FLOWCHART AND ALGORITHMS

ALGORITHM:

The word “algorithm” relates to the name of the mathematician Al-khowarizmi, which means a procedure or a technique. Software Engineer commonly uses an algorithm for planning and solving the problems. **An algorithm is a sequence of steps to solve a particular problem** or algorithm is an ordered set of unambiguous steps that produces a result and terminates in a finite time Algorithm has the following characteristics

- **Input:** An algorithm may or may not require input
- **Output:** Each algorithm is expected to produce at least one result
- **Definiteness:** Each instruction must be clear and unambiguous.
- **Finiteness**: If the instructions of an algorithm are executed, the algorithm should terminate after finite number of steps

The algorithm and flowchart include following three types of control structures.

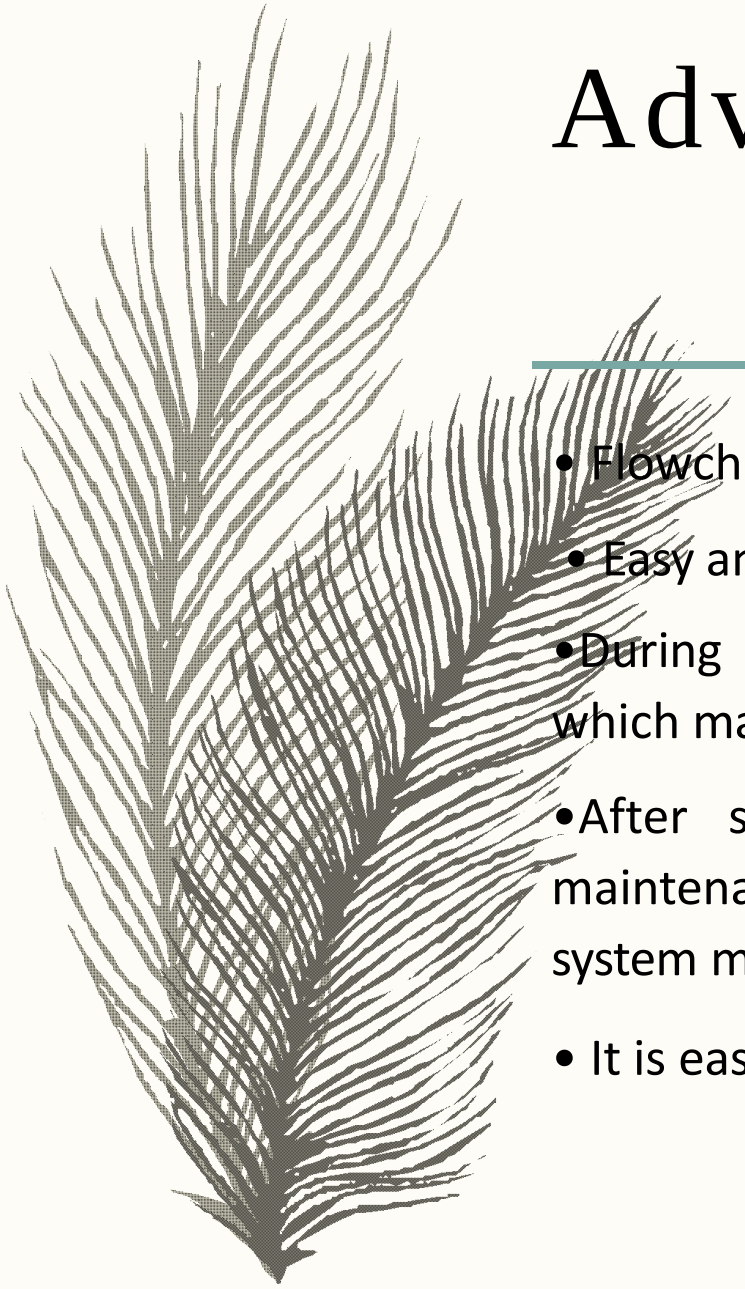
1. **Sequence:** In the sequence structure, statements are placed one after the other and the execution takes place starting from up to down.
2. **Branching (Selection):** In branch control, there is a condition and according to a condition, a decision of either TRUE or FALSE is achieved. In the case of TRUE, one of the two branches is explored; but in the case of FALSE condition, the other alternative is taken. Generally, the ‘IF-THEN’ is used to represent branch control.
3. **Loop (Repetition):** The Loop or Repetition allows a statement(s) to be executed repeatedly based on certain loop condition e.g. WHILE, FOR loops.

Advantages of algorithm

- It is a step-wise representation of a solution to a given problem, which makes it easy to understand.
- An algorithm uses a definite procedure.
- It is not dependent on any programming language, so it is easy to understand for anyone even without programming knowledge.
- Every step in an algorithm has its own logical sequence so it is easy to debug

FLOWCHART:

- The first design of flowchart goes back to 1945 which was designed by John Von Neumann. Unlike an algorithm, Flowchart uses different symbols to design a solution to a problem. It is another commonly used programming tool. By looking at a Flowchart ,one can understand the operations and sequence of operations performed in a system. Flowchart is often considered as a blueprint of a design used for solving a specific problem.
- Flowchart is a **diagrammatic representation** of **an algorithm**. Flowchart are very helpful in writing program and explaining program to others.
- Though, flowchart are useful in efficient coding, debugging and analysis of a program, drawing flowchart in very complicated in case of complex programs and often ignored.
- Flowcharts use special shapes to represent different types of actions or steps in a process. Lines and arrows show the sequence of the steps, and the relationships among them. These are known as flowchart symbols. So **Flowchart symbols** are specific shapes used to create a visual representation of a program.



Advantages of flowchart:

- Flowchart is an excellent way of communicating the logic of a program.
- Easy and efficient to analyze problem using flowchart.
- During program development cycle, the flowchart plays the role of a blueprint, which makes program development process easier.
- After successful development of a program, it needs continuous timely maintenance during the course of its operation. The flowchart makes program or system maintenance easier.
- It is easy to convert the flowchart into any programming language code.

Comparison between Algorithm and Flowchart

Algorithm

- It is a procedure for solving problems.
- The process is shown in step-by-step instruction.
- It is complex and difficult to understand.
- It is convenient to debug errors
- The solution is showcased in natural language.
- It is somewhat easier to solve complex problem.
- It costs more time to create an algorithm.

Flowchart

- It is a graphic representation of a process.
- The process is shown in block-by-block information diagram.
- It is intuitive and easy to understand.
- It is hard to debug errors.
- The solution is showcased in pictorial format.
- It is hard to solve complex problem.
- It costs less time to create a flowchart.

Commonly used operators while creating algorithms and flowcharts

Mathematical Operators:

Operator	Meaning	Example
+	Addition	A + B
-	Subtraction	A – B
*	Multiplication	A * B
/	Division	A / B
^	Power	A^3 for A^3
%	Reminder	A % B

Commonly used operators while creating algorithms and flowcharts(continued)

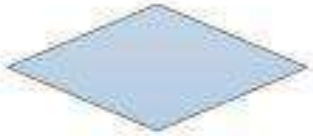
Relational Operators

Operator	Meaning	Example
<	Less than	A < B
<=	Less than or equal to	A <= B
= or ==	Equal to	A = B
# or !=	Not equal to	A # B or A !=B
>	Greater than	A > B
>=	Greater tha or equal to	A >= B

Logical Operators

Operator	Example	Meaning
AND	A < B AND B < C	Result is True if both A<B and B<C are true else false
OR	A< B OR B < C	Result is True if either A<B or B<C are true else false
NOT	NOT (A >B)	Result is True if A>B is false else true

Symbols Commonly Used In Flowchart

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

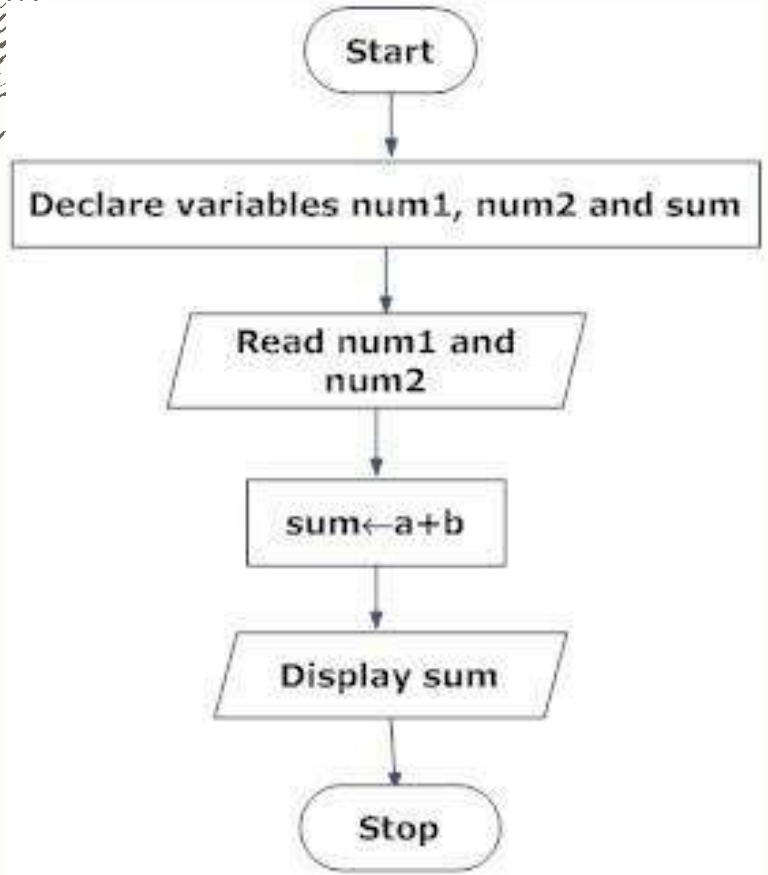
- **Rectangle Shape -** Represents a process
- **Oval or Pill Shape -** Represents the start or end
- **Diamond Shape -** Represents a decision
- **Parallelogram -** Represents input/output

Functions of Flowchart Symbols

- Each symbol has its own function within the program. Each symbol represents a piece of the code written for the program. The **start/end** symbol can be used to represent either the beginning or ending of a program. The symbol for **process** allows you to show how the program is functioning, like when you need the program to calculate two numbers or even analyze the information.
- When you decide to enter data, show it on the screen, or print it to paper, you use the **input/output** symbol. The **display** symbol signifies that information is displayed to the user.
- There are many other symbols frequently used in flowcharts. The **decision** symbol is used for things like 'if statements,' where you must choose an option based on a specified criteria. A decision question may be something as simple as: if the grade is at least 70 then send out the message 'Passing' to the screen. Otherwise, send 'Failing' to the screen.

Some Examples

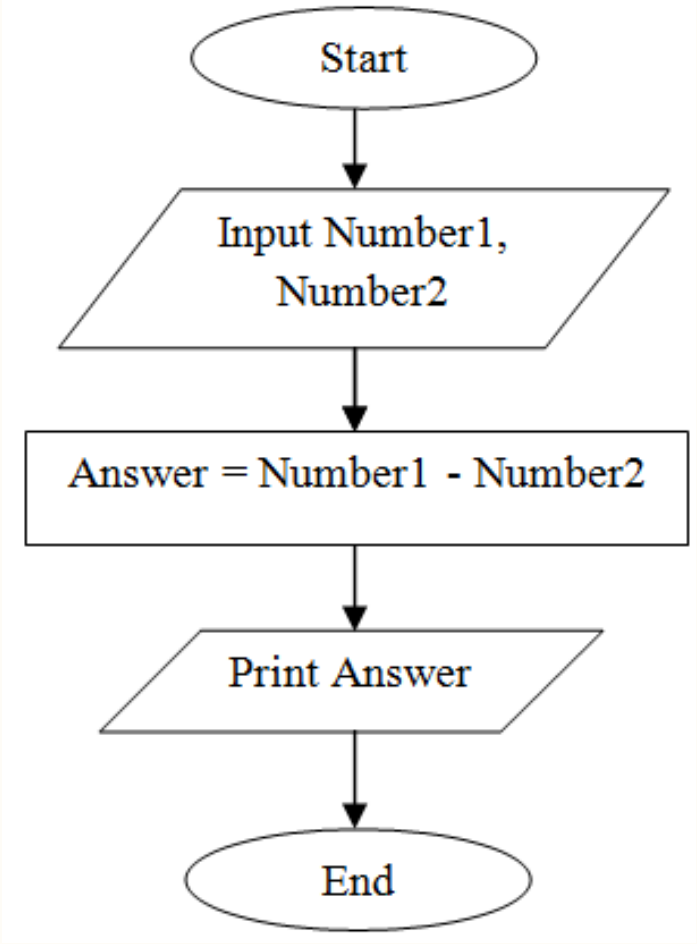
Draw a flowchart along with its algorithm to add two numbers entered by user.



AN ALGORITHM TO FIND THE SUM OF TWO NUMBERS:

- STEP 1 : START
- STEP 2 : DECLARE VARIABLES
- STEP 3 : READ NUMBERS
- STEP 4 : SUM THESE TWO NUMBERS
- STEP 5 : DISPLAY SUM
- STEP 6 : STOP

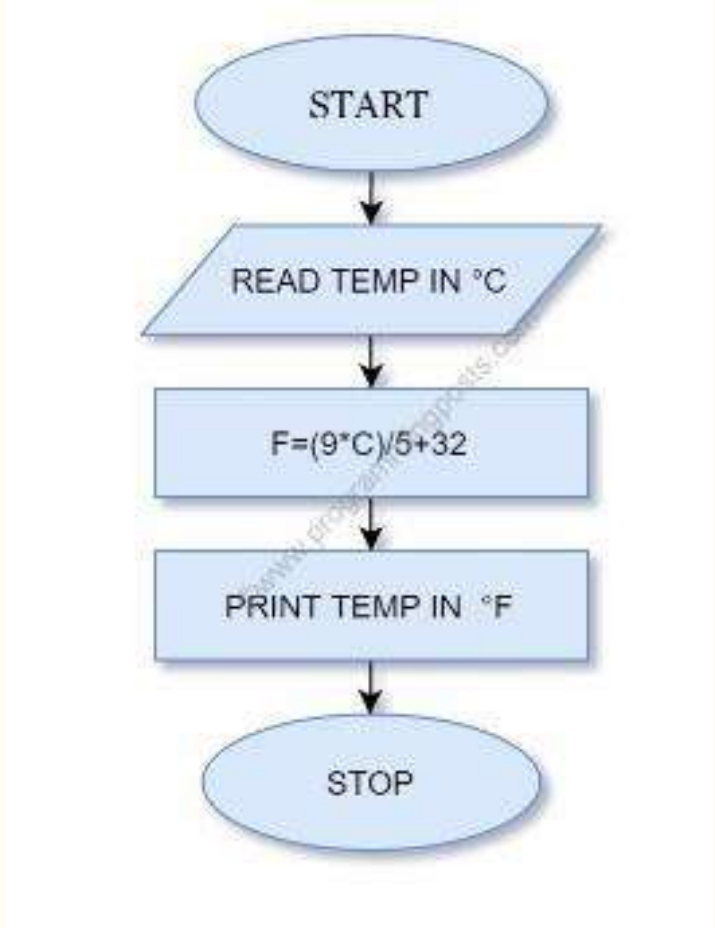
Draw a flowchart along with its algorithm to do difference among two numbers entered by user.



AN ALGORITHM TO FIND THE DIFFERENCE IN BETWEEN TWO NUMBERS:

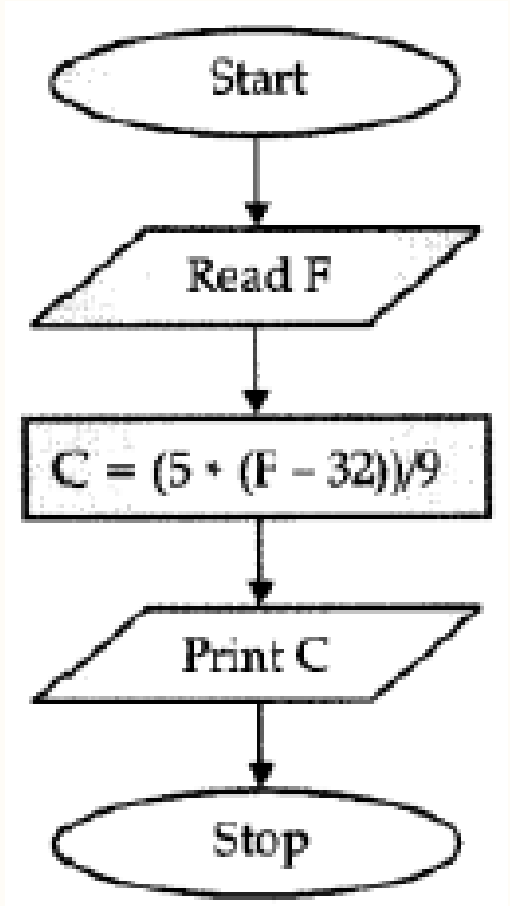
- STEP 1 : START
- STEP 2 : DECLARE VARIABLES
- STEP 3 : PERFORM DIFFERENCE IN BETWEEN THESE TWO NUMBERS
- STEP 5 : DISPLAY ANSWER
- STEP 6 : END

Draw a flowchart along with its algorithm to convert temperature (Celsius to Fahrenheit)



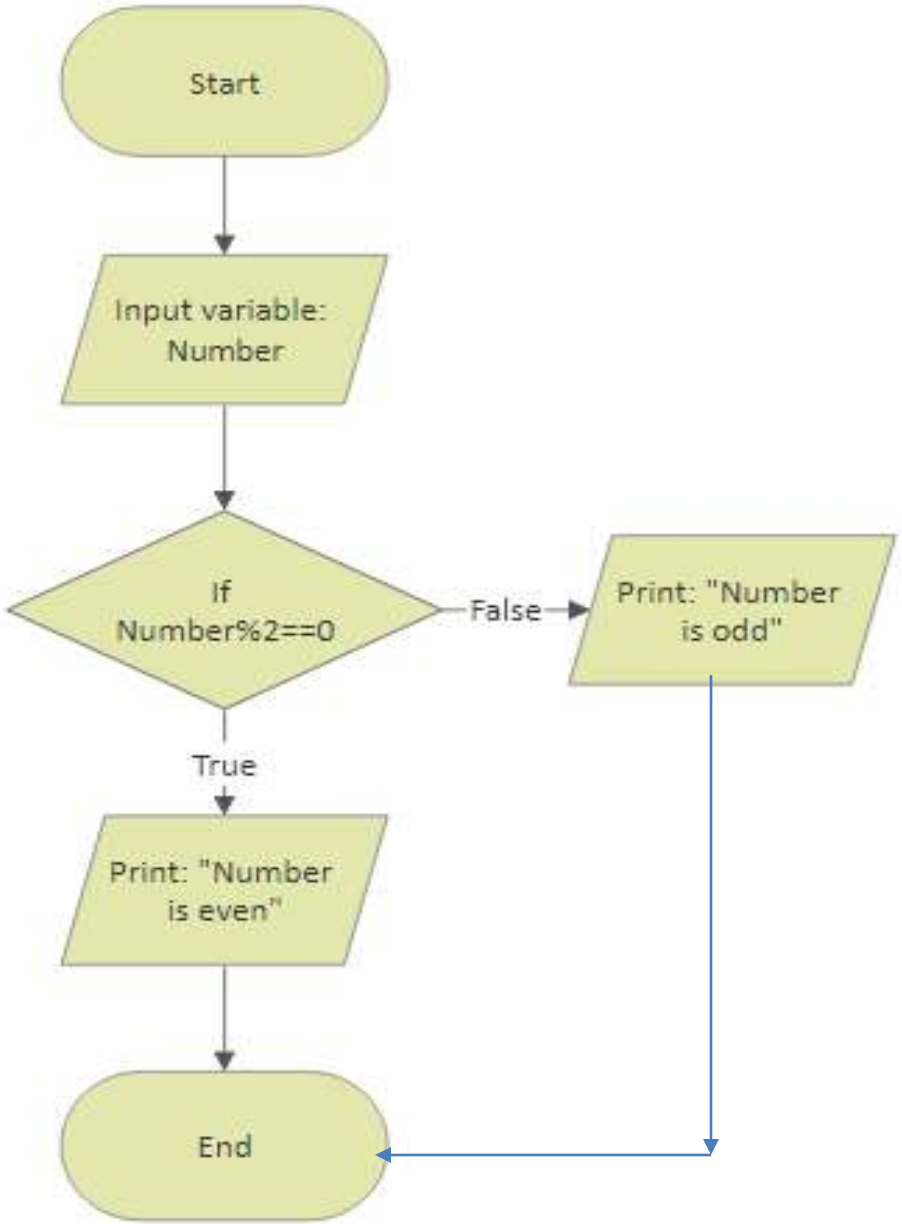
- Step 1: Start
- Step 2: Read the temperature value in Celsius
- Step 3: Applying Formula of Conversion i.e, F=(9*C)/5+32
- Step 4: Print the Temperature in Fahrenheit
- Step 5: Stop

Draw a flowchart along with its algorithm to convert temperature (Fahrenheit to Celsius)

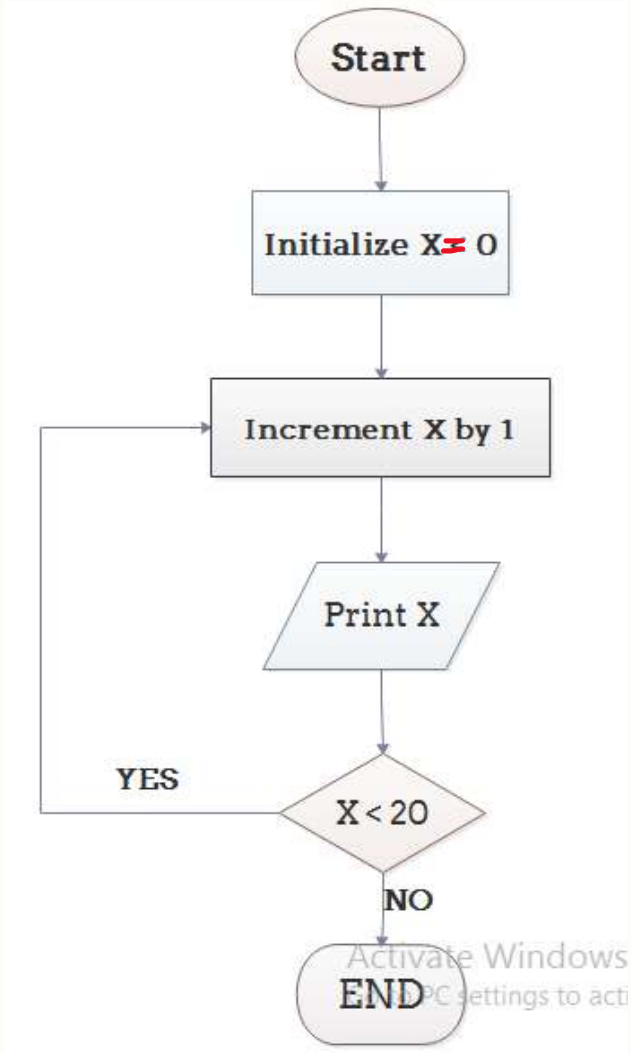


- Step 1: Start
- Step 2: Read the temperature value in Fahrenheit
- Step 3: Applying Formula of Conversion i.e, C=(5*(F-32))/9
- Step 4: Print the Temperature in Celsius
- Step 5: Stop

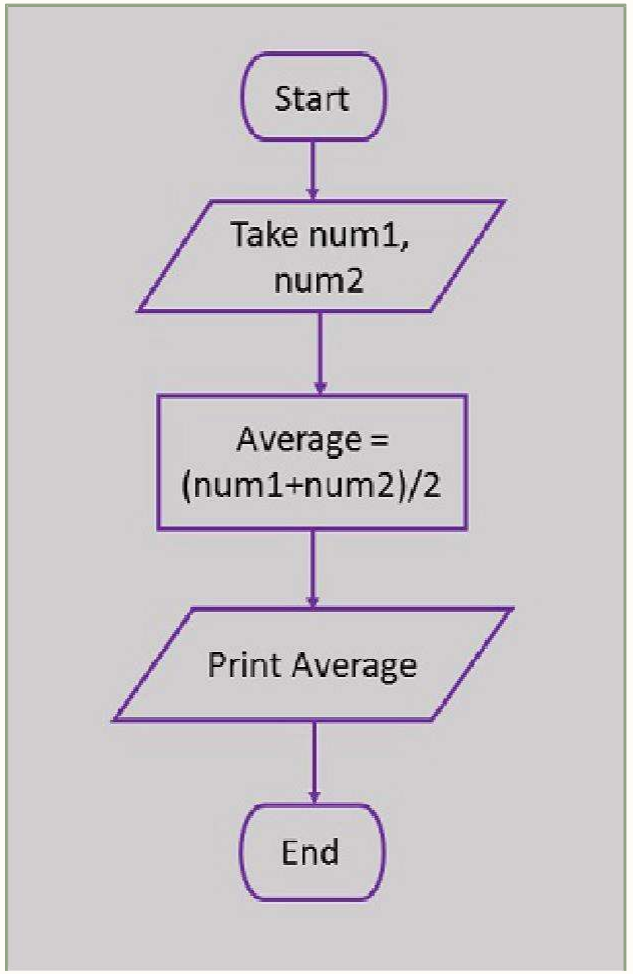
Print Even and Odd Number



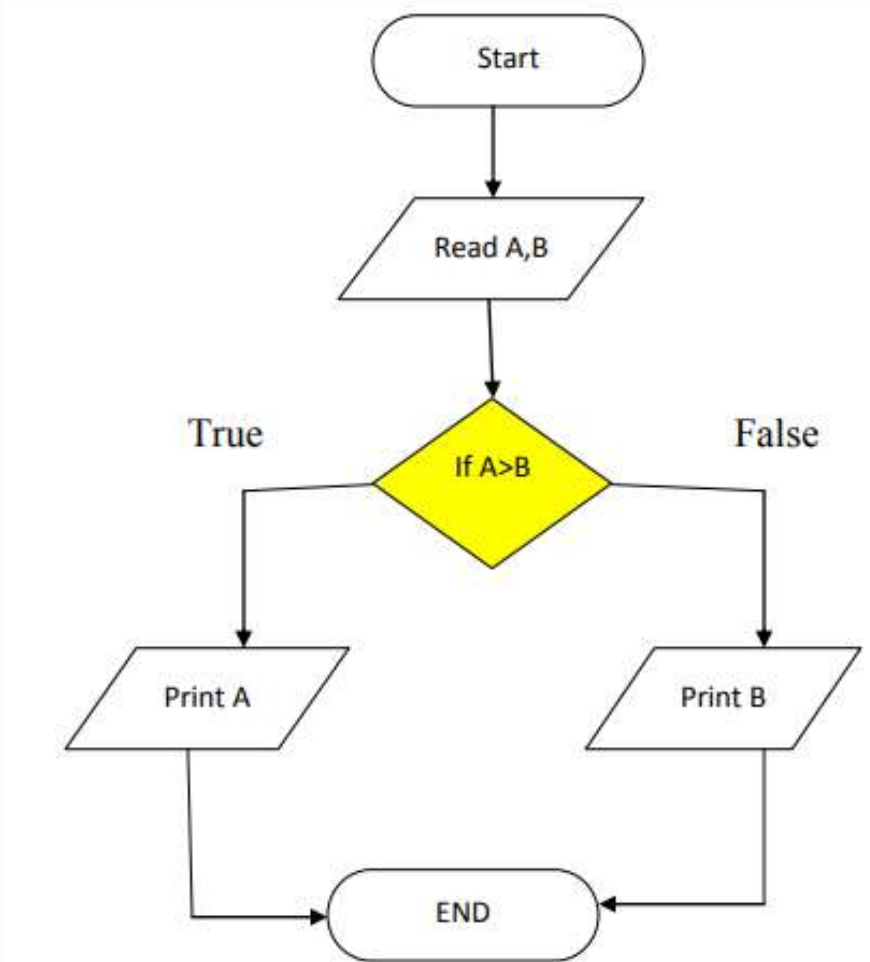
Some more examples (flowchart for printing numbers 1 to 20)



Some more examples (flowchart for finding average of two numbers) try writing the algorithm by yourself



Some more examples (flowchart for finding greater number of among given two numbers) try writing the algorithm by yourself



Practice

Q1. Draw a flowchart to compute the result of the algebraic function (A – B)(A+B) and display the result in variable, F.

Q2. An airport has a conveyer belt to pass the luggage to the passengers. This conveyor belt is operated by a push button and 2 lights (GREEN and RED) are fitted in the system. **If** the button is pressed once then the belt will circulate in the clockwise direction and the GREEN light will remain ON keeping the RED light OFF. If the button is not pressed then the conveyer belt will not be circulating and the RED light will remain ON keeping the GREEN light OFF. This entire system is built around an **Arduino Uno platform**.

Draw a flowchart to operate the **lights** and **conveyor belt** through the **switch** considering the given restraints.

Practice

A traffic control system uses 3 different colors of lights: Red, Yellow and Green. Dhaka Metropolitan Police wants to move away from the human-controlled traffic system and move to an automated system. To test out their idea, they are trying to implement this proposed automated system only at a few traffic points. One of these points was chosen to be in front of Radisson Hotel near Kurmitola. Considering the cost, it was proposed that an Arduino Uno platform may be used. Now, prepare a program in Arduino Uno to implement a traffic control system at those chosen traffic point which will perform the following operations:

- Red light will light up for 30sec.
- Red will go off and Green will light up for 55sec.
- 50s after green lights up, Yellow will light up for 5s.
- Only green will turn off.
- Yellow will blink for 5s at a 1s interval and then turn off. [**Hints:** You have to use **for (int i = 0; i <??; i = i+1)**]
- Red will turn on again and sequence will be repeated.
- Consider blink to be a light lighting up for 1s and staying off for 1s and the sequence is repeated.

REFERENCES:

- http://www.yspuniversity.ac.in/cic/algorithm-manual.pdf
- http://programmingposts.com/c-program-converting-celsius-fahrenheit/
- https://www.edrawsoft.com/explain-algorithm-flowchart.html
- https://www.c-programming-simple-steps.com/flow-chart.html
- https://faradars.org/wp-content/uploads/2015/07/Algorithm-and-Flow-Chart.pdf