Python Zero to Hero

Teaching you Python from the ground up, but for advanced programmers.

October 1, 2020 · 11 min · Bee

What is Python?

Python is a programming language created by Guido (pronounced gree-do) Van Rossum. Specifically, Python is an intrepreted, high-level, general purpose programming language.

Let’s talk about what these mean.

General Purpose

General Purpose means that Python was created to do everything. Some programming languages like Matlab or R were created for data science. Others like HTML / CSS were created for web development.

Python aims to do everything, it is generalised. This is both a fault and an advantage. You can do everything you want in Python, but it does not have one area where it shines.

High Level

Let’s use a different language as an example, C++. When we write code in C++ code, we write it in a language similar to English.

```cpp
#include <iostream>

int main()
{
  std::cout << "Hello, World!" << std::endl;
  return 0;
}
```

This code prints “Hello, World!” to the screen. Looks confusing, right? But if you read the words you can see some English words. `main` , include, end, “Hello, World!", return and some more.

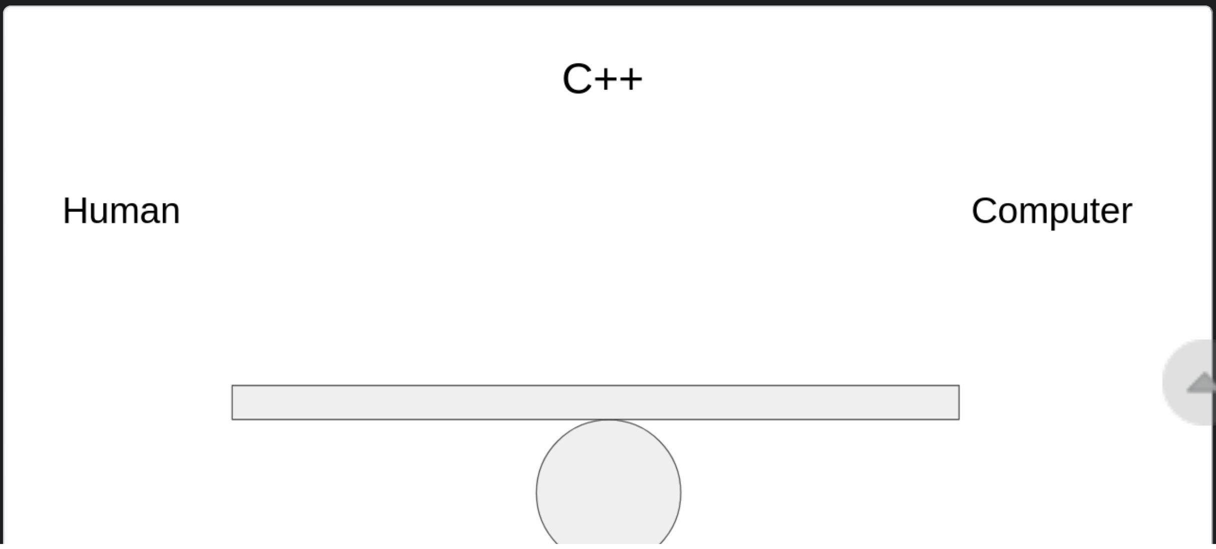
When we write code, we write it in a language that is similar to English but also technical enough for the computer to understand.

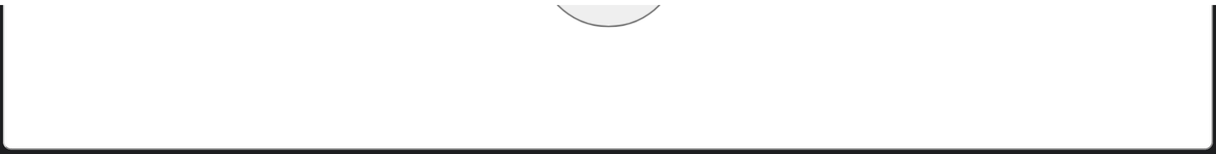
Normal English is a bad programming language, since we can mean different things from the same sentence. For example:

“Alright” and “Alright” mean 2 different things in British English (Alright means “hello” and “it’s good”).

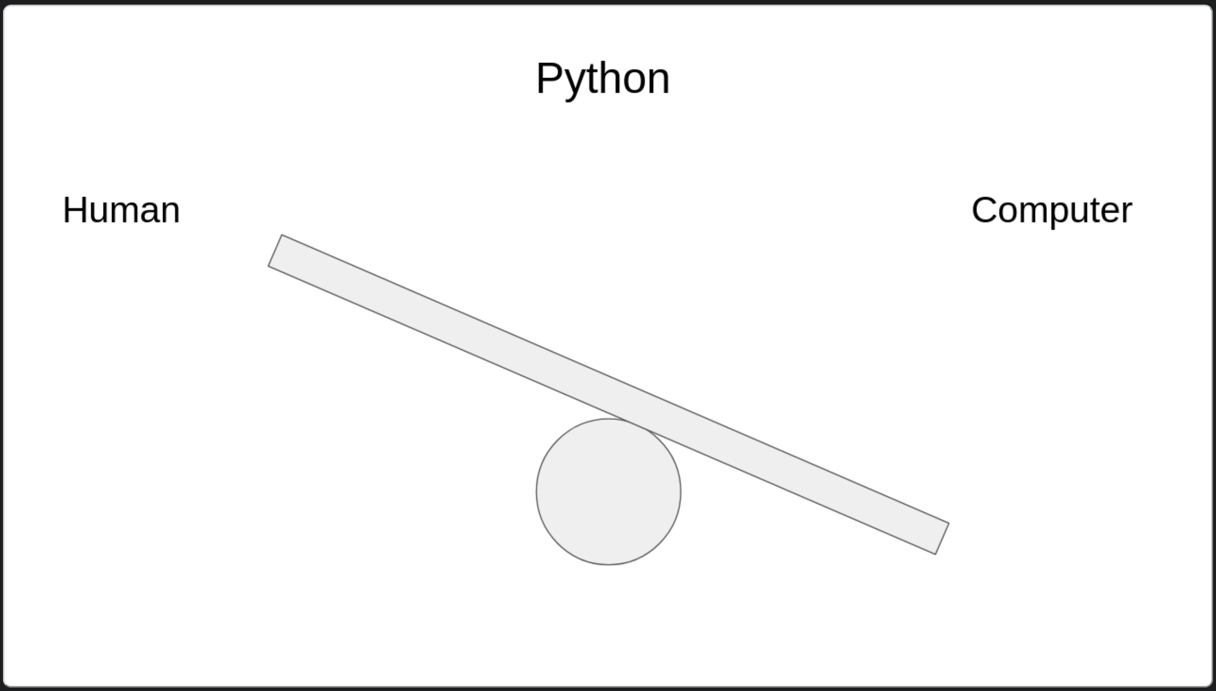
The computer would have no idea how to interpret this. English is a bad programming language, so we have to use something that’s a mixture of something the computer can understand and something we can understand.

In the case of C++ that mixture is more 50% human, 50% computer (arbitrary numbers). The more the mixture leans to the human side, the more “high level” it is





Python is more high level, so it leans more to the human side.



Take a look at this Python code:

```
def hello_world():
    print("Hello, World!")
```

If I told you that `def` was short for `define` you'd now know every single word in that program. Whereas with C++ it was a lot harder to understand.

This is what we mean by high level and low level.

Python is high level because it is more understandable by humans with no programming experience. Whereas C++ is less understandable.

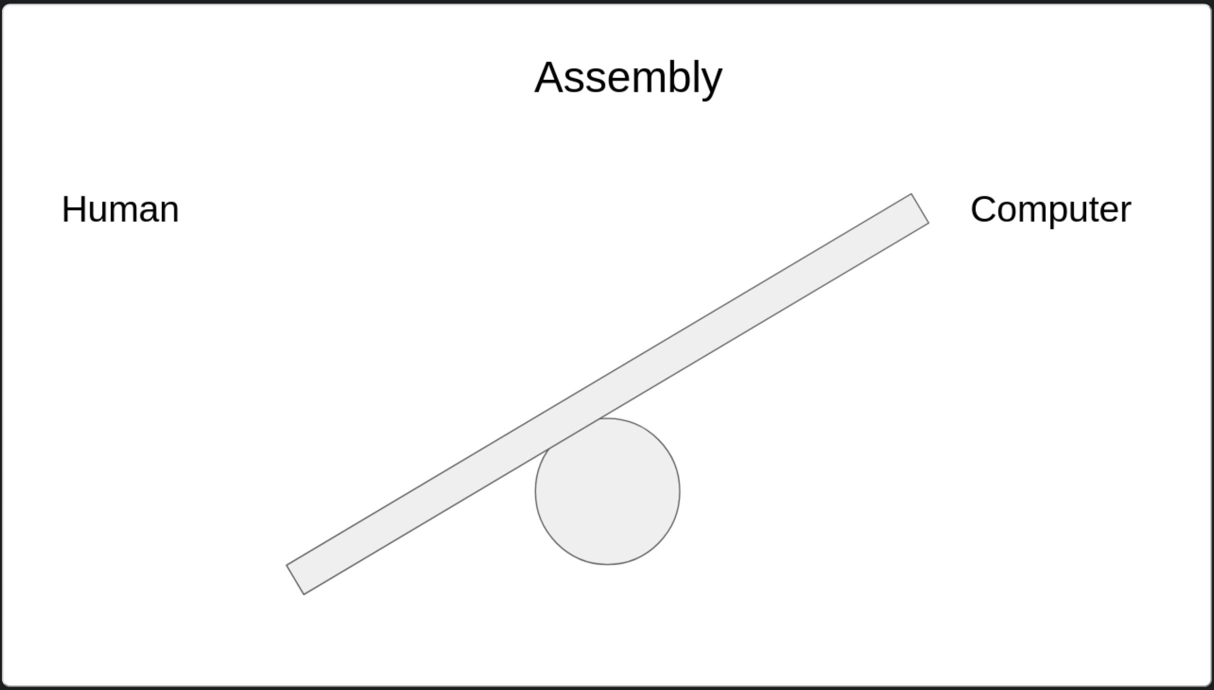
Now, what if I told you that I lied to you? The computer doesn't understand any human language at all.

That's right! Even C++ it doesn't understand. What if I told you that there's an even more un-readable language called Assembly?

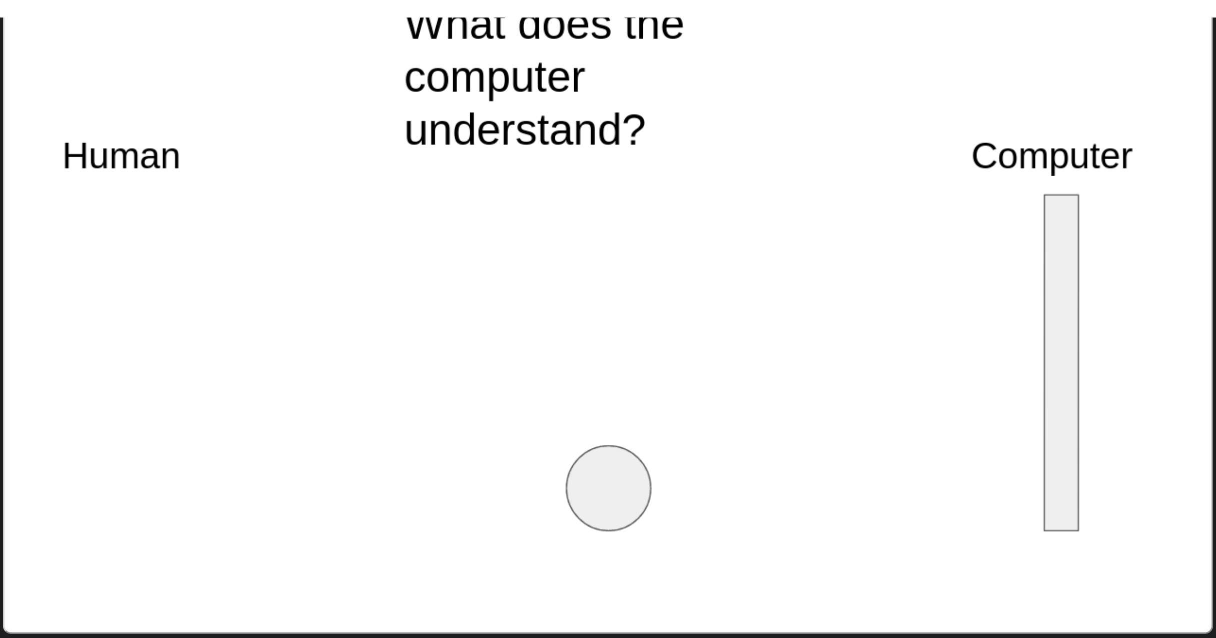
Here's an example I stole from the web, “Hello, World!” in x86 Assembly.

```
global    _start

          section   .text
_start:   mov       rax, 1                  ; system call for write
          mov       rdi, 1                  ; file handle 1 is stdout
          mov       rsi, message            ; address of string to output
          mov       rdx, 13                 ; number of bytes
          syscall                           ; invoke operating system to do
          mov       rax, 60                 ; system call for exit
          xor       rdi, rdi                ; exit code 0
          syscall                           ; invoke operating system to exi

          section   .data
message:  db        "Hello, World", 10      ; note the newline at the end
```

This language right here is very machine-like, but the computer still cannot understand it!



So, what does the computer understand? In terms of our very weird see-saw:



Imagine someone takes our see-saw, they carry the plank to Mars and they stand it up. That's what it's like. The computer does not understand the human language **at all**.

If computers cannot understand the human language, why do we write human language? Why do we not write in machine language? How does the computer understand human language, the?

1.Why do we write human language, not machine language?

Abstraction. Abstraction is where we take something complex, we remove some of the complexity and make it simpler.

Abstraction is the backbone of every computer scientist in the world, and all machines. Abstraction is what causes exploits in machines, but it's also what causes better & more secure code to be written.

The "Hello, World!" function in x86 assembly you saw is 12 lines. In Python, we can make it one line:

```
print("Hello, World!")
```

If we had to write 12 lines for every 1 line of Python, we'd never finish any software.

Not to mention that it's far easier for us to introduce bugs in code if there are more lines then less.

With Python, we know that other people smarter than us have read the `print` code and can confirm it cannot be exploited.

With our hand-written Assembly, we cannot.

In fact, we cannot even confirm that our assembly code is the most efficient method. In C++ we use something called zero cost abstractions for this. See my Rust room for more information `room code: rust`.

1. How does the computer understand human language?

Bingo! This is where I was going with this.

Let's say you're from the United Kingdom. And you visit China. Here's a typical conversation:

> You: "Oi bruv givs a botla ov wotr"
>
> Shop Keeper: 你这个傻小子，我们这里不说这种语言

Do you see the problem here?

Now, how would you go about talking to the shop keeper?

You'd use a translator. Either a person, or an app.

How does our human-readable code talk to the computer? We use a translator called a *compiler*.

The compiler converts our code into binary code for the computer to understand. And at the end, we get an executable file we can run.

Translating is rather slow and expensive. We don't want to spend 5 minutes translating!

This brings us onto…. Let's use a different language as an example, C++. When we write code in C++ code, we write it in a language similar to English.

```cpp
#include <iostream>

int main()
{
  std::cout << "Hello, World!" << std::endl;
  return 0;
}
```

This code prints "Hello, World!" to the screen. Looks confusing, right? But if you read the words you can see some English words. `main` , include, end, "Hello, World!", return and some more.

When we write code, we write it in a language that is similar to English but also technical enough for the computer to understand.

Normal English is a bad programming language, since we can mean different things from the same sentence. For example:

"Alright" and "Alright" mean 2 different things in British English (Alright means "hello" and "it's good").

The computer would have no idea how to interpret this. English is a bad programming language, so we have to use something that's a mixture of something the computer can understand and something we can understand.

In the case of C++ that mixture is more 50% human, 50% computer (arbitrary numbers). The more the mixture leans to the human side, the more "high level" it is

Python is more high level, so it leans more to the human side.

Take a look at this Python code:

```python
def hello_world():
    print("Hello, World!")
```

If I told you that `def` was short for `define` you'd now know every single word in that program. Whereas with C++ it was a lot harder to understand.

This is what we mean by high level and low level.

Python is high level because it is more understandable by humans with no programming experience. Whereas C++ is less understandable.

Now, what if I told you that I lied to you? The computer doesn't understand any human language at all.

That's right! Even C++ it doesn't understand. What if I told you that there's an even more un-readable language called Assembly?

Here's an example I stole from the web, "Hello, World!" in x86 Assembly.

```
global    _start

          section   .text
_start:   mov       rax, 1                  ; system call for write
          mov       rdi, 1                  ; file handle 1 is stdout
          mov       rsi, message            ; address of string to output
          mov       rdx, 13                 ; number of bytes
          syscall                           ; invoke operating system to do
          mov       rax, 60                 ; system call for exit
          xor       rdi, rdi                ; exit code 0
          syscall                           ; invoke operating system to exi

          section   .data
message:  db        "Hello, World", 10      ; note the newline at the end
```

This language right here is very machine-like, but the computer still cannot understand it!

So, what does the computer understand? In terms of our very weird see-saw:

Imagine someone takes our see-saw, they carry the plank to Mars and they stand it up. That's what it's like. The computer does not understand the human language **at all**.

If computers cannot understand the human language, why do we write human language? Why do we not write in machine language? How does the computer understand human language, the?

1.Why do we write human language, not machine language?

Abstraction. Abstraction is where we take something complex, we remove some of the complexity and make it simpler.

Abstraction is the backbone of every computer scientist in the world, and all machines. Abstraction is what causes exploits in machines, but it's also what causes better & more secure code to be written.

The "Hello, World!" function in x86 assembly you saw is 12 lines. In Python, we can make it one line:

```
print("Hello, World!")
```

If we had to write 12 lines for every 1 line of Python, we'd never finish any software.

Not to mention that it's far easier for us to introduce bugs in code if there are more lines then less.

With Python, we know that other people smarter than us have read the `print` code and can confirm it cannot be exploited.

With our hand-written Assembly, we cannot.

In fact, we cannot even confirm that our assembly code is the most efficient method. In C++ we use something called zero cost abstractions for this. See my Rust room for more information `room code: rust` .

1. How does the computer understand human language?

Bingo! This is where I was going with this.

Let's say you're from the United Kingdom. And you visit China. Here's a typical conversation:

> You: "Oi bruv givs a botla ov wotr"
>
> Shop Keeper: 你这个傻小子，我们这里不说这种语言

Do you see the problem here?

Now, how would you go about talking to the shop keeper?

You'd use a translator. Either a person, or an app.

How does our human-readable code talk to the computer? We use a translator called a *compiler*.

The compiler converts our code into binary code for the computer to understand. And at the end, we get an executable file we can run.

Translating is rather slow and expensive. We don't want to spend 5 minutes translating!

This brings us onto….

Intrepreted

Python is an interpreted language. That means that instead of translating the whole code into machine code at once, it translates the code piece by piece. And once it's converted a piece of code, it runs it, and then continues until the program stops running.

Tooling

Tooling

Before we begin writing Python code, let's get the tooling right.

Here we'll install Python and a text editor / IDE.

Check if you have Python installed already with:

```
python --version
```

If this number is below 3, try:

```
python3 --version
```

- If `python3` works, whenever I say `python` type `python3` instead.
- If neither of these worked and presented a version higher than 3 then:

Install the latest release of Python from here. Note that on Windows, this website defaults to 32-bit Python. Please install 64-bit Python, tool developers will thank you.

Now, let's install a text editor or IDE. I would suggest an IDE, but they are rather heavy on resources.

An IDE will show you errors before you run the code, and will help you to automatically fix those errors.

The best Python IDE is PyCharm.

However, if your computer has limited resources you may want to use a text editor. I use Visual Studio Code but you can use Atom or Sublime.

Honestly if you're not going to use PyCharm the choice of text editor at this stage doesn't matter too much. In the wise words of someone I once knew:

> Deciding on the tooling is another form of procrastination. Choose something and get it over with.

Download Visual Studio Code if PyCharm didn't work.

Hello, World!

Hello, World!

It is very traditional for every programmer, when starting out, to start with a hello world program.

Create a new file called `hello.py` and open it up in your text editor of choice (the one you downloaded in the last section).

In this new file, copy and paste this line:

```
print("Hello, World!")
```

Let’s explain what this does:

- Print

Print is a function. We give it some text and it’ll print it to the screen.

- “Hello, World!”

Is what we call a string (a string of characters). It’s just text.

Now, open up a Terminal, navigate to your directory and run:

```
python hello.py
```

_Make sure you use `python` or `python3`, whichever one worked for you in the last section.

And you’ll see on your screen printed:

```
$ Hello, World!
```

Congratulations! You have just run your first Python program! 🥳

Python Computer Science Ebook Programming