

# Problem Solving Methodology

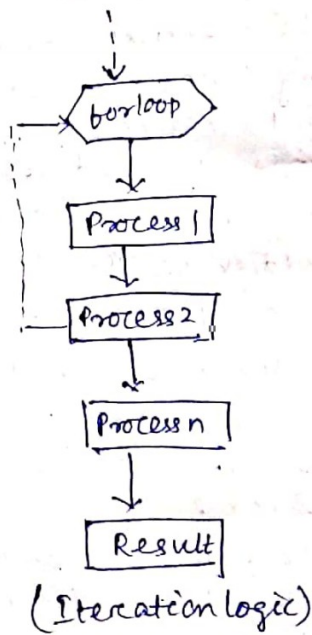
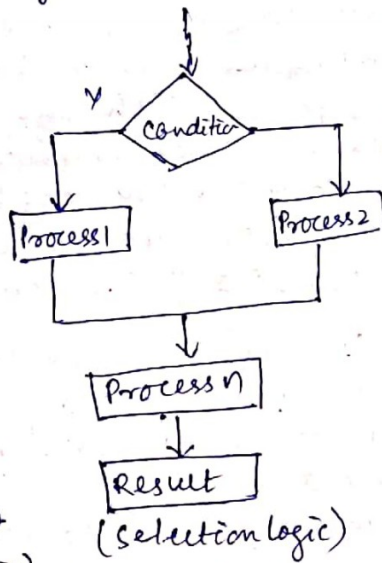
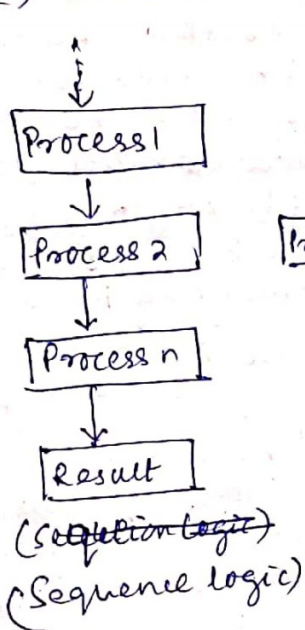
Algorithm:- An algorithm is defined as a step by step method for writing the various steps of the solution to a problem. Before writing any program it is always advisable to have the algorithm for the problem.

## Algorithm characteristics.

- (1) Algorithm should be finite. definite
- (2) Algorithm should have finite number of steps.
- (3) Algorithm should mention the input required for the program clearly.
- (4) Algorithm should ~~has~~ give an idea the output that will be obtained.

Pseudocode :- When we write the logic of a problem solution in a step manner in English and follow certain programming construction, then it is known as Pseudocode. Like Algorithm pseudocode can be written in a 3 basic ways

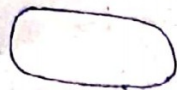
- (1) Sequence logic
- (2) Selection logic and
- (3) Iteration logic.

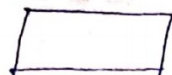


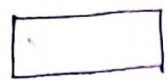
## Flowchart:->


A flowchart is a graphical or symbolic representation of a process. The greatest advantage with flowchart is that any person can easily understand the flow of the logic as it is represented in a graphical manner.


## Basic Flowchart Symbols:-

 → Contains START or STOP.

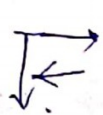
 → Contains input statement

 → Contains any calculation or processing statement

 → Contains condition for selection logic

 → Contains number of iterations in the for of a starting and ending condition.

⊙ → Continuation Symbol.

 → shows the direction of flow of logic and connect the different symbols of the flowchart.

## Advantages & Disadvantages of flowchart.

Following are some typical advantages and disadvantages

### Advantages

- (1) Program logic represented in a graphical manner is easy to create.
- (2) The logic in a flowchart is easy to interpret.
- (3) It can be used as a program planning document even by non computer professionals.
- (4) It is easy to modify the logic of a problem solution if it is in the form of a flowchart.
- (5) Long and complicated problem solution can be represented by small and simple flowchart.

### Disadvantages:-

- (1) The problem solution represented in a flowchart is difficult to convert into a program.
- (2) Sometimes it become difficult to represent problem solution in flowchart if it contain certain specific type of structures.

## Levels of programming language-

- 1) First Generation of Programming Language:-  
1GL is machine language. Machine language is a set of instructions and data that a computer's central processing unit can execute directly. Machine language statements are written in binary code, and each statement corresponds to one machine action.
- 2) Second Generation of Programming Language:-  
2GL is assembly language. Assembly language is the human readable notation for the machine language used to control specific computer operations. An assembly language programmer writes instructions using symbolic instructions codes that are meaningful abbreviations or mnemonics. An assembler is a program that translates assembly language into machine language.
- 3) Third Generation of Programming Language.  
3GL is procedural language used a series of English like words that are closer to human language, to write instructions. High level programming languages make complex programming simpler and easier to read, write and maintain. Programs written in high-level programming language must be translated into machine language by a compiler or interpreter. PASCAL, FORTRAN, BASIC, COBOL, C and C++ are examples of third generation programming language.
- 4) Fourth Generation of Programming Language:-  
4GL or non procedural language, enables users to access data in database. A very high level programming language is often referred to as goal-oriented programming language because it is usually limited to a very specific application and it might use syntax that is never used in other programming languages. SQL, NOMAD, FOCUS are example of 4th generation programming language.
- 5) Fifth Generation of Programming Language:-  
~~SQL~~ SQL is also known as natural language. Provides a visual or graphical interface, called a visual programming environment, for creating source codes. Fifth generation programming allows people to interact with computers without needing any specific specialised knowledge. People can talk to computers and the voice recognition systems can convert spoken sounds into written words.  
Ex:- prolog.

## structured programming language

Structured programming (sometimes known as modular programming) is a subset of procedural programming that enforces a logical structure on the program being written to make it more efficient and easier to understand and modify.

### Examples of problem solving through Algorithm.

Ex 1. Write an algorithm to find the largest among three numbers  $x, y, z$ .

Step 1: Read three numbers  $x, y, z$ .

Step 2: Compare  $x$  and  $y$ .

Step 3: If  $x$  is larger, compare it with  $z$ .

Step 4: If  $x$  is larger than  $z$  then  $x$  is largest otherwise  $z$  is larger.

Step 5: If  $x$  is smaller than or equal,  $y$  is the largest if  $y$  is compared with  $z$  is largest number.

Step 6: If  $y$  is larger than  $z$ , then  $y$  is the largest otherwise  $z$  is largest number.

Step 7: Stop.

Ex 2. - write an algorithm to display roots of a quadratic equation.  $ax^2 + bx + c = 0$

Step 1: Read the value of  $a, b, c$ .

Step 2:  $d = b^2 - 4 * a * c$

Step 3: If  $d < 0$  then display the "roots are imaginary" else then display, roots are equal if  $d = 0$ .

$r = -b / 2 * a$ , display  $r$ .

else  $r_1 = -b + \sqrt{d} / 2 * a$

$r_2 = -b - \sqrt{d} / 2 * a$ .

Display roots are real  $r_1$  and  $r_2$

Step 4: Stop.

Ex 3. - write an algorithm to find the area of triangles whose three sides are  $a, b$  and  $c$ .

Step 1: Read the value of  $a, b, c$

Step 2:  $S = (a + b + c) / 2$

Step 3:  $\text{area} = \sqrt{S(S-a)(S-b)(S-c)}$

Step 4: Display the area of the triangle

Step 5: Stop.

Example 4: Write an Algorithm to check whether number is even or odd.

- step 1: Read the value of  $x$   
step 2: If  $(x \% 2 = 0)$  then  
step 3: Print number is even  
step 4: else  
step 5: Print number is odd

Ex 5: Write an algorithm of swapping two numbers

- step 1: Start  
step 2: Read 'a' and 'b' value  
step 3: Interchange the values.  
temp = a  
a = b  
b = temp.  
step 4: write a and b values  
step 5: stop.

Ex 6:-

write algorithm for the factorial of an integers.

- step 1: read a value of  $n$   
step 2: set variable fact as 1  
step 3: fact  $\leftarrow$  fact \*  $n$ .  
decrease  $n$   
step 4: Check if  $n$  is equal to 0.  
If  $n$  is equal to zero goto step 5  
else goto step 3  
step 5: Print the result fact

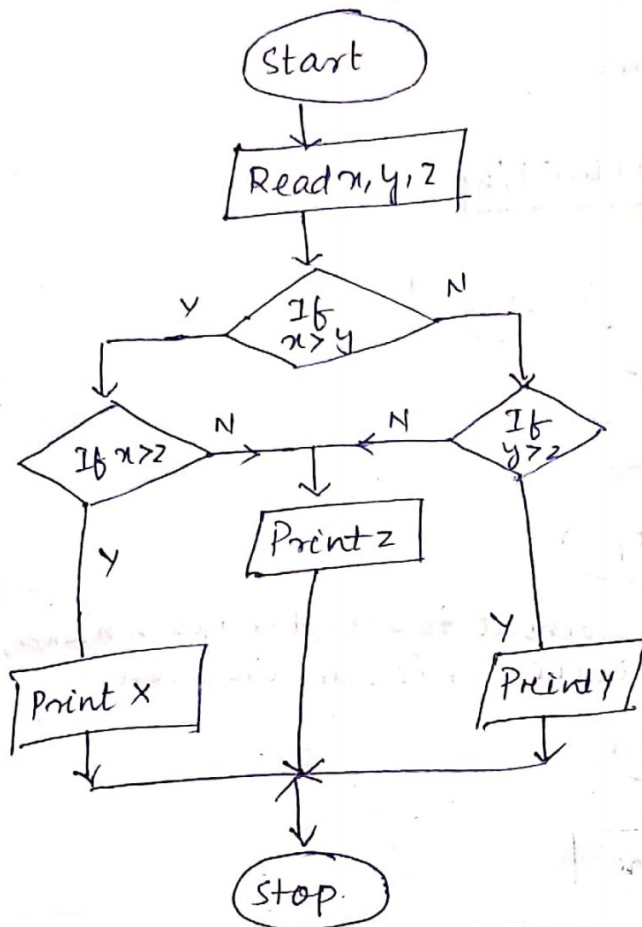
Ex 7:-

write an algorithm to convert temperature in Centigrade into Fahrenheit.

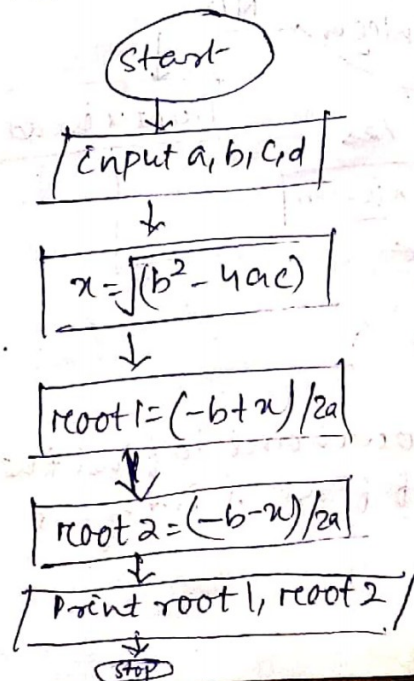
- step 1: start  
step 2: Read the temperature in centigrade  
step 3: store the value in  $C$   
step 4: Set  $F$  to  $32 + \left(\frac{9}{5} * C\right)$   
step 5: Print the value of  $C$  and  $F$   
step 6: stop.

## Examples of problem solving through flowchart

- ① Draw a flowchart to find the largest among three numbers  $x$ ,  $y$  and  $z$ .

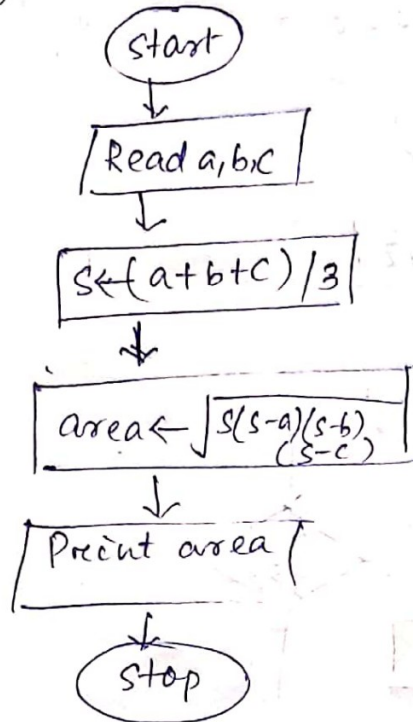


- ② Draw a flowchart to calculate and print the roots of a quadratic equation given by  $ax^2 + bx + c = 0$ .

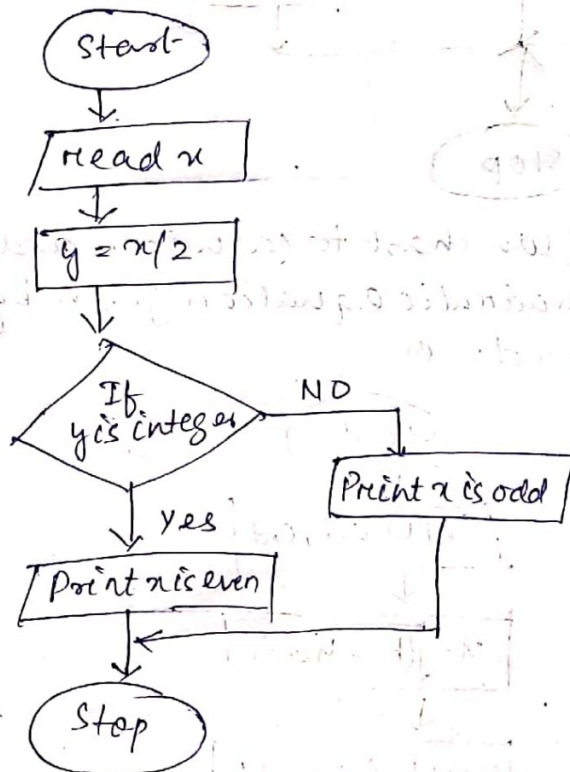


Example 3

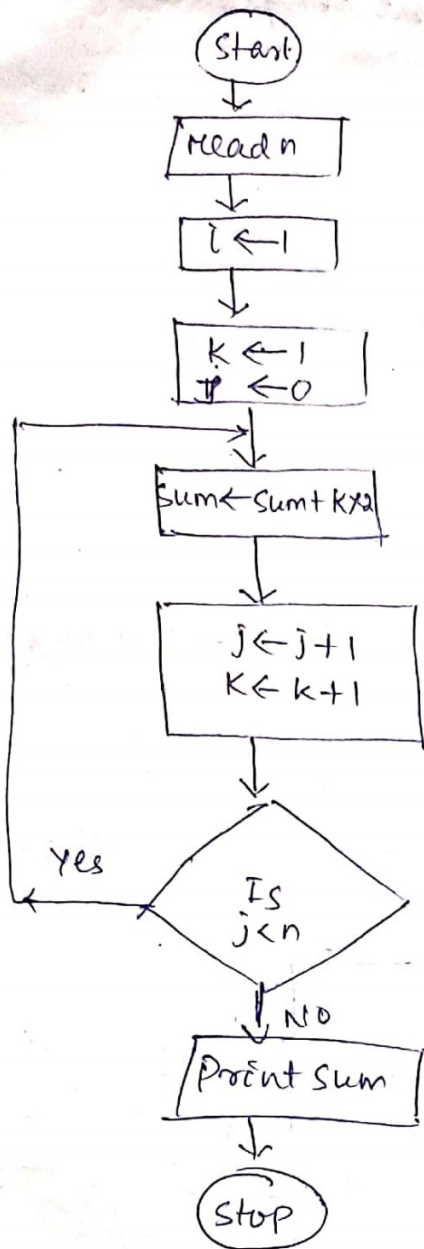
Draw a flowchart to calculate the area of a triangle whose sides are a, b and c



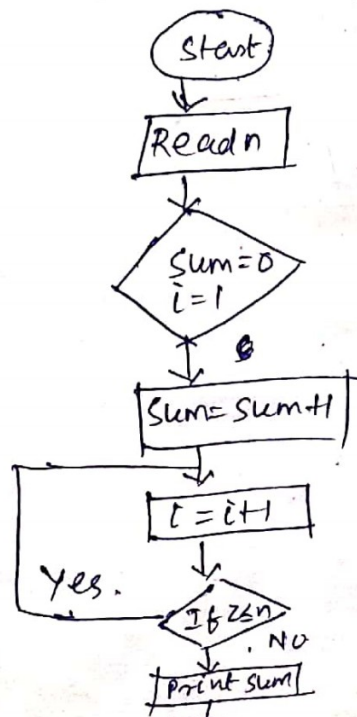
Ex 4 :- Draw a flowchart to accept a given number and test whether it is odd or even.



Ex 5 : Draw a flowchart to find the sum of squares of first n integers.

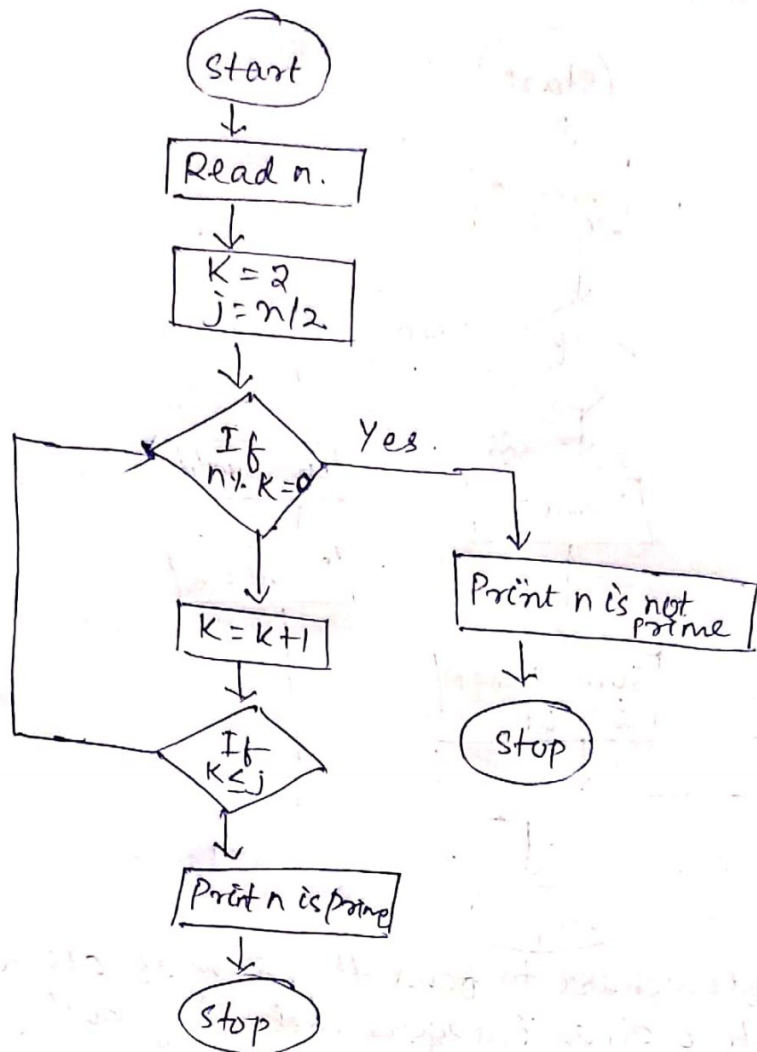


Ex II :- Draw a flowchart to find the sum of first n integers

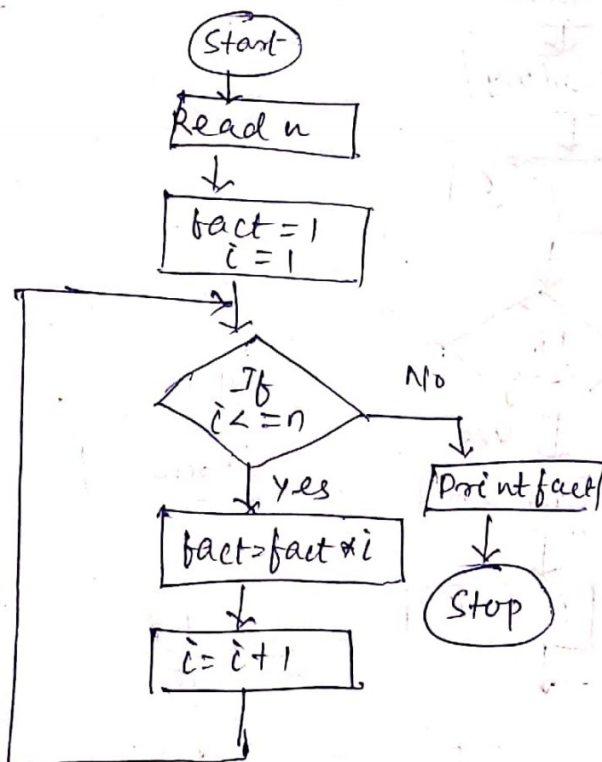




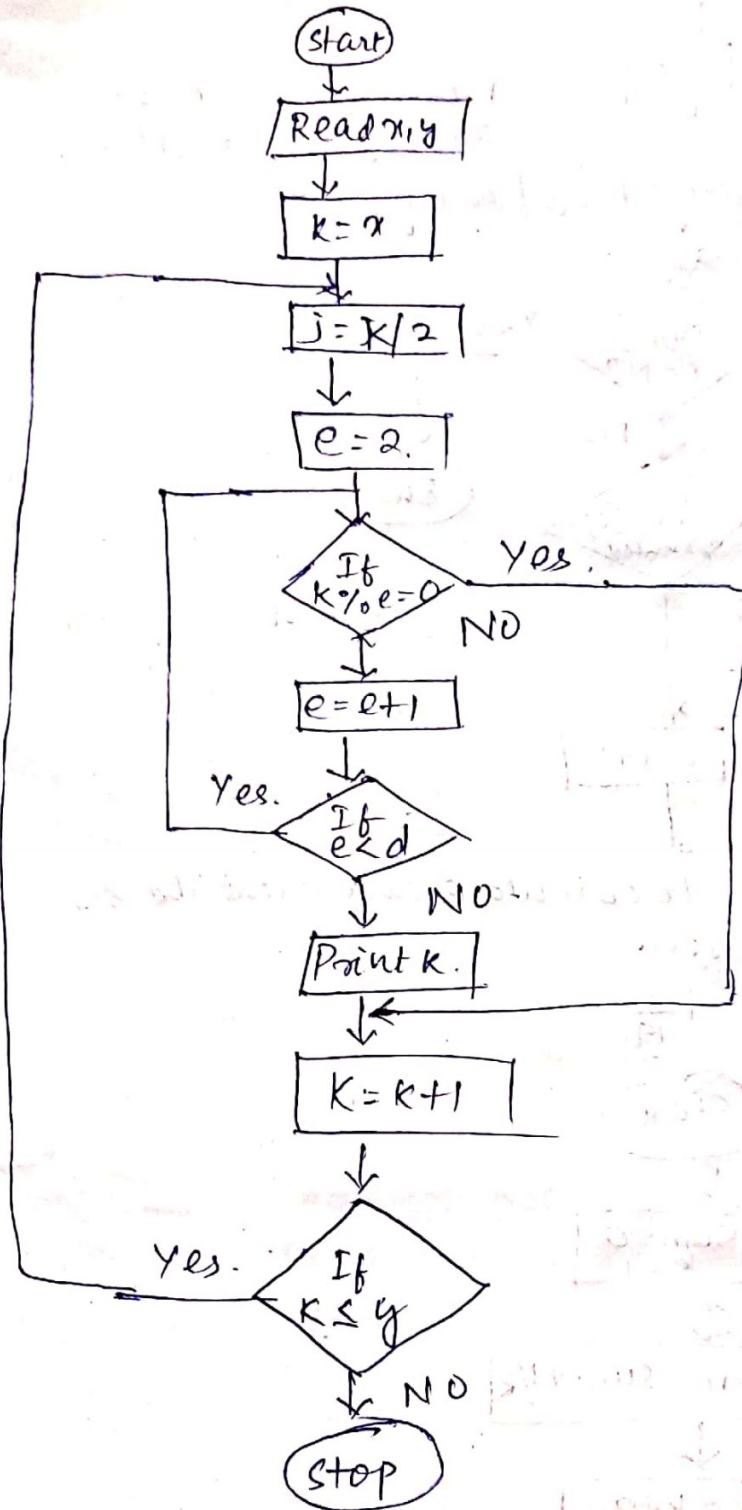
Draw a flowchart to test whether an integer is prime or not.

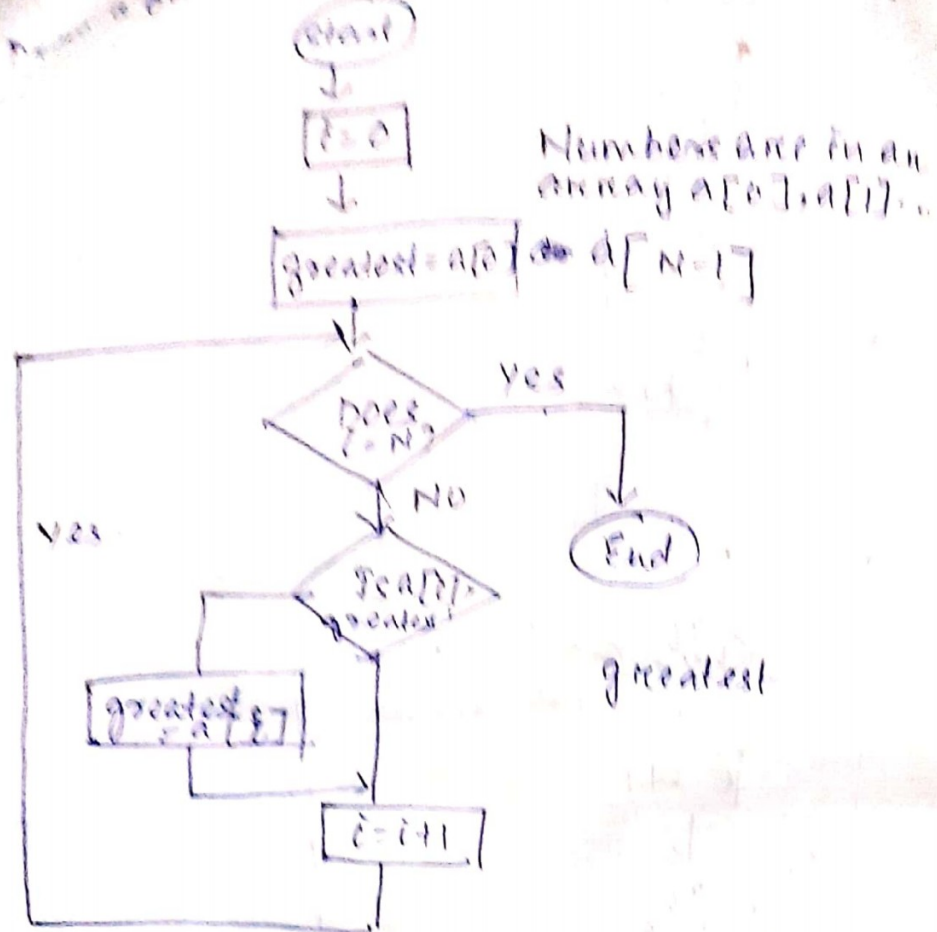


WAP to print n factorial.

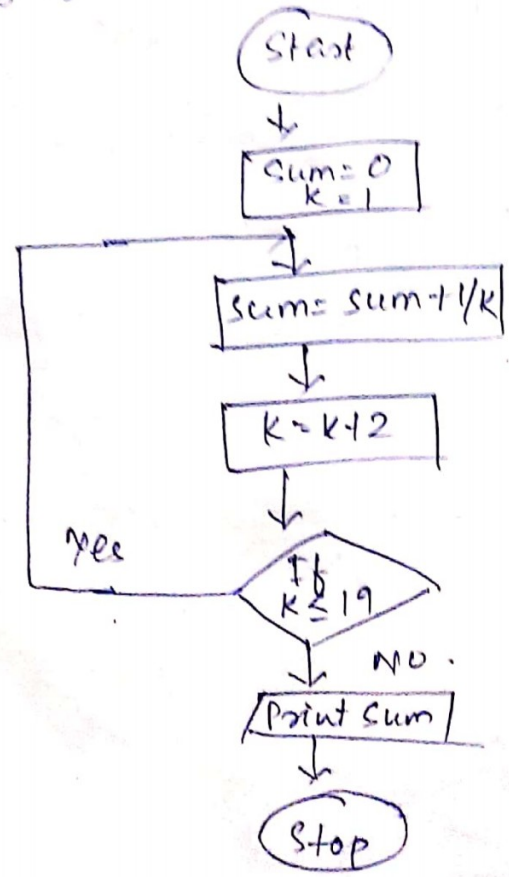


Draw a flowchart to print all prime numbers between  $x$  and  $y$ .

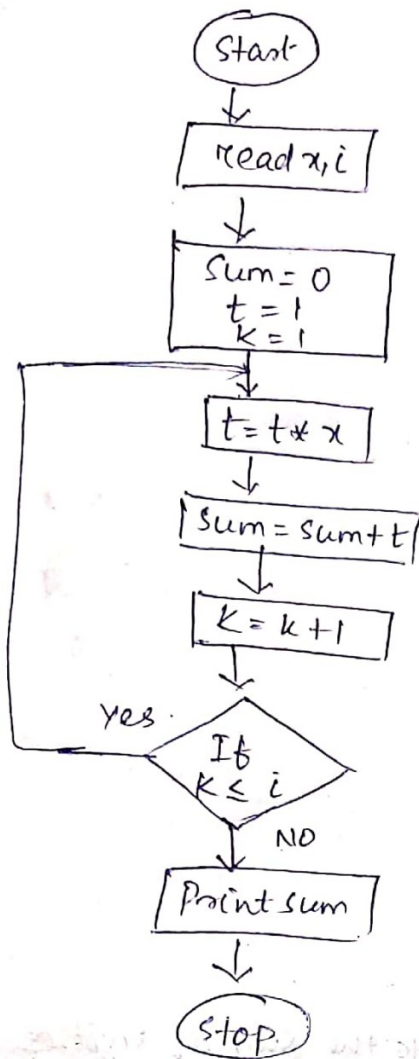




Draw a flowchart to calculate and print the sum of the following series:

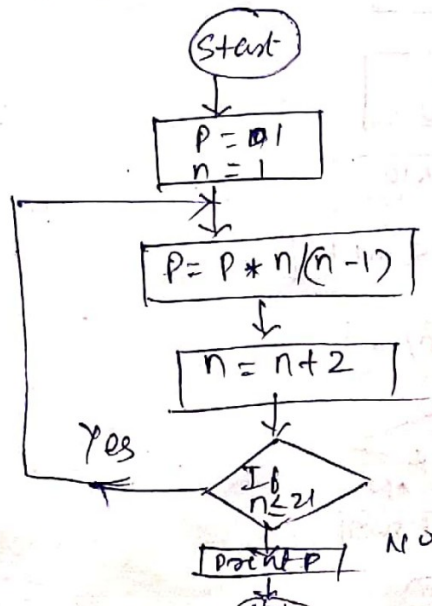
$$1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{19}$$


Draw a flowchart to calculate and print the sum of  $\sum_{k=1}^i x^k$



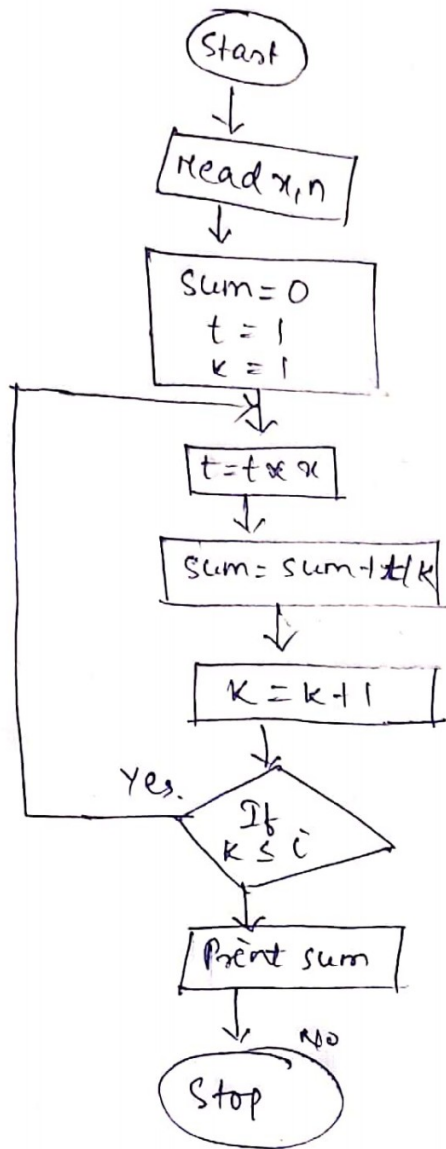
Draw a flowchart to calculate and print the product of the following series.

$$\frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdots \frac{21}{22}$$



Draw a flowchart to calculate and print

$$\sum_{k=1}^n \frac{x^k}{k}$$



Draw a flowchart to calculate the sum of digits of a given number

