

The need for Programming Languages

- Computers are very simple devices that only “understand” a handful of simple commands, like adding two numbers or reading a value from memory.
- The set of commands understood by a computer is called *machine code*.

The need for Programming Languages

- The *processor* is the component of a computer that executes the commands in a program. Each processor has its own machine code.
- A program needs to be stored in the memory of the computer, so it can be executed. Information is stored in a computer in binary format, i.e, information is encoded as a sequence of 0's and 1's.

Binary Code

Below is a binary program in machine code for a processor called 8086. This program prints the word “hello” on the screen.

```
10111010000011000000000011011010000001001110011  
01001000011011100000000000001001100110011010010  
0001010010000110010101101100011011000110111100  
10110000100000010101111011011110111001001101100  
01100100000100001000011010000110001101111
```

Binary Code

```
10111010000011000000000110110100000010011
100110100100001101110000000000000100110011
0011010010000101001000011001010110110001
10110001101111001011000010000001010111101
10111101110010011011000110010000010000100
0011010000110001101111
```

Binary code is hard for humans to understand, as a sequence of 0's and 1's has no meaning to us.

Programming Languages

Compare the above binary program with the following equivalent python program

```
print ("hello")
```

Python is called a *high level* programming language and it was designed to make computer programs readable to humans.

High Level Programming Languages

- However, a computer does not understand python,Java, C++, or any other high level programming language.
- A *compiler* is a program that translates from a programming language to machine code that the computer can understand.

Java

- In this course we will be writing programs in Java.
- A Java program must be stored in a file with the extension `.java`.
- A Java compiler does not directly produce machine code, but it translates the Java program into another language called *Java bytecode*.
- Java bytecode is a type of *intermediate language*.

Java

- Java bytecode is stored in files with the extension `.class`.
- A *java interpreter* or *virtual machine* can execute the java bytecode.
- Eclipse has an integrated java compiler that runs as you type your program.
- If you want to compile your Java program for a terminal or command window, the name of the Java compiler is `javac` and the name of the Java interpreter is `java`.