Unit 4
Need of programming

Most of the activities we perform on day-to-day basis have lots of little steps. For e.g., an activity like send greeting card will contain small steps like go to the greeting card shop, choose it, pay for it, write the names and address, go to the post office, buy stamps, affix the stamps and drop the card in the post drop box. In this some steps like going to the post office, buying stamps and dropping the card in the post box are time-consuming and repetitive. Where as calculating the price of all the cards we bought, paying the money to the shop-keeper and counting the change returned is error prone. These kind of steps which does not need lot of human intervention and are not person dependent can be automated using Computer Programming. Please note that no matter how many steps we automate, there will be things like choosing the right card which needs the human intervention and the personal touch.

The Computer Programming help in automating the tasks which are time consuming, error prone, repetitive, not person dependent etc., They also help in stream lining the processes, provide better experience to the end users, keeping track of historical data, analyze the data etc., Some programs are very expensive and could take 5 or more years with multiple teams working on it, while some might be relatively easy and can be built in matter of weeks by an individual developer. One can Improve their Programming Skills through Computer Programming.

Below are few examples of how computer programs changed the life in the last 15 years or so.

With Out Computer Programs	With Computer Programs
Communicate with others: 3-4 days for sending a letter to some one even in the same district and it costs money.	Less than 1-minute to send an email to any place in the world at no cost.
Booking Railway Tickets: Stand in really long queues. Can reserve railway tickets only for the quota of that station. Even if other stations quota is not filled, we can not reserve the tickets. Can only book tickets from that station and can not book return tickets.	Can book tickets from anywhere to anywhere, sitting at home.
Sending money from parent to the child studying in a college: This involves the parent going to the bank for the DD, send it to the student by post, student submitting the DD in the bank, wait for the DD to clear and withdraw the money by showing the passbook and filling an withdrawal form.	The money transfer is almost instant and money can be withdrawn from any ATM.
Seat allocation in engineering college: Go to the counseling center far away from your town, wait for hours together for your turn, but make the decision of	Have lots of time to research the colleges, decide upon the colleges and branches, review them multiple people

which college and branch to choose in less than 5 minutes.	and submit it online with peace of mind.

As explained at Computer Programming is the process of designing, writing, testing, debugging, and maintaining the source code of computer programs. This source code is written in one or more programming languages (such as Java, C++, C#, Python, etc.). The purpose of programming is to create a set of instructions that computers use to perform specific operations or to exhibit desired behaviors. The process of writing source code often requires expertise in many different subjects, including knowledge of the application domain, specialized algorithms and formal logic.

What is Programming Language

A programming language is a method to communicate with machines in a systematic format. To understand programming languages first we need to start from programs.

What is a program?

A program is a group of logical, mathematical, systematical and managed functions grouped together to perform a specific task. Just like there are various programs in the marriage such as Shanti, Barat Prasthan, Lagan, Vadhu Pravesh, reception, Dham etc.

Stages of program development process

The various stages in the development of a computer program are :

1. Problem Definition
2. Program Design
3. Coding
4. Debugging
5. Testing
6. Documentation
7. Maintenance

Problem Definition:

- The first step in the process of program development is the thorough understanding and identification of the problem for which is the program or software is to be developed.
- In this step the problem has to be defined formally.
- All the factors like Input/output, processing requirement, memory requirements, error handling, interfacing with other programs have to be taken into consideration in this stage.

Program Design:

- The next stage is the program design. The software developer makes use of tools like algorithms and flowcharts to develop the design of the program.
    - Algorithm
    - Flowchart

Coding:

- Once the design process is complete, the actual computer program is written, i.e. the instructions are written in a computer language.
- Coding is generally a very small part of the entire program development process and also a less time consuming activity in reality.
- In this process all the syntax errors i.e. errors related to spelling, missing commas, undefined labels etc. are eliminated.
- For effective coding some of the guide lines which are applied are :
    - Use of meaningful names and labels of variables,
    - Simple and clear expressions,
    - Modularity with emphasis on making modules generalized,
    - Making use of comments and indenting the code properly,
    - Avoiding jumps in the program to transfer control.

Debugging:

- At this stage the errors in the programs are detected and corrected.

- This stage of program development is an important process. Debugging is also known as program validation.
- Some common errors which might occur in the programs include:
  - Un initialization of variables.
  - Reversing of order of operands.
  - Confusion of numbers and characters.
  - Inverting of conditions eg jumping on zero instead of on not zero.

Testing:

- The program is tested on a number of suitable test cases.
- A test plan of the program has to be done at the stage of the program design itself.
- This ensures a thorough understanding of the specifications.
- The most trivial and the most special cases should be identified and tested.
- It is always useful to include the maximum and minimum values of all variables as test data.

Documentation:

- Documentation is a very essential step in the program development.
- Documentation help the users and the people who maintain the software.
- This ensures that future modification if required can be done easily. Also it is required during redesigning and maintenance.

Maintenance:

- Updating and correction of the program for changed conditions and field experience is accounted for in maintenance.
- Maintenance becomes essential in following situations:
  - Change in specification,
  - Change in equipment,
  - Errors which are found during the actual execution of the program.

Algorithm

Standard Definition : " An *algorithm* is a procedure or formula for solving a problem, based on conducting a sequence of specified actions. A computer program can be viewed as an elaborate *algorithm*". The algorithm is written in simple English Language and can be converted afterwards into any programming language.

Characteristics of Algorithms:

1. **Precision** – the steps are precisely stated (defined).
2. **Uniqueness** – results of each step are uniquely defined and only depend on the input and the result of the preceding steps.
3. **Finiteness** – the algorithm stops after a finite number of instructions are executed.
4. **Input** – the algorithm receives input.
5. **Output** – the algorithm produces output.
6. **Generality** – the algorithm applies to a set of inputs.

Advantages of Algorithms:

1. It is a step-wise representation of a solution to a given problem, which makes it easy to understand.
2. An algorithm uses a definite procedure.
3. It is not dependent on any programming language, so it is easy to understand for anyone even without programming knowledge.
4. Every step in an algorithm has its own logical sequence so it is easy to debug.
5. By using algorithm, the problem is broken down into smaller pieces or steps hence; it is easier for programmer to convert it into an actual program.

Disadvantages of Algorithms:

1. Algorithm is Time consuming.
2. Difficult to show Branching and Looping in Algorithms.
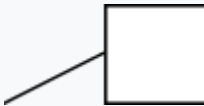3. Big tasks are difficult to put in Algorithms.

Assignment

1. Write an Algorithm to find Average of 10 Numbers.
2. Write an Algorithm to find Number is Even or Odd.
3. Write an Algorithm to find roots of a quadratic Equation.
4. Write an Algorithm to interchange the value of two variables.
5. Write an Algorithm to find the area of Circle.
    6. Write an Algorithm to convert temperature in **Celsius** to **Fahrenheit**.

Flowchart

A **flowchart** is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task.

The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.

| ANSI/ISO Shape	Name	Description
	Flowline (Arrowhead)	Shows the process's order of operation. A line coming from one symbol and pointing at another. Arrowheads are added if the flow is not the standard top-to-bottom, left-to right.
	Terminal	Indicates the beginning and ending of a program or sub-process. Represented as oval. They usually contain the word "Start" or "End",
	Process	Represents a set of operations that changes value, form, or location of data. Represented as a rectangle.
	Decision	Shows a conditional operation that determines which one of the two paths the program will take. The operation is commonly a yes/no question or true/false test. Represented as a diamond (rhombus).
	Input/Output	Indicates the process of inputting and outputting data, as in entering data or displaying results. Represented as a parallelogram.
	Comment	Indicating additional information about a step in the program. Represented as an open rectangle with a dashed or solid line connecting it to the corresponding symbol in the flowchart.

	Predefined Process	Shows named process which is defined elsewhere. Represented as a rectangle with double-struck vertical edges.
	On-page Connector	Pairs of labeled connectors replace long or confusing lines on a flowchart page. Represented by a small circle with a letter inside.
	Off-page Connector	A labeled connector for use when the target is on another page. Represented as a home plate-shaped pentagon.

Flowchart Example – Simple Algorithms

A flowchart can also be used in visualizing algorithms, regardless of its complexity. Here is an example that shows how flowchart can be used in showing a simple summation process.
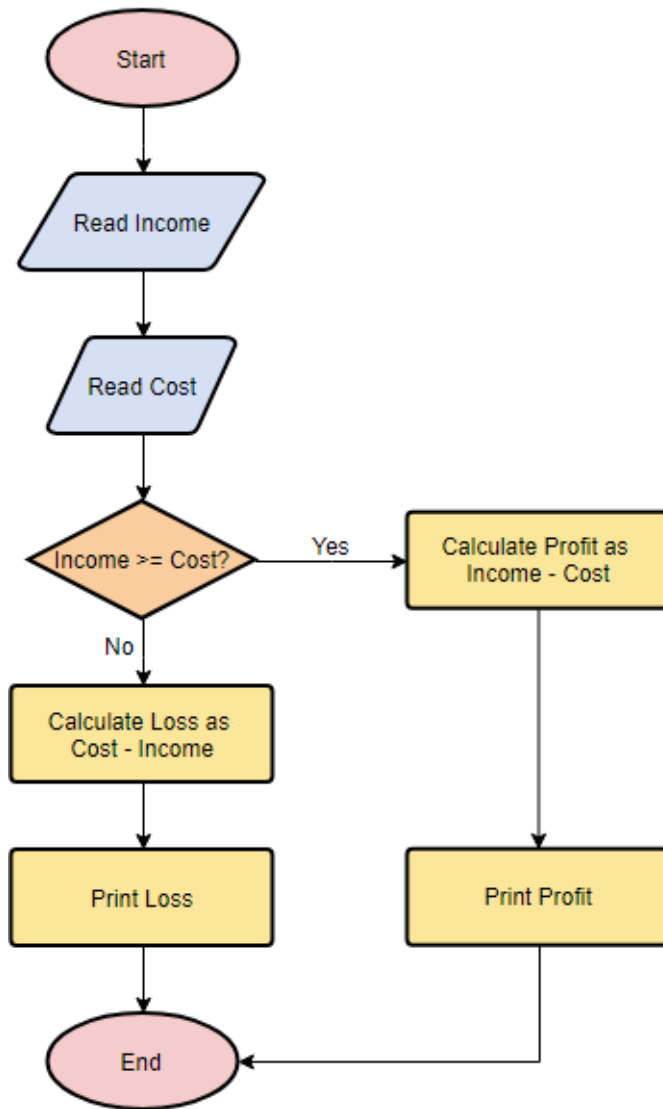

Find the sum of 529 and 256
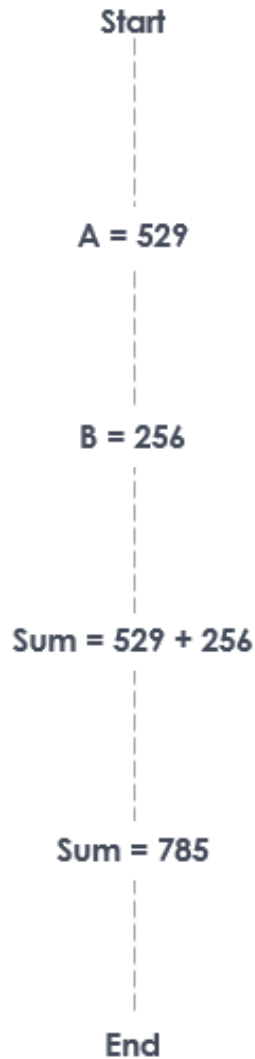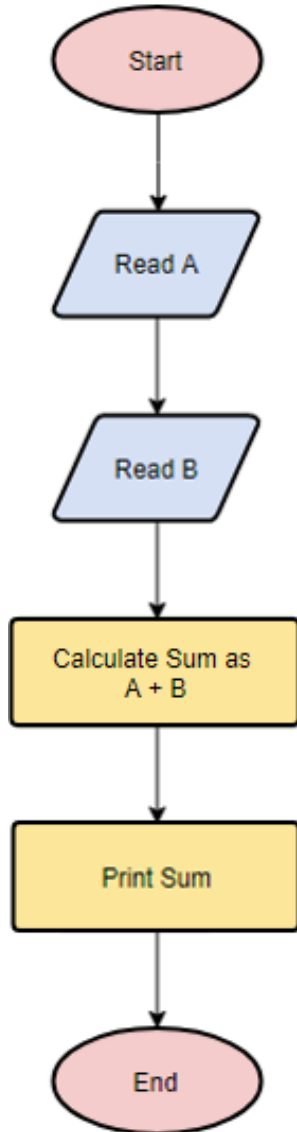
Flowchart Example – Calculate Profit and Loss

The flowchart example below shows how profit and loss can be calculated.

Find the profit/loss when income = 1,000, cost = 800

Advantages and Disadvantages of Flowchart

Advantages Of Using FLOWCHARTS:

• **Communication:** Flowcharts are better way of communicating the logic of a system to all concerned or involved.

• **Effective analysis:** With the help of flowchart, problem can be analysed in more effective way therefore reducing cost and wastage of time.

• **Proper documentation:** Program flowcharts serve as a good program documentation, which is needed for various purposes, making things more efficient.

• **Efficient Coding:** The flowcharts act as a guide or blueprint during the systems analysis and program development phase.

• **Proper Debugging:** The flowchart helps in debugging process.

• **Efficient Program Maintenance:** The maintenance of operating program becomes easy with the help of flowchart. It helps the programmer to put efforts more efficiently on that part

Disadvantages Of Using FLOWCHARTS:

• **Complex logic:** Sometimes, the program logic is quite complicated. In that case, flowchart becomes complex and clumsy. This will become a pain for the user, resulting in a waste of time and money trying to correct the problem

• **Alterations and Modifications:** If alterations are required the flowchart may require re-drawing completely. This will usually waste valuable time.

• **Reproduction**: As the flowchart symbols cannot be typed, reproduction of flowchart becomes a problem.

Difference Between Algorithm and Flowchart

Flowchart	Algorithm
It is a pictorial representation of a process.	It is step wise analysis of the work to be done.
Solution is shown in graphical format.	Solution is shown in non computer language like English.
Easy to understand as compared to algorithm.	It is somewhat difficult to understand.
Easy to show branching and looping.	Difficult to show branching and looping
Flowchart for big problem is impractical	Algorithm can be written for any problem
Difficult to debug errors.	Easy to debug errors.
It is easy to make flowchart.	It is difficult to write algorithm as compared to flowchart.

Assignment

1. Draw a Flowchart to convert temperature in **Celsius** to **Fahrenheit**
2. Draw a Flowchart to find Number is Even or Odd.
3. Draw a Flowchart to find roots of a quadratic Equation.
4. Draw a Flowchart to interchange the value of two variables.
5. Draw a Flowchart to find the area of Circle.
6. Draw a Flowchart to find Average of 10 Numbers.