

COMPUTER PROGRAMMING

writing computer programs

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About the Tutorial

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.

Computer Programming is fun and easy to learn provided you adopt a proper approach. This tutorial attempts to cover the basics of computer programming using a simple and practical approach for the benefit of novice learners.

Audience

This tutorial has been prepared for the beginners who are willing to learn computer programming but they are unable to learn it due to lack of proper guidance. We are confident that after completing this tutorial, you will be at a level where you can code in C Programming language and will have a basic understanding of Java and Python programming languages as well from where you can continue further.

If you are completely new to Computer Programming, then we recommend you to read this tutorial twice or even thrice. First reading will not give you much idea, but during your second reading, you will start grasping most of the concepts and you will enjoy writing computer programs.

Prerequisites

We do not expect much from you as prerequisites, however, we assume that you have some amount of exposure to computers and its peripherals like keyboard, mouse, screen, printer, etc.

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Table of Contents

About the Tutorial	i
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Audience.....	i
Prerequisites.....	i
Copyright & Disclaimer	i
Table of Contents.....	ii
1. OVERVIEW.....	1
Introduction to Computer Program.....	1
Introduction to Computer Programming.....	2
Uses of Computer Programs	2
Computer Programmer	3
Algorithm.....	3
2. BASICS.....	5
3. ENVIORNMENT.....	7
Text Editor	8
Compiler	8
Interpreter.....	9
Online Compilation	10
4. BASIC SYNTAX.....	11
Hello World Program in C.....	11
Syntax Error	15
Hello World Program in Java	15
Hello World Program in Python	16
5. DATA TYPES.....	17
C and Java Data Types.....	18
Python Data Types	19
6. VARIABLES.....	20

Creating variables	20
Store Values in Variables	21
Access Stored Values in Variables	22
Variables in Java	23
Variables in Python	24
7. KEYWORDS.....	26
C Programming Reserved Keywords	27
Java Programming Reserved Keywords.....	27
Python Programming Reserved Keywords	28
8. OPERATORS.....	30
Arithmetic Operators.....	30
Relational Operators.....	32
Logical Operators.....	34
Operators in Java	36
Operators in Python.....	37
9. DECISION STATEMENTS.....	39
if...else statement	41
if...else if...else statement.....	42
The switch statement	44
Decisions in Java	46
Decisions in Python.....	47
10. LOOPS	48
The while Loop.....	50
The do...while Loop	51
The break statement.....	53
The continue statement.....	54

Loops in Java	56
Loops in Python	56
11. NUMBERS	58
Math Operations on Numbers	59
Numbers in Java.....	62
Numbers in Python	63
12. CHARACTERS.....	65
Escape Sequences	66
Characters in Java	68
Characters in Python.....	69
13. ARRAYS	70
Create Arrays	71
Initializing Arrays	71
Accessing Array Elements	72
Arrays in Java	73
Arrays (Lists) in Python	74
14. STRINGS	76
Basic String Concepts	79
Strings in Java	79
Strings in Python.....	80
15. FUNCTIONS	81
Defining a Function	83
Calling a Function.....	83
Functions in Java.....	85
Functions in Python	86

16. FILE I/O.....	88
Computer Files.....	88
File Input/Output.....	88
File Operation Modes	88
Opening Files	89
Closing a File	90
Writing a File.....	90
Reading a File.....	91
File I/O in Java	92
File I/O in Python	93
17. SUMMARY.....	95

1. OVERVIEW

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.

Computer Programmer

Someone who can write computer programs or in other words, someone who can do computer programming is called a Computer Programmer.

Based on computer programming language expertise, we can name a computer programmers as follows:

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

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 $L_1, L_2, L_3 \dots L_N$
2. Assume L_1 is the largest, $\text{Largest} = L_1$
3. Take next number L_i from the list and do the following
4. If Largest is less than L_i
5. $\text{Largest} = L_i$
6. If L_i 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

The above algorithm has been written in a crude way to help beginners understand the concept. You will come across more standardized ways of writing computer algorithms as you move on to advanced levels of computer programming.

2. BASICS

We assume you are well aware of English Language, which is a well-known **Human Interface Language**. English has a predefined grammar, which needs to be followed to write English statements in a correct way. Likewise, most of the Human Interface Languages (Hindi, English, Spanish, French, etc.) are made of several elements like verbs, nouns, adjectives, adverbs, propositions, and conjunctions, etc.

Similar to Human Interface Languages, Computer Programming Languages are also made of several elements. We will take you through the basics of those elements and make you comfortable to use them in various programming languages. 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

We will explain all these elements in subsequent chapters with examples using different programming languages. First, we will try to understand the meaning of all these terms in general and then, we will see how these terms can be used in different programming languages.

This tutorial has been designed to give you an idea about the following most popular programming languages:

- C Programming
- Java Programming
- Python Programming

A major part of the tutorial has been explained by taking C as programming language and then we have shown how similar concepts work in Java and Python. So after completion of this tutorial, you will be quite familiar with these popular programming languages.

3. ENVIRONMENT

Though Environment Setup is not an element of any Programming Language, it is the first step to be followed before setting on to write a program.

When we say Environment Setup, it simply implies a base on top of which we can do our programming. Thus, we need to have the required software setup, i.e., installation on our PC which will be used to write computer programs, compile, and execute them. For example, if you need to browse Internet, then you need the following setup on your machine:

- A working Internet connection to connect to the Internet
- A Web browser such as Internet Explorer, Chrome, Safari, etc.

If you are a PC user, then you will recognize the following screenshot, which we have taken from the Internet Explorer while browsing tutorialspoint.com.



Similarly, you will need the following setup to start with programming using any programming language.

- A text editor to create computer programs

- A compiler to compile the programs into binary format
- An interpreter to execute the programs directly

In case you don't have sufficient exposure to computers, you will not be able to set up either of these software. So, we suggest you take the help from any technical person around you to set up the programming environment on your machine from where you can start. But for you, it is important to understand what these items are.

Text Editor

A text editor is a software that is used to write computer programs. Your Windows machine must have a Notepad, which can be used to type programs. You can launch it by following these steps:

Start Icon → All Programs → Accessories → Notepad → Mouse Click on Notepad

It will launch Notepad with the following window:



You can use this software to type your computer program and save it in a file at any location. You can download and install other good editors like **Notepad++**, which is freely available.

If you are a Mac user, then you will have **TextEdit** or you can install some other commercial editor like **BEdit** to start with.

Compiler

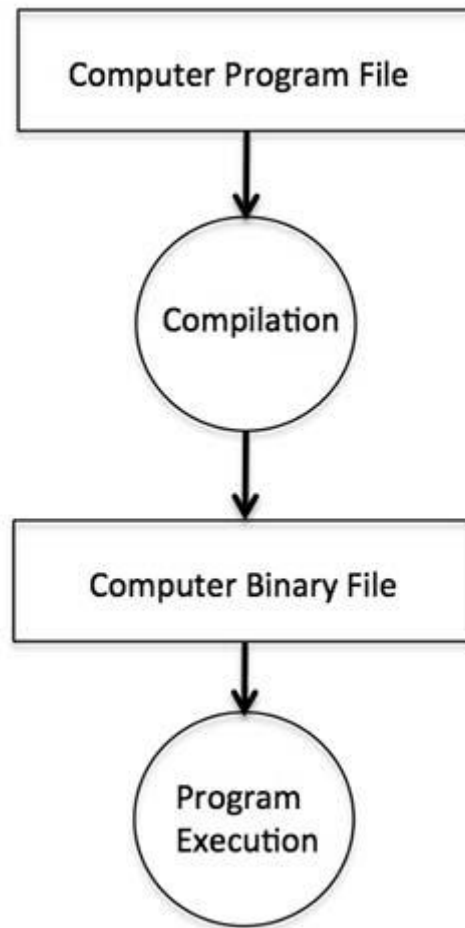
You write your computer program using your favorite programming language and save it in a text file called the program file.

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.

We are not going into the details of a compiler and the different phases of compilation.

The following flow diagram gives an illustration of the process:

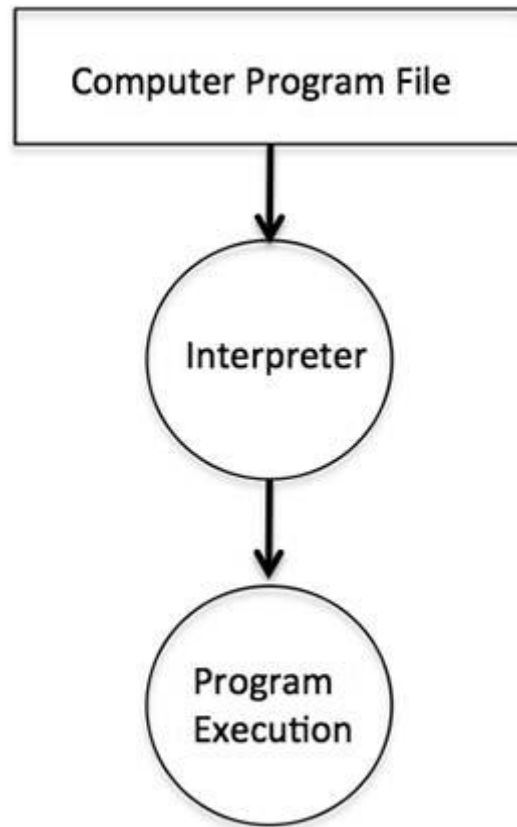


So, if you are going to write your program in any such language, which needs compilation like C, C++, Java and Pascal, etc., then you will need to install their compilers before you start programming.

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.

Online Compilation

If you are not able to set up any editor, compiler, or interpreter on your machine, then *tutorialspoint.com* provides a facility to compile and run almost all the programs online with an ease of a single click.

So do not worry and let's proceed further to have a thrilling experience to become a computer programmer in simple and easy steps.

4. BASIC SYNTAX

Let's start with a little coding, which will really make you a computer programmer. We are going to write a single-line computer program to write **Hello, World!** on your screen. Let's see how it can be written using different programming languages.

Hello World Program in C

Try the following example using our online compiler option available at www.compileonline.com.

For most of the examples given in this tutorial, you will find a **Try it** option in our website code sections at the top right corner that will take you to the online compiler.

Try to change the content inside `printf()`, i.e., type anything in place of **Hello World!** and then check its result. It just prints whatever you keep inside the two double quotes.

```
#include <stdio.h>

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

This little Hello World program will help us understand various basic concepts related to C Programming.

Program Entry Point

For now, just forget about the **#include <stdio.h>** statement, but keep a note that 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.

Functions

Functions are small units of programs and they are used to carry out a specific task. For example, the above program makes use of two functions: **main()** and **printf()**. 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.

Some of the programming languages use the word **sub-routine** instead of function, but their functionality is more or less the same.

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.

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:

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.

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