Introduction to DSA

Data Structure and Algorithm

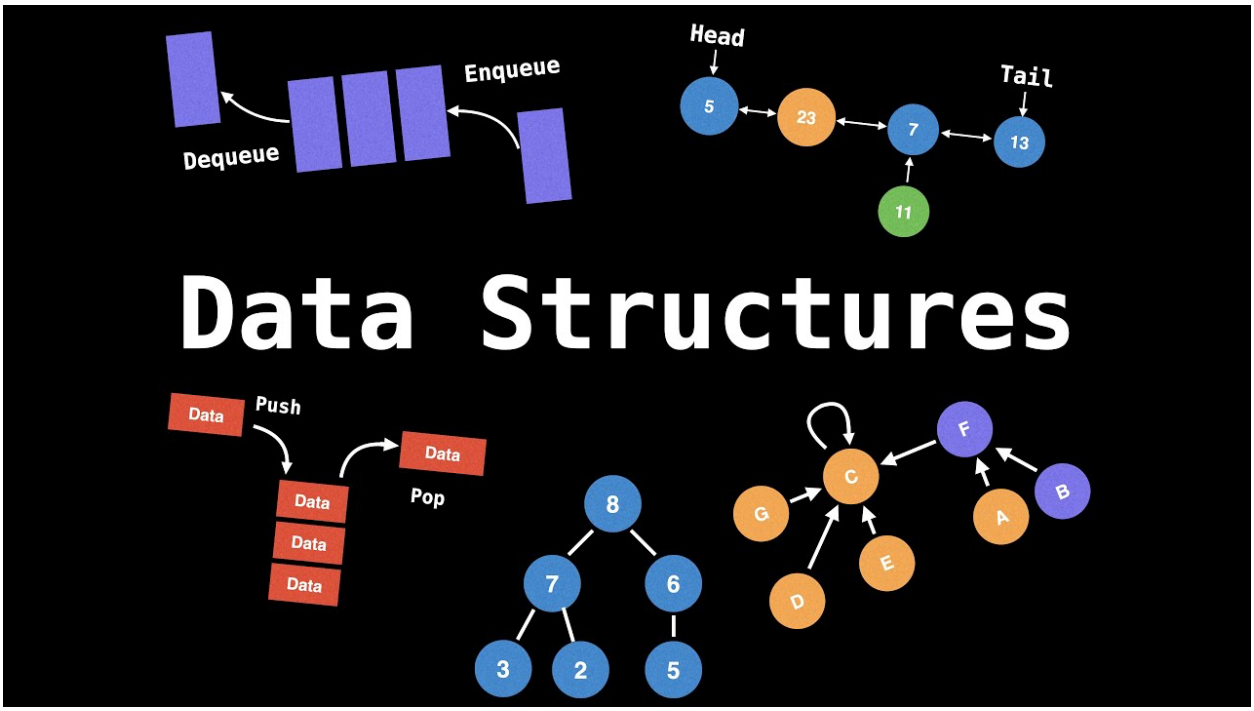
Data

- In the real world, we use to deal with data. As we used a lot of applications like WhatsApp, Instagram, browser, etc.
- Getting the data is not important, the main problems are
  1. how we store it and
  2. how we do analysis on it, to produce some meaningful results

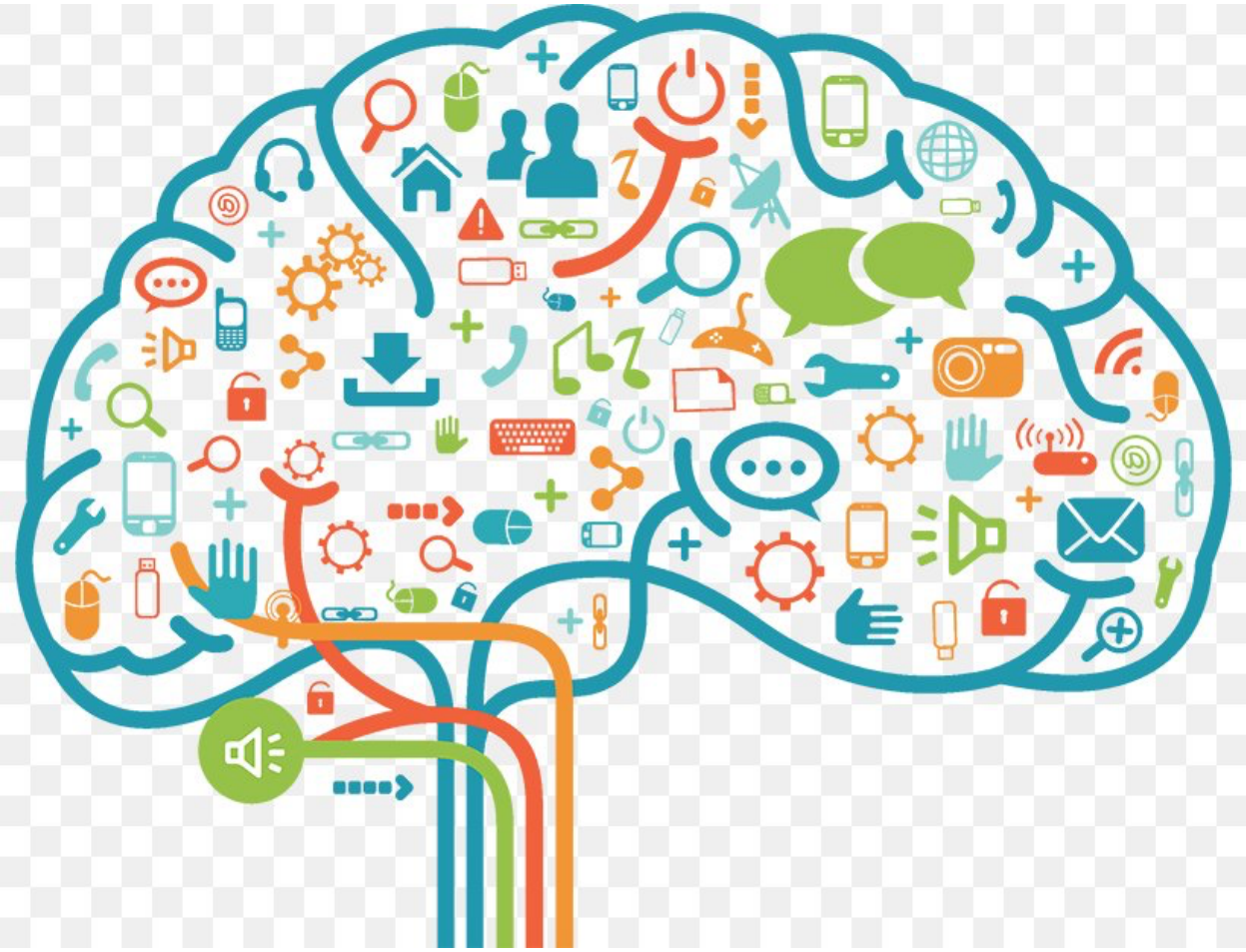
For Example :

- Using past Weather Forecasting data, we can analyze that data using tools and perform meaningful predictions on that and produce results about future weather conditions.
- Using Past Customer data, we can analyze what products customer use to buy more often.

1. To Store the Data, we need Data Structure



2. To Analyze the data, we need an Algorithm



Let’s try to understand how we store the data using data structure but before that Let’s understand Data Structure.

What is Data Structure?

Since Everybody loves food, let’s start with the kitchen

1. Masala Jar

- In our home kitchen, we use to have a lot of masalas.
- There are different ways of storing that different kind of masala:

What will be the best way to store them?

Let’s see a different approach to storing these masalas

1. **Use Jar**

- we can use jars, to store those masalas.
- Every time whenever we need any particular type of masala, we will first search it and then use it directly.

b. **Use Single Box**

- we can use a single Masala Box that has multiple sections.
- Each section will store a particular kind of masala.

The second way is a better way because lot of masalas need to be used at the same time while cooking various dishes (and in small quantities).

However jars are better for dry fruits or namkeens - because mostly one of them is consumed at a time.

Basically the type of DS to be used is determined by the Purpose for which it is needed!

2. Big Bazaar

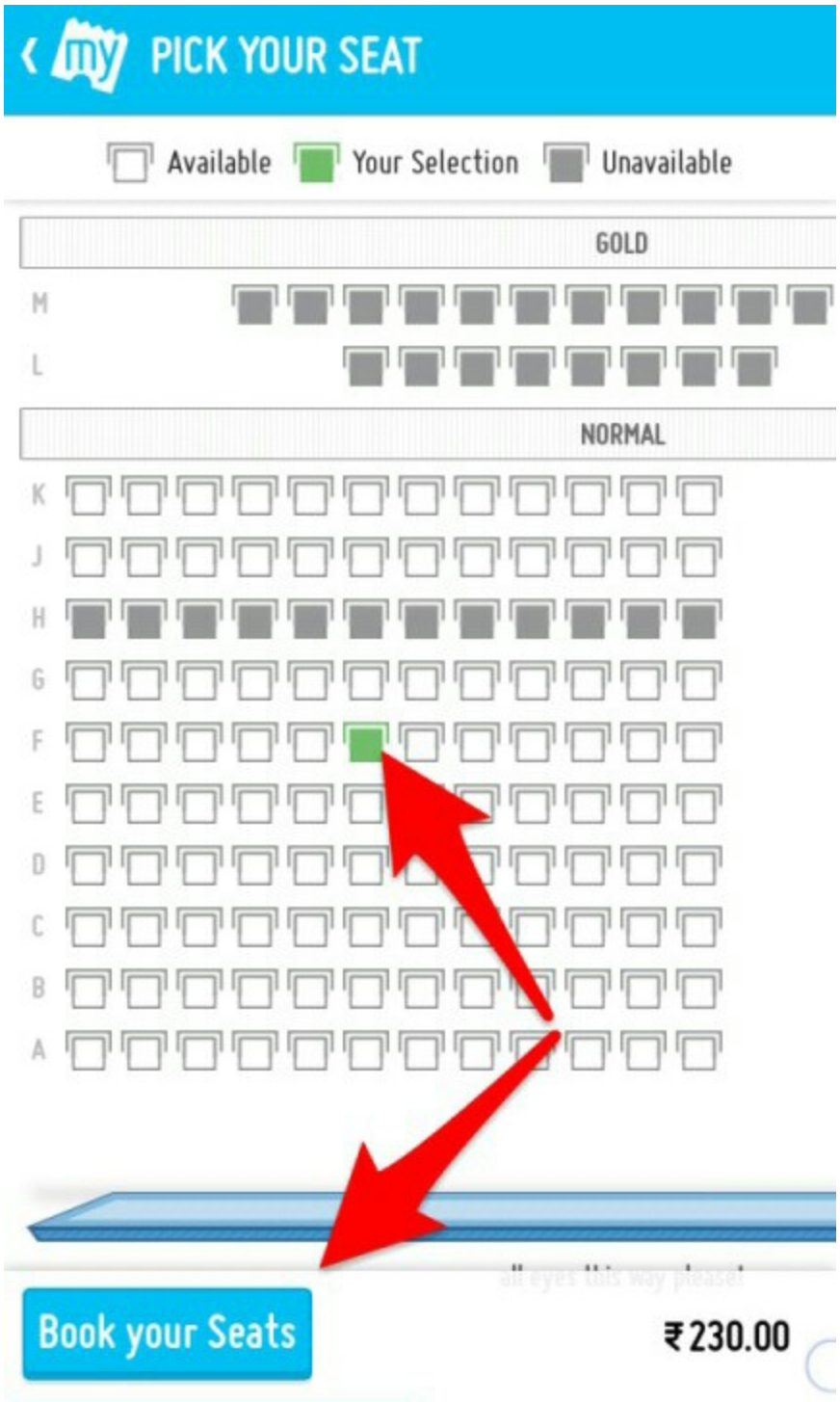
- Suppose you went to the big bazaar because you want to do some shopping.
- On entering, I will be having multiple choice of carrying the bucket.
    - Small Size Bucket
    - Medium Size Bucket
    - Trolley

- Which one of the above you will carry depends upon the quantity of items, I want to buy.
- If I want to buy less no. of items, then I will use Small Size Bucket, If I want to buy large no of items, in that case I can use the trolley.

3. Book My Show

- Most of people use Book my show application, to select the seats when they go for watching movie.

- Whenever we book the seats, we already know there is particular arrangement is use that is in a matrix form.
- we use 2d arrays



1. Which Data Structure we use to store our money ?

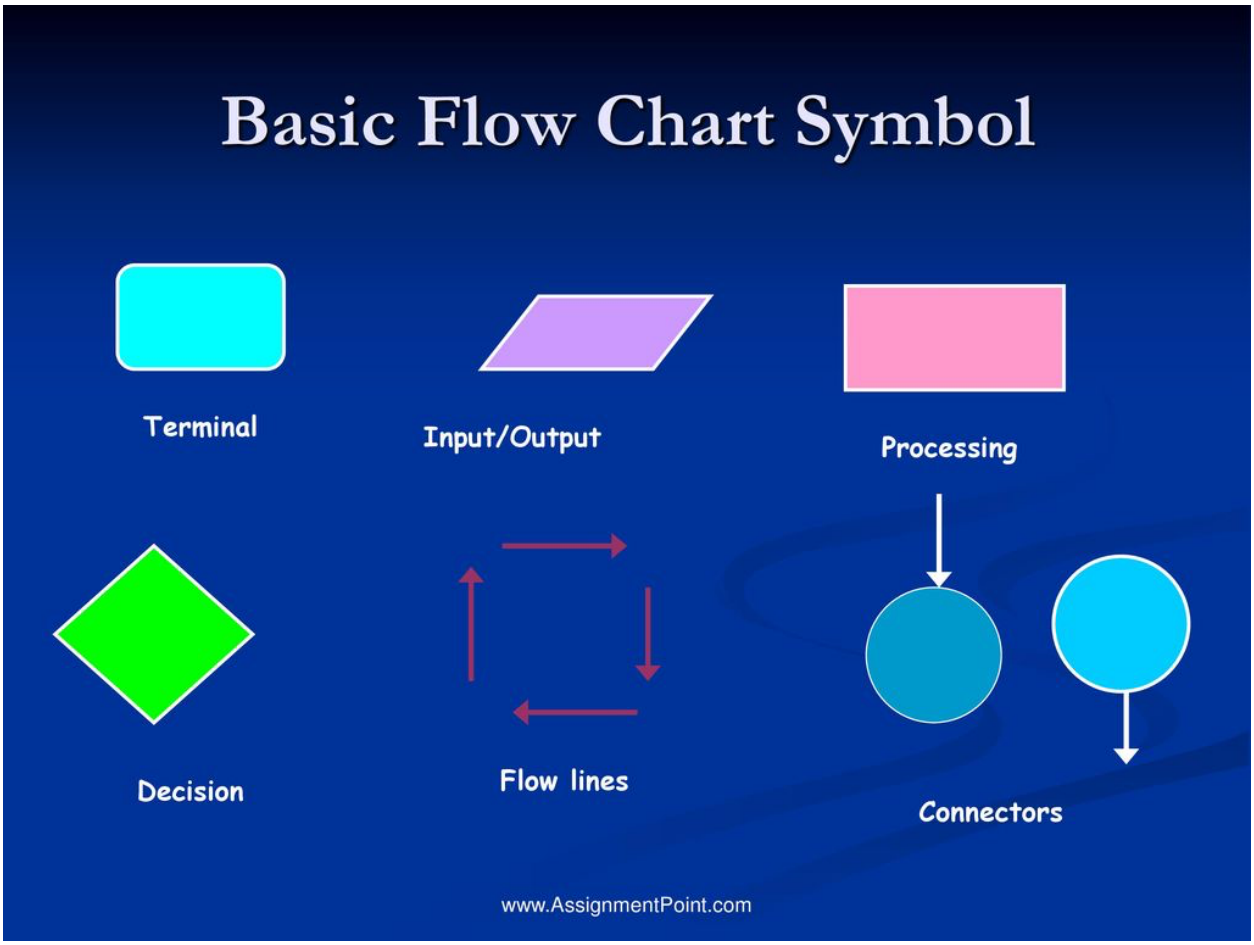
1. Wallet : Can hold less amount but portable
2. Bank : Can hold Large amount but not portable
3. Locker (Home Safe)

- It depends on the amount of money we have, if it is less amount then we can use the wallet, If we have lot of money we use to prefer to put in bank.

2. Which Data Structure we use to store our stuff ?

1. Drawer
2. Cupboard
3. Backpack
4. Suitcase
5. House

Flowchart Convention

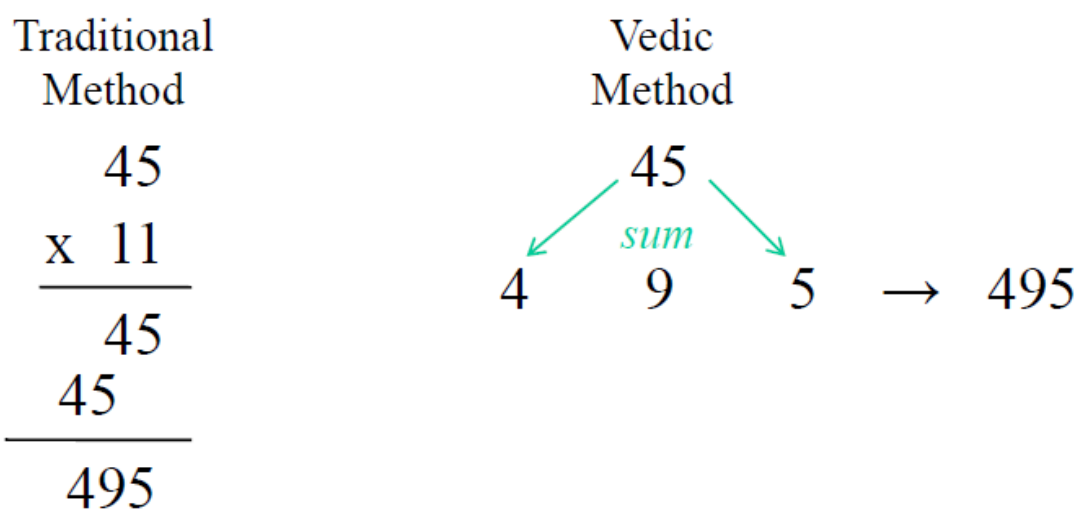


Algorithm

- Algorithm is a way to Analyse data or perform tasks on it.
- You may have heard of “Algorithms” for the first time but you have been using it all your life!

1. Mathematical Operations

- Let’s consider a problem of multiplication, of multiplying two numbers i.e 45 X 11
- we will solve it using Traditional Method and Vedic Method.



Note

- Traditional way : Take time
- Vedic Maths way : Faster and Efficient

There can be different Algorithms to perform the same task. Some will be more efficient than others.

2. Exam Paper

During our exams, every student follows different algorithm to solve the question.

- Some students start solving from first to last.
- Some students start solving from last to first.
- Some students solve 1 mark question first and then later 2 mark question

3. Other Algorithms

- Restaurant Orders : Starters first, then Main Course
- Tic Tac Toe
- Chess

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Some of the most famous / groundbreaking Algorithms:
- One QR for All UPI (by Bharat Pe)
- Google Earth
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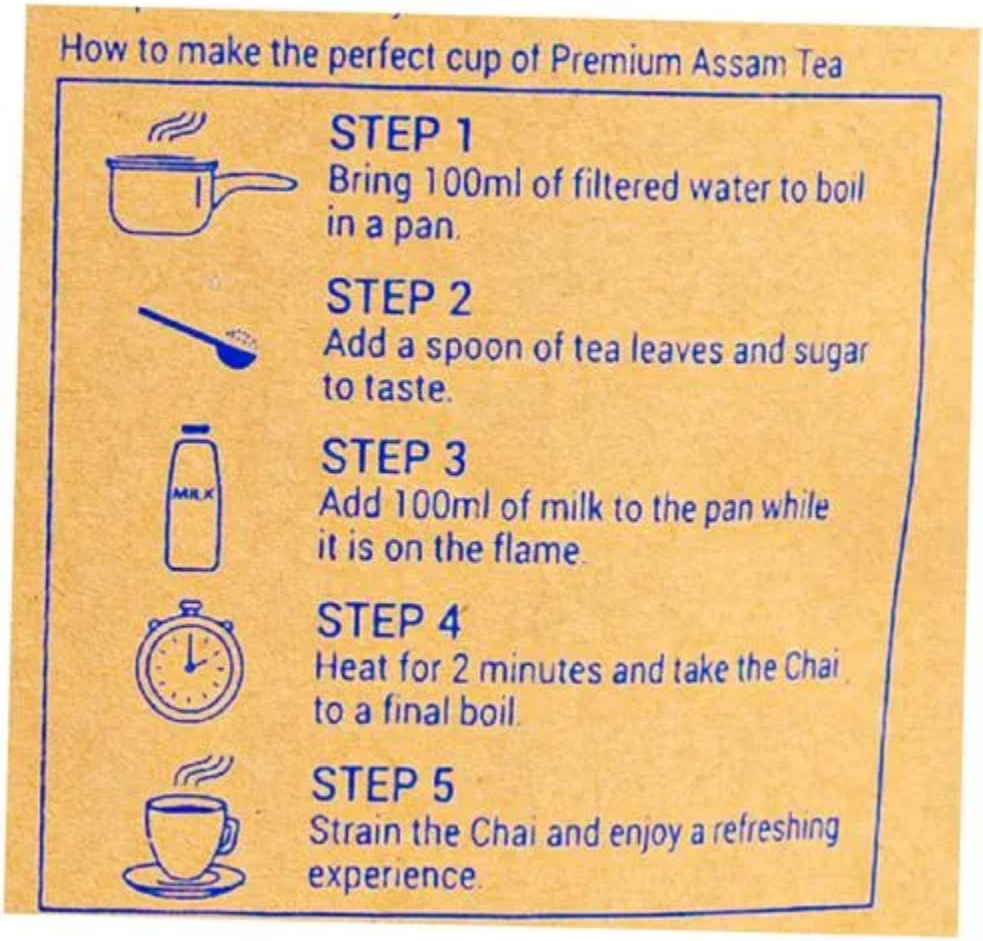
Lets say a friend asks you to share your tea recipe. You would probably write it and give it.

Mom Recipe of making Tea

1. Add water
2. Add some tea and sugar
3. Add milk
4. Heat for Some time

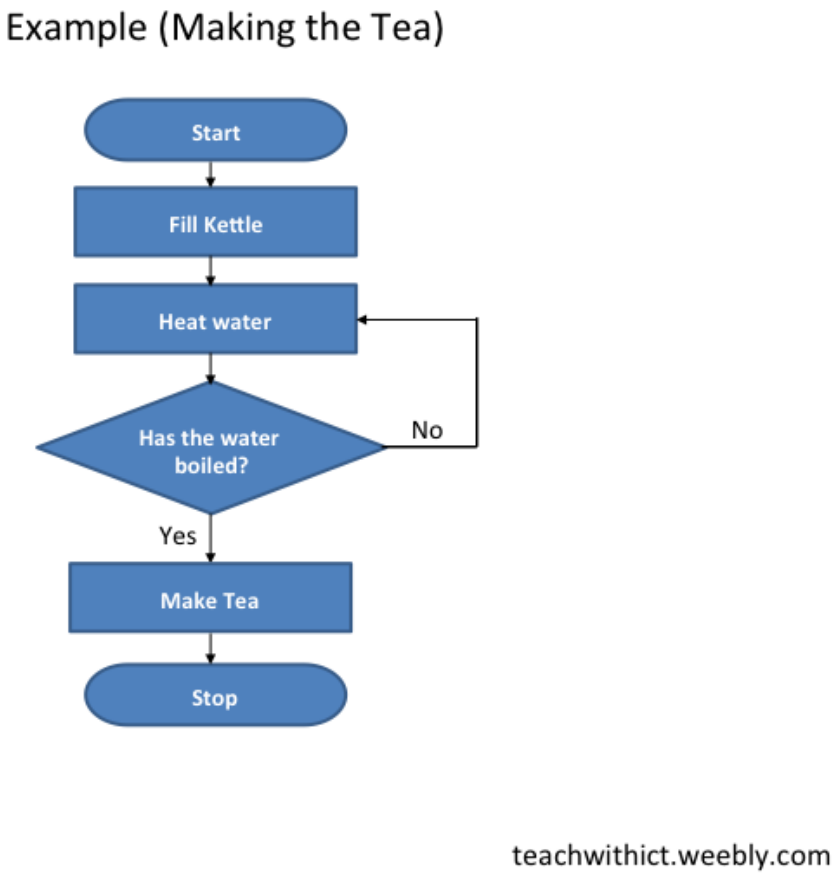
- The problem with this recipe is that it holds lot of **Ambiguous Instruction** like in Step 2 we mention Add some tea and sugar, but How much ? its not clear

Lets see a precise Recipe for tea



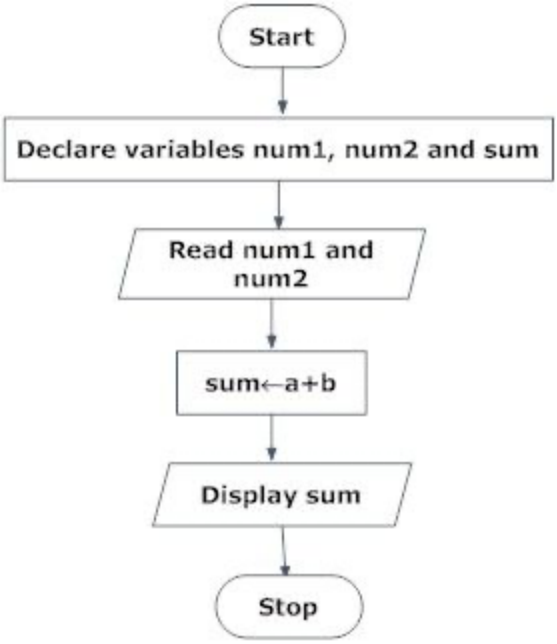
For computers to solve problems, a very Precise set of instructions needs to be given!

- **An Algorithm is a Precise set of instructions.**
- There's a shorter and standard way of representing an Algorithm - Flowchart!

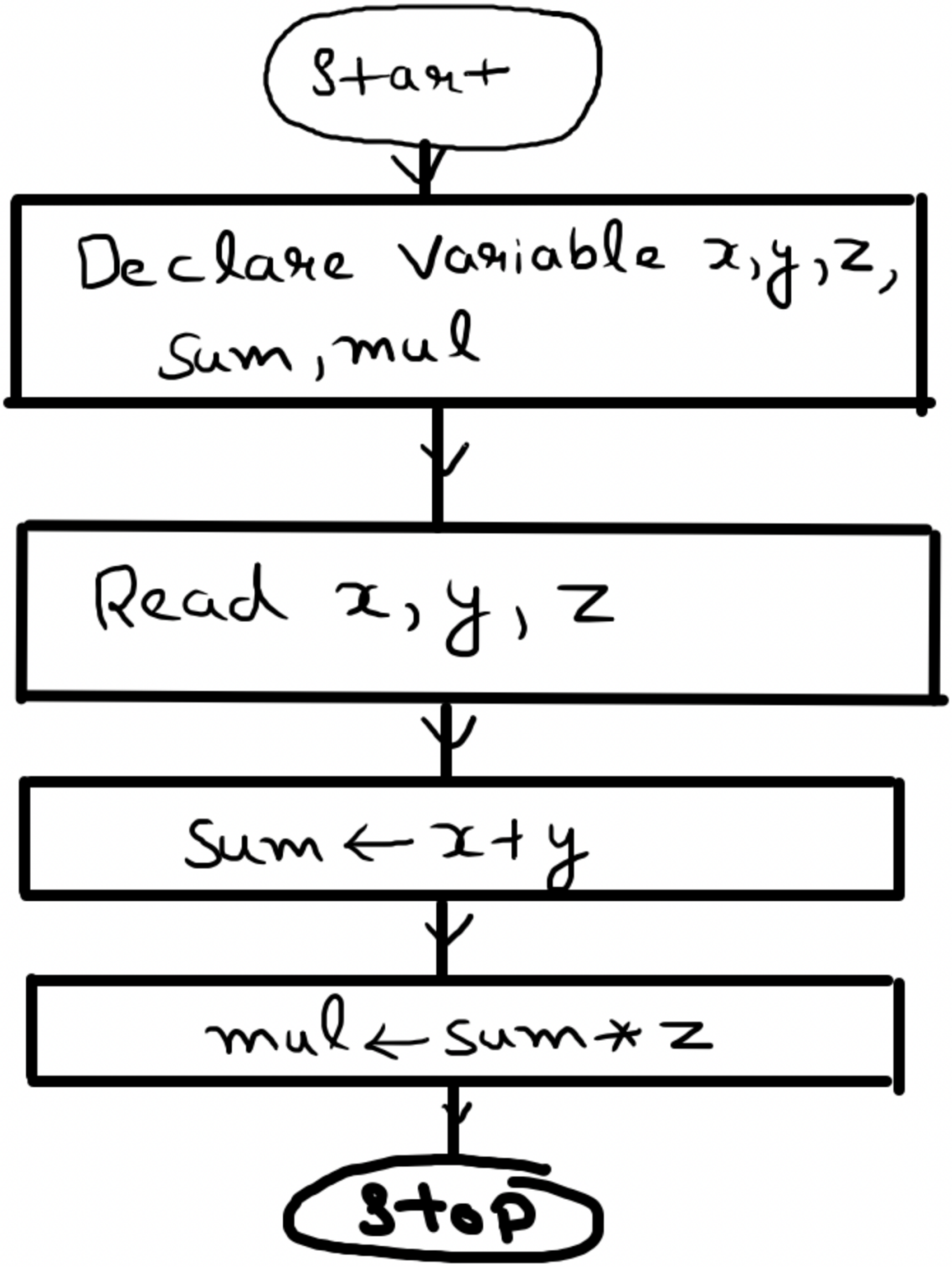


Flowchart

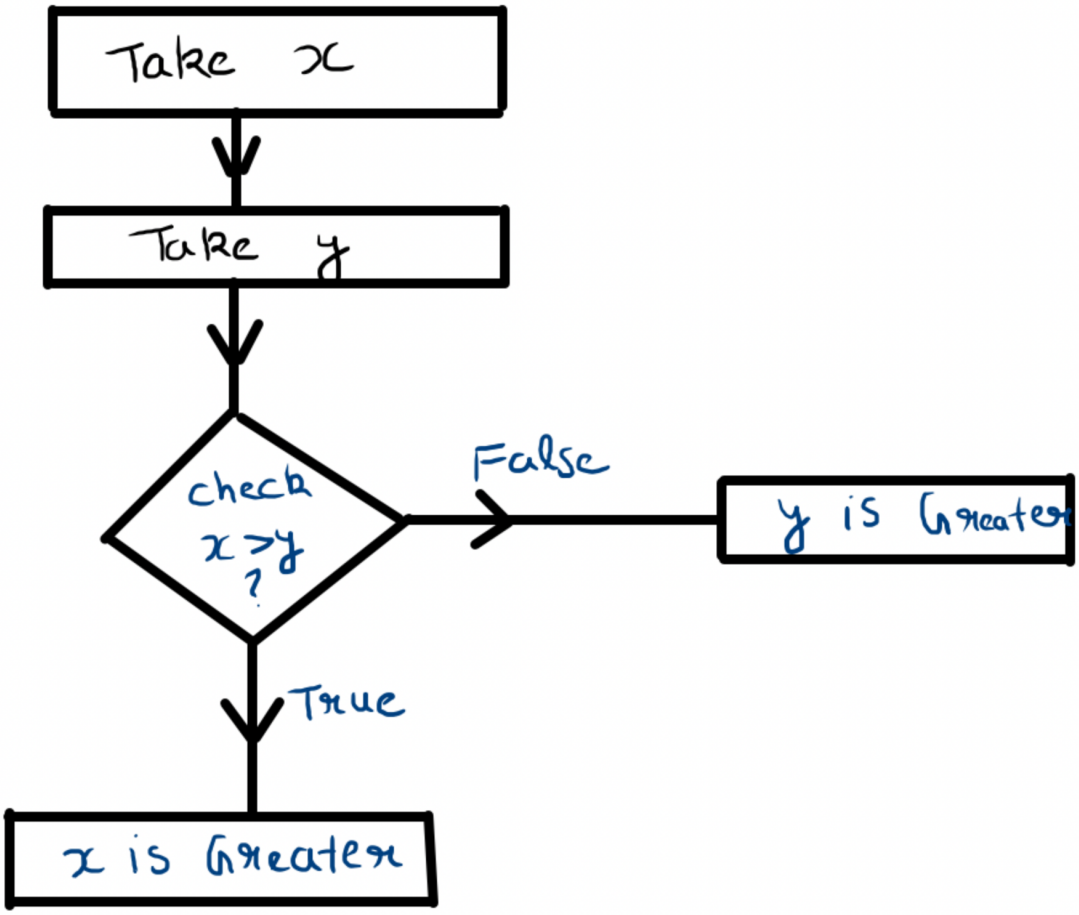
Given Two numbers, you have to print their sum



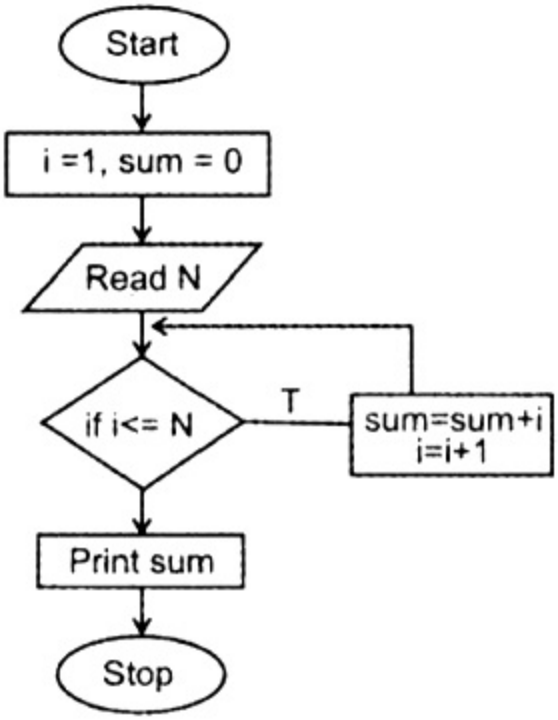
Given Three numbers , calculate the sum of first two numbers and multiply with the third and print the result.



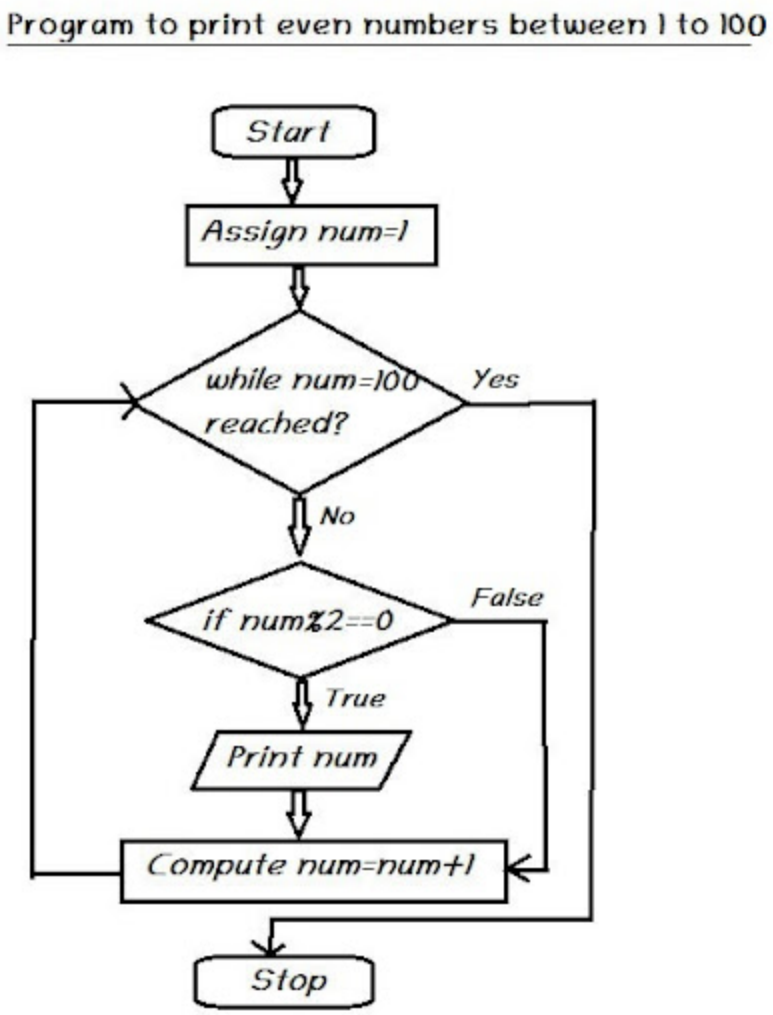
Given Two numbers , find which one is greater)



Print sum of first n numbers (loops)



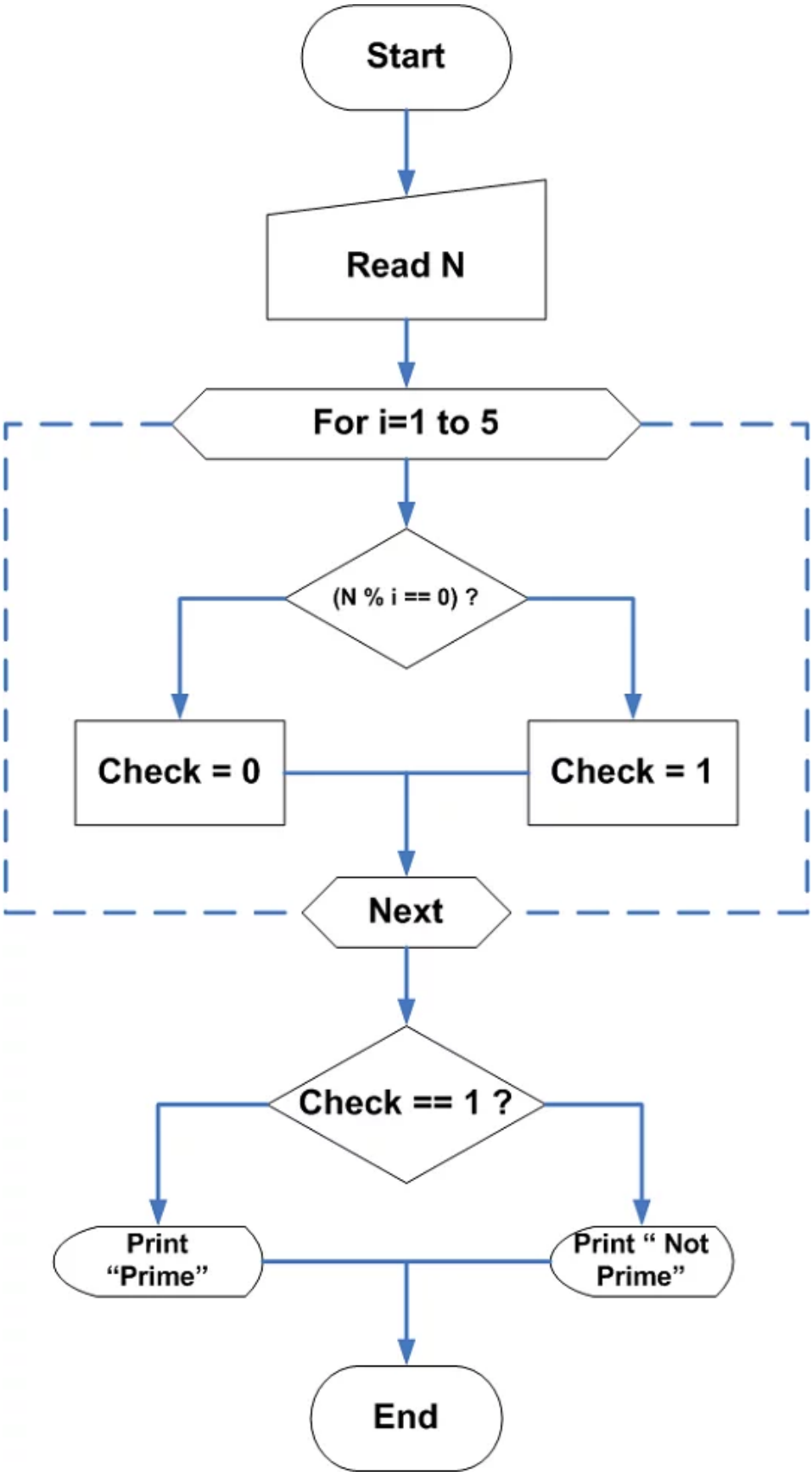
Print even numbers between 1 to 100



Fix the given Algorithm / Flowchart

Test if given number is prime.

1. Run this flowchart for 4, 7, 9
2. Did you notice a mistake? Fix it and share the updated Flowchart.
3.


Start
Read N
For i=1 to 5
(N % i == 0) ?
Check = 0
Check = 1
Next
Check == 1 ?
Print "Prime"
Print " Not Prime"
End