UNIT-1
Topic - Algorithm and Flowchart for Various Control Statements

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.

HOW TO WRITE ALGORITHMS

Step 1 **Define your algorithms input**: Many algorithms take in data to be processed, e.g. to calculate the area of rectangle input may be the rectangle height and rectangle width.

Step 2 **Define the variables**: Algorithm's variables allow you to use it for more than one place. We can define two variables for rectangle height and rectangle width as HEIGHT and WIDTH (or H & W). We should use meaningful variable name e.g. instead of using H & W use HEIGHT and WIDTH as variable name.

Step 3 **Outline the algorithm's operations:** Use input variable for computation purpose, e.g. to find area of rectangle multiply the HEIGHT and WIDTH variable and store the value in new variable (say) AREA. An algorithm's operations can take the form of multiple steps and even branch, depending on the value of the input variables.

Step 4 **Output the results of your algorithm's operations**: In case of area of rectangle output will be the value stored in variable AREA. if the input variables described a rectangle with a HEIGHT of 2 and a WIDTH of 3, the algorithm would output the value of 6.

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 Flowchartone 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.

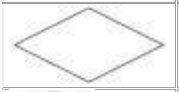
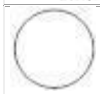
Advantages of flowchart:

- 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.

Flowchart is diagrammatic /Graphical representation of sequence of steps to solve a problem. To draw a flowchart following standard symbols are use

Symbol	Purpose	Description
	Flow line	Used to indicate the flow of logic by connecting symbols.
	Terminal(Stop/Start)	Used to represent start and end of flowchart.
	Input/Output	Used for input and output operation.
	Processing	Used for airthmetic operations and data-manipulations.
	Desicion	Used to represent the operation in which there are two alternatives, true and false.
	On-page Connector	Used to join different flowline
	Off-page Connector	Used to connect flowchart portion on different page.
	Predefined Process/Function	Used to represent a group of statements performing one processing task.

The language used to write algorithm is simple and similar to day-to-day life language. The variable names are used to store the values. The value store in variable can change in the solution steps. In addition some special symbols are used as below

Assignment Symbol (=) is used to assign value to the variable.
e.g. to assign value 5 to the variable HEIGHT, statement is HEIGHT = 5
The symbol „=" is used in most of the programming language as an assignment symbol, the same has been used in all the algorithms and flowcharts.

The statement C = A + B means that add the value stored in variable A and variable B then assign/store the value in variable C.

The statement R = R + 1 means that add I to the value stored in variable R and then assign/store the new value in variable R, in other words increase the value of variable R by 1

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

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

Selection control Statements

Selection Control	Example	Meaning

IF (Condition) Then
…
ENDIF
	IF (X > 10) THEN
	Y=Y+5
	ENDIF
		If condition X>10 is True execute the statement between THEN and ENDIF

IF (Condition) Then
…
ELSE
…..
ENDIF
	IF (X > 10)
	THEN Y=Y+5
	ELSE
	Y=Y+
	8
	Z=Z+3
	ENDIF
		If condition X>10 is True execute the statement between THEN and ELSE otherwise execute the statements between ELSE and ENDIF

Loop control Statements

Selection Control	Example	Meaning

WHILE (Condition) DO
..
..
ENDDO
	WHILE (X < 10) DO
	print
	x
	x=x+
	1
	ENDDO
		Execute the loop as long as the condition is TRUE

DO …. … UNTILL (Condition)	DO print x x=x+ 1 UNTILL (X >10)	Execute the loop as long as the condition is false

GO TO statement also called unconditional transfer of control statement is used to transfer control of execution to another step/statement. . e.g. the statement GOTO n will transfer control to step/statement n.

Note: The algorithm is given in simpler form you can learn it for pseudocode also By ignoring start and stop.

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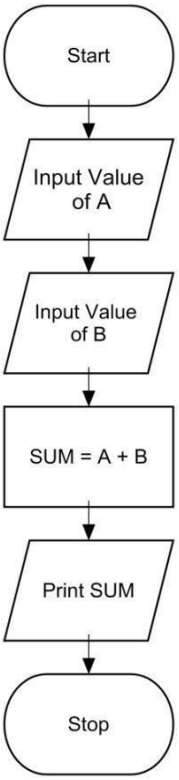
Algorithm & Flowchart to find the sum of two numbers

Algorithm

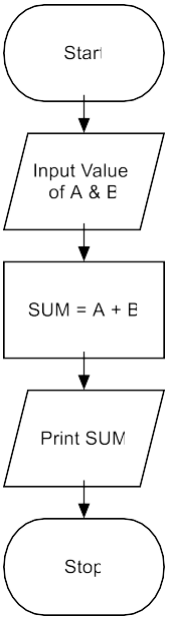
Step-1 Start
Step-2 Input first numbers say A
Step-3 Input second number say B
Step-4 SUM = A + B
Step-5 Display SUM
Step-6 Stop



OR

Algorithm

Step-1 Start
Step-2 Input two numbers say A & B
Step-3 SUM = A + B
Step-4 Display SUM
Step-5 Stop



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Algorithm & Flowchart to convert temperature from Celsius to Fahrenheit

C : temperature in Celsius
F : temperature Fahrenheit

Algorithm

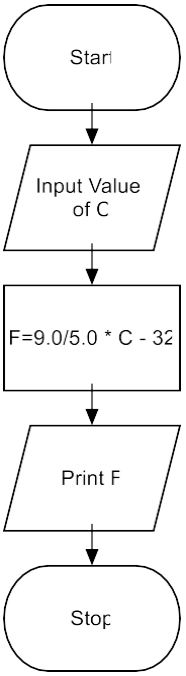
Step-1 Start

Step-2 Input temperature in Celsius say C

Step-3 F = (9.0/5.0 x C) + 32

Step-4 Display Temperature in Fahrenheit F

Step-5 Stop



Algorithm & Flowchart to convert temperature from Fahrenheit to Celsius

C : temperature in Celsius
F : temperature Fahrenheit

Algorithm

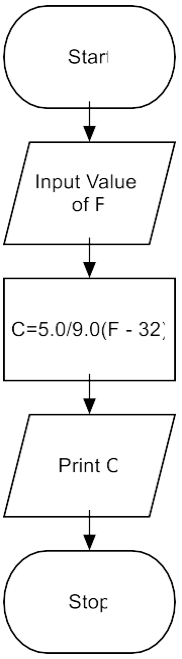
Step-1 Start

Step-2 Input temperature in Fahrenheit say F

Step-3 C = 5.0/9.0 (F - 32)

Step-4 Display Temperature in Celsius C

Step-5 Stop



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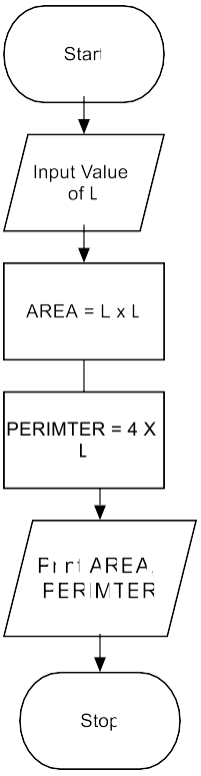
Algorithm & Flowchart to find Area and Perimeter of Square

L : Side Length of Square
AREA : Area of Square
PERIMETER : Perimeter of Square

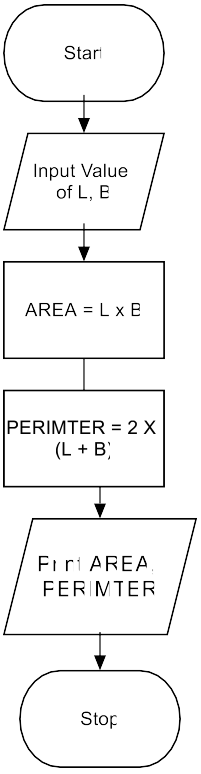


Algorithm

Step-1 Start
Step-2 Input Side Length of Square say L
Step-3 Area = L x L
Step-4 PERIMETER = 4 x L
Step-5 Display AREA,PERIMETER
Step-6 Stop

Algorithm & Flowchart to find Area and Perimeter of Rectangle

L : Length of Rectangle
B : Breadth of Rectangle
AREA : Area of Rectangle
PERIMETER : Perimeter of Rectangle



Algorithm

Step-1 Start
Step-2 Input Side Length & Breadth say L, B
Step-3 Area = L x B
Step-4 PERIMETER = 2 x (L + B)
Step-5 Display AREA, PERIMETER
Step-6 Stop

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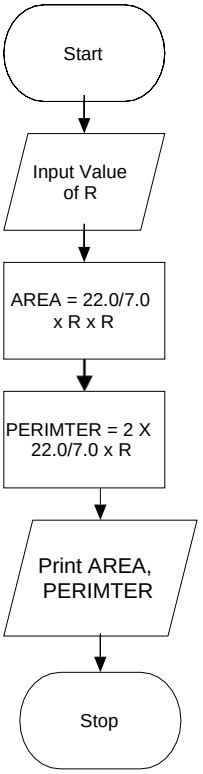
Algorithm & Flowchart to find Area and Perimeter of Circle

R : Radius of Circle
AREA : Area of
Circle
PERIMETER : Perimeter of Circle



Algorithm

Step-1 Start

Step-2 Input Radius of Circle as R

Step-3 Area = 22.0/7.0 x R x R

Step-4 PERIMETER = 2 x 22.0/7.0 x R

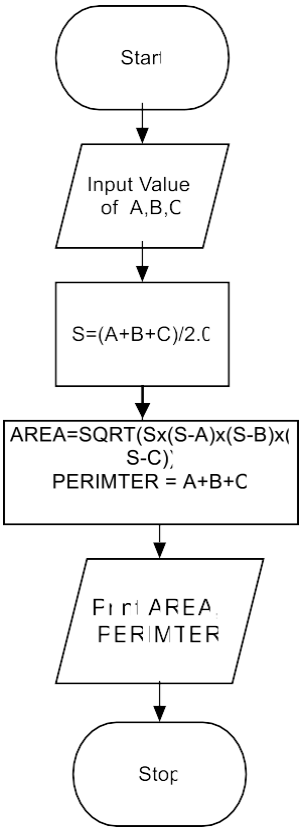
Step-5 Display area and perimeter,

Step-6 Stop

Algorithm & Flowchart to find Area & Perimeter of Triangle

(when three sides are given)

A : First Side of Triangle
B : Second Side of Triangle
C : Third Side of Triangle
AREA : Area of Triangle
PERIMETER : Perimeter of Triangle



Algorithm

Step-1 Start
Step-2 Input Sides of Triangle A,B,C
Step-3 S= (A + B + C)/ 2.0
Step-4 AREA = SQRT(S x (S-A) x (S-B) x(S-C))
Step-5 PERIMETER = S1 + S2 + S3
Step-6 Display AREA, PERIMETER
Step-7 Stop

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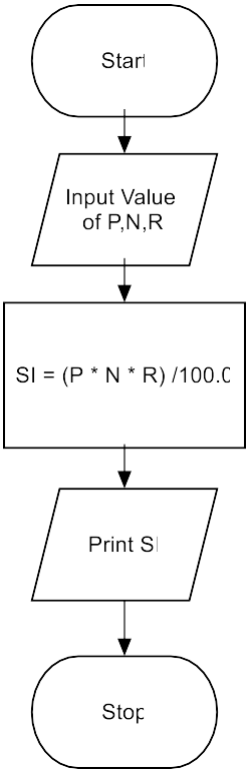
Algorithm & Flowchart to find Simple Interest

P : Principle Amount
N : Time in Years
R : % Annual Rate of Interest
SI : Simple Interest



Algorithm

Step-1 Start

Step-2 Input value of P, N, R

Step-3 SI = (P x N x R)/100.0

Step-4 Display SI

Step-6 Stop

Algorithm & Flowchart to find Compound Interest

P : Principle Amount
N : Time in Years
R : % Annual Rate of Interest
CI : Compound Interest

Algorithm

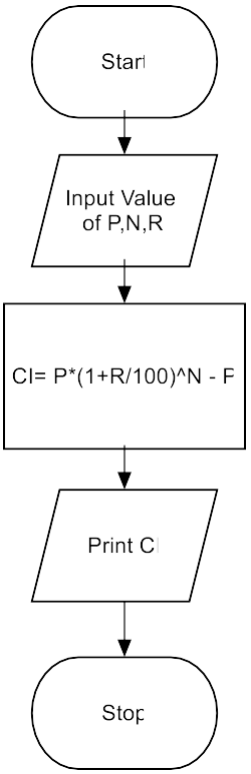
Step-1 Start

Step-2 Input value of P, N, R

Step-3 $CI = P(1+R/100)^N - P$

Step-4 Display CI

Step-6 Stop



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Algorithm & Flowchart to Swap Two Numbers using Temporary Variable

Algorithm

Step-1 Start

Step-2 Input Two Numbers Say NUM1,NUM2

Step-3 Display Before Swap Values NUM1, NUM2

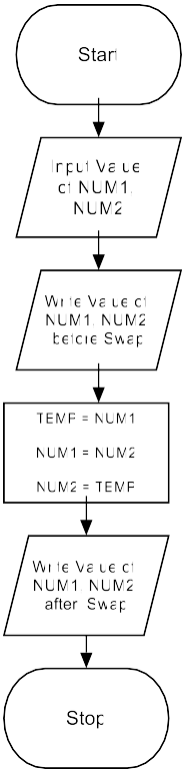
Step-4 TEMP = NUM1

Step-5 NUM1 =NUM2

Step-6 NUM2 = NUM1

Step-7 Display After Swap Values NUM1,NUM

Step-8 Stop



Algorithm & Flowchart to Swap Two Numbers without using temporary variable

Algorithm

Step-1 Start

Step-2 Input Two Numbers Say A,B

Step-3 Display Before Swap Values A, B

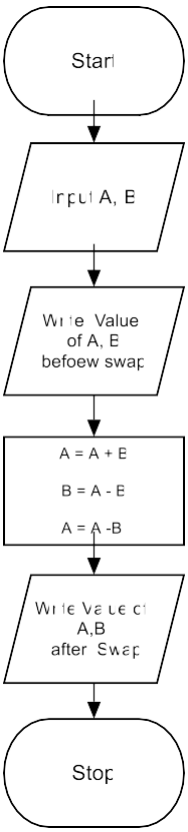
Step-4 A = A + B

Step-5 B = A - B

Step-6 A = A - B

Step-7 Display After Swap Values A, B

Step-8 Stop



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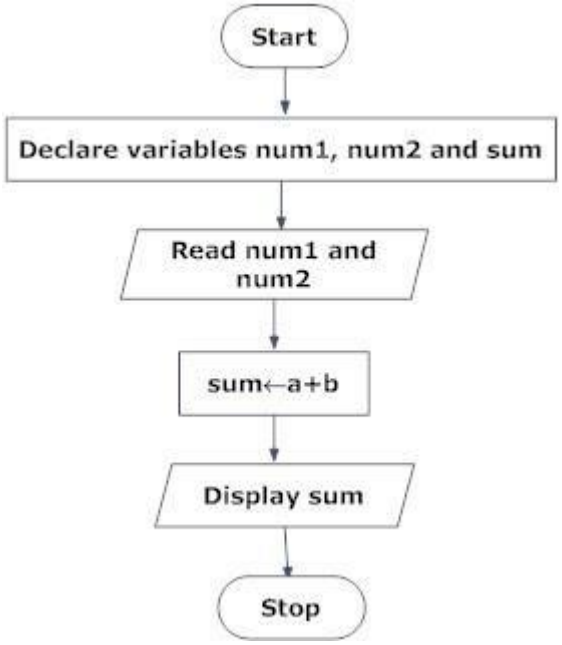
Draw a flowchart to add two numbers entered by user. Mention algorithm and pseudocode for it.



Algorithm

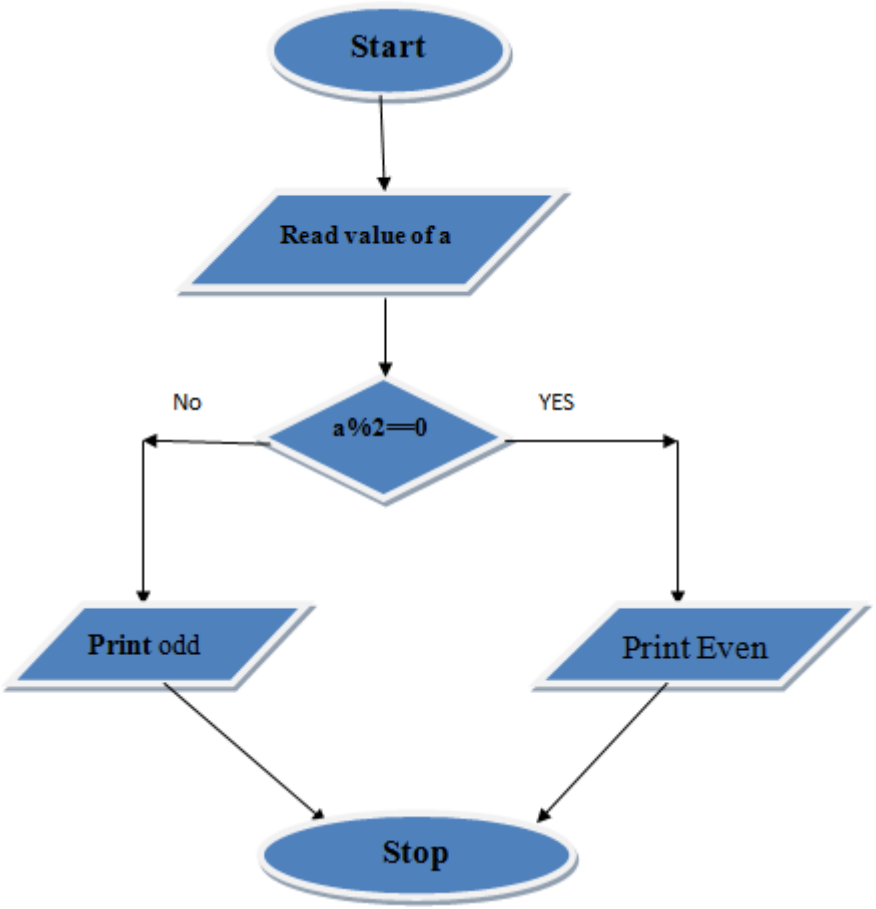
Step-1 Start
Step-2 Input first numbers say a
Step-3 Input second number say b
Step-4 Add a and b store in sum
Step-5 Display sum
Step-6 Stop

Pseudocode

1. Read a
2. Read b
3. sum = a + b
4.Display sum

..

Draw flowchart to find the whether the number entered by user is even or odd.



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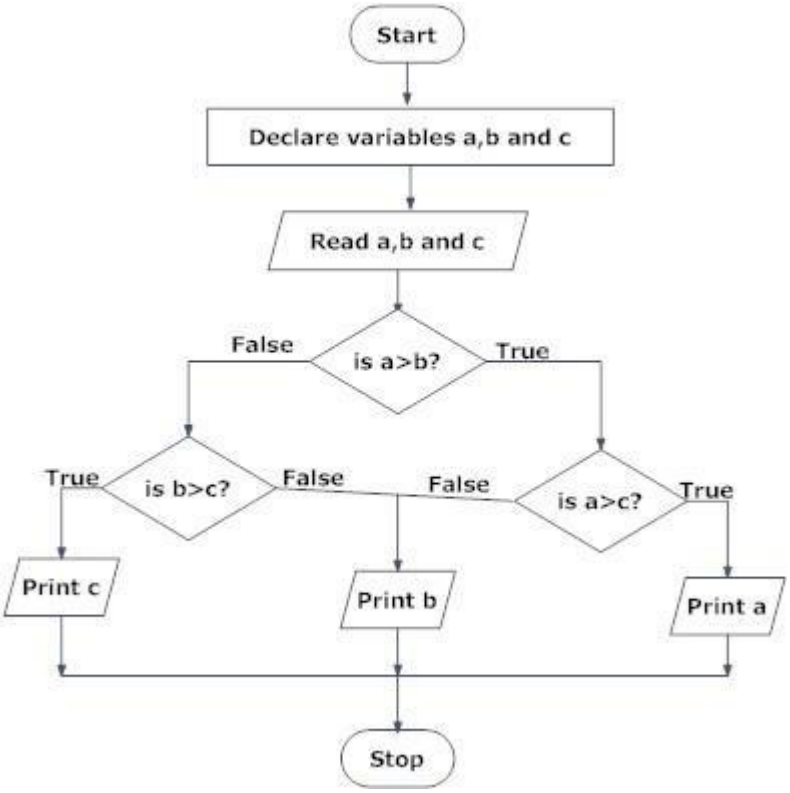
Draw flowchart to find the largest among three different numbers entered by user.



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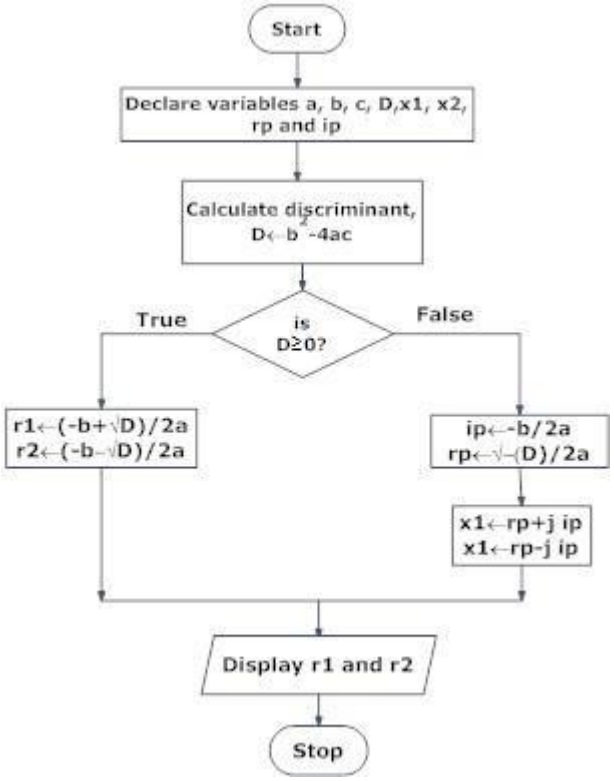
Draw a flowchart to find all the roots of a quadratic equation $ax^2+bx+c=0$



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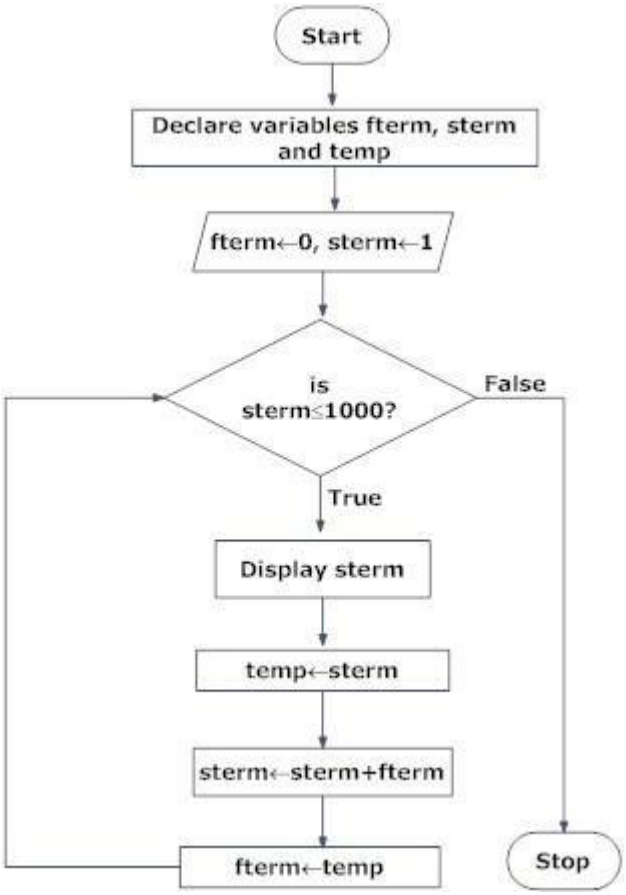
Draw a flowchart to find the Fibonacci series till term≤1000.



Though, flowcharts are useful in efficient coding, debugging and analysis of a program, drawing flowchart in very complicated in case of complex programs and often ignored.