Python Fundamentals

Introduction to Python, source code, byte code, compiler vs interpreter, virtual machine

Objectives:

- Introduction to Python
- Source Code
- Byte Code
- Compiler vs Interpreter
- Python Virtual Machine

Introduction to Python

- Python is a clear and powerful object-oriented programming language, comparable to Perl, Ruby, Scheme, or Java.
- Runs anywhere, including Mac OS X, Windows, Linux, and Unix, with unofficial builds also available for Android and iOS.
- Uses an elegant syntax, making the programs you write easier to read.

Introduction to Python

- Python can be used to develop a wide variety of programs. From basic scripts to automate common tasks, to complex web applications.

- Because Python is not only free to use, but free to extend and modify, it's been applied to areas as diverse as biochemistry and data analytics.

What is a computer program?

Source code is a set of instructions written in a language which is “easy” for us to understand.

```
# Declare our variables
hours = 40
grossPay, payRate = 0.0, 25.0

# Calculate gross pay
grossPay = hours * payRate

# Print it to the console
print('Your gross pay is $', grossPay, sep='')
```

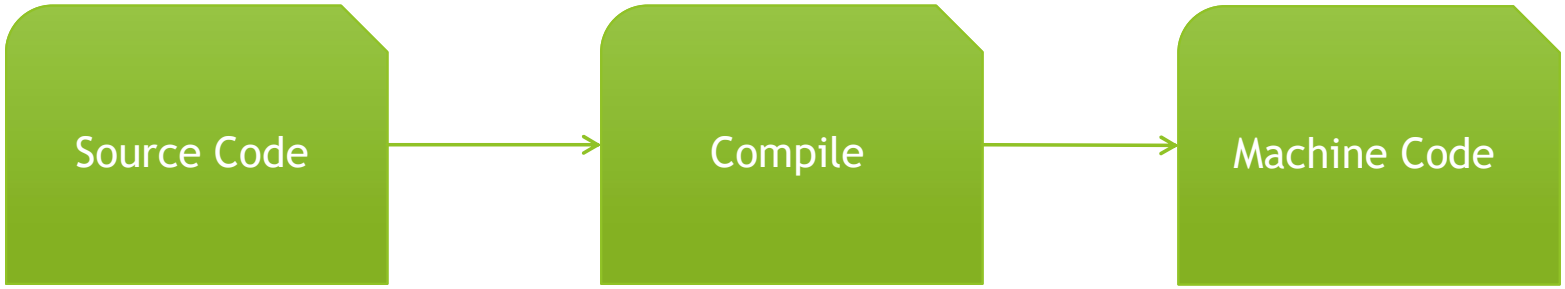
What is a computer program?

- Computers work on instructions that are passed to their central processing unit (CPU). These instructions are in a code that is completely incomprehensible to all sane people.
- An example of Machine Code (executable code)

```
0000: 3018 008A 2F00 3FFF 00FF 0E03
0008: 080A 00FA 018A 1E8C 2826 0804
0010: 0084 081A 3A24 1D03 2817 153F
0018: 0080 0800 0ABC 1A3C 123C 3A0D
0020: 2824 1520 3040 00BC 087C 0084
0028: 0E7E 0083 0EFF 0E7F 0009 3FFF
0030: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF
0038: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF
0040: 158A 160A 2F0A 158A 160A 2F0B
0048: 2C28 0E21 3907 0782 2CBB 2CBB
0050: 2B31 2B31 2892 0821 390F 0782
```

What is a computer program?

- We need to turn our source code into a form that the machine can understand. In traditional languages like C or C++, these are the steps. Python works slightly differently, but the principle is the same.



What is a computer program?

- For most languages, the source code is converted into an executable file containing our machine code. For example, a `.exe` file on Windows.
- For Python, the source code is compiled into bytecode and then interpreted by the Python Virtual Machine.
- This is assuming you're using CPython. Confused yet? Don't worry, this will all be explained!

Compiled vs Interpreted

- Two terms that have arisen are a compiler, or compilation, and an interpreter.

- A compiled language first requires code to be turned into a set of machine instructions, *before* it can be executed.

- An interpreted language can be executed directly. This execution will often translate the code into *byte code*, which is interpreted by a *virtual machine*.

Compiled vs Interpreted

- Compiled languages have a few advantages, mainly speed. C and C++ are examples of compiled languages. The disadvantage comes in portability between platforms. A program compiled for Windows can't be run on a Linux machine.

- Interpreted languages sacrifice speed for improved portability. JavaScript, Python, and Ruby are examples of interpreted languages. Code can easily be run on a wide variety of platforms without much (if any) modification.

References

Is Python interpreted or compiled?

https://nedbatchelder.com/blog/201803/is_python_interpreted_or_compiled_yes.html

Demonstration:

- Introduction to Python
- Source Code
- Byte Code
- Compiler vs Interpreter
- Python Virtual Machine