Programming Fundamentals

Introduction to Computer Program

Before getting into computer programming, let us first understand computer programs and what they do.

> *A computer program is a sequence of instructions written using a Computer Programming Language to perform a specified task by the computer.*

The two important terms that we have used in the above definition are:

- Sequence of instructions
- Computer Programming Language

To understand these terms, consider a situation when someone asks you about how to go to a nearby KFC. What exactly do you do to tell him the way to go to KFC?

You will use Human Language to tell the way to go to KFC, something as follows:

```
First go straight, after half kilometer, take left from the red light and
then drive around one kilometer and you will find KFC at the right.
```

Here, you have used English Language to give several steps to be taken to reach KFC. If they are followed in the following sequence, then you will reach KFC:

```
1.  Go straight
2.  Drive half kilometer
3.  Take left
4.  Drive around one kilometer
5.  Search for KFC at your right side
```

Now, try to map the situation with a computer program. The above sequence of instructions is actually a **Human Program** written in **English Language**, which instructs on how to reach KFC from a given starting point. This same sequence could have been given in Spanish, Hindi, Arabic, or any other human language, provided the person seeking direction knows any of these languages.

Now, let's go back and try to understand a computer program, which is a sequence of instructions written in a Computer Language to perform a specified task by the computer. Following is a simple program written in **Python** programming Language:

```
print "Hello, World!"
```

The above computer program instructs the computer to print "Hello, World!" on the computer screen.

- A computer program is also called a **computer software**, which can range from two lines to millions of lines of instructions.
- Computer program instructions are also called program source code and **computer programming** is also called **program coding**.
- A computer without a computer program is just a dump box; it is programs that make computers active.

As we have developed so many languages to communicate among ourselves, computer scientists have developed several computer-programming languages to provide instructions to the computer (i.e., to write computer programs). We will see several computer programming languages in the subsequent chapters.

Introduction to Computer Programming

If you understood what a **computer program** is, then we will say: *the act of writing computer programs is called computer programming.*

As we mentioned earlier, there are hundreds of programming languages, which can be used to write computer programs and following are a few of them:

- Java
- C
- C++
- Python
- PHP
- Perl
- Ruby

Uses of Computer Programs

Today computer programs are being used in almost every field, household, agriculture, medical, entertainment, defense, communication, etc. Listed below are a few applications of computer programs:

- MS Word, MS Excel, Adobe Photoshop, Internet Explorer, Chrome, etc., are examples of computer programs.
- Computer programs are being used to develop graphics and special effects in movie making.
- Computer programs are being used to perform Ultrasounds, X-Rays, and other medical examinations.
- Computer programs are being used in our mobile phones for SMS, Chat, and voice communication.

Algorithm

From programming point of view, an **algorithm** is a step-by-step procedure to resolve any problem. An algorithm is an effective method expressed as a finite set of well-defined instructions.

Thus, a computer programmer lists down all the steps required to resolve a problem before writing the actual code. Following is a simple example of an algorithm to find out the largest number from a given list of numbers:

```
1.      Get a list of numbers L1, L2, L3....LN
2.      Assume L1 is the largest,  Largest = L1
3.      Take next number Li from the list and do the following
4.      If Largest is less than Li
5.      Largest = Li
6.      If Li is last number from the list then
7.      Print value stored in Largest and come out
8.      Else repeat same process starting from step 3
```

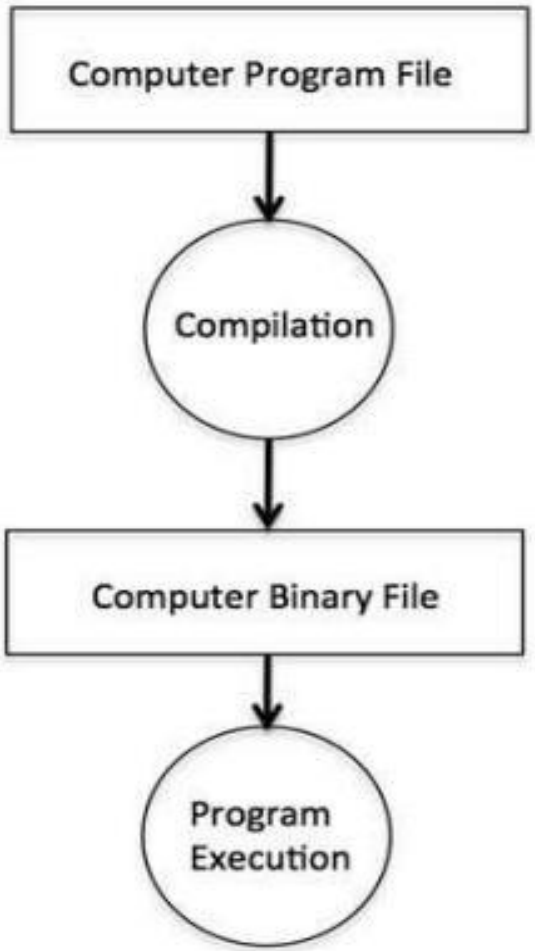
Compiler

You write your computer program using your favorite programming language and save it in a text file called the program file.

Now let us try to get a little more detail on how the computer understands a program written by you using a programming language. Actually, the computer cannot understand your program directly given in the text format, so we need to convert this program in a binary format, which can be understood by the computer.

The conversion from text program to binary file is done by another software called Compiler and this process of conversion from text formatted program to binary format file is called program compilation. Finally, you can execute binary file to perform the programmed task.

The following flow diagram gives an illustration of the process:

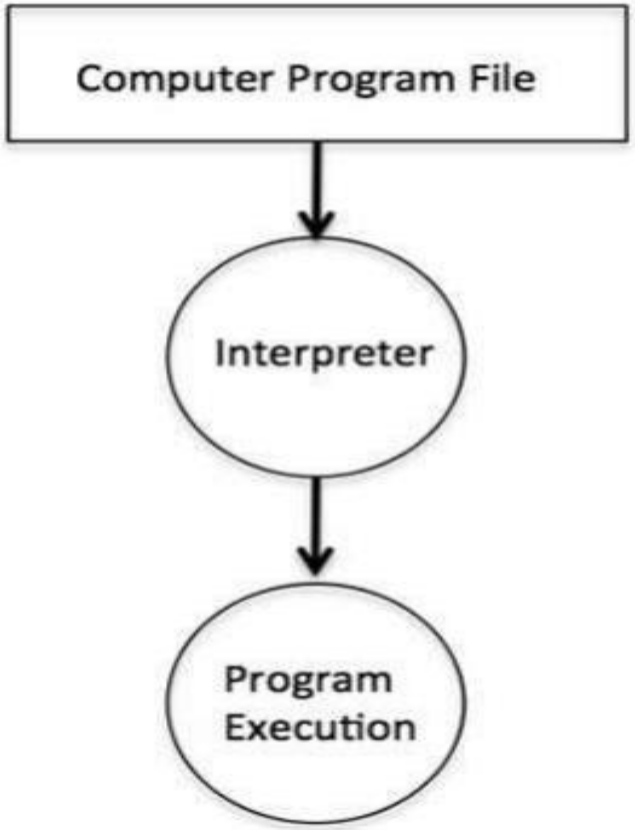


So, if you are going to write your program in any such language, which needs compilation like C, C++, Java and Pascal, etc., then you will need to install their compilers before you start programming.

Interpreter

We just discussed about compilers and the compilation process. Compilers are required in case you are going to write your program in a programming language that needs to be compiled into binary format before its execution.

There are other programming languages such as Python, PHP, and Perl, which do not need any compilation into binary format, rather an interpreter can be used to read such programs line by line and execute them directly without any further conversion.



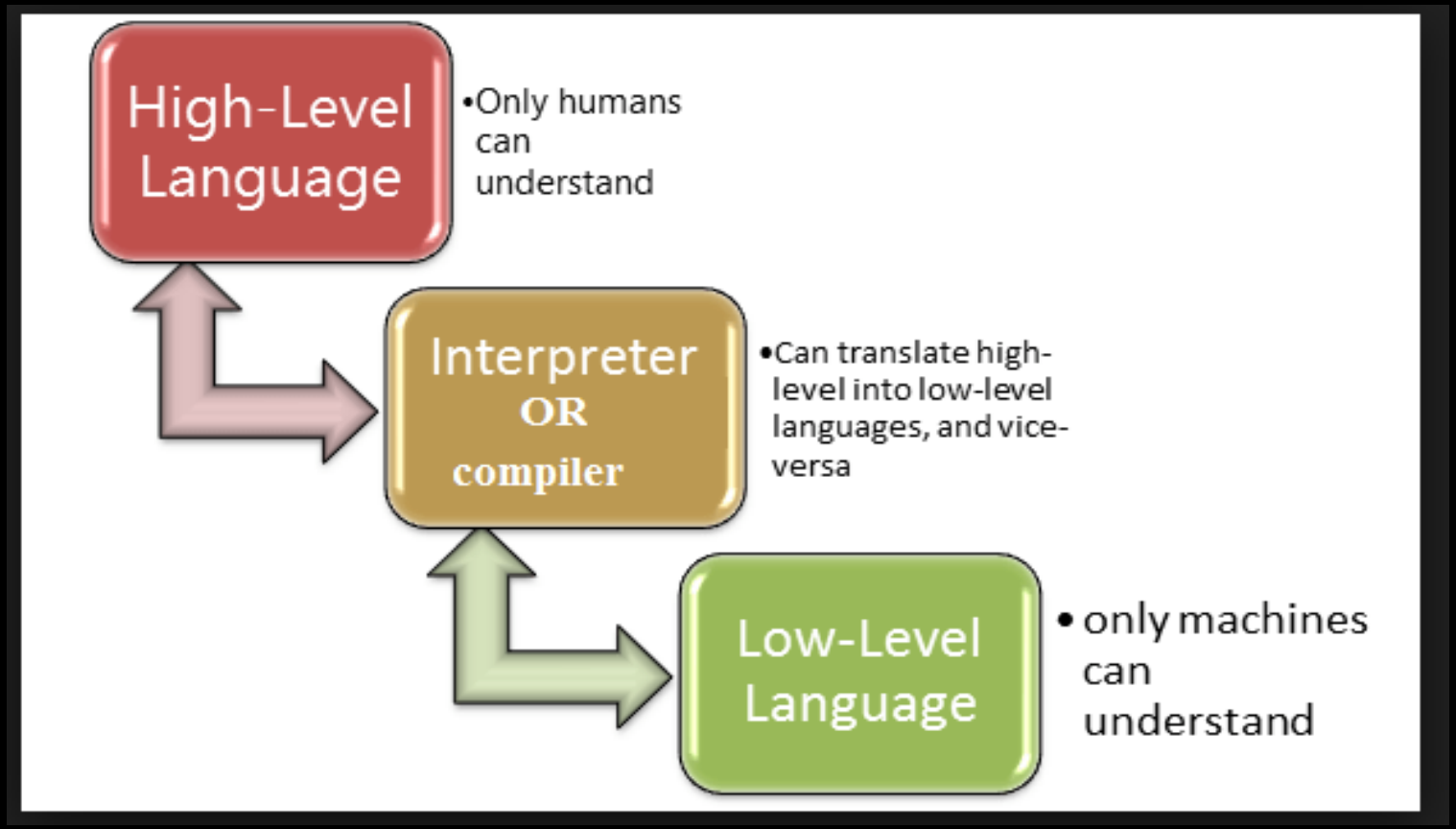
So, if you are going to write your programs in PHP, Python, Perl, Ruby, etc., then you will need to install their interpreters before you start programming.

High Vs. Low Level Languages

Human languages	E.g., English, French, Spanish, Chinese, German, Arabic etc.
High level programming language	E.g., Python, Java, C++ for (i = 1; i <= 10; i++)
Low level programming language	Assembly MOV #10, R0
Machine language	Binary 10100000 1010 00
	Computer hardware

High level

Low level


High-Level Language
•Only humans can understand
Interpreter
OR
compiler
•Can translate high-level into low-level languages, and vice-versa
Low-Level Language
• only machines can understand

The C++ Programming Language

Hello world! Example Program

Description

This program demonstrates the text output function of the C++ programming language by displaying the message "Hello world!".

Source Code

```
#include <iostream.h>

main()
{
    cout << "Hello World!";
    return 0;
}
```

Sample Run

```
Hello world!
```