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MINIMIZATION OF TRANSPORTATION COST IN A TYPICAL WAREHOUSE AND SHOWROOM SCENARIO

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Abstract: Minimizing the cost of transporting products from production and storage locations to demand centers is an essential part of maintaining profitability for companies who deal with product distribution. The transportation problems deals with the transportation of product manufactured at different plants or factories (supply origins) to a number of different warehouses (demand destination). The objective is to satisfy the destination requirements within the plant's capacity constraints at the minimum transportation cost. Transportation problems thus typically arise in situations involving physical movement of good from plants to warehouses, warehouses to warehouses, wholesalers to retailers and retailers to customers. In this paper we are discussing how products are shipped from a typical warehouse to showroom in Bengaluru city and try to get an optimal solution using Operation Research technique.

Index Terms **- Factories, Optimal solution, Showrooms, Transportation products, Warehouses.**

I. INTRODUCTION

The transportation problem itself was first formulated by Hitchcock (1941), and was independently treated by Koopmans and Kantorovich. In fact, Monge (1781) formulated it and solved it by geometrical means. Hitchaxic (1941) developed the basic transportation problem; however, it could be solved for optimally as answers to complex business problem only in 1951, when George B. Dantizig applied the concept of Linear programming in solving the transportation model. Dantzing (1951) gave the standard LP-formulation TP and applied the simplex method to solve it. Since, then the transportation problem has become the classical common subject in almost every textbook on operation research and mathematical programming.

A typical transportation problem is shown in Table 1. It deals with sources where a supply of some commodity is available and destinations where the commodity is demanded. The classic statement of the transportation problem uses a matrix with the rows representing sources and columns representing destinations. The algorithms for solving the problem are based on this matrix representation. The costs of shipping from sources to destinations are indicated by the entries in the matrix. If shipment is impossible between a given source and destination, a large cost of M is entered. This discourages the solution from using such cells. Supplies and demands are shown along the margins of the matrix. As in the example, the classic transportation problem has total supply equal to total demand.

Table 1 – Simple Transportation Table

	D1	D2	D3	Supply
S1	3	1	M	5
S2	4	2	4	7
S3	M	3	3	3
Demand	7	3	5	

II. MATHEMATICAL MODEL

Let m → origins

i^{th} origin possessing a_i units.

n → destinations (n may or may not be equal to m)

destination j requiring b_j units

C_{ij} → cost of shipping one unit product from origin i to destination j

Assumed: total availability $\sum a_i$ satisfy total requirement $\sum b_j$

Minimize total cost of transportation:

$$Z = \sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij}\, c_{ij} \qquad \text{(objective function)}$$

Satisfying both:

1) availability constraints

$$\sum_{j=1}^{n} x_{ij} = a_i \qquad \text{(for } i = 1, 2, \ldots m \text{)}$$

2) Requirement constraints

$$\sum_{i=1}^{m} x_{ij} = b_j \qquad \text{(for } j = 1, 2, \ldots n \text{)}$$

III. Computational Results

In our work we have considered five warehouse and five showrooms of Bengaluru City. Typical distance matrix is given below.

Table 2 – Distance Matrix

Warehouse/ Showrooms	Jaynagar	Indiranagar	J P Nagar	Sadashivnagar	Rajajinagar	SUPPLY
Nelmangala	37	34	46	25	23	100
Whitefield	24	15	24	28	26	125
Electronics City	17	20	16	23	25	115
Bidadi	37	38	34	47	32	175
Hoskote	31	21	34	34	38	160
DEMAND	105	190	146	120	114	

Table 3 – Cost Matrix @ Rs. 12/- per km

Warehouse/ Showrooms	Jaynagar	Indiranagar	J P Nagar	Sadashivnagar	Rajajinagar	SUPPLY
Nelmangala	444	408	552	300	276	100
Whitefield	288	180	288	336	312	125
Electronics City	204	240	192	276	300	115
Bidadi	444	456	408	564	384	175
Hoskote	372	252	408	408	456	160
DEMAND	105	190	146	120	114	

Existing methodology followed to pay the transportation cost is as follows. Calculate the average cost involved for transportation of products from each warehouse to all the showrooms. For example – if we consider Nelmangala as Warehouse then the average cost will be 444+408+552+300+276=396. Similarly calculating all the warehouses, we get the average costs as depicted in below table:

Table 4 – Average Cost Matrix

Warehouse	**Average Cost**	**Total cost to ship the products**
Nelmangala	396	39600
Whitefield	280.8	35100
Electronics City	242.4	27876
Bidadi	451.2	78960
Hoskote	295.6	47296
	TOTAL	**Rs. 228832/-**

We used the existing algorithm to find optimal solution for the same problem statement and this is what our findings are.

Table 5 – OPTIMAL COST

Method	IBFS	Optimal Cost
North West Corner Method	198924	165996
Least Cost Entry Method	169716	165996
Vogel's Approximation Method	167196	165996
	TOTAL	**Rs. 165996/-**

Our solution resulted in savings of Rs. 228832 – Rs. 165996 **= Rs. 62836/-**

IV. CONCLUSION

The Transportation Problem, has been, is and will continue to be a topic for further study and advancement. The advantages that lie in finding and perfecting new methods to obtain the feasible solution effectively are manifold. The objective of transportation problem is to minimize the cost of distribution of product from number of sources or origins to a number of destinations. This approach helps to solve most of the real time transportation problems with multi-objective through an interactive decision making process. By this approach, simultaneously the most possible value of the total costs are minimized, possibility of obtaining lower total costs are maximized.

REFERENCES

[1] Ilija NIKOLIĆ, "TOTAL TIME MINIMIZING TRANSPORTATION PROBLEM" Yugoslav Journal of Operations Research 17 (2007), Number 1, 125-133.
[2] Abdallah A. Hlayel, Mohammad A. Alia, "SOLVING TRANSPORTATION PROBLEMS USING THE BESTCANDIDATES METHOD"
[3] Ramakrishna, C. S. - An Improvement to Goyal's Modified VAM for the Unbalanced Transportaion Problem, JOpl. Res. Soc. Vol. 39, 609-610 (1988).
[4] Sultan, A. - Heuristic for Finding an Initial B. F. S. in Transportation Problems, Opsearch Vol. 25, 197-199(1988).
[5] Pandian, P. and Natarajan, G. - A New Method for Finding an Optimal Solution for Transportation Problems, International J. of Math. Sci. & Engg. Appls. Vol. 4 59-65 (2010).
[6] Sudhakar, V. J., Arunsankar, N. and Karpagam, T. - A New approach for finding an Optimal Solution for Transportation Problems, European Journal of Scientific Research, vol. 68, 254-257 (2012).
[7] Frederick S. Hillier and Gerald J. Lieberman: Introduction to Operations Research: Concepts and Cases, 8thEdition, Tata McGraw Hill, 2005.