method requires less number of operation still it gives assuring optimal solution.

7. Conclusion

In this writing, an algorithm has been discussed to solve time minimizing transportation problems. Efficiency of the developed algorithm has also been justified by solving numerical problems. During this process, a comparative study between the proposed method and the other existing methods is also carried out; where it is observed that the proposed method requires a minimum number of iterations to obtain the optimal transportation time. Therefore, the proposed algorithm claims its wide application in optimization in solving the time minizine transportation problem.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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