Available online at www.ijrp.org

International Journal of Research Publications

Investigation of Basic Feasible Solution by Modified Algorithm

Arifuzzaman[1], Md.Rumman Rafi[2], Md. Salehin Ferdous[2], Ariful Islam[3],Maksuda Akter Sawpna[4]

[1]*Department of Mathematics, Fareast International University, Dhaka -1213, Bangladesh*
[2]*Department of Electrical & Electronic Engineering, Fareast International University, Dhaka -1213, Bangladesh*
[3]*Department of Civil & Environmental Engineering, Fareast International University, Dhaka -1213, Bangladesh*
[4]*Department of Mathematics, European University, Dhaka -1213, Bangladesh*

Abstract

A significant undertaking in Operation Research (OR) is to locate the Basic Feasible Solution (BFS) of Transportation Problem (TP). In this, the distribution indicators (DI) have been resolved from the distinction of the biggest unit cost and average value of total unit cost of each row and column .The area of the fundamental cells have been resolved as the biggest entrance of the transportation Table (TT) along the biggest DI**.** The modified technique is delineated with a model alongside the optimality test to legitimize its proficiency. It is seen that the strategy introduced in this is material similarly on the reasonable and lopsided TP with equivalent imperatives**.**

Keyword: BFS, TP, TT, biggest unit cost and average value of total unit cost etc

1. INTRODUCTION

Transportation model assumes an indispensable job to guarantee the productive development and in-time accessibility of crude materials and completed merchandise from sources to goals. Transportation issue is a Linear Programming Problem (LPP) originated from a system structure comprising of a limited number of hubs and circular segments joined to them [2, 5, 8]. The goal of the TP is to decide the transportation plan that limits the all out transportation cost while fulfilling the request and supply limit [1,9,14].In writing, a great number of looks into [1, 3, 13, 6] are accessible to get the fundamental achievable answer for TP with equivalent imperatives. Here we present the common issue of single item to be moved from m causes (production lines) to n goals (stockrooms/deals focuses) wherein and are the limits of the sources and goals separately. There is a consistent called per unit moving expense from the starting point to the goal .There is a variable speaking to the obscure amount to be moved from the beginning to the goal. A few strategies are accessible to accomplish the objective. The outstanding techniques are: Vogel's Approximation Method (VAM) [8, 11, 12], Balakrishnan's variant of VAM [4, 6, 9], Shore's use of VAM [7, 10, 14], H.S. Kasana et. al's. Extreme Difference Method for Transportation [1, 3, 6] are useful for the essential doable arrangement. In this paper, our modified technique which gives preferred BFS over given by the strategies just referenced.

2. Algorithm of the Modified Method

Step 1: Put the row and the column allocation markers just after and underneath the supply limits and request necessities respectively inside first brackets.These are the distinction among the biggest unit cost and average values of complete unit cost of each row and column of TT.In the event that there are at least two biggest components in succession/section, contrast must be taken as zero.

Step 2: Identify the largest distribution indicator and choose the smallest cost element along the largest distribution indicator. If there is more than one smallest element, choose any one of them arbitrarily.

Step 3: Allocate $x_{ij} = \min(a_j, b_j)$ on the left-apex of the best unit cost in the $(i,j)th$ cell of the TT where x_{ij} is the sum to be delivered by the ***i**^th^* factories of *j^th^* items; a_i and b_j are the manufacture capacity and demand requirement of the ***i**^th^* factories and ***j**^th^* manufacture respectively

Step 4: If $a_i < b_j$, leave the i-th row and re-adjust b_j as $b_j^{/} = b_j - a_i$.

If $a_i > b_j$, leave the j-th column and re-adjust a_i as $a_i^{/} = a_i - b_j$.

If $a_i = b_j$, then leave either i-th row or j-th column but not both.

Step 5: Repeat Step1 to 4 until the demand and supply are exhausted.

Step 6: $z = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}$, c_{ij} being the cost elements of the TT where , c_{ij} is the cost unit of i^{th} row and j^{th} column of the TT.

3. Example

An organization fabricates concretes and it has three factories F_1, $F_2$and F_3 in three unique areas, whose weekly generation limits are 30, 50 and 20 measurement tones separately. The organization supplies concretes to its four distribution centres situated at D_1, D_2 ,D_3 and D_4 whose week after week requests are 20, 40, 30 and 10 measurement tones individually. The transportation costs per metric tone of concretes (in thousand dollars) from various processing plants to stock rooms are given beneath in the TT:

Factories	Showrooms				Supply
	D_1	D_2	D_3	D_4	
F_1	1	2	1	4	30
F_2	3	3	2	1	50
F_3	4	2	5	8	20
Demand	20	40	30	10	100

The distribution made by the distinction among the biggest unit cost and average value of total unit cost is

Factories	Warehouse				Capacity of Supply						
	P_1	P_2	P_3	P_4		Row distribution indicator					
F_1	20_1	2	10_1	4	30	1	1	1			
F_2	3	20_3	20_2	10_1	50	0	0	0	0	0	0
F_3	4	20_2	5	8	20	5	0				
Demand	20	40	30	10	100						
Column distribution indicator	1	0	2	5							
	0	0	1	1							
		0	1	1							
		0	1	2							
		0	1								
		0									

The number of basic variables is 6(= 4+3-1) and the basic cells do not contain a loop. Thus the solution obtained in this modified method is a basic feasible solution.

∴ The initial basic feasible solution is

$$x_{11} = 20, x_{13} = 10, x_{22} = 20, x_{23} = 20, x_{24} = 10 \text{ and } x_{32} = 20$$

Therefore, the minimum transportation cost is

Z = 1*20 + 1*10 +3*20 + 2*20 + 1*10 + 2*20

= $180 thousand

3.1 Test for optimality

Evaluation for basic cells:

$$u_1 + v_1 = c_{11}, u_1 + v_1 = 1$$
$$u_1 + v_3 = c_{13}, u_1 + v_3 = 1$$
$$u_2 + v_2 = c_{22}, u_2 + v_2 = 3$$
$$u_2 + v_3 = c_{23}, u_2 + v_3 = 2$$
$$u_2 + v_4 = c_{24}, u_2 + v_4 = 1$$
$$u_3 + v_2 = c_{32}, u_3 + v_2 = 2$$

And we get, u_2=0, $v_2 = 3$,$u_3 = -1$,$v_4 = 1$,$u_1 = -1$,$v_1 = 2$ and $v_3 = 2$

3.2 Evaluation for non-basic cells:

$$\Delta_{12} = u_1 + v_2 - c_{12} = -1 + 3 - 2 = 0$$
$$\Delta_{14} = u_1 + v_4 - c_{14} = -1 + 1 - 4 = -4$$
$$\Delta_{21} = u_2 + v_1 - c_{21} = 0 + 2 - 3 = -1$$
$$\Delta_{31} = u_3 + v_1 - c_{31} = -1 + 2 - 4 = -3$$
$$\Delta_{33} = u_3 + v_3 - c_{33} = -1 + 2 - 5 = -4$$
$$\Delta_{34} = u_3 + v_4 - c_{34} = -1 + 1 - 8 = -8$$

We see that all Δ_{ij} (for i=1, 2, 3 and j=1, 2, 3,4) are negative. Therefore, the initial basic feasible solution found in our method is optimal.

We may conclude that the optimal transportation cost is 180 thousand dollars.

4. Comparison of transportation cost obtained in different methods

Method	Transportation Cost (in thousand dollars)
Modified Method	180
VAM	180
Column Minima	180
Matrix Minima	180
Row Minima	180

5. CONCLUSION

The displayed technique gets an essential possible arrangement of transportation issue with equivalent imperatives. The modified technique can be utilized to take care of a wide range of transportation issue. As a rule it gives better fundamental practical arrangement comparative with the other existing techniques. All the time this technique gives the ideal arrangement legitimately.

References:

[1] Adlakha, V. and K. Kowalski, A Simple heuristic for solving Small Fixed Charge Transportation Problems,Omega,Vol.31,No.3,pp.205-211,2003.

[2] Ahuja, K.K., Production Management, CBS Publishers and Distributors, New Delhi, India ,2007

[3] Balakrishnan, N., Modified Vogel's Approximation Method for Unbalance Transportation problem, Applied Mathematics Letters, Vol.3, No.2,pp.9-11,1990.

[4] Gupta, p.k. and D.S. Hira, Operations Research, S. Chand and Company Ltd. New Delhi,2009.

[5] Kapoor, V.K., Operations Research, Sultan Chand and Sons, New Delhi,2002.

[6] Kasana, H.S. and k.D. kumar, Introductory Operations Research:Theory and Applications, springer international Publications,pp.509-511,2004.

[7] Korukoglu, S and S. Balli, An Improved Vogel's Approximation Method for the Transportation Problem, Association for Scientific Research, Mathematical and Computational Application Vol.16 No.2, 370-381,2011.

[8] Pandian, p. and G. Nataraj, A New Approach for solving Transportation Problems with Mixed constraints, Journal of physical Sciences,Vol.14,pp.53-61,2010.

[9] Ravindran, a., Don T. Phillips james j. Solberg, Operation Research: Principles and Practice , John wiley and sons, New York.

[10] Swarup, k., p.k. Gupta and Man Mohan, Operation Research, Fourteenth Edition, S. Chand and Sons, New Delhi.

[11] Taha, H.A, Operation Research ,An Introduction ,Sixth Edition, Prentice –Hall of India Private Ltd.

[12] www.easycalculation.com/operation-research.

[13] Anderson, Sweeney and Williams. An Introduction to management Science quantitative Approaches to decision making.Chp-7,pp 296 315.

[14] Dr. Ganesh Chandra ray, Operation Research, Transportation and Assignment Problem, PP 56-80.