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Study of Initial Basic Feasible solution of Transportation Problem

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Abstract:

In this paper our aim is to find the best initial basic feasible solution. To fulfill this aim 7 methods are used to find the initial basic feasible solution of transportation problem. After comparing these methods we concluded that RED (Revised Distribution Method) is suitable for finding optimal basic feasible solution. Transportation problem (TP), that is a special class of the linear programming (LP) in the operation research (OR). The main objective of transportation problem solution methods is to minimize the cost or the time of transportation. So RED method solve this purpose.

Key words: Transportation problem, feasible, basic, RED

Introduction

The transportation problem is a special type of linear programming problem where the objective is to minimize the cost of distributing a product from a number of **sources** or **origins** to a number of **destinations.** In the 1920s A.N. Tolstoi was one of the first to study the transportation problem mathematically. In 1930, in the collection Transportation Planning Volume I for the National Commissariat of Transportation of the Soviet Union, he published a paper "Methods of Finding the Minimal Kilometrage in Cargo-transportation in space". Major advances were made in the field during World War II by the Soviet mathematician and economist Leonid Kantorovich. Consequently, the problem as it is stated is sometimes known as the Monge–Kantorovich transportation problem. The linear programming formulation of the transportation problem is also known as the Hitchcock–Koopmans transportation problem.

The **Transportation Method** of linear programming is applied to the problems related to the study of the efficient transportation routes i.e. how efficiently the product from different sources of production is transported to the different destinations, such as the total transportation cost is minimum.

METHODS TO FIND INITIAL BASIC FEASIBLE SOLUTION

There are so many methods to find the initial basic feasible solution

1. Column Minimum Method

In this method, we start with the first column and allocate as much as possible in the lowest cost cell of column, so that either the demand of the first destination center is satisfied or the capacity of the 2nd is exhausted or both. There are three cases:

a) If the demand of first distribution center is satisfied, cross off the first column and move to the column on the right.

b) If the supply (capacity) of the ith plant is satisfied, cross off the ith row and reconsider, the first column with the remaining demand.

c) If the demand (requirement) of the first distribution center as also the capacity of ith plant are .completely satisfied, make a zero allotment in the second lowest cost cell of the first column. Cross off the column as well as the ith row and move to the second column.

2. **Row Minimum Method**

Row minima methodconsists in allocation as much as possible in the lowest cost requirement at distribution centre is satisfied or both cell of the first row so that either the capacity of the first plant is exhausted or the.

3. **North West Corner Method**

Northwest Corner Method starts in the cell (route) corresponding to the northeast corner, or the upper left, of the tableau . Below is a description of the steps:

Step 1: Allocate the maximum amount available to the selected cell and adjust the associated supply and demand quantities by subtracting the allocated quantity.

Step 2: Exit the row or the column when the supply or demand reaches zero and cross it out, to show that you cannot make any more allocations to that row or column. If a row or a column simultaneously reach zero, only cross out one (the row or the column) and leave a zero supply (demand) in the row (column) that is not crossed out.

Step 3: If exactly one row or column is left that is not crossed out, stop. Otherwise, advance to the cell to the right if a column has just been crossed out, or to the cell below if a row was crossed out. Continue with Step 1.

4. **Matrix Minima Method**

Matrix minimum (Least cost) method is a method for computing a basic feasible solution of a transportation problem, where the basic variables are chosen according to the unit cost of transportation. This method is very useful because it reduces the computation and the time required to determine the optimal solution.

Steps in Matrix Minimum Method for Transportation Problem

1. Identify the box having minimum unit transportation cost (c_{ij}).
2. If the minimum cost is not unique, then you are at liberty to choose any cell.
3. Choose the value of the corresponding x_{ij} as much as possible subject to the capacity and requirement constraints.
4. Repeat steps 1-3 until all restrictions are satisfied

5. **Vogel's Approximation Method**

Vogel's approximation method is an improved version of the minimum cell cost method.

Steps in Vogel's Approximation Method for Transportation Problem

Step 1: Determine a penalty cost for each row (column) by subtracting the lowest unit cell cost in the row (column) from the next lowest unit cell cost in the same row (column).

Step 2: Identify the row or column with the greatest penalty cost. Break the ties arbitrarily (if there are any). Allocate as much as possible to the variable with the lowest unit cost in the selected row or column. Adjust the supply and demand and cross out the row or column that is already satisfied. If a row and column are satisfied simultaneously, only cross out one of the two and allocate a supply or demand of zero to the one that remains.

Step 3:

- If there is exactly one row or column left with a supply or demand of zero, stop.
- If there is one row (column) left with a *positive* supply (demand), determine the basic variables in the row (column) using the Minimum Cell Cost Method. Stop.
- If all of the rows and columns that were not crossed out have zero supply and demand (remaining), determine the basic *zero* variables using the Minimum Cell Cost Method. Stop.

In any other case, continue with Step 1.

6. REDI (Revised Distribution Method)

ALGORITHM OF REDI METHOD

STEP 1 :- Start with the minimum value in the supply column and demand row . If tie occurs, then select the demand or supply value with least cost.

STEP 2 :- Compare the figure of available supply in the row and demand in the column and allocates the units equal to capacity or demand whichever is less.

STEP 3 :- If the demand in the column is satisfied , move to the next minimum value in the demand row and supply column.

STEP 4 :- Repeat steps 2&3 until capacity condition of all the sources demand conditions of all destinations have been satisfied

7. ZERO SUFFX METHOD

ALGORITHM OF ZERO SUFFX. METHOD

STEP 1 :- In a given transportation problem , subtract each row entries of the transportation problem from the row minimum and then subtract each column entries of the resulting TP

STEP 2 :- In the reduced cost matrix there will be at least one zero in each row and column , then find the suffix value of all the zeroes in reduced cost matrix by following simplification , the suffix value is denoted by S, therefore S = {add the costs of nearest adjacent sides of zero / no. of cost added}

STEP 3:- Choose the maximum of S, then supply to that demand corresponding to the cell .

STEP 4 :- After the above step, the exhausted demands (column) or supplies (row)are to be trimmed. The resultant matrix must possess at least one zero in each row and column , else repeat step 1

STEP 5 :- Repeat step 2 & 4 until to find basic solution.

DIFFERENCE BETWEEN REDI AND ZERO SUFFIX METHOD

REDI method is simple and easy to understand as comparatively to Zero Suffix Method.

Zero Suffix Method is long and difficult to understand . This method create a haphazard situation and somebody will be confused to find the solution.

	1	2	3	4	SUPPLY
A	13	18	30	8	8
B	55	20	25	40	10
C	30	6	50	10	11
DEMAND	4	7	6	12	

There are many methods to find initial feasible solution. If we find the initial feasible solution of example 1 by using NWCM , CM , RM , MM , Vogel's , REDI and Zero suffix method then the feasible solution are :-

NWCM - 484

CM - 476

RM - 589

MM – 516

Vogel's – 476

REDI – 412

Zero suffix -412

Conclusion:

Amoung these 7 methods REDI and Zero Suffix method are giving minimum cost so these two methods can be considered as best methods. Since REDI method is easy to use and simple computational facility are required to find the solution so we recommend to use this for further finding optimal feasible solution.

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