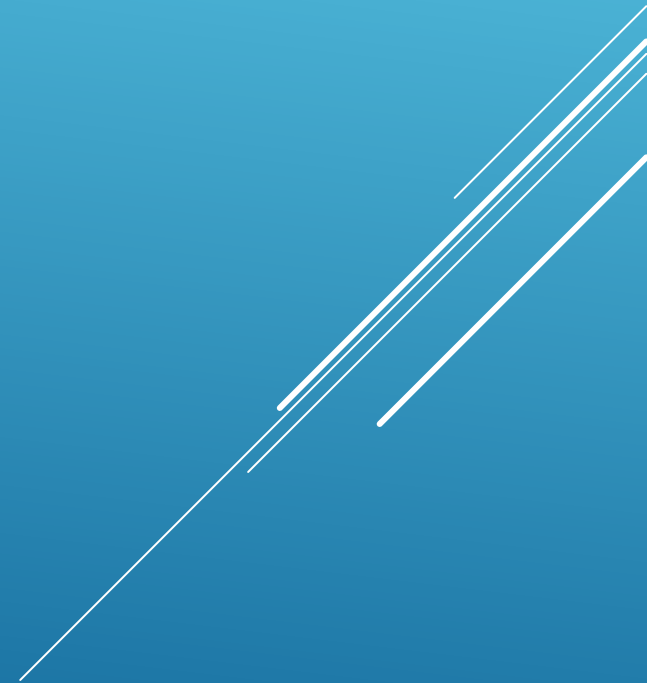


# **Transportation Problem**

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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/WZlyL6pcItY>

A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

## 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.  $A_i$  be the quantity of commodity available at origin  $i$ .  $b_j$  the quantity of commodity needed at destination  $j$ . Above TP can be stated in the table form as

	Destinations							
	1	2	.....	j	.....	n	Availability	
Origins	1	$x_{11}^{c11}$	$x_{12}^{c12}$	.....	$x_{1j}^{c1j}$	.....	$x_{1n}$	$a_1$
	2	$x_{21}$	$x_{22}$	.....	$x_{2j}$	.....	$x_{2n}$	$a_2$
	.....	.....	.....	.....	.....	.....	.....	.....
	i	$x_{i1}$	$x_{i2}$	.....	$x_{ij}$	.....	$x_{in}$	$a_i$
	.....	.....	.....	.....	.....	.....	.....	.....
	m	$x_{m1}$	$x_{m2}$	.....	$x_{mj}$	.....	$x_{mn}$	$a_m$
Demand	$b_1$	$b_2$	.....	$b_j$	.....	$b_n$	$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$	

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

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

Subject to constraints

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

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

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

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

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

**Feasible Solution:** Any set of non-negative allocations ( $x_{ij} > 0$ ) which 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  $m$  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....!

