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The New Way of Finding Minimum Transportation Cost Diagonal Minima Method

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Abstract: A Transportation model is special type of network model; It deals with sources where a supply of some commodity is available and destinations where the commodity is demanded and also well known as a basic network problem. The classic statement of the transportation problem uses a matrix with the rows representing sources and columns representing destinations. The costs of shipping from sources to destinations are indicated by the entries in the matrix. The solution procedure of such type of problem illustrate in given paper.
Keywords: Transportation problem, source, destination, diagonal minima method

INTRODUCTION

A Transportation model is special type of network model; It deals with sources where a supply of some commodity is available and destinations where the commodity is demanded and also well known as a basic network problem [1-4]. The problem was formalized by the French mathematician Gaspard Monge in 1781 [5]. The Transportation problem is one if the original application of Linear Programming Problem [6]. A Linear programming problem that is concerned with the optimal pattern of the distribution of goods from several points of origin to several different destinations, with the specified requirements at each destination [6-7].

The main objective of transportation problem is to minimize the cost of transportation from the source to destination while satisfying supply as well as demand. Transportation theory is a name given to the study of optimal transportation and allocation of resources.

EXPERIMENTAL

Mathematical Representation of Transportation Problem

A problem concerned with the optimal pattern of the distribution of units of a product from number of several origin to several destinations.

Suppose there are n points of origin $A_1, \ldots, A_i, \ldots, A_n$ and n destinations $B_1, \ldots, B_j, \ldots, B_n$. The point $A_i (i = 1, \ldots, n)$ can supply a_i units, and the destination $B_j (j = 1, \ldots, n)$ requires b_j units. It is assumed that

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

The cost of shipping a unit of the product from A_i to B, is c_{ij}. The problem consists in determining the optimal distribution pattern for which shipping costs are at a minimum.

The requirements of the destinations B_j, $j = 1, \ldots, n$, must be satisfied by the supply of units available at the points of origin A_j, $i = 1, \ldots, n$.

Transportation problems are solved by means of special linear programming techniques.

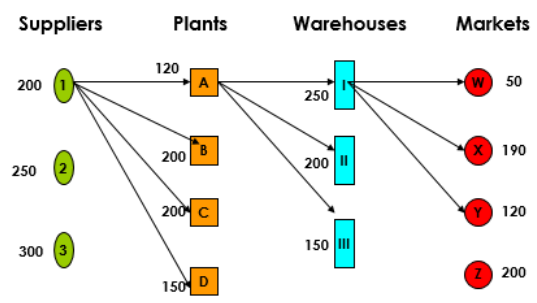

Figure- 1: Diagonal Minima Method

Diagonal Minima Method [8-9]:

The method for Diagonal minima proceeds as follows –

Step -1: Make transportation table for given problem and convert into balance one if it is not.

Step -2: subtract the minimum diagonal element from each diagonal element.

Step -3: after subtracting; put the supply of product according to their demand to the each row minimum.
Step -4: if the supply is satisfy according to their demand than the row Supply is over and if after satisfy demand, supply is remaining then put the remaining value of supply according to their demand on Second minimum row element and this process is followed whenever supply is not over.
Step -5: Satisfy first row supply and demand we can move on second row minimum element and put the supply according his demand and after moving next element of this row, follow this process whenever row supply and demand is not over.
Step -6: Now same process follows on each row whenever all given supply and demand not satisfy.
Step -7: after satisfying demands and supply of each column and row multiply Allocated row or column element with allocation values.
Step -8: add all this multiplied value this is the required transportation cost is given Problem.

Solved Examples:

Example – 1 **Find the minimum transportation cost for given data –**

	A	B	C	D	Supply
X	10	0	20	11	20
Y	12	7	9	20	25
Z	0	14	16	18	15
Demand	10	15	15	20	

Solution - The given transportation problem is balanced type. So start from step – 2

Subtract the minimum diagonal element to each diagonal element.

	A	B	C	D	Supply
X	3	0	20	11	20
Y	12	0	9	20	25
Z	0	14	9	18	15
Demand	10	15	15	20	

Put the supply of product according to their demand to the first row minimum.

	A	B	C	D	Supply
X	$^{5}3$	$^{15}0$	20	11	20
Y	12	0	9	20	25
Z	0	14	9	18	15
Demand	10	15	15	20	

Satisfy the first row supply now we can move on second row minimum element (0) but this column demand are satisfy so we can move second minimum element and follow this process whenever second row supply is not over.

	A	B	C	D	Supply
X	$^{5}3$	$^{15}0$	20	11	20
Y	$^{5}12$	0	$^{15}9$	$^{5}20$	25
Z	0	14	9	18	15
Demand	10	15	15	20	

Same process follow with the next row whenever the whole demand and supply is not satisfy.

	A	B	C	D	Supply
X	$^{5}3$	$^{15}0$	20	11	20
Y	$^{5}12$	0	$^{15}9$	$^{5}20$	25
Z	0	14	9	$^{15}18$	15
Demand	10	15	15	20	

After completion of all allocation the allocated element multiplied by same row element.

Mini Transportation Cost= 5 * 3 + 15 * 0 + 5 * 12 + 15 * 9 + 5 * 20 + 15 * 18
= 15 + 0 + 60 + 135 + 100 + 270 = **580 Rs.**

Therefore the solution of problem is $x_{11} = 5$, $x_{12} = 15$, $y_{11} = 5$, $y_{13} = 15$, $y_{14} = 5$, $z_{14} = 15$ and the transportation cost is = **580 Rs.**

Example -2 Find the minimum transportation cost for unbalanced problem –

	A	B	C	D	Supply
X	10	0	20	11	20
Y	12	7	9	20	25
Z	0	14	16	18	10
Demand	10	15	15	20	

Solution - The given transportation problem is unbalanced type. So first we can balance the given problem

	A	B	C	D	Supply
X	10	0	20	11	20
Y	12	7	9	20	25
Z	0	14	16	18	10
W	0	0	0	0	5
Demand	10	15	15	20	

Subtract the minimum diagonal element to each diagonal element but the minimum diagonal element is zero so the reduced matrix is same.

	A	B	C	D	Supply
X	10	0	20	11	20
Y	12	7	9	20	25
Z	0	14	16	18	10
W	0	0	0	0	5
Demand	10	15	15	20	

Put the supply of product according to their demand to the first row minimum.

	A	B	C	D	Supply
X	$^{5}10$	$^{15}0$	20	11	20
Y	12	7	9	20	25
Z	0	14	16	18	10
W	0	0	0	0	5
Demand	10	15	15	20	

Satisfy the first row supply now we can move on second row minimum element (7) but this column demand are satisfy so we can move second minimum element and follow this process whenever second row supply is not over.

	A	B	C	D	Supply
X	$^{5}10$	$^{15}0$	20	11	20
Y	$^{5}12$	7	$^{15}9$	$^{5}20$	25
Z	0	14	16	18	10
W	0	0	0	0	5
Demand	10	15	15	20	

Same process follow with the next row whenever the whole demand and supply is not satisfy.

	A	B	C	D	Supply
X	$^{5}10$	$^{15}0$	20	11	20
Y	$^{5}12$	7	$^{15}9$	$^{5}20$	25
Z	0	14	16	$^{10}18$	10
W	0	0	0	$^{5}0$	5
Demand	10	15	15	20	

After completion of all allocation the allocated element multiplied by same row element. Mini Transportation Cost

$= 5 * 10 + 15 * 0 + 5 * 12 + 15 * 9 + 5 * 20 + 10 * 18 + 5 * 0$

$= 50 + 0 + 60 + 135 + 100 + 180 + 0$ = **525 Rs.**

Therefore the solution of problem is $X_{11} = 5$, $X_{12} = 15$, $Y_{11} = 5$, $Y_{13} = 15$, $Y_{14} = 5$, $Z_{14} = 5$, $W_{14} = 5$ and the transportation cost is = **525 Rs.**

CONCLUSION:

The Diagonal minima method is easy to use and apply for all type of transportation problem. This method gives a minimum transportation cost as compared to North West Corner Method and Row Minima Method [10] but not give a optimal solution for a given problem.. So it is very useful for decision making.

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