Contents

- **We will learn**
  1. Computer Programming Languages
  - ✓ Machine language
  - ✓ Assembly language
  - ✓ High level language

Computer Programming Languages

Computer Programming Languages:

- A **programming language** is an artificial language that can be used to control the behavior of a machine, particularly a computer.
- Programming languages, like human languages, are defined through the rules, to determine structure and meaning.

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Computer Programming Languages (Contd…):

- Programming languages are used to facilitate communication about the task of organizing and manipulating information, and to express algorithms precisely.
- For 50 years, computer programmers have been writing codes.
- New technologies continue to emerge, develop, and mature at a rapid pace.
- Now there are more than 2,500 documented programming languages!

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Most Popular Programming Languages –

C
Python
C++
Java
SCALA
C#
R
Ruby
Go
Swift
JavaScript

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Characteristics of a programming Language –

- ✓ A programming language must be simple, easy to learn and use, have good readability and human recognizable.
- ✓ Programming language's efficiency must be high so that it can be easily converted into a machine code.
- ✓ A programming language should be well structured and documented so that it is suitable for application development.
- ✓ Necessary tools for development, debugging, testing, maintenance of a program must be provided by a programming language.
- ✓ A programming language must be consistent in terms of syntax and semantics.

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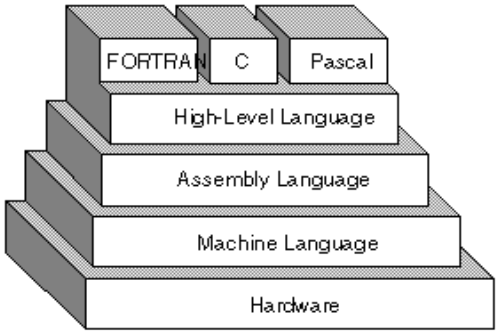
Machine language:

- It is the low-level programming language.



- Machine languages are the only languages understood by computers.

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Machine language:

- While easily understood by computers, machine languages are almost impossible for humans to use because they consist entirely of numbers.

For example, a processor can execute the following binary instruction as expressed in machine language:

```
Binary: 10110000 01100001
```

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How these instructions are organized is interesting to note two things.

First, each instruction is composed of a sequence of 1's and 0's. The number of bits that make up a single command vary.

Second, each set of binary digits is interpreted by the CPU into a command to do a very specific job.

However, because different CPUs have different instruction sets, instructions that were written for one CPU type could not be used on another CPU.

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Assembly Level Language:

- An **assembly language** is a low-level language for programming computers.
- The word "**low**" does not imply that the language is inferior to high-level programming languages but rather refers to the small amount of abstraction between the high level language and machine language.
- It implements a symbolic representation of the numeric machine codes and other constants needed to program a particular CPU architecture.

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Assembly Level Language (contd):

- An utility program called an **assembler**, is used to translate assembly language statements into the target computer's machine code.

Example: **Assembly language representation is easier to remember**

mov al, 061h

This instruction means:
Move the hexadecimal value 61 into the processor register named "al".

The "mov" is an *operation code* or *opcode*,

A comma-separated list of arguments or parameters follows the opcode;

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However, assembly still has some downsides.

First, assembly languages still require a lot of instructions to do even simple tasks.

While the individual instructions themselves are somewhat human readable, understanding what an entire program is, can be challenging (it's a bit like trying to understand a sentence by looking at each letter individually).

Second, assembly language still isn't very portable - a program written in assembly for one CPU will likely not work on hardware that uses a different instruction set, and would have to be rewritten or extensively modified.

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High-level language:

- **High-level languages** are relatively easy to learn because the instructions bear a close resemblance to everyday language.
- The programmer does not require a detailed knowledge of the internal workings of the computer.
- Each instruction in a high-level language is equivalent to several machine-code instructions.
- High-level languages are used to solve problems and are often described as **problem-oriented languages**

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High-level language (Contd…):

Examples of HLL:

- BASIC was designed to be easily learnt by first-time programmers.
- The language BASIC was an acronym for Beginner's All-Purpose Symbolic Instruction Code.
- It was developed by Dartmouth mathematicians as a teaching tool for undergraduates.
- BASIC was traditionally one of the most commonly used computer programming languages, considered an easy step for students to learn before more powerful languages such as FORTRAN.

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FORTRAN (formula transition)

- FORTRAN is used for programs solving scientific and mathematical problems.
- It was developed in 1957 by IBM.

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COBOL

- COBOL is used in solving business problems;
- The word **COBOL** is an acronym that stands for **CO**mmon **B**usiness **O**riented **L**anguage.
- As the expanded acronym indicates, COBOL is designed for developing business, typically file-oriented, applications. It is not designed for writing system programs.

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Examples of HLL:

- BASIC was designed to be easily learnt by first-time programmers;
- COBOL is used to write programs solving business problems;
- FORTRAN is used for programs solving scientific and mathematical problems.
- With the increasing popularity of windows-based systems, the next generation of programming languages was designed to facilitate the development of GUI interfaces;
- Support for object-oriented programming has also become more common, for example in C++ and Java.