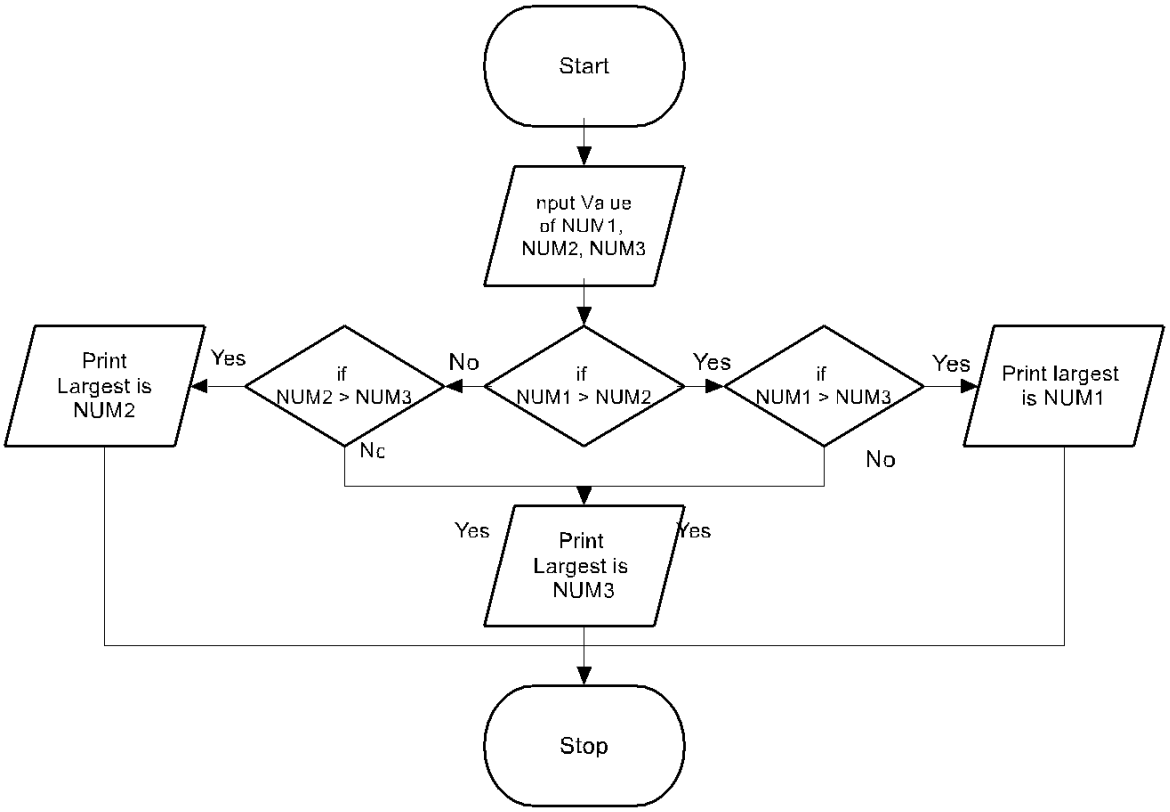
ALGORITHM & FLOWCHART MANUAL
for
STUDENTS



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.

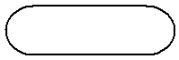
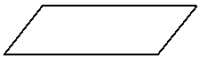
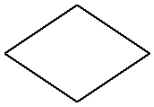
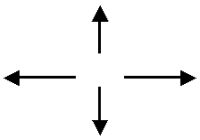
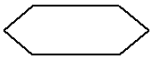
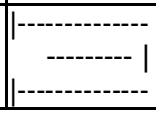
FLOWCHART:

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 Name	Symbol	function
Oval		Used to represent start and end of flowchart
Parallelogram		Used for input and output operation
Rectangle		Processing: Used for arithmetic operations and data-manipulations
Diamond		Decision making. Used to represent the operation in which there are two/three alternatives, true and false etc
Arrows		Flow line Used to indicate the flow of logic by connecting symbols
Circle		Page Connector
		Off Page Connector
		Predefined Process /Function Used to represent a group of statements performing one processing task.
		Preprocessor
		Comments

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 (← or =) is used to assign value to the variable.

e.g. to assign value 5 to the variable HEIGHT, statement is

HEIGHT ← 5

or

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 in the manual.

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: We can use keyword INPUT or READ or GET to accept input(s) /value(s) and keywords PRINT or WRITE or DISPLAY to output the result(s).

Algorithm & Flowchart to find the sum of two numbers

Algorithm

Step-1 Start

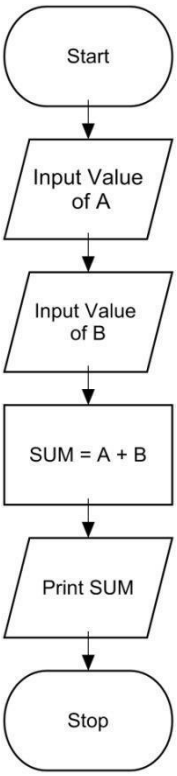
Step-2 Input first numbers say A

Step-3 Input second number say B

Step-4 SUM = A + B

Step-5 Display SUM

Step-6 Stop



OR

Algorithm

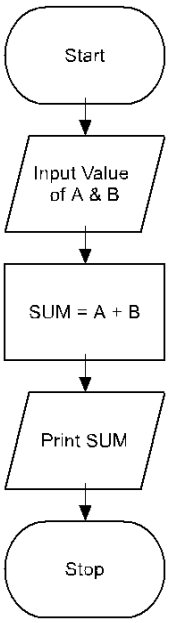
Step-1 Start

Step-2 Input two numbers say A & B

Step-3 SUM = A + B

Step-4 Display SUM

Step-5 Stop



Algorithm & Flowchart to convert temperature from Celsius to Fahrenheit

C : temperature in Celsius
F : temperature Fahrenheit

Algorithm

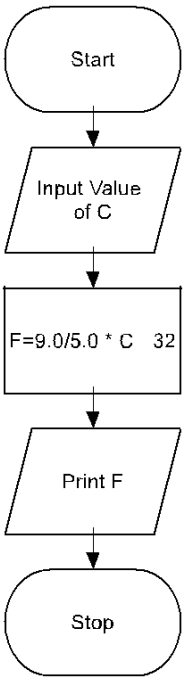
Step-1 Start

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

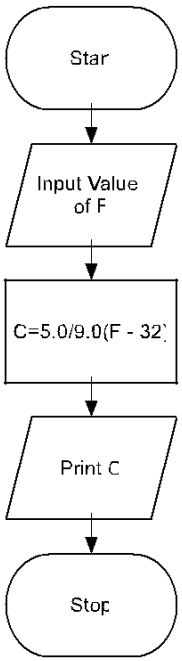
Step-1 Start

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



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

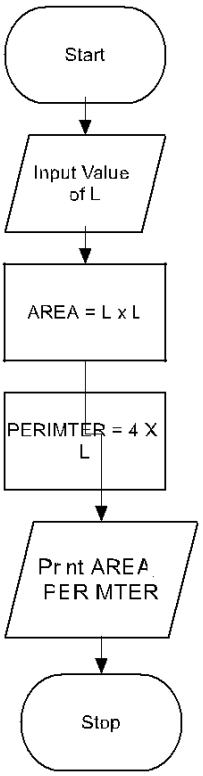
Step-2 Input Side Length of Square say L

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

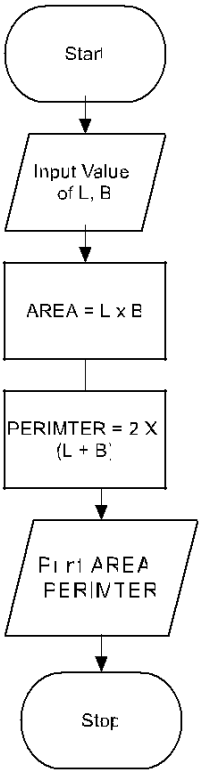
Step-2 Input Side Length & Breadth say L, B

Step-3 Area = L x B

Step-4 PERIMETER = 2 x (L + B)

Step-5 Display AREA, PERIMETER

Step-6 Stop



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

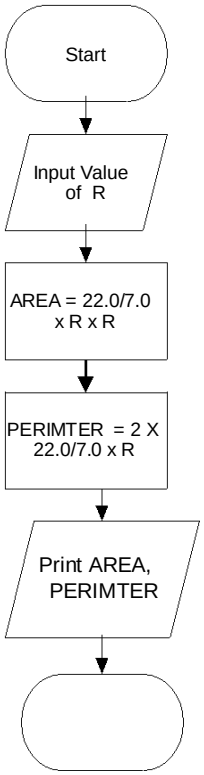
Step-2 Input Radius of Circle say R

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, PERIMETER

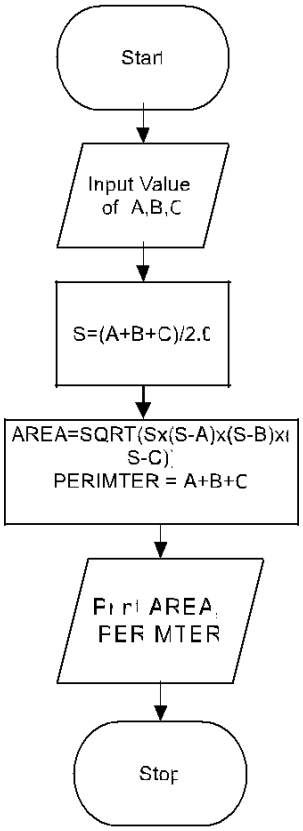
Step-6 Stop



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))

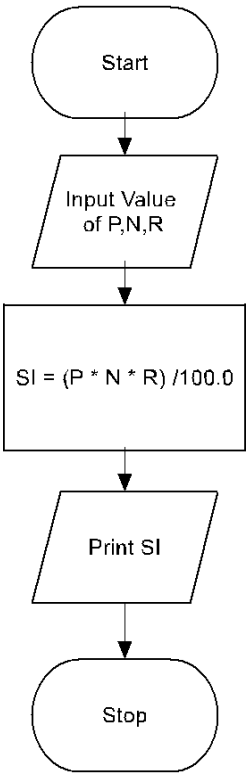
Step-5 PERIMETER = S1 + S2 + S3

Step-6 Display AREA, PERIMETER

Step-7 Stop

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

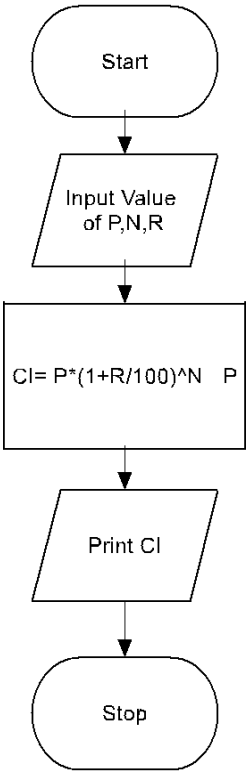
Step-3 SI = (P x N x R)/100.0

Step-4 Display SI F

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

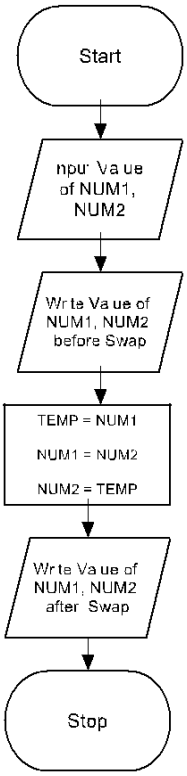
Step-2 Input value of P, N, R C

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

Step-4 Display CI

Step-6 Stop

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

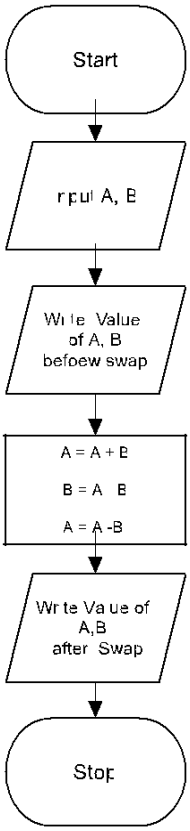
Step-4 A = A + B

Step-5 B = A - B

Step-6 A = A - B

Step-7 Display After Swap Values A, B

Step-8 Stop



Algorithm & Flowchart to find the smallest of two numbers

Algorithm

Step-1 Start

Step-2 Input two numbers say

NUM1,NUM2

Step-3 IF NUM1 < NUM2 THEN

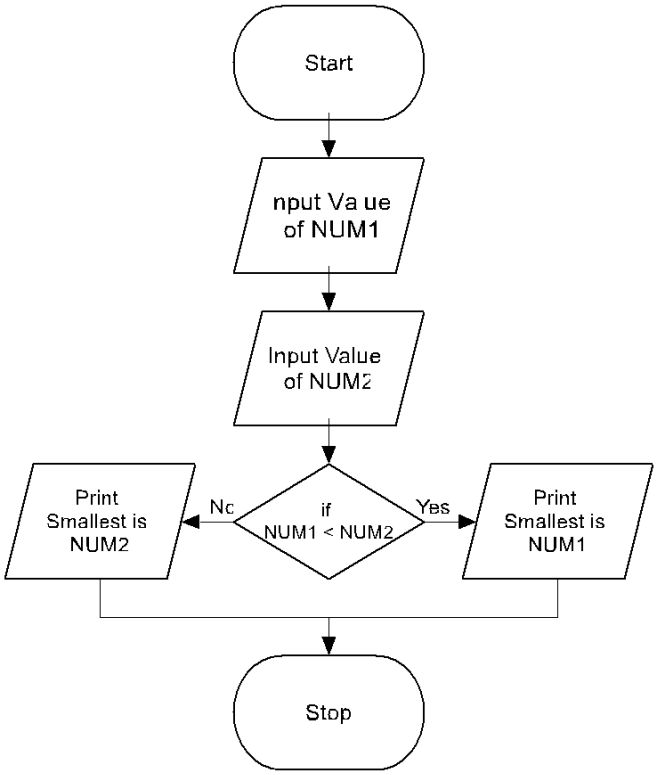
print smallest is NUM1

ELSE

print smallest is NUM2

ENDIF

Step-4 Stop



Algorithm & Flowchart to find the largest of two numbers

Algorithm

Step-1 Start

Step-2 Input two numbers say

NUM1,NUM2

Step-3

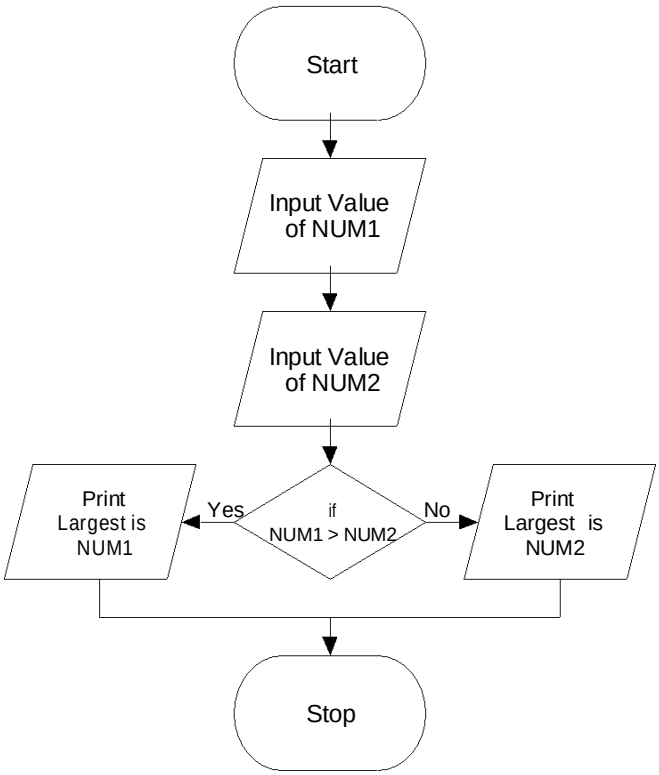
IF NUM1 > NUM2 THEN
print largest is NUM1

ELSE

print largest is NUM2

ENDIF Step-4

Stop



Algorithm & Flowchart to find the largest of three numbers

Algorithm

Step-1 Start

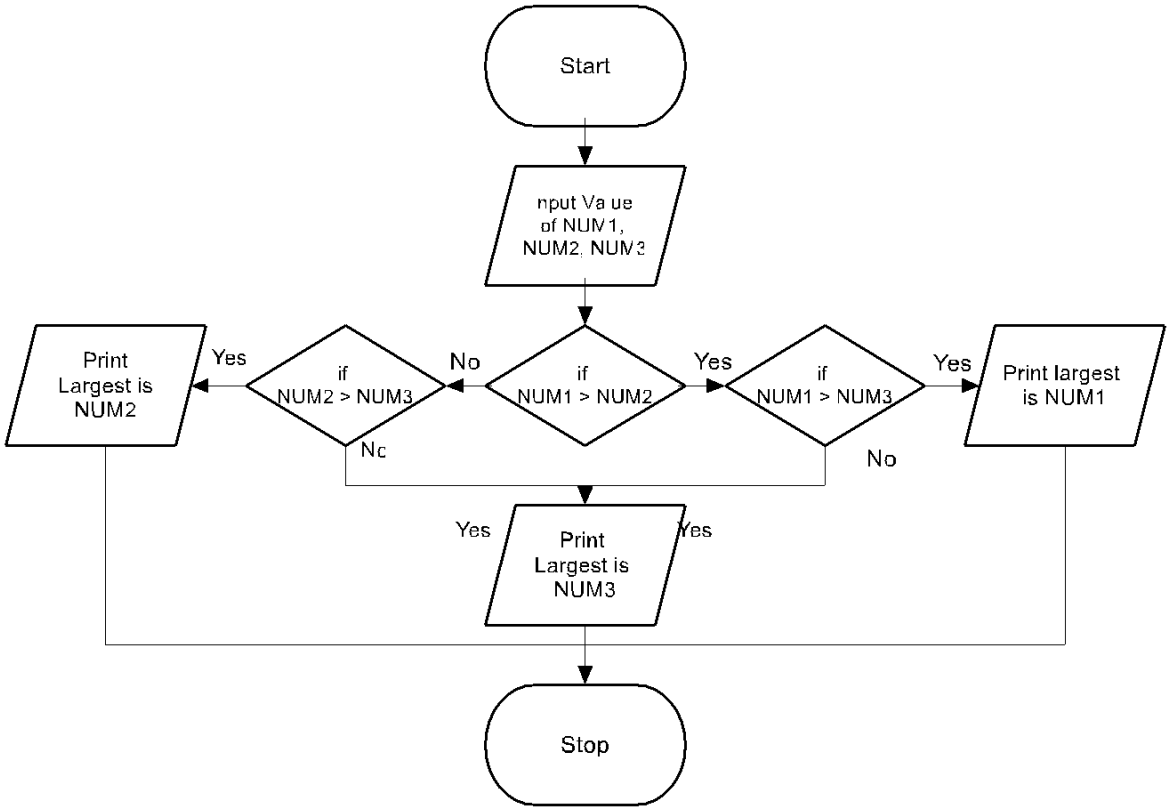
Step-2 Read three numbers say num1,num2, num3

Step-3 if num1>num2 then go to step-5

Step-4 IF num2>num3 THEN
print num2 is largest
ELSE
print num3 is largest
ENDIF
GO TO Step-6

Step-5 IF num1>num3 THEN
print num1 is largest
ELSE
print num3 is largest
ENDIF

Step-6 Stop



Algorithm & Flowchart to find the largest of three numbers (an another way)

Algorithm

Step-1 Start

Step-2 Read three numbers say A,B,C

Step-3 BIG = A

Step-4 IF B > BIG THEN

BIG = B

ENDIF

Step-5 IF C >BIG THEN

BIG = C

ENDIF

Step-6 Write BIG

Step-7 Stop

Algorithm & Flowchart to find Even number between 1 to 50

Algorithm

Step-1 Start

Step-2 I = 1

Step-3 IF (I >50) THEN

GO TO Step-7

ENDIF

Step-4 IF ((I % 2) =0) THEN

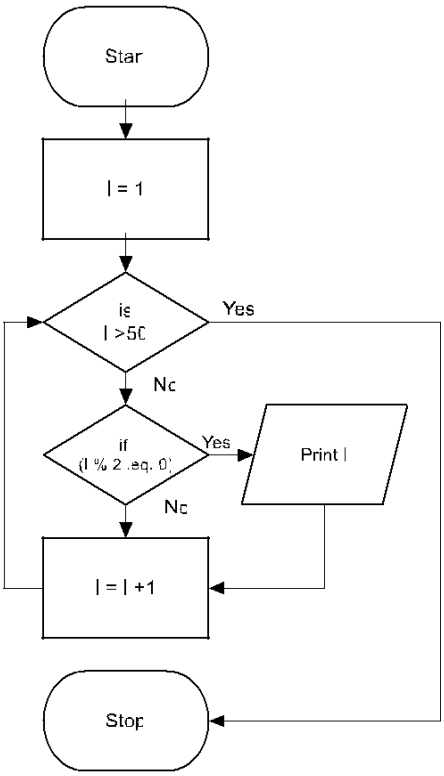
Display I

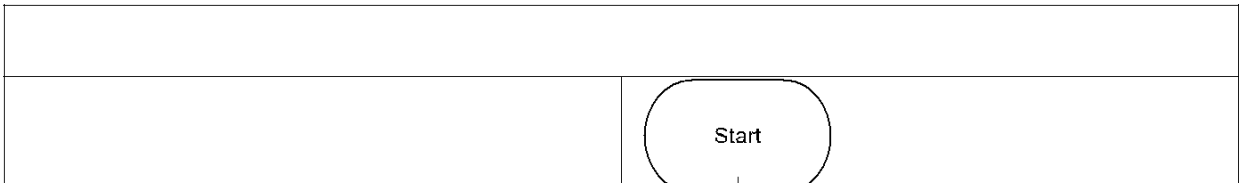
ENDIF

Step-5 I = I + 1

Step-6 GO TO Step--3

Step-7 Stop





Algorithm & Flowchart to find Odd numbers between 1 to n where n is a positive Integer

Algorithm

Step-1 Start

Step-2 Input Value of N

Step-3 I = 1

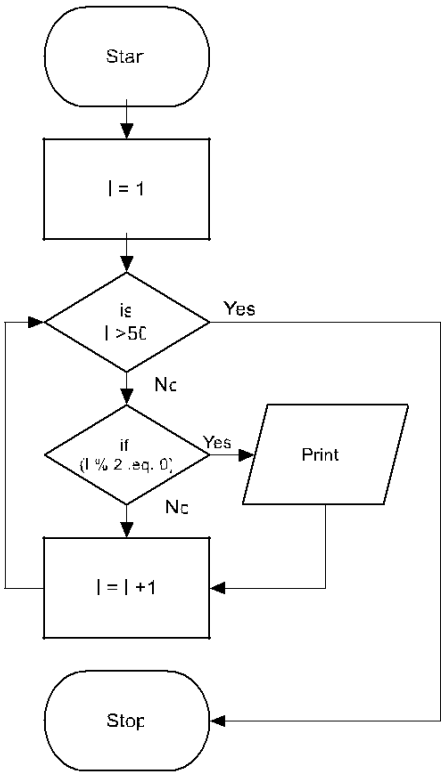
Step-4 IF (I >N) THEN
GO TO Step-8
ENDIF

Step-5 IF ((I % 2)=1) THEN
Display I
ENDIF

Step-6 I = I + 1

Step-7 GO TO Step-4

Step-8 Stop



Algorithm & Flowchart to find sum of series 1+2+3+…..+N

Algorithm

Step-1 Start

Step-2 Input Value of N

Step-3 I = 1, SUM=0

Step-4 IF (I >N) THEN
GO TO Step-8
ENDIF

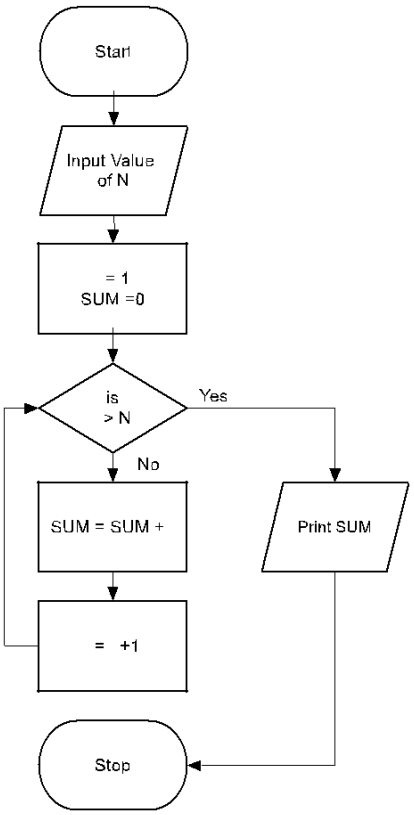
Step-5 SUM = SUM + I

Step-6 I = I + 1

Step-7 Go to step-4

Step-8 Display value of SUM

Step-9 Stop



Algorithm & Flowchart to find sum of series 1+3+5+…..+N, Where N is positive odd Integer

Algorithm

Algorithm

Step-1 Start

Step-2 Input Value of N

Step-3 I = 1, SUM=0

Step-4 IF (I >N) THEN
GO TO step 8
ENDIF

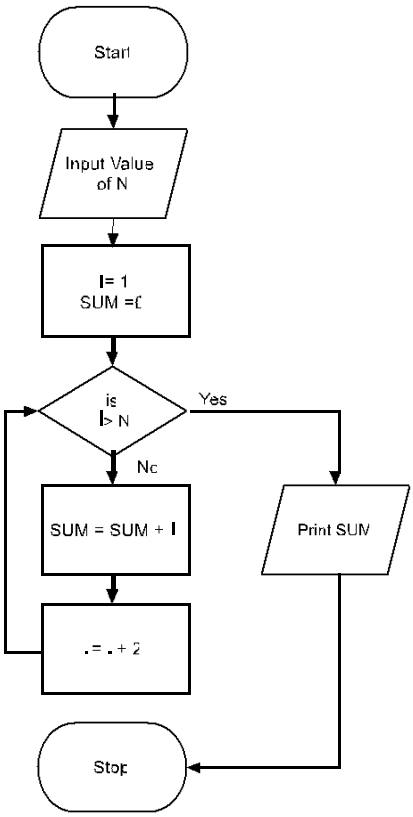
Step-5 SUM = SUM + I

Step-6 I = I + 2

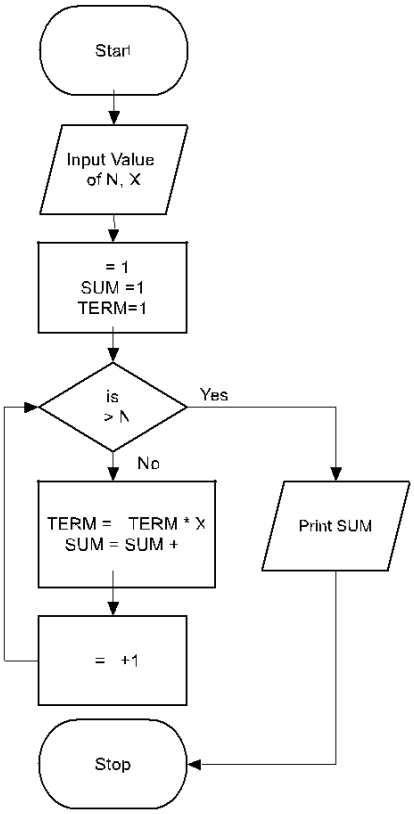
Step-7 Go to step-4

Step-8 Display value of SUM

Step-9 Stop



Algorithm & Flowchart to find sum of series $1 - X + X^2 - X^3 \ldots X^N$



Algorithm

Step-1 Start

Step-2 Input Value of N, X

Step-3 I = 1, SUM=1, TERM=1

Step-4 IF (I >N) THEN
GO TO Step-9
ENDIF

Step-5 TERM = - TERM * X

Step-6 SUM = SUM + TERM

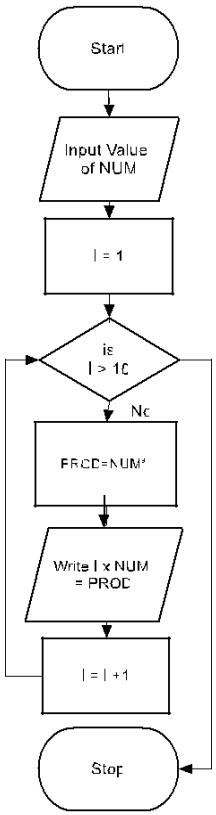
Step-7 I = I + 1

Step-8 Go to step-4

Step-9 Display value of SUM

Step-10 Stop

Algorithm & Flowchart to print multiplication Table of a number



Algorithm

Step-1 Start

Step-2 Input Value of NUM

Step-3 I = 1

Step-4 IF (I >10) THEN
GO TO Step 9
ENDIF

Step-5 PROD = NUM * I

Step-6 WRITE I “x” NUM “=” PROD

Step-7 I = I + 1

Step-8 Go to step-4

Step-9 Stop

..

Algorithm & Flowchart to generate first n Fibonacci terms 0,1,1,2,3,5…n (n>2)

Algorithm

Step-1 Start

Step-2 Input Value of N

Step-3 A=0, B=1, COUNT=2

Step-4 WRITE A, B

Step-5 IF (COUNT >N) then go to step 12

Step-6 NEXT= A + B

Step-7 WRITE NEXT

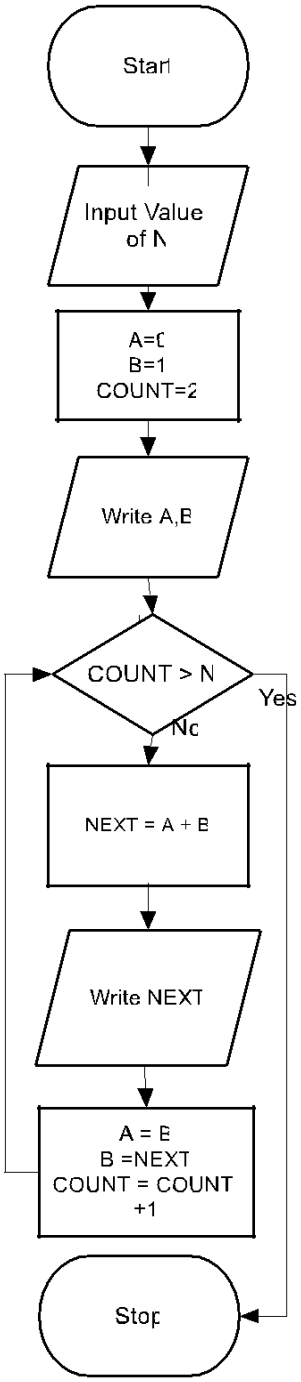
Step-8 A=B

Step-9 B=NEXT

Step-10 COUNT=COUNT + 1

Step-11 Go to step-4

Step-12 Stop



Algorithm & Flowchart to find sum and average of given series of numbers

Algorithm

Step-1 Start

Step-2 COUNT=0

Step-3 SUM=0

Step-4 Input NUM (next number in series)

Step-5 SUM= SUM +NUM

Step-6 COUNT=COUNT+1

Step-7 IF More Number in Series then

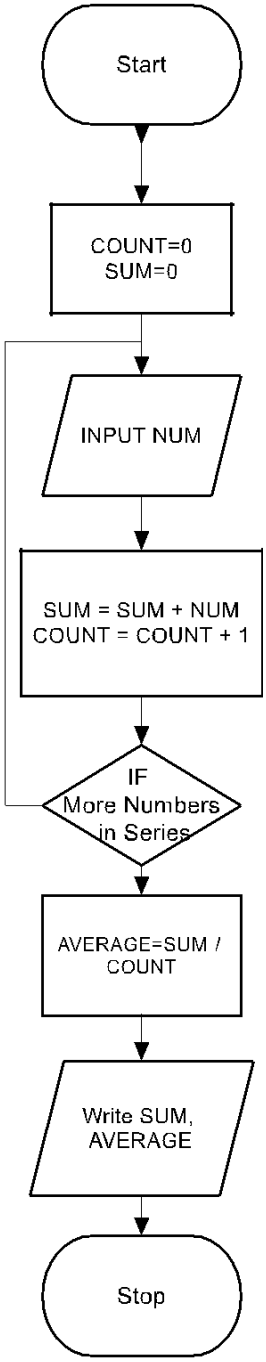
GOTO Step-4

ENDIF

Step-8 AVERGAE=SUM / COUNT

Step-9 WRITE SUM, AVERAGE

Step-10 Stop



Algorithm & Flowchart to find Roots of Quadratic Equations $AX^2+BX+C=0$

Algorithm

Step-1 Start

Step-2 Input A,B,C

Step-3 DISC= B^2 – 4 A * C

Step-4 IF (DISC < 0) THEN

Write Roots are Imaginary

Stop

ENDIF

Step-5 IF (DISC==0) THEN

Write Roots are Real and Equal

X1 = - B/(2*A)

Write Roots are X1,X1

Stop

ENDIF

Step-6 IF (DISC >0)

Write Roots are Real and Unequal

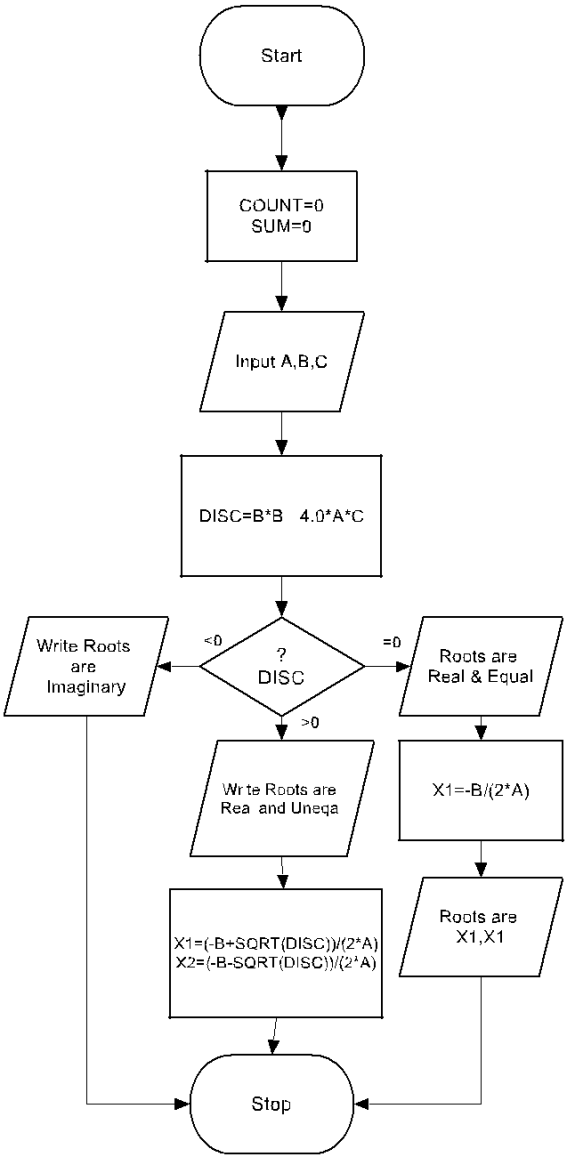
X1= (- B + SQRT(DISC)) / (2*A)

X2= (- B + SQRT(DISC)) / (2*A)

Write Roots are X1,X2

Stop

ENDIF



Algorithm & Flowchart to find if a number is prime or not

Algorithm

Step-1 Start

Step-2 Input NUM

Step-3 R=SQRT(NUM)

Step-4 I=2

Step-5 IF (I > R) THEN

Write NUM is Prime Number

Stop

ENDIF

Step 6 IF (NUM % I ==0) THEN

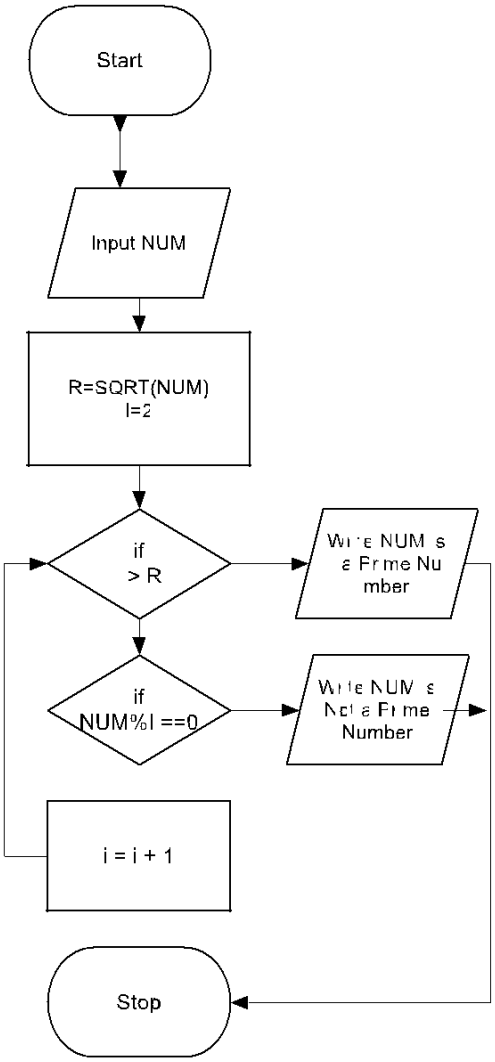
Write NUM is Not Prime

Stop

ENDIF

Step-7 I = I + 1

Step-8 Go to Step-5



Algorithm & Flowchart to find GCD and LCM of two numbers

Algorithm

Step-1 Start

Step-2 Read two number A, B

Step-3 IF (A > B) THEN

N =A

D=B

ELSE

N=B

D=A

ENDIF

Step-4 r=N/D

Step-5 WHILE (r != 0)

DO

N=D

D=r

r =N%D

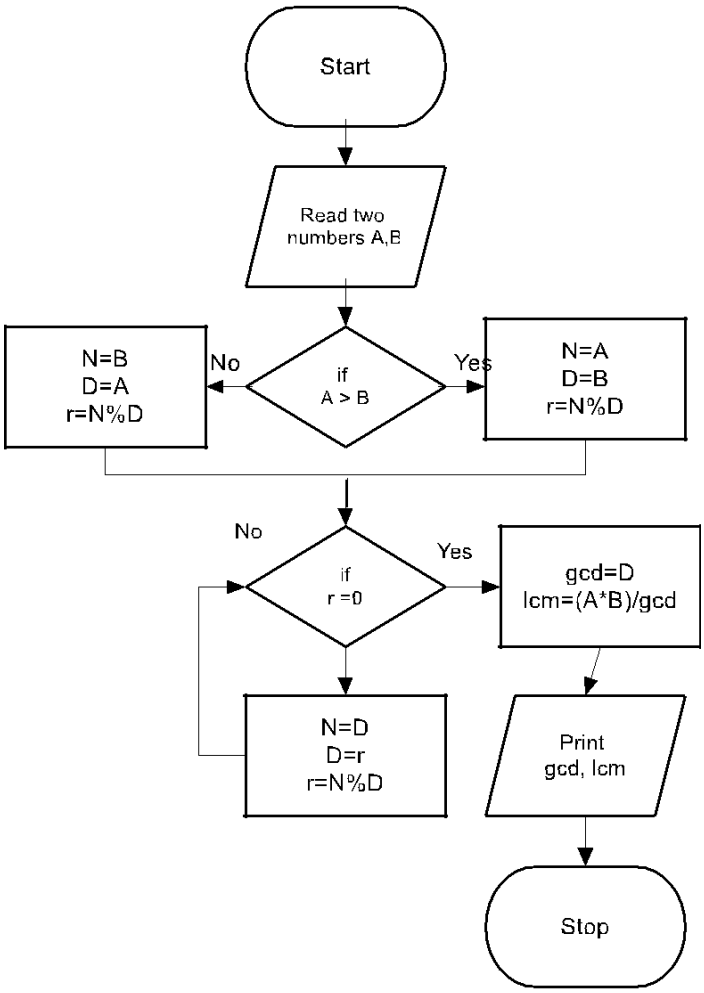
DONE

Step-6 gcd=d

Step-7 lcm = (a*b)/gcd

Step-8 Display gcd, lcm

Step-9 Stop



Algorithm & Flowchart to find Factorial of number n (n!=1x2x3x…n)

Algorithm

Step-1 Start

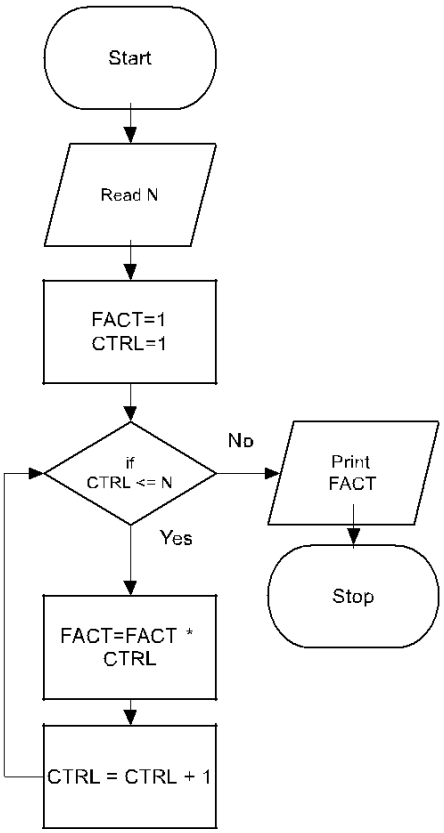
Step-2 Read number N

Step-3 FACT=1 CTRL=1

Step-4 WHILE (CTRL <= N)
DO
FACT=FACT*I
CTRL=CTRL+1
DONE

Step-5 Display FACT

Step-6 Stop



Algorithm & Flowchart to find all the divisor of a number

Algorithm

Step-1 Start

Step-2 Read number N

Step-3 D=1

Step-4 WHILE (D< N)
DO
IF (N % D ==0) THEN
PRINT D
ENDIF
D=D+1
DONE

Step-5 Stop