

Operation Research In Transportation Using Demand Management

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Abstract

The structure of transportation problem involves a large number of shipping routes from several supply origins to several demand destinations. The objective is to determine the number of units of an item that should be shipped from an origin to a destination in order to satisfy the required quantity of goods or services at each destination centre. This should be done within the limited quantity of goods.

Keyword: - Distance, Time, Balance, Graph, Direct Graph, Multi Graph, Simple Graph, node

1- INTRODUCTION

One important applications of linear programming in the aria of physical transportations of goods and services from several supply demand centers it is easy to mathematically express a transportation problem in terms of an LP model which can be solved by the simplex method. But because it includes a large number of variables and constraints, it takes a long time to solve it however transportation algorithms.

2- UNBALANCED SUPPLY AND DEMAND

For a feasible solution to exist, it is necessary that the total supply must equal the total demand. That is

$$\text{Total Supply} = \text{Total Demand}$$

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$$

But a situation may arise when the total available supply is not equal to the total demand.

The following two cases may arise.

- (a) if the total supply exceeds the total demand. Then an additional column can be added to the transportation table in order to absorb the excess supply. The unit transportation cost for the cells in this column is set equal to zero because these represent product items that are not being made and not being set.
- (b) If the total demand exceeds the total supply, a demand row can be added to the transportation table to account for the excess demand quality. The unit transportation cost here also for the cells in the dummy row is set equal to zero.

Three towns A, B and C required the amount of gravel in this problem received a contract to supply gravel in this table.

Project Location	Weekly requirement (Truck Loads)
A	72
B	102
C	41

The company has 3 gravel pits located in towns x, y and z. The gravel required by the construction projects can be supply by three pits.

The amount of gravel that can be supply by each pit is as follows.

Plant	:	x	y	z
Amount available (truck loads)	:	76	82	77

The company has computed the delivery cost from each pit to each project site. Those costs are shown in the following table.

Project location

		A	B	C
Pit	x	4	8	8
	y	16	24	16
	z	8	16	24

Schedule the shipment from each pit to each project in such a manner that is minimizes the total transportation cost within constraints imposed by pit capacities and product requirements. Also find the minimum cost.

The total plant availability of 235 truckloads exceeds the total requirement of 215 truckloads by 20 truckloads. The excess truckloads capacity of 20 is handled by adding a dummy project location D excess with a requirement equal to 20. We use zero unit transportation cost to the dummy project location. The modified transportations table is shown in table A.

	A	B	C	D	Supply
W	4	8 35	8 41	0	76
Y	16	24 62	16	0 20	82
Z	8 72	16	24 5	0	77
Demand	72	102	41	20	235

Table – A Initial Solution

The initial solution is obtained by using vogel's approximation method as shown in table A. It may be noted that 20 units are allocated from pit x to dummy project location D. this means pit x is short by 20 units.

Now in order to the apply optimality test, calculate u_i s and v_j s corresponding to rows and column respectively in the same way as discussed before. These values are shown in table B.

	A	B	C	D	Supply	U_i
w	4 + 4	+ (35)	8 (41)	8	0	$U_1 = 8$
x	16	24 (62)	16 (+) - 8	0 (20)	82	$U_2 = 24$
y	8 (72)	(5)	16 + 8	24 + 8	0	$U_3 = 16$
Demand	72	102	41	20	235	
V_j	$V_1 = -8$	$V_2 = 0$	$V_3 = 0$	$V_4 = 24$		

Table – B

In table B all opportunity costs d_{ij} are not positive, the current solution is not optimal thus, the unoccupied cell (X, C) where $d_{23} = -8$ must enter into the basis and cell (W, C) must leave the basis, as shown by the closed path. The new solution is shown in table C.

	A	B	C	D	Supply	U_i
w	4 + 4	(76)	8 + 8	8 + 16	0	$U_1 = -16$
x	16 0	24 (21)	16 (41)	0 (20)	82	$U_2 = 6$
y	8 (72)	(5)	16 + 16	24 + 8	0	$U_3 = -8$
Demand	72	102	41	20	235	
V_j	$V_1 = 16$	$V_2 = 24$	$V_3 = 16$	$V_4 = 0$		

Table – C

Since all opportunity costs d_{ij} s are non-negative in table C the current solution is optimal. The total minimum transportation cost associated with this solution is

$$\text{Total Cost} = 8 \times 76 + 24 \times 21 + 16 \times 41 + 0 \times 20 + 8 \times 72 + 16 \times 5 = \text{Rs. } 2424.00$$

3- MAXIMIZATION TRANSPORTATION PROBLEM

In general, the transportation model is used for cost minimization problems. However it is also used to solve problems in which the objective is to maximize total value or benefit. That

is, instead of unit cost C_{ij} , the unit profit or payoff P_{ij} associated with each route, (i, j) is given the objective function in terms of total profit or pay off is then stated as follows.

$$\text{Maximize } Z = \sum_{i=1}^m \sum_{j=1}^n P_{ij} X_{ij}$$

The algorithm for solving this problem is same as that for the minimization problem. However, since we are given profits instead of costs therefore a few adjustments in Vogel's approximation method for finding initial solution by VAM, the penalties are computed as difference between the largest and next largest pay off in each row of column. In this case, row and column differences represent payoffs. Allocations are made in those cells where the payoff is largest corresponding to the highest row or column difference.

Since it is a maximization problem, the criterion of optimality is the converse of the rule for minimization. The rule is A solution is optimal if all opportunity costs d_{ij} for the unoccupied cells are zero or negative.

A company has four manufacturing plants and five warehouses. Each plant manufactures the same product, which is sold at different prices in each warehouse area. The cost of manufacturing and cost of raw materials are different in each plant due to various factors. The capacities of the plants are also different. The relevant data is given in the following table

Item	Plant			
	1	2	3	4
Manufacturing Cost (Rs.) Per Unit	12	10	8	8
Raw Material Cost (Rs.) Per Unit	8	7	7	3
Capacity Per Unit Time	100	200	120	80

The company has five warehouses the sale prices transportation costs and demands are given in the following table.

4- CONCLUSION

The main aim of this paper is to present the importance of operation research theoretical Idea in inventory control. Researcher may get some information related to or and inventory control.

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