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A NEW AND EFFICIENT PROPOSITION TO FIND AN INITIAL BASIC FEASIBLE SOLUTION OF TRANSPORTATION PROBLEM

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ABSTRACT: Transportation problem (TP) is mostly related to find the total transportation cost (TC) that minimization through an optimal solution. An initial basic feasible solution (IBFS) is to find out the optimal solution. In this paper a new method to find an initial basic feasible solution of transportation problem. This method is illustrated with some numerical examples using proposition.

Keywords: TP, IBFS, TC, Transportation Table

I.INTRODUCTION

Transportation problem is famous in operation research for its real life applications. This is a special kind of network optimization problems which deals with the determination of minimum cost schedule for transporting a single commodity from a number of warehouses(Supply) to a number of markets(demand). This class of problem is basically a linear programming problem. In the transportation problem, the availability can be equal to the demand (balanced problem), the availability may be superior to the demand and the availability may be less than the demand. If the model is unbalanced, we can always augment it with a dummy source or a dummy destination to restore balance.The basic transportation problem was originally developed by Hitchcock in 1941[1].

Mathematical Formulation for Transportation Problem:

The following notations are used in formulating the TP.

Notations

Supply quantity (S_i) in units from i^{th}supply node; The demand (d_j) in units per unit time

C_{ij} Unit transportation cost from i^{th}supply node to j^{th}demand node; X_{ij}Number of units transported from i^{th}supply node to j^{th}demand node ; mTotal number of supply nodes (suppliers)

nTotal number of demand nodes (buyers);

The basic problem (sometimes called as the general, classical or Hitchcock transportation problem) can be stated mathematically as Min $\sum_{i=1}^{m}\sum_{j=1}^{n} C_{ij}X_{ij}$ Subject to $\sum_{j=1}^{n} X_{ij} \leq S_i$,

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i=1 to m; $\sum_{i=1}^{m} X_{ij} \geq d_j$, j=1 to n; Where $X_{ij} \geq 0$for all i, j. A necessary and sufficient condition for the existence of a feasible solution to the transportation problem is $\sum_{i=1}^{m} S_i = \sum_{j=1}^{n} d_j$. This means that the total supply is equal to total demand. Then the Transportation problem is called as a Balanced Transportation Problem. If not the problem is called as an Unbalanced Transportation Problem. Although, TP can be solved by the simplex algorithm.

II. PROPOSED ALGORITHM:

Step 1: Construct the transportation matrix from the given transportation problem.
Step 2: Whether the TP is balanced or not. If not, make it balanced.
Step 3: Subtract the smallest entry of every row from each of the element of the subsequent row of the transportation table and place them on the left – top of the corresponding elements.
Step 4: Apply the same operation on each of the column and put the value on the left-bottom of the corresponding elements.
Step 5: In the next transportation table, the entries are the summation of left-top and left-bottom elements of step 3 and step 4.
Step 6: Find the smallest cost cell in the transportation table. Allocate $X_{ij} = \min(S_i, D_j)$ at the cell (i ,j). In case of ties, select the cell where maximum allocation can be made. Again in case of same cost cells and allocation values select the cell for which sum of demand and supply is maximum in the original transpotation table. Finally if all these are same, choose the next cell from selected smallest cost cell.
Step 7: Regulate the supply and demand requirement in the respective rows and columns.
Step 8: Repeat Step-6 and 7, in the reduced transportation table until all the demand and supply are exhausted.
Step 9: Finally calculate the total transportation cost of the transportation table. This calculation is the sum of the product of cost and corresponding allocated value of the transportation table.

Numerical Illustration

1) Consider the following Cost minimizing Transportation problem:

	D_1	D_2	D_3	Supply
S_1	6	4	1	50
S_2	3	8	7	40
S_3	4	4	2	60
Demand	20	95	35	150

Applying the proposed method,

$\genfrac{}{}{0pt}{}{5}{3}$ 6	$\genfrac{}{}{0pt}{}{3}{0}$ 4	$\genfrac{}{}{0pt}{}{0}{0}$ 1
$\genfrac{}{}{0pt}{}{0}{0}$ 3	$\genfrac{}{}{0pt}{}{4}{5}$ 8	$\genfrac{}{}{0pt}{}{6}{4}$ 7
$\genfrac{}{}{0pt}{}{1}{2}$ 4	$\genfrac{}{}{0pt}{}{0}{2}$ 4	$\genfrac{}{}{0pt}{}{1}{0}$ 2

The allocation cell values

8	3	15 0	35
0	20 9	20 10	
3	2	60 1	

Total Cost obtained by new method is as follows,
Total Minimum cost = (15*4) + (35*1) + (20*3) + (20*8) + (60*4) =555

III.CONCLUSION

The comparisons of the results are studied in this research to measure the effectiveness of the proposed method.The main aim of this paper is to achieve the optimal transportation cost by using the new method and it is very easy to understand. Based on the optimal solution it allows us to take a decision effectively. The decision maker goes through all the steps of algorithm which makes our approach very useful to solve real problems.

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