Program Logic Formulation

Algorithm & Flowchart

What is a program?

- A program is a set of instructions for a computer, telling it what to do or how to behave.
- The person who create, develop and write a program are called Programmer.

How to create a program?

- ✓ A program is created using different programming languages.
- ✓ A program is created with different stages. Sometime called as **programming cycle.**

Program Definition -> Problem Analysis -> Algorithm Development -> Coding & Debugging

PROBLEM DEFINITION

- ✓ Specifies what we want the compute to do.
- ✓ “What do I want the computer to do?”

PROBLEM ANALYSIS

- ✓Breaking down the problem into smaller sub problems
- ✓“What programming language should I use? Do I need hardware or soft ware?”

ALGORITHM DEVELOPMENT

- ✓ Strategy on how to do the task.

  May be expressed in:

  - Human language
  - Graphical representation (flowchart)
  - Pseudocode

CODING & DEBUGGING

- ✓ The process of removing errors of your program.

WHAT IS AN ALGORITHM?

- ✓ A step by step procedure in solving problem.
- ✓ Finite set of instructions that specify a sequence of operations to be carried out.

ALGORITHM VS. PROGRAM

- ✓ Domain Knowledge
- ✓Any language
- ✓Optional (hardware and software)

- ✓Programmer
- ✓Programming Language
- ✓Mandatory (hardware and software)

Sample Exercise

✓ My friend gave me a code for my C++ language program. He wrote the code on a piece of paper.

Is the code an algorithm or a program?

An Algorithm

Characteristic of Algorithm

- ✓Input – Zero to more.
- ✓Output – At least one output.
- ✓Definiteness – instructions must be clear and realistic.
- ✓Finiteness – Must terminate and should have a stopping point
- ✓Effectiveness – instructions must be efficient and useful

What is a Flowchart?

- ✓ It is a design aid used by problem analysts in the solution of computer-related problems.
- ✓ It is a means of visually presenting the flow of data through
  - an information processing system
  - the operations performed within the system
  - the sequence in which they are performed.

Advantages of using a flowchart

- ✓ Communication: Flowcharts are better way of communicating the logic of a system to all concerned.
- ✓ Effective analysis
- ✓ Proper documentation
- ✓ Efficient coding: Flowcharts act as guide or blueprint during the systems analysis and program development phase.

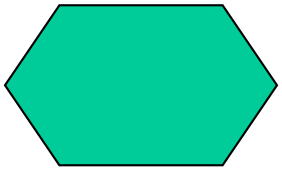
2 Types of Flowchart :

- ✓ System Flowchart – visually describes the operations performed on data through all parts of data processing system.

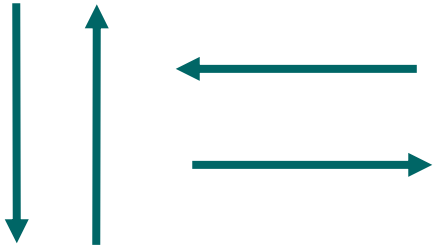
- ✓ Program Flowchart – pictorial representation of a procedure. It is used to indicate the flow and sequence of detailed steps in a procedure.

Flowchart Symbols :

Terminal Box - signifies the beginning or end of the procedure.



Initialization Box - used for declaring / initializing data needed to solve a certain process.



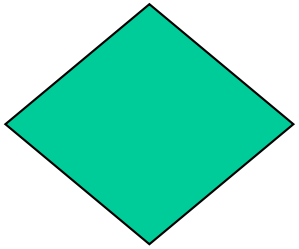
Flow Lines – used to connect blocks by exiting from another.

Declaration vs. Initialization

Flowchart Symbols :

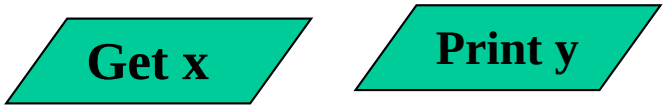
Input/output Box – indicates input to output operations.

Process Box – indicates a processing block, for such things as calculations and closing files, and so forth.

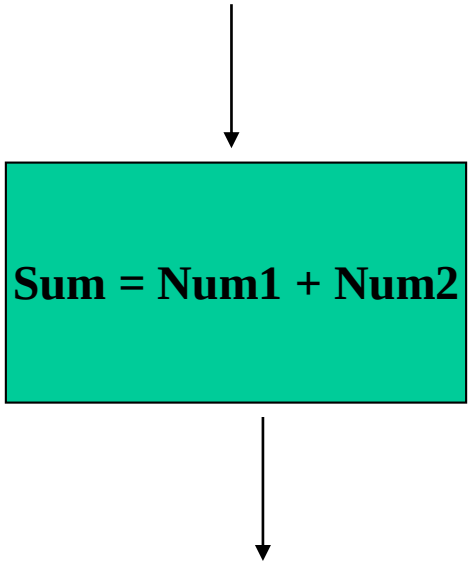


Decision Box – it has one entrance and exactly two exits from the block. One exit is the action when the resultant is **TRUE** and the other exit is the action when resultant is **FALSE**.

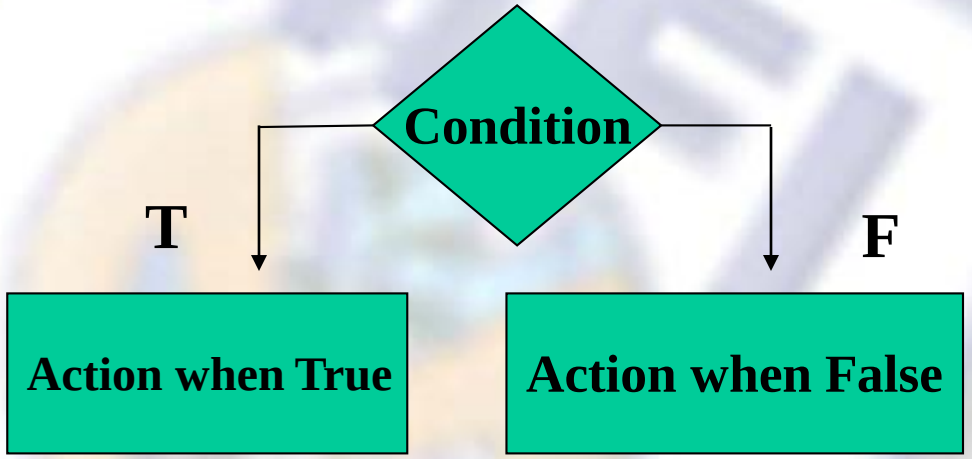
Input/Output



Process Box



Decision

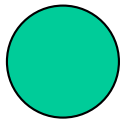


Condition

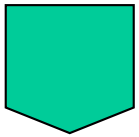
- A question or statement that gives you an answer of T/F Yes/No.

Flowchart Symbols :

Connectors – it is used as a connection point between two section of a flowchart that are not adjacent or closely located to each other.



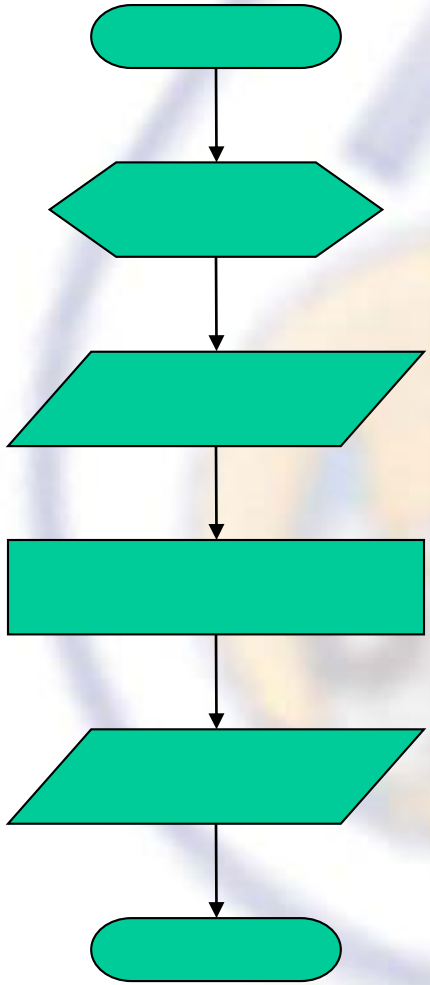
On-page Connector



Off-page connector

Note: These connectors should be used as little as possible. They should only be used to enhance readability.

Control Structures:



Control flows from one process box to another

Sequence Structure

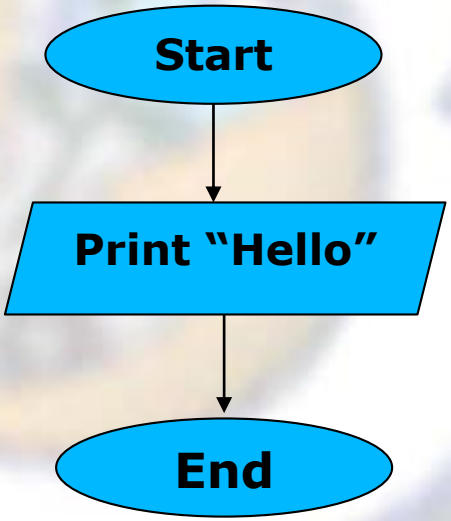
Example 1

Create a flowchart that display “Hello”

Algorithm

1. Print “Hello”

Flowchart



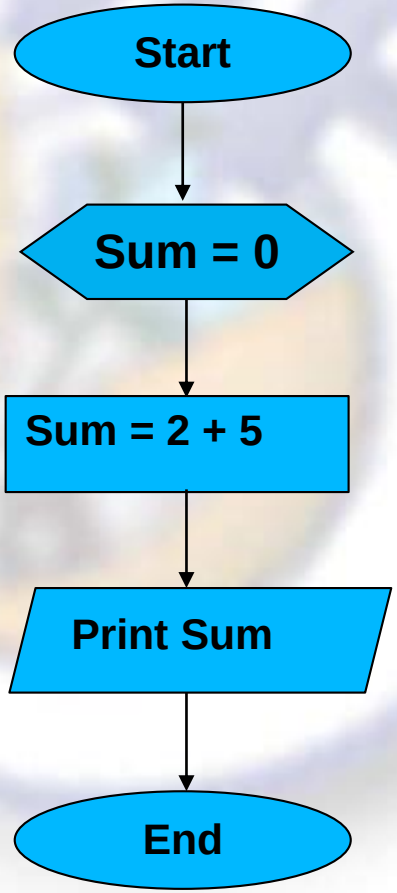
Example 2

Create a flowchart that display the sum of 2 and 5.

Algorithm

1. Compute for the sum of 2 and 5.
2. Print Sum.

Flowchart

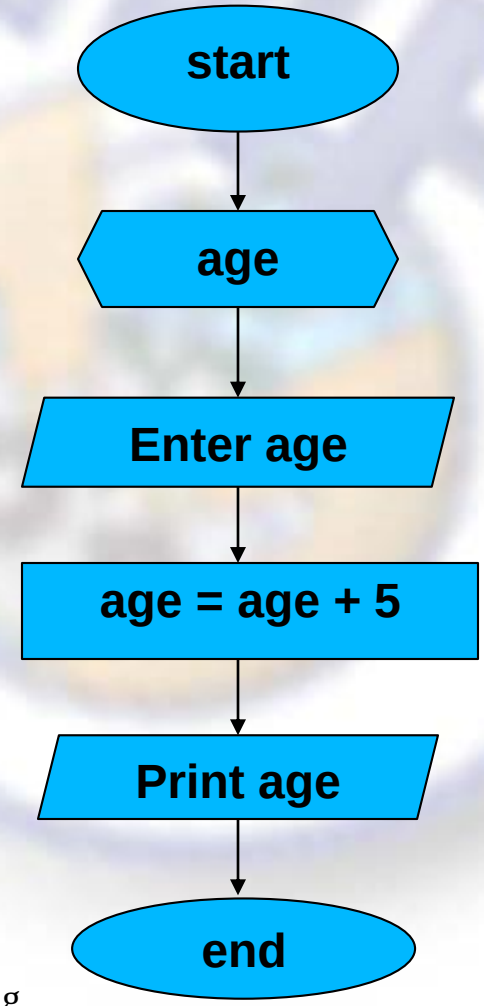


Example 3: Sequence Control Structure

Design a flowchart that will ask the user's age. Compute and display his o her age five years from now.

Algorithm

1. **Get user's age**
2. **Compute age 5 years from now; age = age + 5**
3. **Print age.**



Example 4: Sequence Control Structure

Design a flowchart that will ask for two integers. Compute and display the following:

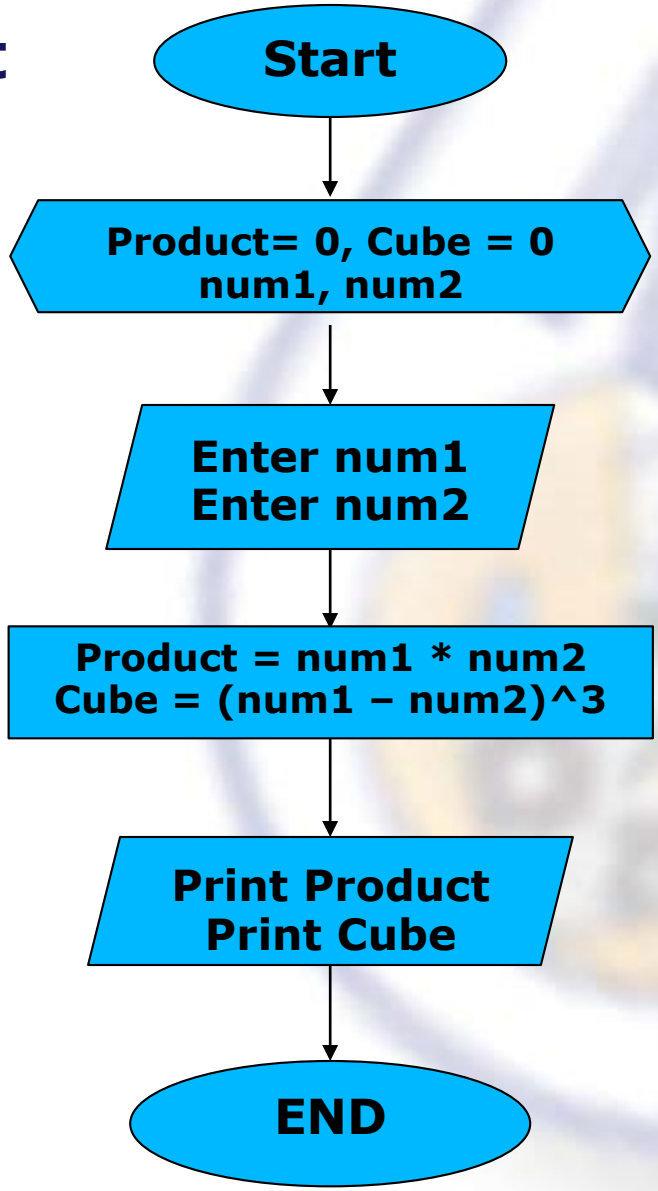
a. product of these two integers

b. cube of the difference of these two integers

Algorithm

1. **Enter 1st number (num1)**
2. **Enter 2nd number (num2)**
3. **Compute for the product of num1 and num2 (Product = num1 * num2)**
4. **Compute for the cube of the difference of num1 and num2 (Cube = (num1 – num2)^3)**
5. **Print Product and Cube.**

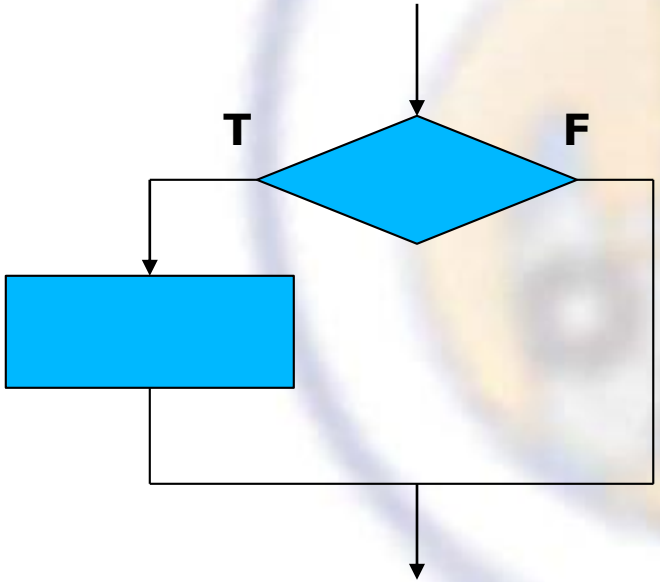
Flowchart


Start
Product= 0, Cube = 0
num1, num2
Enter num1
Enter num2
Product = num1 * num2
Cube = (num1 – num2)^3
Print Product
Print Cube
END

Selection Structure: Conditional Statement

- ✓ Statements that results to True or False
- ✓ More on Decision block.

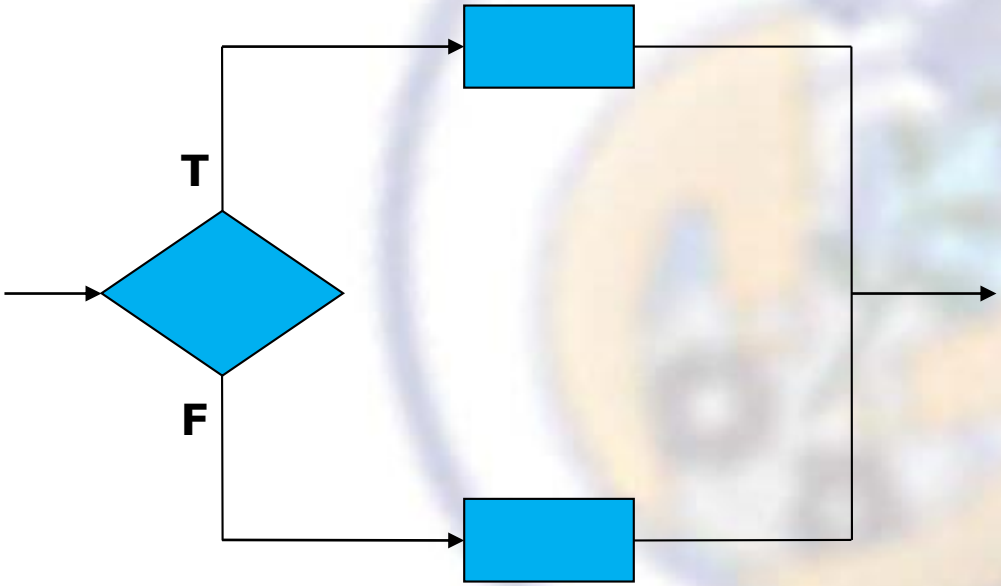
Single Alternative Selection Structure



Control Structures :

Dual Alternative Selection Structure

Performs two different things when the condition is TRUE or FALSE.



Example 1: Selection Control Structure

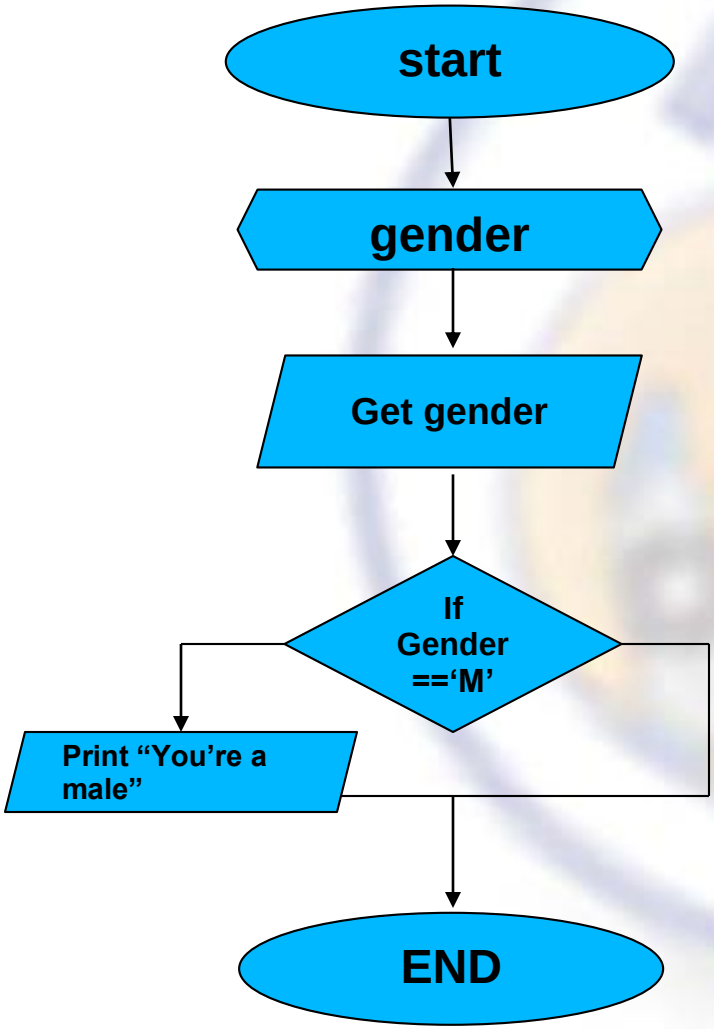
Design a flowchart that will ask the user to enter a character indicating the user's gender. If the user enters 'M' display "You're a male".

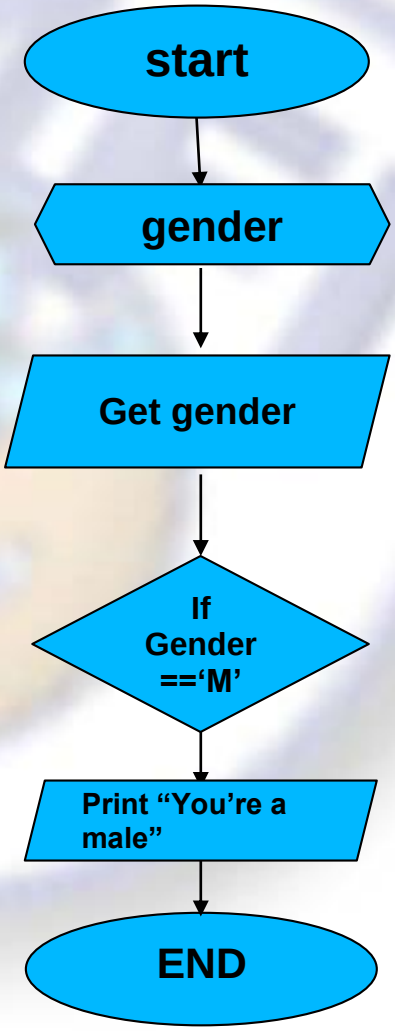
Algorithm

1. **Get user's gender**
2. **Ask if gender is M**
3. **If yes; Display "You're a male.**

Example 1: Selection Control Structure

Flowchart





Example 2: Selection Control Structure

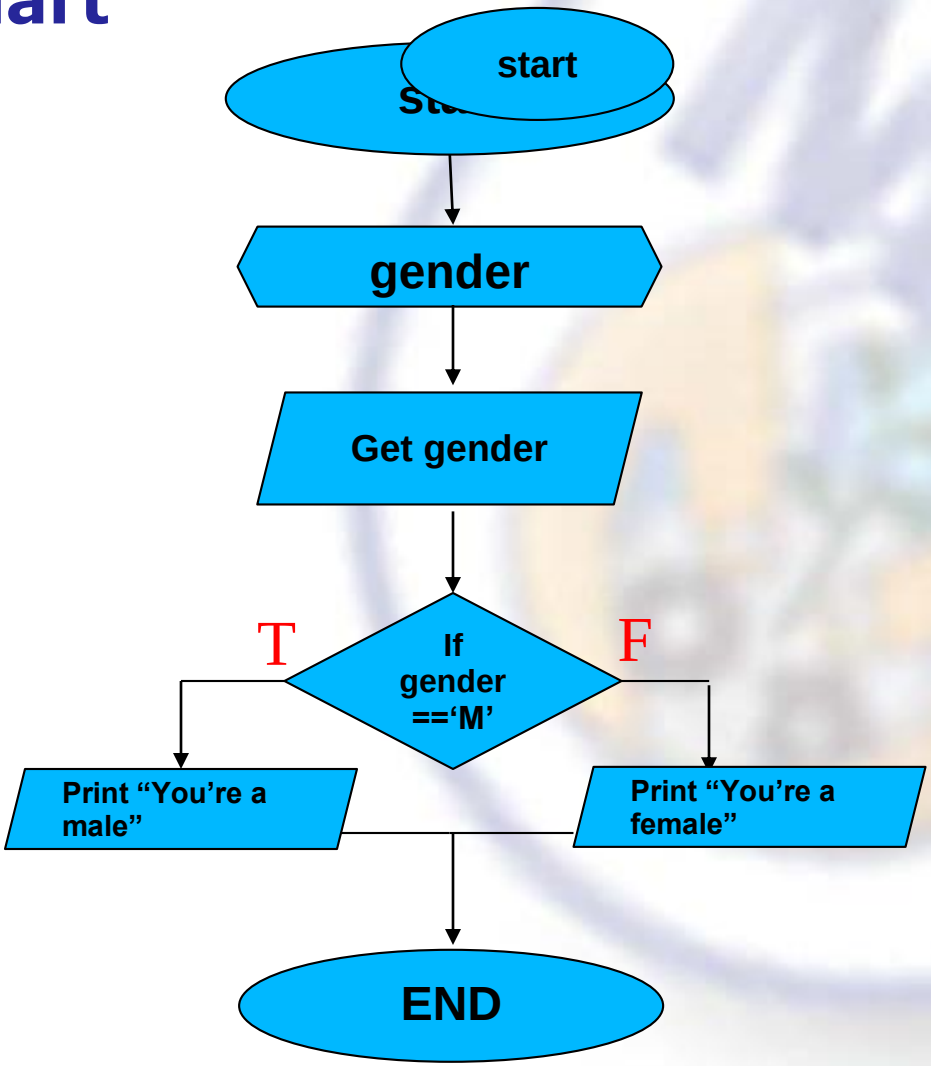
Design a flowchart that will ask the user to enter a character indicating the user's gender. If the user enters 'M' display "You're a male". If not assume that user is a female thus display "You're a female"

Algorithm

1. **Get user's gender**
2. **Decide for the gender**
3. **If M; Display "You're a male."**
5. **If not; Display "You're a female."**

Example 2: Selection Control Structure

Flowchart



Example 3: Selection Control Structure

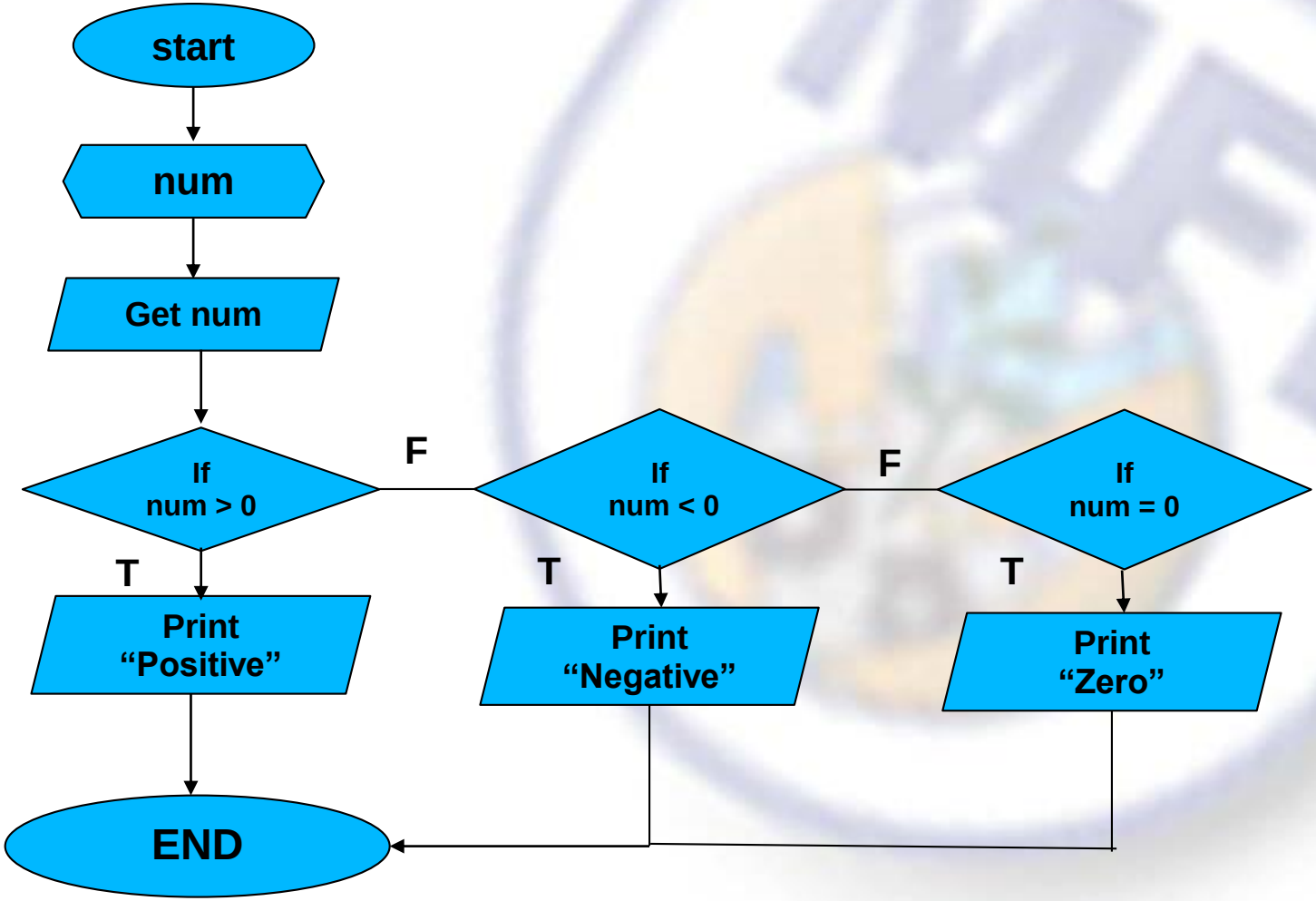
Design a flowchart that will determine if the input number is positive, negative or zero.

Algorithm

1. **Enter number (num)**
2. **Ask if num is greater than 0; num > 0**
3. **If true; Display "Positive" then terminate.**
4. **If false; Ask if num is less than 0; num < 0**
5. **If true; Display "Negative" then terminate.**
6. **Else; Display "Zero" then terminate.**

Example 3: Selection Control Structure

Flowchart



Repetition Control Structure

Repetition Structures

Performs a specific action/statement a number of times until a condition is satisfied.

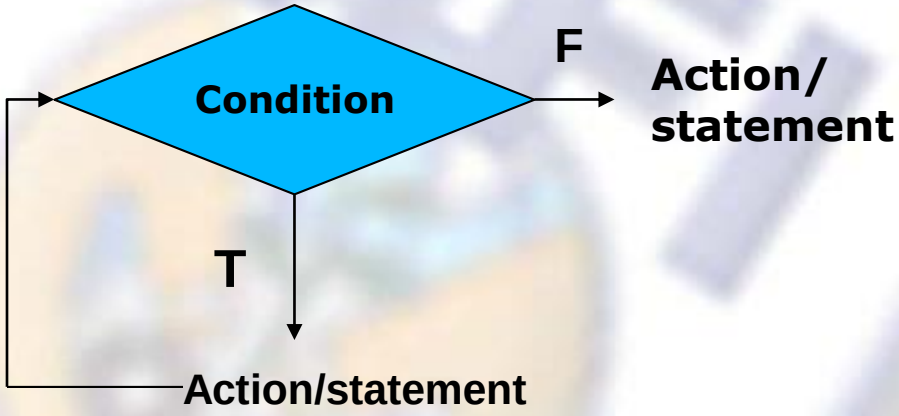
These structures include type such as:

- **While loop**
- **Do-While loop**
- **For Loop**

Repetition Control Structure

While Loop

Statement or block of statements that is repeated as long as some conditions is satisfied.



Example 1: Repetition Structure

Create a flowchart that ask the user if he/she wants to display the word “Hello”. The answer may either be N for no and Y for yes.

Algorithm

1. **Ask the user if he/she wants to display the word Hello?**
   - **N for no**
   - **Y for yes**

2. **Y print “Hello”**
   - **Ask again the user**

3. **N, terminate**

Output

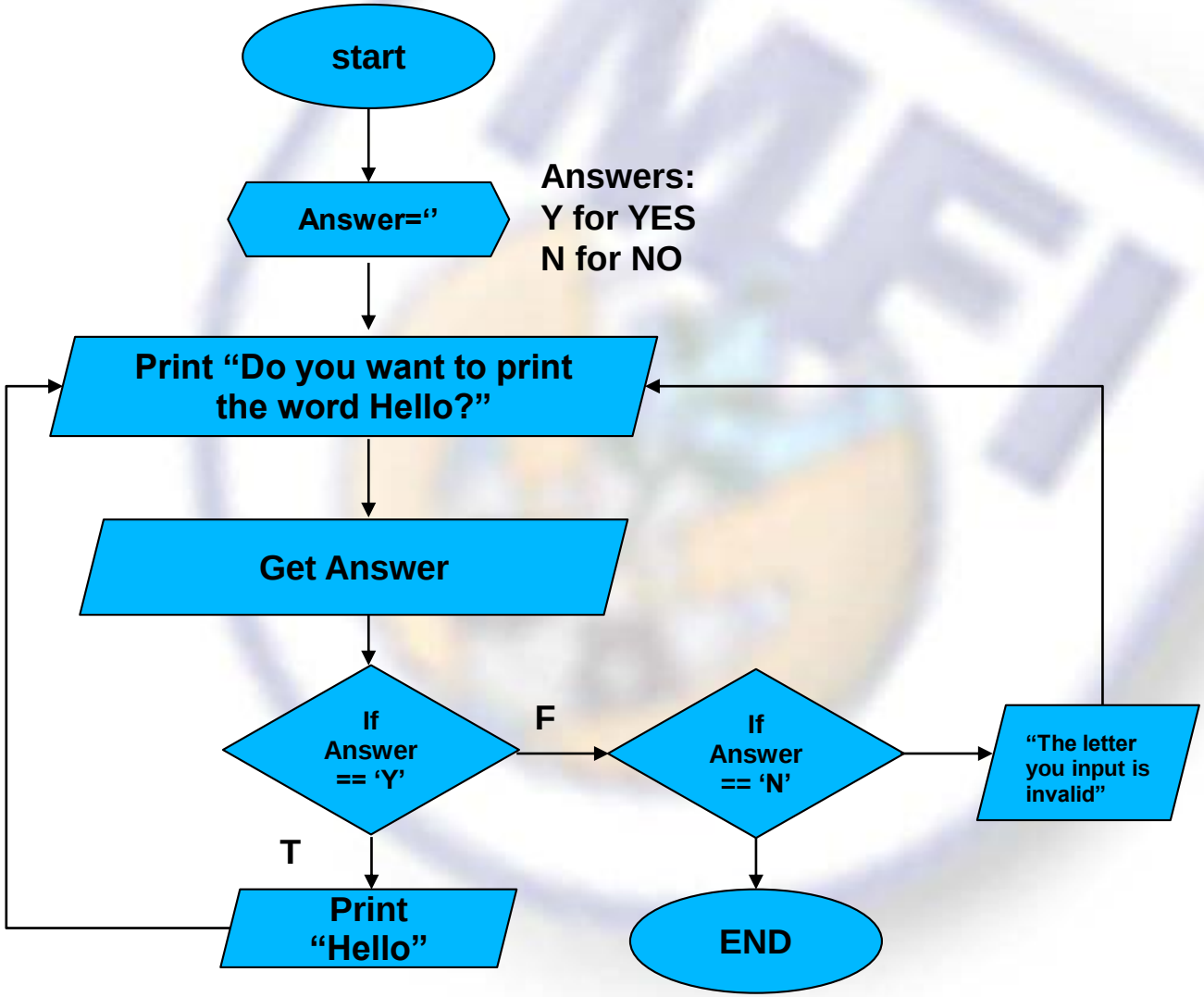
Do you want to print Hello? Y
Hello

Do you want to print Hello? Y
Hello

Do you want to print Hello? N

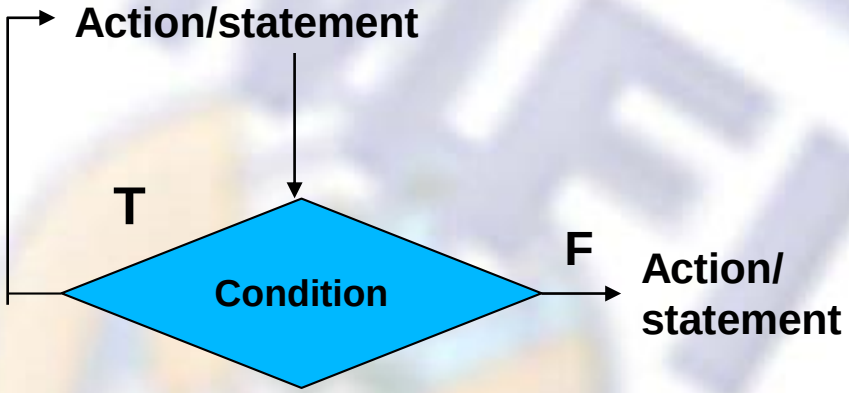
Example 1: Repetition Structure

Flowchart



Do - While Loop

The action or statement is executed first before asking the condition



Example 2: Repetition Structure

Create a flowchart that display the word “Hello” then ask the user if he/she wants to print it again. The answer may either be N for no and Y for yes.

Algorithm

1. **Print Hello**
2. **Ask the user if he/she wants to print again the word Hello?**
   - **N for no**
   - **Y for yes**
3. **Y print again**
   - **“Hello”**
4. **Enter N**
   - **terminate**

Output

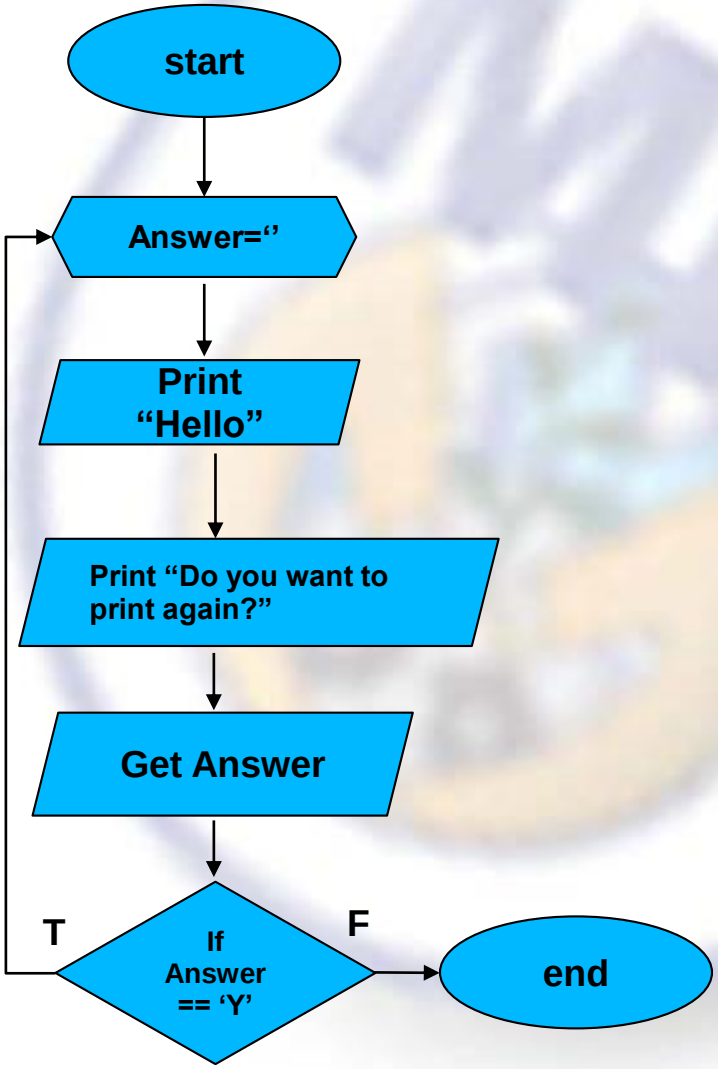
Hello
Do you want to print again? Y

Hello
Do you want to print Hello? Y

Hello
Do you want to print Hello? N

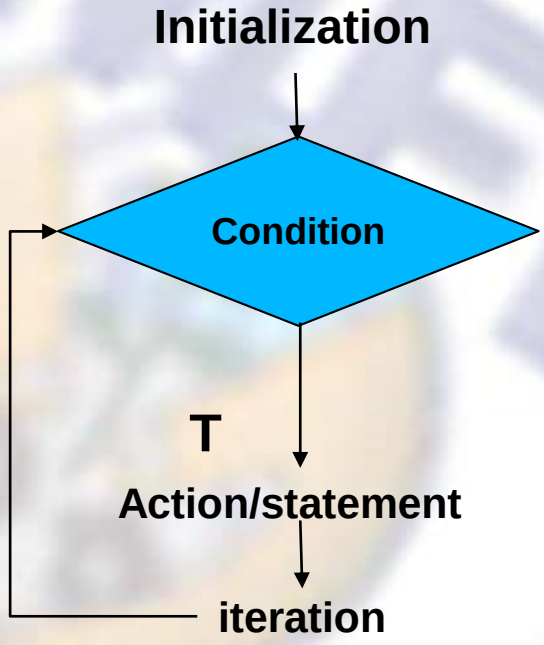
Example 2: Repetition Structure

Flowchart



For Loop

- Executes an action/statement repeatedly.
- There are many applications for a For loop, including tasks such as reading through a list of data items or initializing an array.



Example 3: Repetition Structure

Create a flowchart that display the word “Hello” five times.

Algorithm

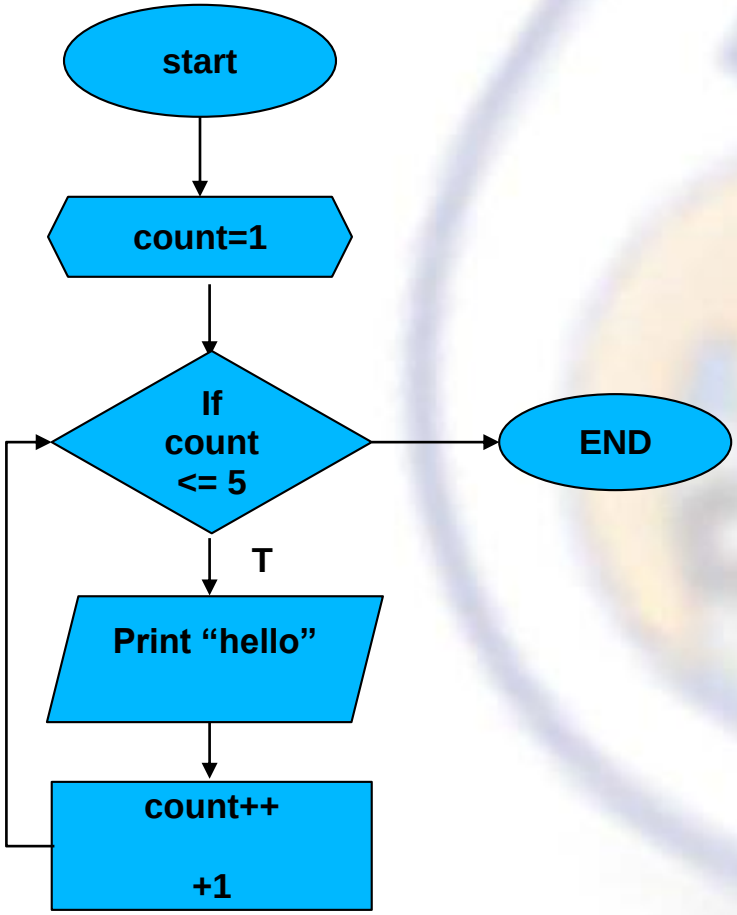
1. Print Hello
2. Ask if it is printed 5 times.

Output

HELLO
HELLO
HELLO
HELLO
HELLO

Example 3: Repetition Structure

Flowchart



count = 1

If 1 <= 5

count = 2

If 2 <= 5

count = 3

If 3 <= 5

count = 4

If 4 <= 5

count = 5

If 5 <= 5

count = 6

If 6 <= 5

Output

Hello

Hello

Hello

Hello

Hello

EXIT PROGRAM

Example 4: Repetition Structure

Create a flowchart that allows the user to enter a number and display the numbers from 0 to the given number.

Algorithm

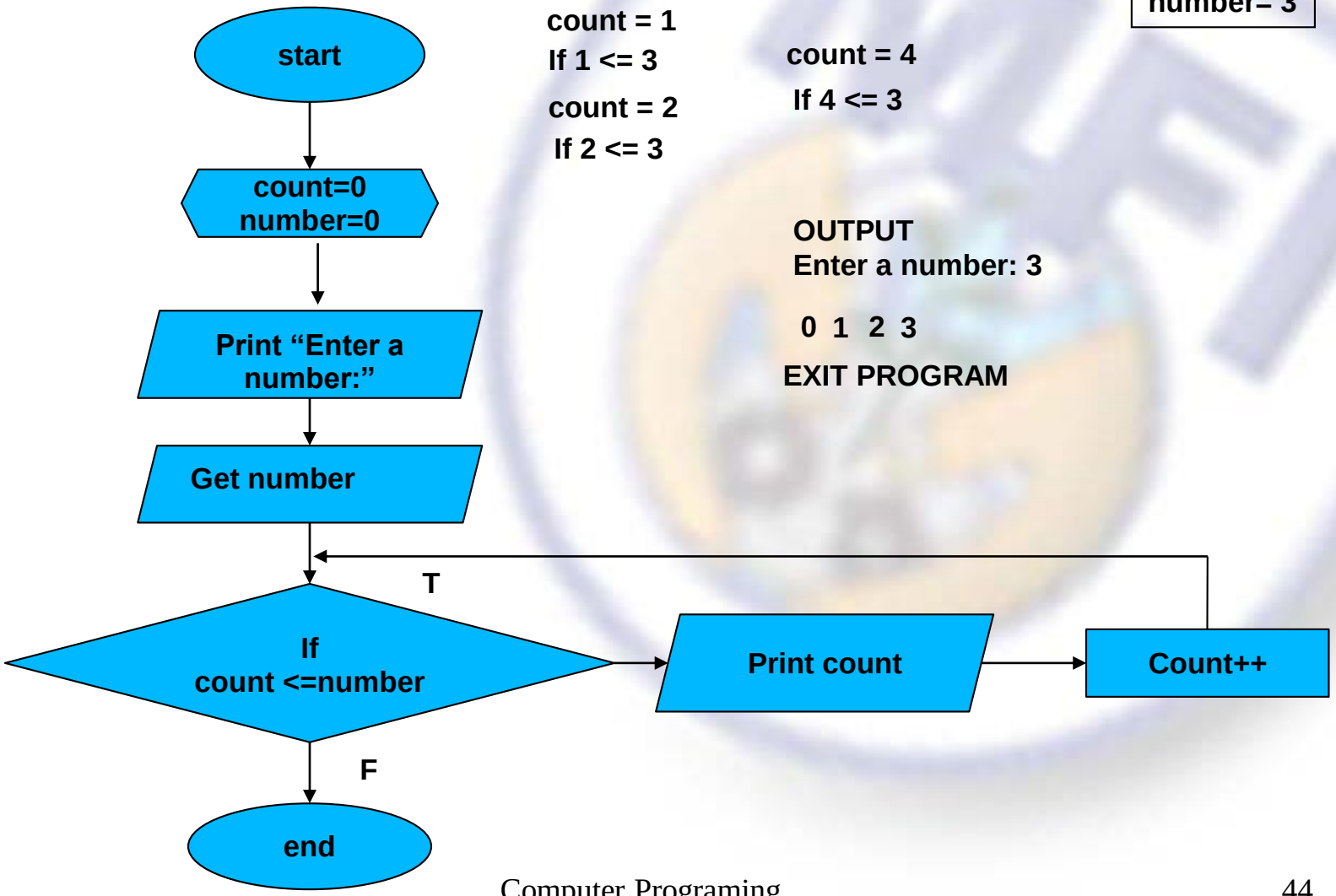
1. **Ask the user to enter a number**
2. **Display the number from 0 to number**

Output

Enter a number: 9
0123456789

Example 4: Repetition Structure

Flowchart



count= 0
If 0 <= 3
count = 1
If 1 <= 3
count = 2
If 2 <= 3

count=3
If 3 <= 3
count = 4
If 4 <= 3

number= 0
number= 3

OUTPUT
Enter a number: 3
0 1 2 3
EXIT PROGRAM

Example 5: Repetition Structure

Create a flowchart that allows the user to enter a number and display its factorial

Algorithm

1. **Ask the user to enter a number**
2. **Compute for the factorial**
   - **N!**
   - **N*N-1*N-2…**
3. **Display the factorial**

Output

Enter a number:
5
Factorial: 120
Factorial =5*4*3*2*1

Example 5: Repetition Structure

Flowchart