

STMC coding team training

Lesson 0: Introduction

TSAI Yun Chen

September 17, 2022



To begin with...

What do you think of when talking about programming?



What is programming?

- A **computer program** is a collection of instructions that can be executed by a computer to perform a specific task [1].
- Tell computer what to do and how to response to input and produce outputs
- Similar to writing an article, you need to follow a few rules

writing	coding
grammar	syntax
content	logic/algorithm
organization	structure and indentation



Examples of computer programs

- Web browser
- Computer games
- Mobile applications
- Operation system (e.g. Windows, Linux, Unix, etc.)
- Productivity software (e.g. Word, PowerPoint, Excel, etc.)



Cool, but what is INSIDE a computer program?

- Computer programs consist of **machine code** that are made up of 0s and 1s
- It's groups of 0s and 1s that represent instructions directly executable by computer.
- Different operation systems (e.g. windows vs Mac) have different set of instruction.

```
00000000 0000 0001 0001 1010 0010 0001 0004 0128
00000010 0000 0016 0000 0028 0000 0010 0000 0020
00000020 0000 0001 0004 0000 0000 0000 0000 0000
00000030 0000 0000 0000 0000 0010 0000 0000 0204
00000040 0004 8384 0084 c7c8 00c8 4748 0048 e8e9
00000050 00e9 6a69 0069 a8a9 00a9 2828 0028 fdfc
00000060 00fc 1819 0019 9898 0098 d9d8 00d8 5857
00000070 0057 7b7a 007a bab9 00b9 3a3c 003c 8888
00000080 8888 8888 8888 8888 288a be88 8888 8888
00000090 3b83 5788 8888 8888 7657 778e 8828 8888
000000a0 dc1f 7abd 8818 8888 467c 565f 8814 e188
000000b0 8b06 e8f7 88aa 8888 8b3b 88f3 88bd e988
000000c0 8a18 880c e841 c988 b328 6871 688e 958b
000000d0 a948 5862 5884 7e81 3788 1ab4 5a84 3eec
000000e0 3d86 dc88 5cbb 8888 8888 8888 8888 8888
000000f0 8888 8888 8888 8888 8888 8888 8888 0000
00001000 0000 0000 0000 0000 0000 0000 0000 0000
*
00001300 0000 0000 0000 0000 0000 0000 0000
000013e0
```

Figure 1: Machine code (Source: <https://bit.ly/3sQendj>)



But... We don't speak machine code right?

- In order to communicate to machine more efficiently, people invented the **high level language**
- Examples: C/C++, Java, Python, Ruby, R, PHP, etc.
- It is composed of word and symbol that are used in daily life (e.g. if, while, $y=x+c$ etc.)
- Code written in high level language are usually called **source code**

A screenshot of a code editor showing C++ source code. The code is written in a dark-themed editor with syntax highlighting. It includes various C++ constructs such as namespaces, classes, and functions. The code is organized into multiple sections, with some parts commented out. The editor has a sidebar on the right showing a file explorer and a search bar.

Figure 2: Source code in C++ (Source: me)



Compiler: Translate source code to machine code

- Like we don't speak machine code, machine don't know how to interpret source code.
- We need a “translator” to do the translation, from source code to machine code
- That's what a **compiler** do
- The compiled result is called an **executable**, which has the file extension of .exe in Windows

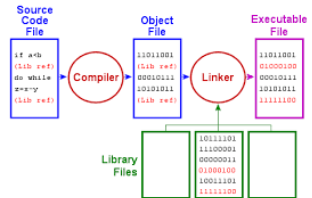


Figure 3: Compiling source code to executables (Source: <https://bit.ly/3sQendj>)



Some other solution

While machine code is machine dependent (since they have different instruction set), therefore we need to re-compile the source code everytime we change the machine we work on, below are some method to avoid this.

1. Two-step conversion

- Instead of directly translating the source code into machine code, we can first translate it into the instruction needed
- upon running the program, we then translate the instruction to the machine code needed
- Java works in this way (thats why you need to install Java on your computer before playing Minecraft)



Some other solution

2. Interpreter

- For some programming language (like Python), the high level instructions are compiled line-by-line during runtime
- The software that do that is called an **interpreter** instead of a compiler



Let's move on to write our first program ...



Reference I

- [1] Wikipedia contributors. *Computer program* — *Wikipedia, The Free Encyclopedia*. [Online; accessed 27-August-2021]. 2021. URL: https://en.wikipedia.org/w/index.php?title=Computer_program&oldid=1040444998.

