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Applications of Matrices in Transportation Problem

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Definition

Transportation problems are a subset of Linear Programming Problems (LPPs) in which goods are transported from a set of sources to a set of destinations while considering the supply and demand of the sources and destinations, respectively, in order to minimize the total cost of transportation. It is also known as the Hitchcock problem.

Types of Transportation Problems

Balanced

When both supplies and demands are equal

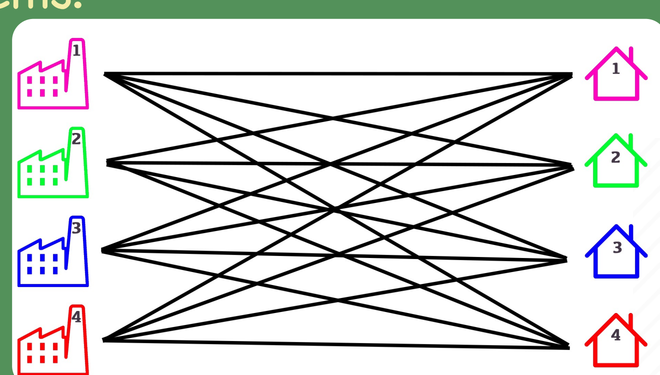
Unbalanced

When both supplies and demands are unequal

Structure of a Transportation problem

We make use of a Matrixes to represent transportation problems.

Let's take an Example:



There are 4 Factories (F) from where we must transport supply (S), according to demand (d) to 4 Destinations (D). So, we write the following in a matrix form as shown where C_{ij} is the cost when the product is delivered from Factory Fi to destination Dj.

In Matrix form

	D1	D2	D3	D4	Supply
F1	C_{11}	C_{12}	C_{13}	C_{14}	S1
F2	C_{21}	C_{22}	C_{23}	C_{24}	S2
F3	C_{31}	C_{32}	C_{33}	C_{34}	S3
F4	C_{41}	C_{42}	C_{43}	C_{44}	S4
Demand	d1	d2	d3	d4	

Matrixes made my work so simple!
Now I can calculate the Total Transportation Cost using Matrix Minima Method

Matrix Minimum Method

Definition

The Matrix Minimum method, also know as Least Count method, is a method for computing a basic feasible solution to a transportation problem in which the basic variables are selected based on the unit cost of transportation. This method is extremely useful because it reduces the computation and time required to find the best solution.

Let's Take an Example.

Factory	Destination				Supply
	1	2	3	4	
1	3	5	7	6	50
2	2	5	8	2	75
3	3	6	9	2	25
Demand	20	20	50	60	

1) We First Look for the minimum transportation cost in the matrix.

2) We then fulfill the demand of the respective minimum cost by subtracting the demand from the supply.

Factory	Destination				Supply
	1	2	3	4	
1	3	5	7	6	50
2	$2^{(20)}$	5	8	2	~~75~~ 55
3	3	6	9	2	25
Demand	~~20~~	20	50	60	

3) We now observe that c_{24}=2, is the minimum transportation cost, so x_{24} = 55. The supply for the respective row is now exhausted.

Factory	Destination				Supply
	1	2	3	4	
1	3	5	7	6	50
2	$2^{(20)}$	5	8	$2^{(55)}$	~~75~~
3	3	6	9	2	25
Demand	~~20~~	20	50	~~60~~ 5	

4) We continue the above procedure until the demand is fully exhausted and utilized by the given supply.

Factory	Destination				Supply
	1	2	3	4	
1	3	$5^{(20)}$	$7^{(30)}$	6	~~50~~
2	$2^{(20)}$	5	8	$2^{(55)}$	~~75~~
3	3	6	$9^{(20)}$	$2^{(5)}$	~~25~~
Demand	~~20~~	~~20~~	~~50~~	~~60~~	

The Total Transportation Cost is:
= (2x20) + (5x20) + (7x30) + (9x20) + (2x55) + (2x5)
= ₹ 650

Note:
The formula for the number of variable is:
Factories + Destinations - 1

In this case:
3 + 4 -1 = 6

References

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