# Transportation Problem

**By**

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**Definition** – The transportation problem is to transport various amounts of a single homogeneous commodity, that are initially stored at various origins to different destinations in such a way that the total transportation cost is minimum.

https://youtu.be/WZIyL6pcItY

**Mathematical Formulation-**

Consider a transportation problem with m origins(rows) and n destinations(columns).

Let $c_{ij}$ be the cost of shipping (transporting) one unit of the product. A.ai be the quantity of commodity available at origin i. $b_j$ the quantity o commodity needed at destination j .Above TP can be stated in the table form as

| | | Destinations | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | | j | | n | Availability |
| **Origins** | 1 | $x_{11}^{c11}$ | $x_{12}^{c12}$ | …… | $xij^{cij}$ | | $x_{n1}$ | $a_1$ |
| | 2 | $x_{21}$ | $x_{22}$ | | $x_{2j}$ | | $x_{n2}$ | $a_2$ |
| | | I | | | | | | |
| | i | $x_{i1}$ | $x_{i2}$ | ……. | $x_{ij}$ | | $x_{in}$ | $a_i$ |
| | | | | | | | | |
| | m | $x_{m1}$ | $x_{m2}$ | ……. | $x_{mj}$ | | $x_{mn}$ | $a_m$ |
| **Demand** | $b_1$ | $b_1$ | $b_2$ | | $b_j$ | | $b_n$ | $\sum_{i=1}^{m} a_i = \sum_{i=1}^{n} b_j$ |

**The linear programming problem of TP is given by**

Minimize $Z = \sum_{i=1}^{m} \sum_{j=i}^{n} c_{ij}\, x_{ij}$

Subject to constraints

$\sum_{j=1}^{n} x_{ij} = a_i$ i = 1,2,…..m (Row sum)

$\sum_{i=1}^{m} x_{ij} = b_j$ j= 1,2……n (Column sum)

$x_{ij} \geq 0$ for all i and j

The given TP is said to be balanced if $\sum_{i=1}^{m} a_i = \sum_{i=1}^{n} b_j$

i.e. if total demand is equal to total supply.

**Feasible Solution**: Any set of non-negative allocations (xij >0) which satisfies the satisfies the row and column sum (rim requirement) is called a feasible solution.

**Basic Feasible Solution**: a feasible solution is called a ‘ basic feasible Solution’ if the number of non-negative allocations is equal to m+n-1, where m is the number of rows and n the number of columns in a transportation table.

**Non-degenerate Basic Feasible solution**: Any feasible solution to transportation problem containing , origins and n destinations is said to be “ non –degenerate “ if it contains m+n-1 occupied cells and each allocation is in an independent position.

# Thank You….!