January 16, 2016

Crux

Lecture -1

Basics of Problem Solving
Flowcharts & Pseudocode

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CODING BLOCKS

Course Content

- Basics of Problem Solving
- Programming Fundamentals
- Object Oriented Programming
- Data Structures

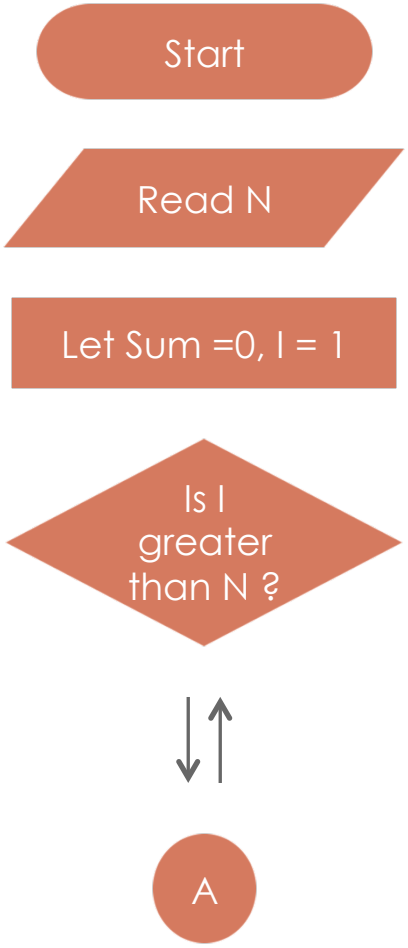
Logistics

- Facebook Group
- Laptops
- Assignments

What is a flowchart?

- Diagrammatic representation illustrating a solution to a given problem.
- Allows you to break down any process into smaller steps and display them in a visually pleasing way.

Flowchart Components



Terminator

Input / Output

Process

Decision

Arrow

Connector

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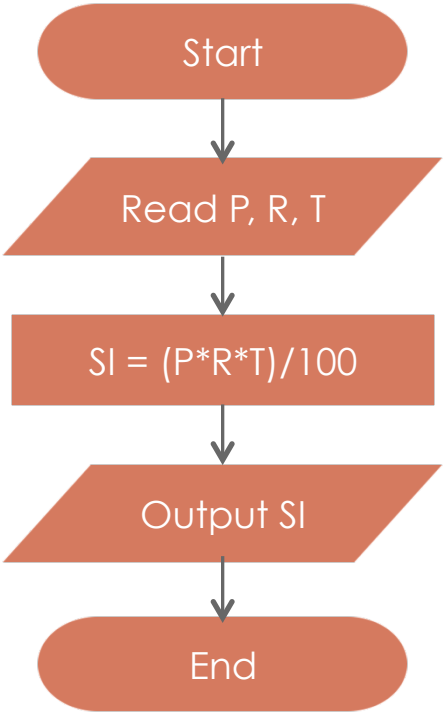
Lets look at few problems and their flowcharts!

Read Principal, Rate & Time and Print SI



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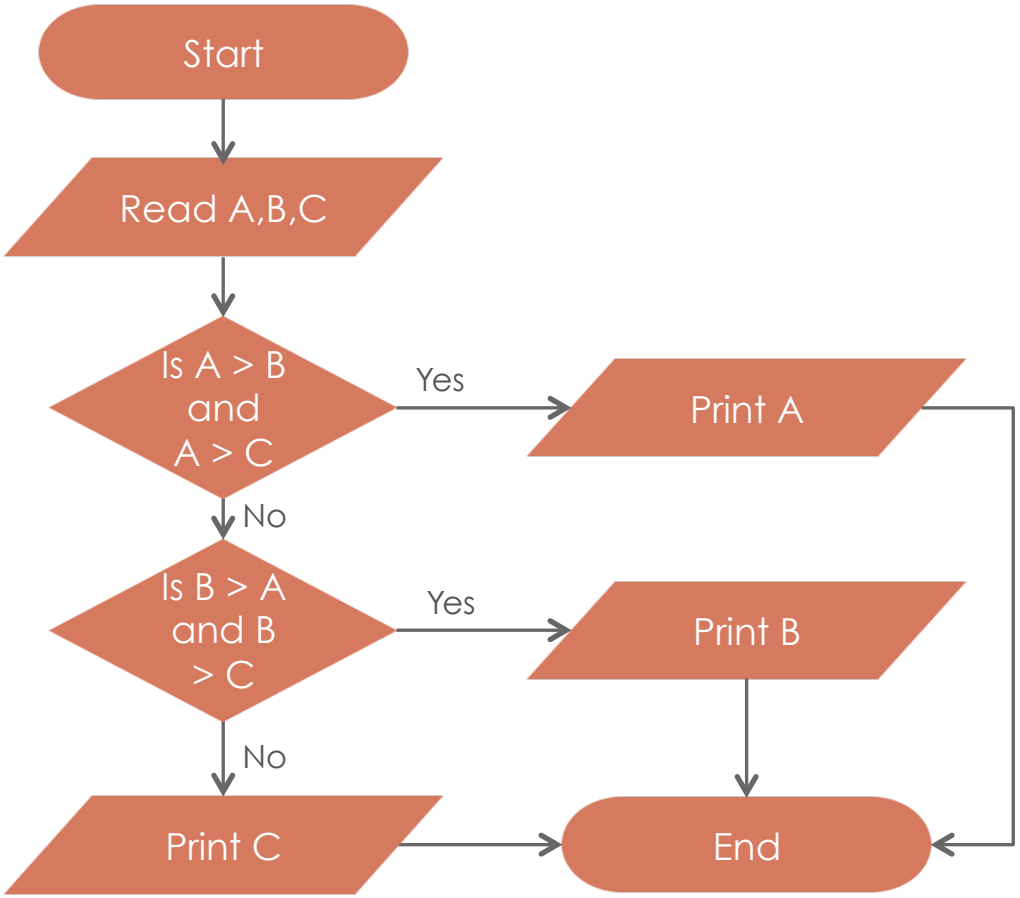
Find largest of three numbers



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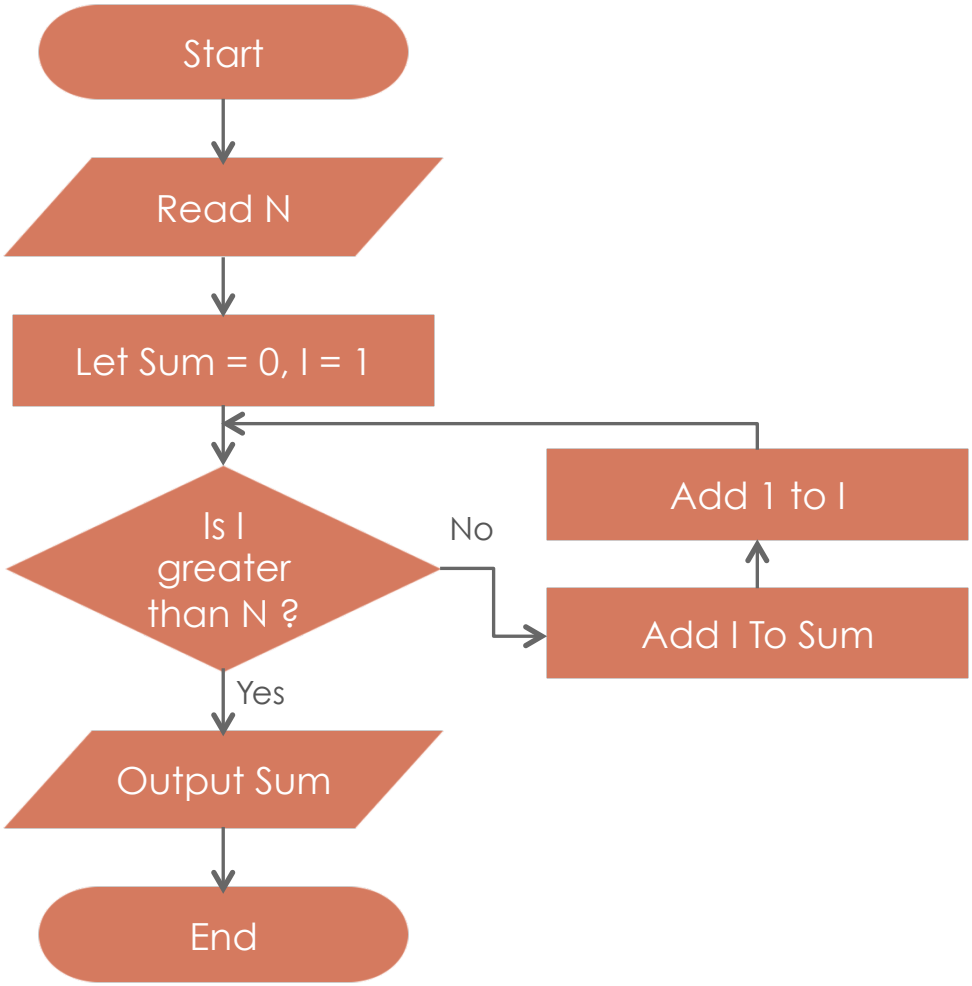
Find Sum of numbers from 1 to N



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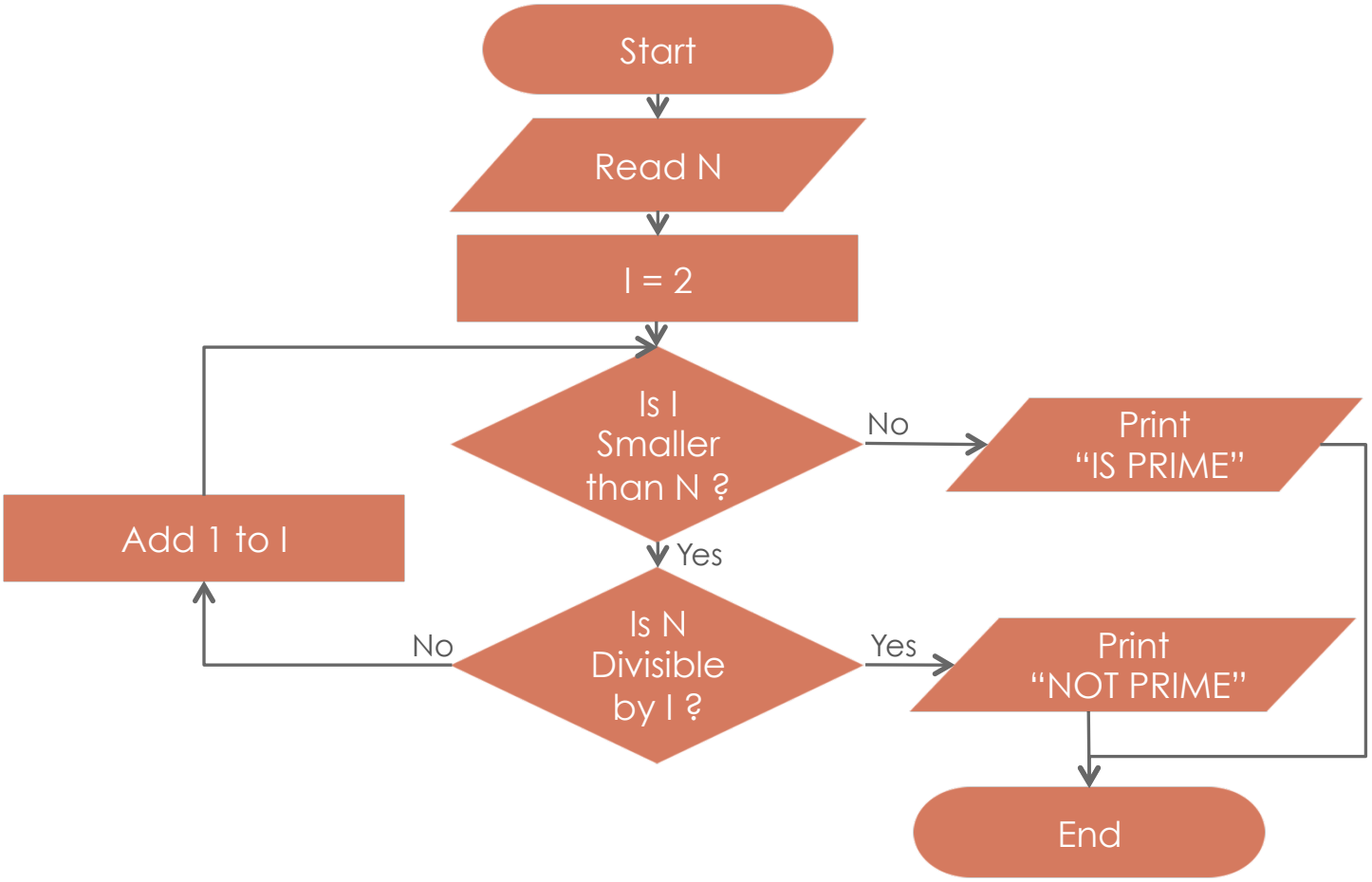
Time to Try?

- Given a Number N, check if it's Prime or Not?
- Given a Number N, check if it's a member of Fibonacci Sequence?

Check if a number Is Prime?



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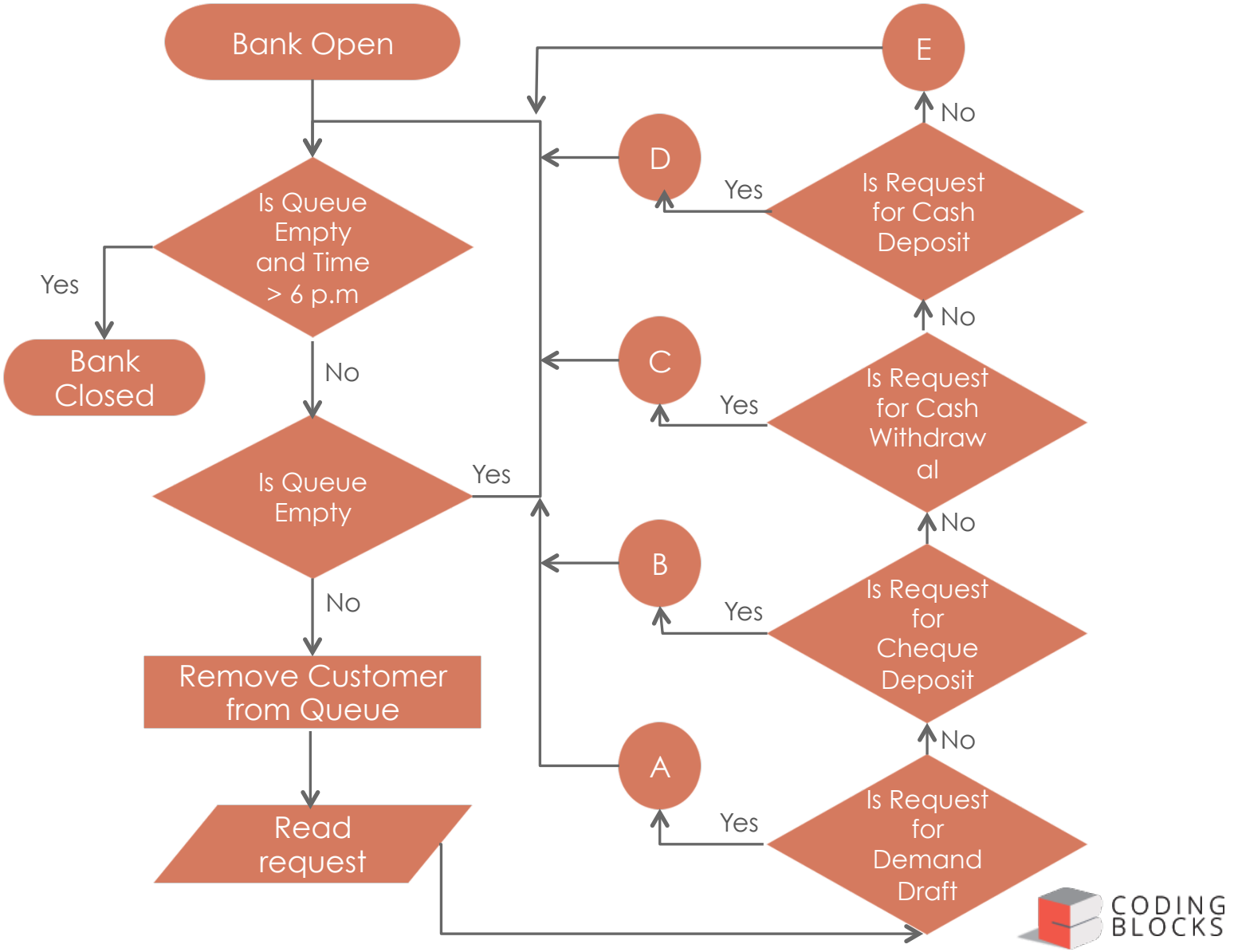
A real world example!

- A Bank is open till 6 p.m. and the banker needs to process requests from customers
- Requests can be one of the four types:
  i. Cash Deposit
  ii. Cash Withdrawal
  iii. Cheque Deposit
  iv. Making A Demand Draft
- Draw the workflow of the banker

Lets see what the banker needs to do?


Bank Open
Is Queue Empty and Time > 6 p.m
Yes
Bank Closed
No
Is Queue Empty
Yes
No
Remove Customer from Queue
Read request
E
No
Is Request for Cash Deposit
Yes
D
No
Is Request for Cash Withdraw al
Yes
C
No
Is Request for Cheque Deposit
Yes
B
No
Is Request for Demand Draft
Yes
A
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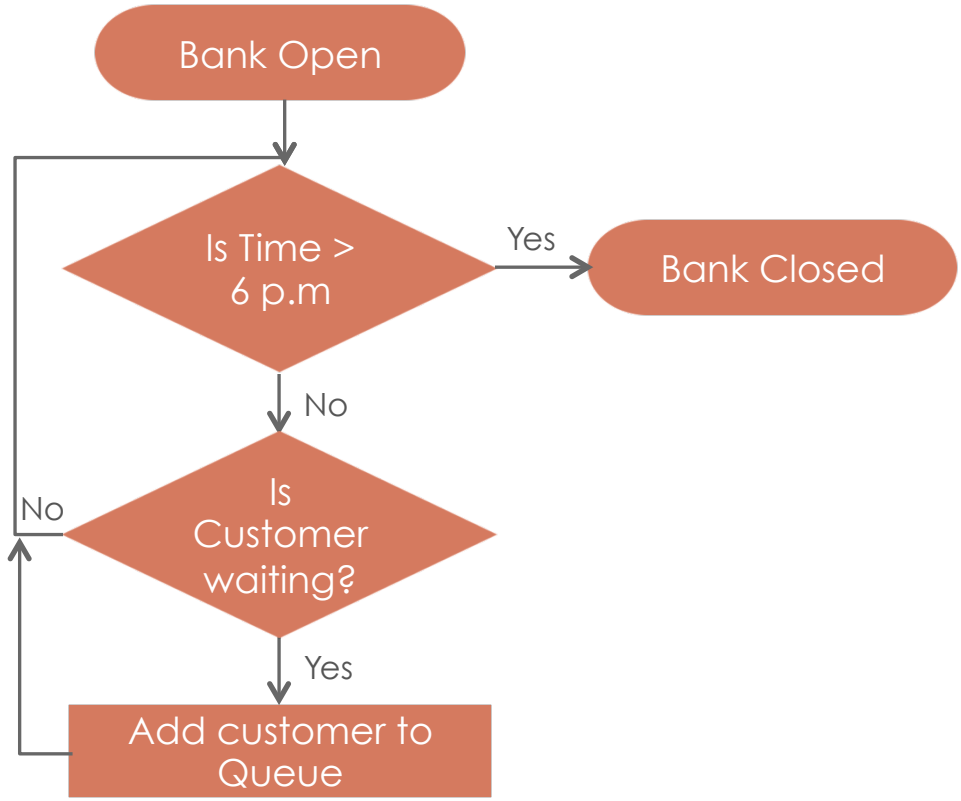
Draw Flowchart for one of the four Requests

What about the Guard?



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Time for Brain Teasers!

BT - 1: Hour Glasses

You have two hourglasses: a 7 minute one and a 11 minute one. Using just two hourglass, **accurately time 15 minutes**.

BT – 2: Apples and Oranges

There are three closed and opaque cardboard boxes. One is labeled "APPLES", another is labeled "ORANGES", and the last is labeled "APPLES AND ORANGES". You know that the labels are currently misarranged, such that no box is correctly labeled. You would like to correctly rearrange these labels. To accomplish this, you may draw only one fruit from one of the boxes. **Which box do you choose, and how do you then proceed to rearrange the labels?**

BT – 3: Average Salary

Three coworkers would like to know their average salary. However, they are self-conscious and don't want to tell each other their own salaries, for fear of either being ridiculed or getting their houses robbed. **How can they find their average salary, without disclosing their own salaries?**

What is a Pseudocode?

Human readable informal description of a algorithm/program

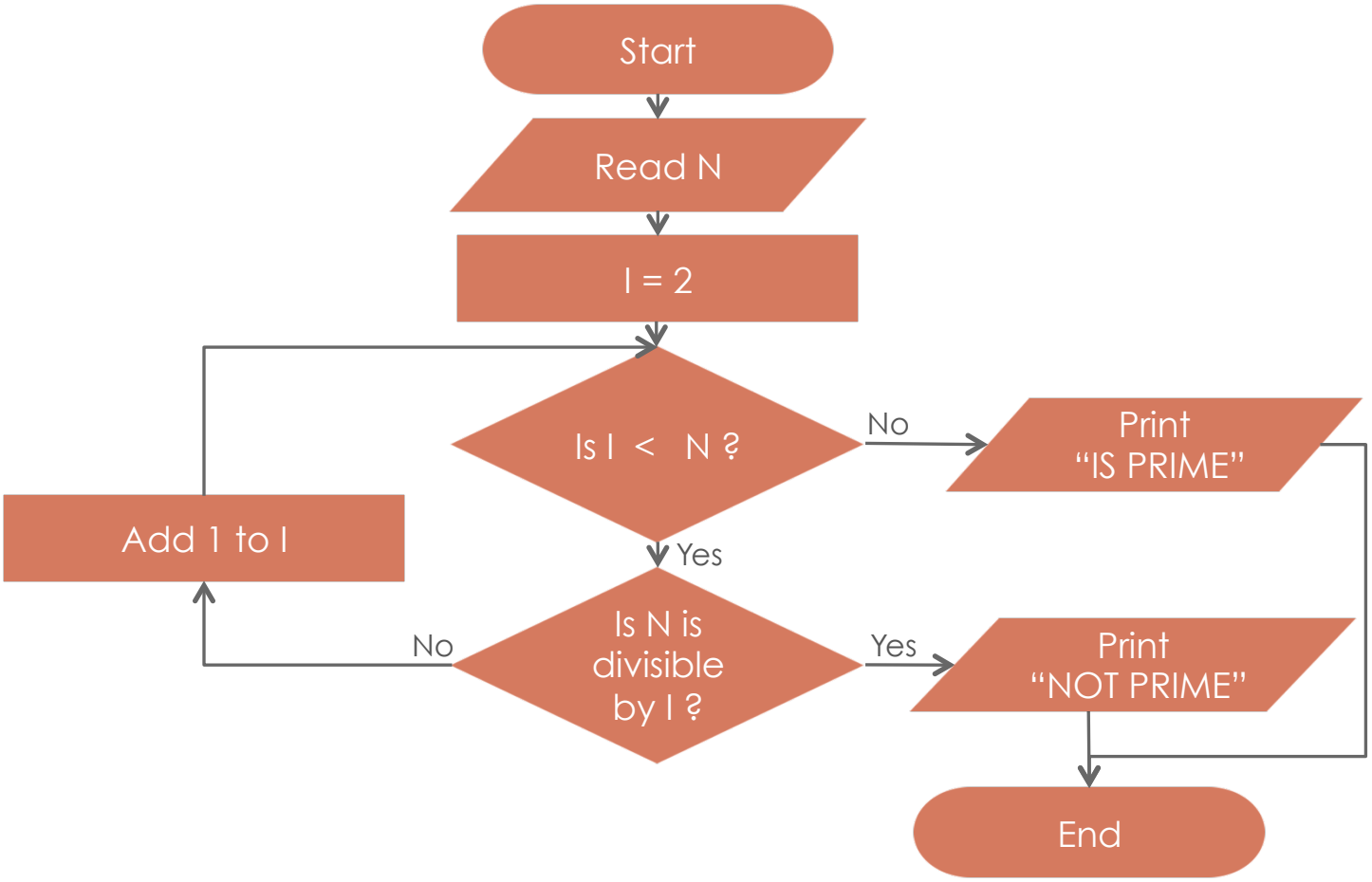
Why Learn It?

- Language Independent.
- Structure your code before writing it.
- Fastest way to verify.

Lets define our own Pseudocode language

- Input [read N]
- Assignment [Sum ← 0]
- Output [print Sum]
- If Else [if I < N then … end else then … end]
- While Loop [while I < N do … end]
- Exit [exit]

Check if a number is prime or not?



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Check if a number is Prime?

```
read N
divisor ← 2
while divisor < N do
        if N is divisible by divisor then
                print "NOT PRIME"
                exit
        end
        divisor ← divisor + 1
end
print "IS PRIME"
exit
```

Lets try one more problem!

Write psuedocode to print following pattern!

1

2 3

4 5 6

7 8 9 10

Pseudocode

```
read N
Row ← 1
Value ← 1
while Row <= N do
        Col ← 1
        while Col <= Row do
                print Value
                Value ← Value + 1
                Col ← Col + 1
        end
        print "\n"
        Row ← Row + 1
end
exit
```

Time to try?

- Write pseudocode to print the following pattern

```
    1
   232
  34543
 4567654
567898765
```

- Find sum of reverse of two numbers.
- Write a program to swap two numbers without using third variable.

Lets write some C++ Code!

C+ + code for If a number is Prime!

```
input = get_input


divisor = 2
while divisor < input
  if input divisible by divisor
      output NO
      exit
  divisor ← divisor + 1
output YES
exit
```

```
bool isPrime() {
int input;
cin >> input;
divisor = 2;
while (divisor < input) {
  if (input % divisor == 0)
  {  return false; }
  divisor = divisor + 1;
}
return true;
}
```

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BT-4: Criminal Cupbearers

An evil king has 1000 bottles of wine. A neighboring queen plots to kill the bad king, and sends a servant to poison the wine. The king's guards catch the servant after he has only poisoned one bottle. The guards don't know which bottle was poisoned, but they do know that the poison is so potent that even if it was diluted 1,000,000 times, it would still be fatal. Furthermore, the effects of the poison take one month to surface. The king decides he will get some of his prisoners in his vast dungeons to drink the wine. **Rather than using 1000 prisoners each assigned to a particular bottle, this king knows that he needs to murder no more than 10 prisoners to figure out what bottle is poisoned, and will still be able to drink the rest of the wine in 5 weeks time. How does he pull this off?**

Why binary number system?

- We humans use a decimal, or base-10, numbering system, presumably because people have 10 fingers
- Early computers were designed around the decimal numbering system. This approach made the creation of computer logic capabilities unnecessarily complex and did not make efficient use of resources. (For example, 10 vacuum tubes were needed to represent one decimal digit.)
- To deal with the basic electronic states of on and off, Von Neumann suggested using the binary numbering system

What is binary number system

- The binary, or base-2, numbering system is based on the same principles as the decimal, or base-10, numbering system, with which we are already familiar
- Bit(Binary Digit) is the basic unit. It can have only one of two values (0 or 1), and may therefore be physically implemented with a two-state device.
- Bits are commonly stored and manipulated in groups generally referred as Byte (group of 8 bits)
- Number of bits effect accuracy of result and also limits the size of numbers manipulated by computer.

Other Number Systems

- Hexadecimal Number System (base 16)
- Octal Number System (base 8)

What is Next Class about?

Programming Fundamentals - 1

- Constants, Variables & Datatypes
- Operands & Operator
- Conditional Statement
- Loops

Thank You !! ☺

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