Linear Programming Problem – Optimization Problem

Example: Consider a chocolate manufacturing company which produces only two types of chocolate – A and B. Both the chocolates require Milk and Choco only. To manufacture each unit of A and B, following quantities are required:

- Each unit of A requires 1 unit of Milk and 3 units of Choco
- Each unit of B requires 1 unit of Milk and 2 units of Choco

The company kitchen has a total of 5 units of Milk and 12 units of Choco. On each sale, the company makes a profit of

- Rs 6 per unit A sold
- Rs 5 per unit B sold.

Now, the company wishes to maximize its profit. How many units of A and B should it produce respectively?

Solution: The first thing I'm gonna do is represent the problem in a tabular form for better understanding.

	Milk	Choco	Profit per unit
A	1	3	Rs 6
B	1	2	Rs 5
Total	5	12	

Let the total number of units produced of A be = X
Let the total number of units produced of B be = Y
Now, the total profit is represented by Z
The total profit the company makes is given by the total number of units of A and B produced multiplied by its per unit profit Rs 6 and Rs 5 respectively.

Profit: Max Z = 6X+5Y

which means we have to maximize Z.
The company will try to produce as many units of A and B to maximize the profit. But the resources Milk and Choco are available in limited amount.
As per the above table, each unit of A and B requires 1 unit of Milk. The total amount of Milk available is 5 units. To represent this mathematically, **X+Y ≤ 5**
Also, each unit of A and B requires 3 units & 2 units of Choco respectively. The total amount of Choco available is 12 units. To represent this mathematically, **3X+2Y ≤ 12**
Also, the values for units of A can only be integers.
So we have two more constraints, **X ≥ 0 & Y ≥ 0**
For the company to make maximum profit, the above inequalities have to be satisfied.
This is called formulating a real-world problem into a mathematical model.

LPP problem is
X- total number of units produced of A
Y- total number of units produced of B
Z- Profit

Max Z = 6X+5Y

s.t X+Y ≤ 5
3X+2Y ≤ 12
X ≥ 0 & Y ≥ 0

min. −6X −5Y.

A [1 1 ; 3 2]
b = [5 12]
lb [0 0] ub = [ ]
Aeq = [ ]
beq = [ ]

3X+2Y = 0

Z = −27 = 27
x1 = 2