Programming Languages

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Computer Programming Language

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Computer Programming Language

- **Computer programming** is the act of writing computer programs, which are a sequence of instructions written using a Computer Programming Language to perform a specified task by the computer.

  - *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

Computer Programming Language

- **First Scenario**

- 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 −

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Introduction to Computer Programming

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

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

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
```

Computer Programming - Basics

- Similar to Human Interface Languages, Computer Programming Languages are also made of several elements. These basic elements include −

- Programming Environment
- Basic Syntax
- Data Types
- Variables
- Keywords
- Basic Operators
- Decision Making

- Loops
- Numbers
- Characters
- Arrays
- Strings
- Functions
- File I/O

Computer Programming - Basic Syntax

```c
#include <stdio.h>

int main() {
    /* printf() function to write Hello, World! */
    printf( "Hello, World!" );
}
```

which produces the following result −

```
Hello, World!
```

Computer Programming - Basic Syntax

Program Entry Point

- **#include <stdio.h>** you have to put this statement at the top of a C program.

- Every C program starts with main(), which is called the main function, and then it is followed by a left curly brace. The rest of the program instruction is written in between and finally a right curly brace ends the program.

- The coding part inside these two curly braces is called the program body. The left curly brace can be in the same line as main(){ or in the next line like it has been mentioned in the above program.

Computer Programming - Basic Syntax

- **Functions**

- Functions are small units of programs and they are used to carry out a specific task. Here, the function **main()** provides the entry point for the program execution and the other function **printf()** is being used to print an information on the computer screen.

- You can write your own functions which we will see in a separate chapter, but C programming itself provides various built-in functions like main(), printf(), etc., which we can use in our programs based on our requirement.

- **Comments**

- A C program can have statements enclosed inside **/*.....*/**. Such statements are called comments and these comments are used to make the programs user friendly and easy to understand. The good thing about comments is that they are completely ignored by compilers and interpreters. So you can use whatever language you want to write your comments.

Computer Programming - Basic Syntax

- **Whitespaces**

- When we write a program using any programming language, we use various printable characters to prepare programming statements. These printable characters are **a, b, c,......z, A, B, C,.....Z, 1, 2, 3,...... 0, !, @, #, $, %, ^, &, *, (,), -, _, +, =, \, |, {, }, [,], :, ;, <, >, ?, /, \, ~. `. ", '**. Hope I'm not missing any printable characters from your keyboard.

- Apart from these characters, there are some characters which we use very frequently but they are invisible in your program and these characters are spaces, tabs (\t), new lines(\n). These characters are called **whitespaces**.

- These three important whitespace characters are common in all the programming languages and they remain invisible in your text document −

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Computer Programming - Basic Syntax

Whitespace	Explanation	Representation
New Line	To create a new line	\n
Tab	To create a tab.	\t
Space	To create a space.	empty space

A line containing only whitespace, possibly with a comment, is known as a blank line, and a C compiler totally ignores it. Whitespace is the term used in C to describe blanks, tabs, newline characters, and comments. So you can write printf("Hello, World!"); as shown below. Here all the created spaces around "Hello, World!" are useless and the compiler will ignore them at the time of compilation.

Computer Programming - Basic Syntax

- **Semicolons**

- Every individual statement in a C Program must be ended with a semicolon (;), for example, if you want to write "Hello, World!" twice, then it will be written as follows −

```
#include <stdio.h>

int main() {
    /* printf() function to write Hello, World! */
    printf( "Hello, World!\n" );
    printf( "Hello, World!" );
}
```

This program will produce the following result −

```
Hello, World!
Hello, World!
```

- Here, we are using a new line character \n in the first printf() function to create a new line.

- Let us see what happens if we do not use this new line character −

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- **Syntax Error**

- If you do not follow the rules defined by the programing language, then at the time of compilation, you will get syntax errors and the program will not be compiled. From syntax point of view, even a single dot or comma or a single semicolon matters and you should take care of such small syntax as well. In the following example, we have skipped a semicolon, let's try to compile the program −

```c
#include <stdio.h>

main() {
   printf("Hello, World!")
}
```

This program will produce the following result −

```
main.c: In function 'main':
main.c:7:1: error: expected ';' before '}' token
 }
 ^
```

So the bottom-line is that if you are not following proper syntax defined by the programming language in your program, then you will get syntax errors. Before attempting another compilation, you will need to fix them and then proceed.

Java Program

- Hello World Program in Java

- Following is the equivalent program written in Java. This program will also produce the same result **Hello, World!**.

```java
public class HelloWorld {
    public static void main(String []args) {
        /* println() function to write Hello, World! */
        System.out.println("Hello, World!");
    }
}
```

which produces the following result −

```
Hello, World!
```

Python Program

- Hello World Program in Python

- Following is the equivalent program written in Python. This program will also produce the same result **Hello, World!**.

```
#  print function to write Hello, World! */
print "Hello, World!"
```

which produces the following result –

```
Hello, World!
```

Hope you noted that for C and Java examples, first we are compiling the programs and then executing the produced binaries, but in Python program, we are directly executing it.

As we explained in the previous chapter, Python is an interpreted language and it does not need an intermediate step called compilation.

Python does not require a semicolon (;) to terminate a statement, rather a new line always means termination of the statement.

Computer Programming - Data Types

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Computer Programming - Data Types

a data type represents a type of the data which you can process using your computer program. It can be numeric, alphanumeric, decimal, etc.

There are different types of data such as strings, characters, whole numbers (integers), and decimal numbers (floating point numbers)

- **C and Java Data Types**

- C and Java support almost the same set of data types, though Java supports additional data types.

- Different programming languages use different keywords to specify different data types. For example, C and Java programming languages use **int** to specify integer data, whereas **char** specifies a character data type.

Computer Programming - Data Types

- **C and Java Data Types**

- a few common data types supported by both languages −

Type	Keyword	Value range which can be represented by this data type
Character	char	-128 to 127 or 0 to 255
Number	int	-32,768 to 32,767 or -2,147,483,648 to 2,147,483,647
Small Number	short	-32,768 to 32,767
Long Number	long	-2,147,483,648 to 2,147,483,647
Decimal Number	float	1.2E-38 to 3.4E+38 till 6 decimal places

These data types are called primitive data types and you can use these data types to build more complex data types, which are called user-defined data type, for example a string will be a sequence of characters

Computer Programming - Data Types

Python Data Types

Python has five standard data types but this programming language does not make use of any keyword to specify a particular data type, rather Python is intelligent enough to understand a given data type automatically.

- **Numbers**
- **String**
- **List**
- **Tuple**
- **Dictionary**

Here, Number specifies all types of numbers including decimal numbers and string represents a sequence of characters with a length of 1 or more characters

Computer Programming - Variables

Variables are the names you give to computer memory locations which are used to store values in a computer program.

- For example, assume you want to store two values 10 and 20 in your program and at a later stage, you want to use these two values. Let's see how you will do it. Here are the following three simple steps −

- Create variables with appropriate names.

- Store your values in those two variables.

- Retrieve and use the stored values from the variables

Computer Programming - Variables

- **Creating variables**

- Creating variables is also called **declaring variables** in C programming. Different programming languages have different ways of creating variables inside a program. For example, C programming has the following simple way of creating variables –

```c
#include <stdio.h>

int main() {
    int a;
    int b;
}
```

```c
/* variable to store long value */
long a;

/* variable to store float value */
float b;
```

Similarly, you can create variables to store **long**, **float**, **char** or any other data type.

Computer Programming - Variables

- **Creating variables**

- You can create variables of similar type by putting them in a single line but separated by comma as follows −

```c
#include <stdio.h>

int main() {
    int a, b;
}
```

Computer Programming - Variables

The key points about variables that you need to keep in mind −

- A variable name can hold a single type of value. For example, if variable **a** has been defined **int** type, then it can store only integer.

- C programming language requires a variable creation, i.e., declaration before its usage in your program. You cannot use a variable name in your program without creating it, though programming language like Python allows you to use a variable name without creating it.

- You can use a variable name only once inside your program. For example, if a variable **a** has been defined to store an integer value, then you cannot define **a** again to store any other type of value.

- There are programming languages like Python, PHP, Perl, etc., which do not want you to specify data type at the time of creating variables. So you can store integer, float, or long without specifying their data type.

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Computer Programming - Variables

Key points continue

- You can give any name to a variable like **age**, **sex**, **salary**, **year1990** or anything else you like to give, but most of the programming languages allow to use only limited characters in their variables names. For now, we will suggest to use only **a....z, A....Z, 0....9** in your variable names and start their names using alphabets only instead of digits.

- Almost none of the programming languages allow to start their variable names with a digit, so **1990year** will not be a valid variable name whereas **year1990** or **ye1990ar** are valid variable names.

Computer Programming - Variables

Store Values in Variables

- You have seen how we created variables in the previous section. Now, let's store some values in those variables −

```c
#include <stdio.h>

int main() {
    int a;
    int b;

    a = 10;
    b = 20;
}
```

The above program has two additional statements where we are storing 10 in variable a and 20 is being stored in variable b. Almost all the programming languages have similar way of storing values in variable where we keep variable name in the left hand side of an equal sign = and whatever value we want to store in the variable, we keep that value in the right hand side.

Now, we have completed two steps, first we created two variables and then we stored required values in those variables. Now variable **a** has value 10 and variable **b** has value 20. In other words we can say, when above program is executed, the memory location named **a** will hold 10 and memory location **b** will hold 20.

Computer Programming - Variables

Access stored values in variables

- Print the values stored in these two variables in C program as follows:

```c
#include <stdio.h>

int main() {
   int a;
   int b;

   a = 10;
   b = 20;

   printf( "Value of a = %d\n", a );
   printf( "Value of b = %d\n", b );
}
```

- When the above program is executed, it produces the following result −

```
Value of a = 10
Value of b = 20
```

- We are making use of %d, which will be replaced with the values of the given variable in **printf()** statements

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Computer Programming - Variables

Access stored values in variables

- We can print both the values using a single **printf()** statement as follows −

```c
#include <stdio.h>

int main() {
   int a;
   int b;

   a = 10;
   b = 20;

   printf( "Value of a = %d and value of b = %d\n", a, b );
}
```

- When the above program is executed, it produces the following result −

```
Value of a = 10 and value of b = 20
```

- If you want to use float variable in C programming, then you will have to use %f instead of %d, and if you want to print a character value, then you will have to use %c. Similarly, different data types can be printed using different % and characters.

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Computer Programming – Variables in Java

- This program will create two variables **a** and **b** and very similar to C programming, it will assign 10 and 20 in these variables and finally print the values of the two variables in two ways −

```java
public class DemoJava {
    public static void main(String []args) {
        int a;
        int b;

        a = 10;
        b = 20;

        System.out.println("Value of a = " + a);
        System.out.println("Value of b = " + b);
        System.out.println("Value of a = " + a + " and value of b = " + b);
    }
}
```

- When the program is executed, it produces the following result below −

```
Value of a = 10
Value of b = 20
Value of a = 10 and value of b = 20
```

Computer Programming – Variables in Python

- This program will create two variables **a** and **b** and assign 10 and 20 in these variables.

- Python does not want you to specify the data type at the time of variable creation and there is no need to create variables in advance.

```
a = 10
b = 20

print "Value of a = ", a
print "Value of b = ", b
print "Value of a = ", a, " and value of b = ", b
```

- When the program is executed, it produces the following result below −

```
Value of a =  10
Value of b =  20
Value of a =  10  and value of b =  20
```

Assignment 1

1. Write all the examples in this presentation as assignment 1, however, this time assigning decimal numbers and some characters.

2. Print your work on the same line and also do another and print your work in new line.

3. Do it for C, Java and Python