Unit-2

Programming Methodology

2.1 Steps Involved In Problem Solving

There are six steps that you should follow in order to solve a problem:

1. Understand the problem
2. Formulate a Model
3. Develop an Algorithm
4. Write the program
5. Test the program
6. Evaluate the Solution

Step 1: Understand the problem: To solve any problems one should understand it by knowing the following factors.

- What is the input data?
- What does it represent?
- What is the format of input?
- Is anything missing?
- Is the complete data required available?
- What is the output to be produced?
- What is the format of the output? Is in the form of text, a picture, a graph…?
- What am I going to have to compute?

Step 2: **Formulate a Model:** one should understand the processing part of the problem. Many problems break down into small problems that require some kind of simple mathematical computations in order to process the data.

Step 3: Develop an Algorithm: Now we understand the problem and have formulated a model, it is time to come up with a precise plan of what we want the computer to do. Now develop algorithm.

Step 4: Write the program: The algorithm developed must be converted into a program by using a computer language.

Step 5: Test the program: Once the program is written compile it and execute the program with many sample data. If the result is obtained correctly proceed to step 6,otherwise find the errors in the program and correct them. if the no errors in the program, if the results are not as expected repeat the steps 2 to 5 till the expected results are obtained.

Step 6: Evaluate the Solution: Once your program produces a result that seems correct, you need to re-consider the original problem and make sure that the answer is formatted into a proper solution to the problem. Sometimes you may realize that more steps are involved then again repeat from step 1 to step 6 till the required result in required format are obtained.

2.2 Algorithm:

Algorithm is defined as a step-by-step procedure for solving a problem.

Example:

Algorithm: To find sum of two numbers

Step 1: start

Step 2: Read data

Input x, y

Step 3: Find sum

S= x+y

Step 4: print results

Output s

Step 5: stop

2.3 CHARACTERISTICS OF ALGORITHM

PROPERTIS OF AN ALGORITHM: Each algorithm should have the following 4 characteristics, only then it is said to be a complete algorithm. They are

Finiteness: An algorithm should terminate a finite number of steps.
i.e., one or more instructions should not be repeated infinitely.

Definiteness: Each step in algorithm is unambiguous. This means that the action specified by the step cannot lead to multiple solutions and can be performed without any confusion.
i.e., each and every instruction should be clear and should have only one meaning.

Input/output: An algorithm should accept zero or more inputs based on the problem being solved. But it should produce at least one output.
i.e., after the instructions are executed, the user should get the required results.

Effectiveness: It consists of basic instruction that is realizable. This means that the instructions can be performed by using the given inputs in a finite amount of time
i.e., each instruction should be performed in finite time.

2.4 Program:

A program is defined as a sequence of instructions written to perform a specified task with a computer. The set of instructions are written in a particular computer programming language such as C, C++, FORTAN and COBOL etc.

Ex :

```
#include<stdio.h>
int main()
{
  int x,y,s;
  scanf("%d%d",&x,&y);
  s=x+y;
  printf("sum of %d and %d is %d \n",x,y,s");
  return 0;
}
```

2.5 Differentiate between program and algorithm:

Algorithm	Program
Algorithm is Step by step procedure for solving a problem.	Program is a sequence of instructions written in particular language.
Algorithm will not be compiled and executable by the computer	Program will be compiled by the compiler and get executed by the computer
Algorithm is solution for problem	Program is a specific implementation of an algorithm
Algorithm is Semi structured	Program is completely structured

2.6 **Steps Involved In Algorithm Development:**

To write any algorithm one should follow steps.

STEP 1: **Describe the problem clearly:** State the problem to cover all the facts.

STEP 2: Analyze the problem: Understand the existing system to solve the problem stated and identify thepossible cases of inputs and outputs required and the tasks to be performed to produce the desire output.

STEP 3: Develop a high-level algorithm: give the steps using English language.

STEP 4: Refine the algorithm by adding detail: Now convert the steps in English to formal steps using notations, operators and expressions.

STEP 5: Review the algorithm: Test the algorithm whether it is giving correct results or not, if not repeat from steps 3 to 5. Otherwise stop.

2.7 differentiate Algorithm and Flow chart:

Flow chart	**Algorithm**
1.Pictorial representation of a problem solution	1.Step by step procedure of a problem solution
2. It uses a set of symbols.	2. It uses a set of steps in human readable.
3. Drawing a flow chart is a time consuming process.	3.Algorithm takes less time to write
4. Converting a flow chart into a program is difficult.	4. Converting a algorithm into a program is easy.
5. Drawing flowchart for complex problems is difficult.	5. Writing algorithm for complex problems is easy.
6. Special software is required to draw a flow chart on the system and special tools are required to draw manually on a paper.	6. Editor is enough to write an algorithm on the system and also no special tools are required to write algorithms manually.

2.8 Algorithm for Simple Problems:

Algorithm 1: Write an algorithm to add two numbers entered by user

Step 1: start
Stet 2: Read values num1 and num2
Step 3: Add num1 and num2 and assign the result to sum.
    Sum= num1+num2
Step 4: Display sum
Step 5: Stop

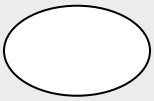
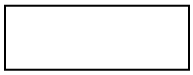
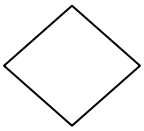
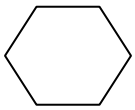
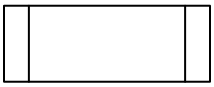
Algorithm 2: write an algorithm for find given number is Even or Odd Number

Step 1: start
Step 2: Input n
Step 3: num = remainder of n%2
Step 4: if(num=0) then
    Output “even”
    else
      Output “odd”
Step 5: stop

2.9 Symbols Used In Flow Charts:

A flow chart is a graphical or symbolic representation of a problem. Each step in the process is represented by a different symbol and contains a short description of the process step.

Flow chart Symbols

Symbol	Symbol name and Purpose
	An Oval represents a start or end point
	Arrow represents the flow of execution.
	A Parallelogram represents input or output operations.
	A rectangle Represents a process such as assignment, formula etc.
	A rhombus indicates a decision, generally it has a single inward arrow and two or more outward arrows labeled with Yes/No/True/False
	Hexagon represents the beginning of a respective structure like for, do, while etc.
	A circle is used to connect flowchart on different pages
	A double lined rectangle represents a call to Subprogram/Function

2.10 draw a flow chart for simple problems:

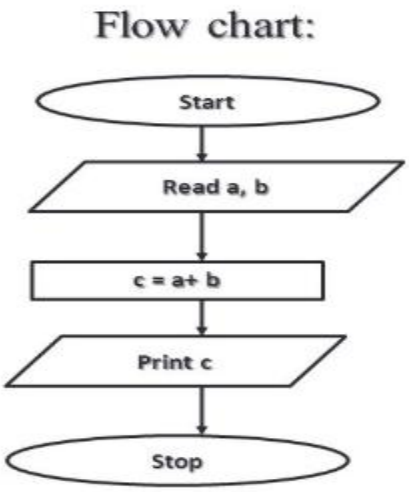


Fig-1: Draw flow chart for addition of Two numbers.

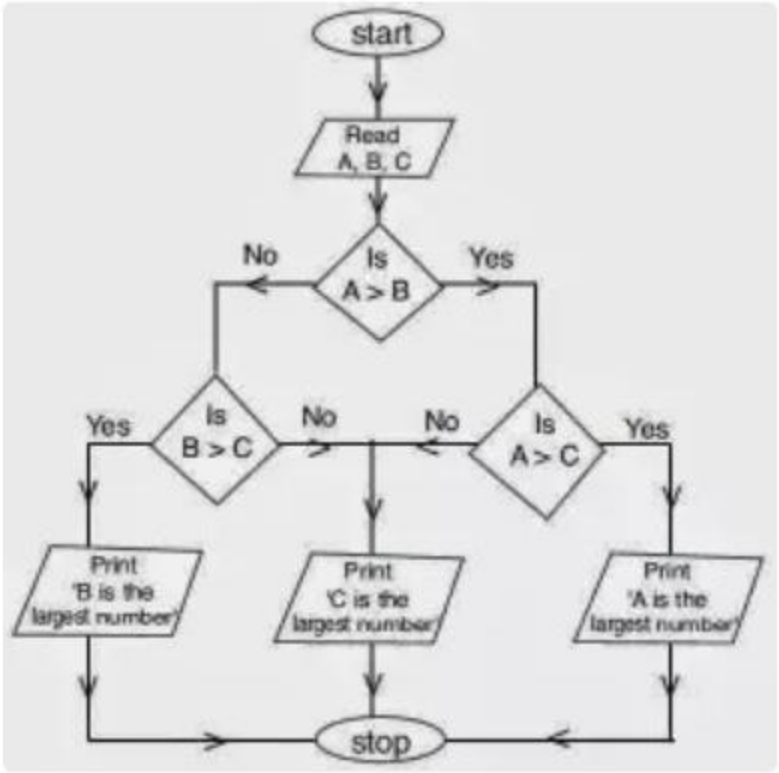


Fig-2: Draw flow chart for biggest/largest among three numbers.

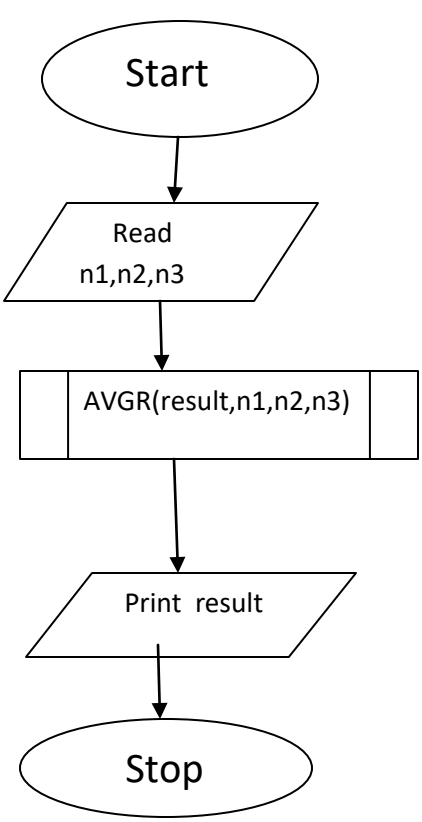


Fig-3: flow chart for calling function

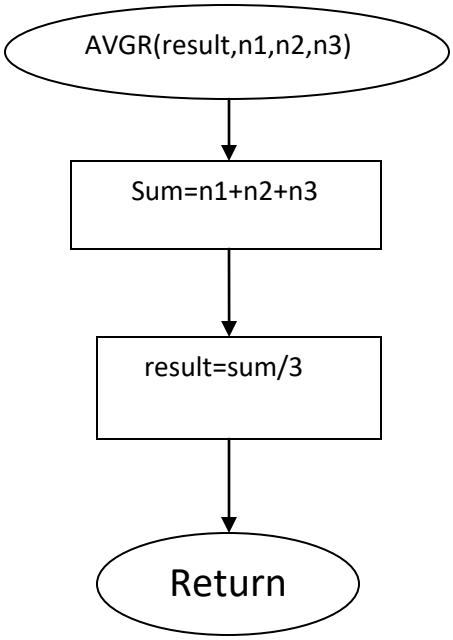


Fig-3a: Flow chart for average of three numbers function

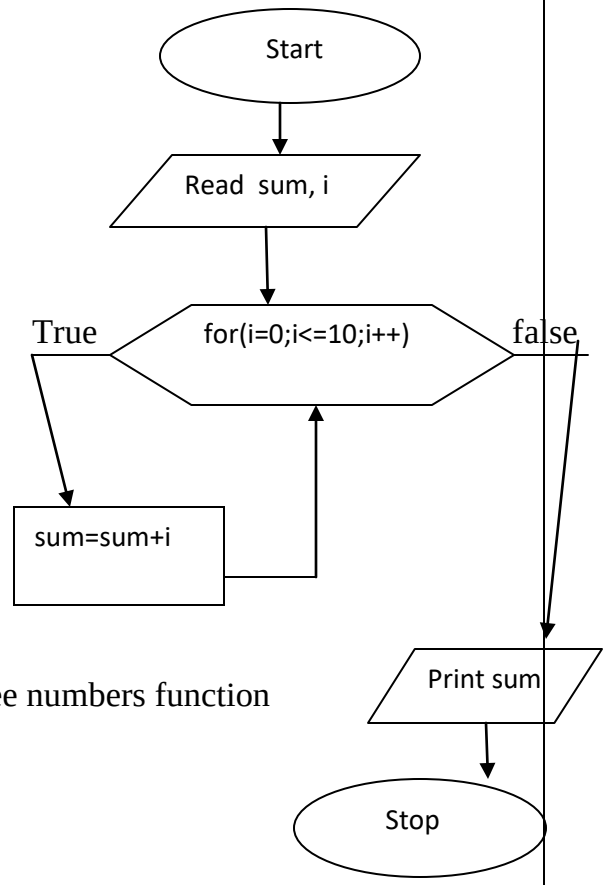


Fig4:flow-chart for sum of n natural numbers