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To Obtain Initial Basic Feasible Solution Physical Distribution Problems

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Abstract

The transportation problem involves a large number of shipping routes from several supply origins to several demand destinations. In this paper a new method, named as Dhu-kar method is proposed for find an Initial Basic Feasible Solution (IBFS) for a wide range of Physical distribution problems. A numerical illustration is established and the IBFS of the result yielded by this method. The most attractive feature of this method is very simple arithmetical and logical calculations.

Keywords: Initial Basic feasible Solution, Physical Distribution Problem, Northwest, Least cost, Vogel's, Dhu-Kar.

I. INTRODUCTION

Transportation problems have been widely studied in computer science and operation Research. It is one of the fundamental problems of network flow problem which is usually use to minimize the transportation cost for industries with number of sources and number of destination while satisfying the supply limit and demand requirement. Transportation models play an important role in Logistics and supply-chain management for reducing cost and improving service. In real world applications, the supply and demand quantities in the Transportation problem are sometimes hardly specified precisely because of changing economic conditions. It was first studied by F.L.Hitchcock in 1941, then separately by T.C.Koopmans in 1947 and finally placed in the framework of Linear programming and solved by simplex method by G.B.Dantzig in 1951. Now a day's Transportation problem has become a standard application for Industrial organizations having several manufacturing units, warehouses and distribution centers.

There are several methods available to obtain an initial basic feasible solution. The advantage of this method is that it gives an initial solution which is nearer to an optimal solution. In this paper, We have presented that the proposed method for finding IBFS of a transportation problem, Two numerical examples are presented to prove my clam.

II PRELIMINARIES

Some basic definitions are presented

2.1 The general form of Transportation problem

Minimize (Total cost) $Z = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}$

Subject to the constraints $\sum_{j=1}^{n} x_{ij} = a_{i}, \quad i=1,2,3,\dots,m$

$$\sum_{i=1}^{m} x_{ij} = b_{j}, \quad j=1,2,3,\dots,n$$

$x_{ij} \geq 0$ for all i and j.

2.2 Feasible solution

A feasible solution to transportation is a set of non-negative allocations x_{ij} that satisfies the rim (row and column) restrictions.

2.3 Basic feasible solution

A feasible solution to a transportation problem is said to be a basic solution if it contains no more than m+ n-1 non-negative allocations, where m is the number of rows and n is the number of columns of the transportation problem.

2.4 Optimal solution

A feasible solution that minimizes the transportation cost is called an optimal solution.

2.5 Non-Degenerate Basic feasible solution

A basic feasible solution to a (m x n) transportation problem is said to be a non-degenerate if,

(a) The total number of non-negative allocations is exactly m+n-1 and

(b) These m+n-1 allocations are in independent positions.

2.6 Degenerate Basic feasible solution

A basic feasible solution in which the total number of non-negative allocations is less than m+n-1 is called degenerate feasible solution.

III. DHU-KAR METHOD

In this section, Dhu-Kar method is proposed to find the IBFS of Physical Distribution Problems. The steps of Dhu-Kar method are as follows;

(i) For each row (column) with strictly positive supply (demand). Determine the cardinality of even (odd) set, which is maximum including zero if it is there.

(ii) Identify the minimum variable in that set, allocate as much as possible to the variable with the least unit cost in the selected row or column. Adjust the supply and demand, and cross out the satisfied row or column. If a row and a column are satisfied simultaneously, only one of the two is crossed out, and the remaining row or column is assigned zero supply (demand).

(iii) Repeat the procedure until the entire available supply at various sources and demand at various destinations is satisfied.

3.1 Numerical example

In this section, the Physical Distribution Problems solved in book Gupta. P.K and Hira, D.S [4] and Sharma [7], using the proposed method.

Example 3.1.1

Determine the IBFS to the following Transportation problem

	D_1	D_2	D_3	D_4	Supply
K_1	2	3	11	7	6
K_2	1	0	6	1	1

K_3	5	8	15	9	10
Demand	7	5	3	2	

Solution:

Since $\sum a_i = \sum b_j$ the problem is a balancedTP. Hence there exist a feasible solution. We find the initial solution by proposed method.

	D_1	D_1	D_1	D_1	Supply
K_1	2	3 (4)	11 (2)	7	6
K_2	1	0	6	1	1
K_3	5 (7)	8	15 (1)	9 (2)	10
Demand	7	5 (1)	3	2	

The total transportation cost of the Initial Basic Feasible solution by proposed method calculated as an below

Total cost= 4 × 3+ 2×11+1×0+7×5+1×15+2×9 = 102.

Example 3.1.2

	S_1	S_2	S_3	S_4	Supply
K_1	1	2	3	4	6
K_2	4	3	2	0	8
K_3	0	2	2	1	10
Demand	4	6	8	6	

Solution:

	S_1	S_2	S_3	S_4	Supply
K_1	1	2 (6)	3	4	6
K_2	4 (4)	3	2 (2)	0 (6)	8
K_3	0	2	2 (6)	1	10
Demand	4	6	8	6	

Total cost = 6 × 2+ 2×2+6×0+4×0+6×2 = 28.

3.2 Results and Discussions

The results of the Physical Distribution Problems, chosen in example 4.1, obtained by using the existing method and the DK method are shown in table 1.

Ex	Existing Method			Proposed Method
	North-west Corner	LCM	VAM	
3.1.1	$x_{11} = 6,$ $x_{21} = 1,$ $x_{32} = 5,$ $x_{33} = 3,$ $x_{34} = 2$ Z = 116	$x_{11} = 6,$ $x_{22} = 1,$ $x_{31} = 1,$ $x_{32} = 4,$ $x_{33} = 3,$ $x_{34} = 2$ Z = 112	$x_{11} = 6,$ $x_{22} = 1,$ $x_{31} = 1,$ $x_{32} = 4,$ $x_{33} = 3,$ $x_{34} = 2$ Z = 102	$x_{12} = 4,$ $x_{13} = 2,$ $x_{22} = 1,$ $x_{31} = 7,$ $x_{33} = 1,$ $x_{34} = 2$ Z = 102
3.1.2	$x_{11} = 4,$ $x_{12} = 2,$ $x_{22} = 4,$ $x_{23} = 4,$ $x_{33} = 4,$ $x_{34} = 6,$ Z =42	$x_{12} = 6,$ $x_{23} = 2,$ $x_{24} = 6,$ $x_{31} = 4,$ $x_{33} = 6,$ Z =28	$x_{12} = 6,$ $x_{23} = 2,$ $x_{24} = 6,$ $x_{31} = 4,$ $x_{33} = 6,$ Z = 28	$x_{12} = 6,$ $x_{23} = 2,$ $x_{24} = 6,$ $x_{31} = 4,$ $x_{33} = 6,$ Z = 28

Note:

(i) The above procedure leads to a solution of any one of the existing method.

(ii) Follow the above procedure for even and odd set without finding the cardinality of the set, which provides the solution of any one of the existing method.

IV CONCLUSION

Thus it can be concluded that Dhu-kar method provides an IBFS easily in fewer iterations for the transportation problems. As this method consume less time and is very easy to understand and apply. So it will be very helpful for decision makers who are dealing with logistic and supply chain problems.

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