

Empowering Creative Thinking Through Programming

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<https://github.com/vmuijers/ECTTP>

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Wie ben ik

- Valentijn Muijers (27)
- 3 jaar HKU teacher in programming courses
- I make games!
- Programming is like having a super power



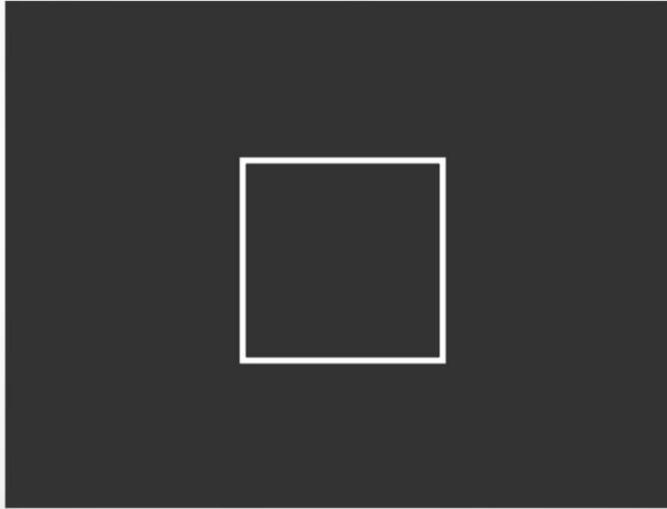
Course Overview

- Week One: Course overview
- Week Two: Variables
- Week Three: Operators
- Week Four: Conditions
- Week Five: Loops
- Week Six: Functions
- Week Seven:
- Week Eight: (Files, Exceptions, IO)
- **First Test!**
- Week Eleven: Lists
- Week Twelve: Classes and Objects
- Week Thirteen:
- Week Fourteen:
- **Second Test!**

Deliverables

- Every week there is a lab (there will be 10-12 in total)!
- 100% presence
- 2 tests (individually!)
- Grade:
 - 40% labs
 - 20% test 1
 - 40% test 2
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Programming is awesome



Example! Can you make a squircle?

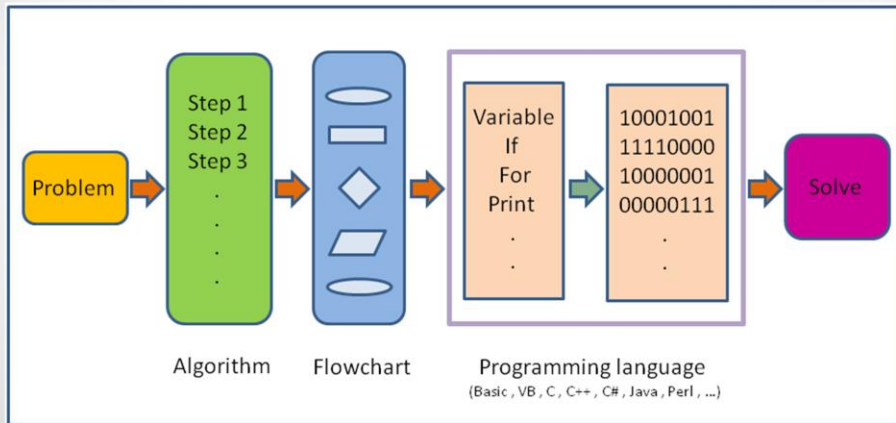
Super Power

- With great power comes great responsibility



Adhere to the Code of conduct. Do not steal code! Do not use code for evil! Also, be nice to your computer, it just executes the code you give it, nothing else (in most cases).

What is Programming?

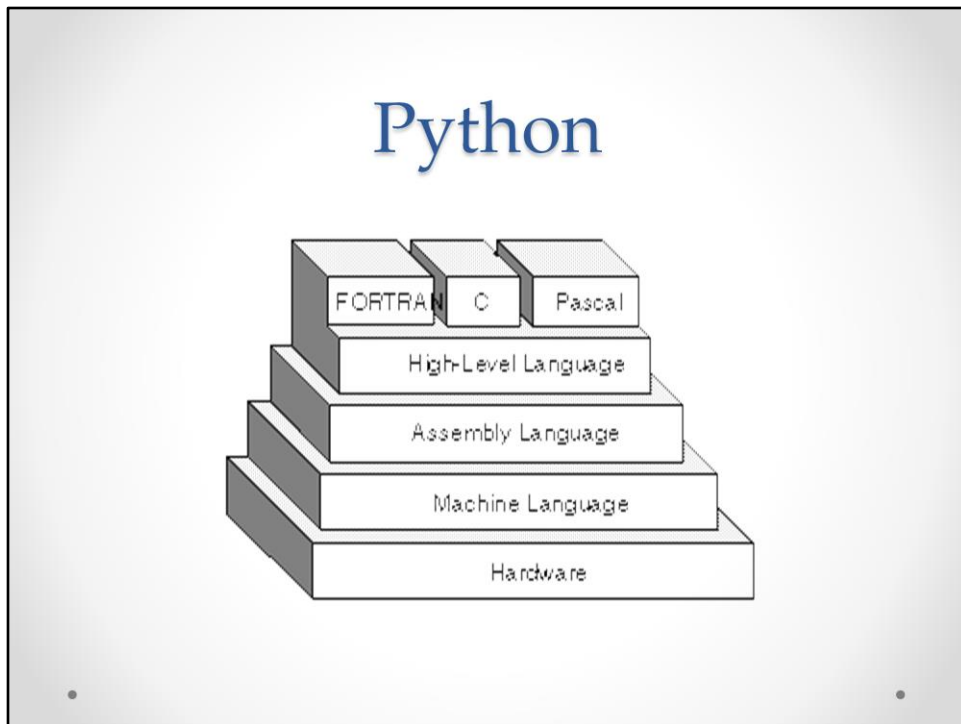


Problem solving means the ability to formulate problems, think creatively about solutions, and express a solution clearly and accurately

How you solve the problem is called an algorithm

An algorithm is a step by step list of instructions, or a program , that if followed exactly will solve the problem under consideration

These algorithms form programs which are written in programming languages (such as Python, Java, C++ or C# and many others!)



Python is an example of a high-level language

There are also low level programming languages (assembly, machine language)

High level languages use human friendly sets of instructions to create programs.

Low level languages are not as human friendly and are written for the hardware.

High vs Low

- `print("Hello")`
- The computer translates this high level language into a low level language for you:
- 01010101 00011101 00111100
- Image coding in machine language
- Clearly high level languages are faster and less prone to error than machine languages

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Binary

- All low level languages are in binary.
- Binary consists of 1's and 0's which are called bits.
- Series of bits form 8-bit patterns which represent numeric values. Each bit represents either on or off. You can think of them like little switches.

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Binary Math

- 0000 0001 is 1
- 0000 0010 is 2
- 0000 0011 is 3
- 0000 0100 is 4
- 0000 0101 is 5
- What is 28 in binary?
- And 0001 1001 in decimal?

128	64	32	16	8	4	2	1	
0	0	0	0	0	0	0	0	
128	64	32	16	8	4	2	1	
0	0	0	0	1	0	0	0	= 8
128	64	32	16	8	4	2	1	
0	0	1	0	0	0	0	0	= 32
128	64	32	16	8	4	2	1	
0	0	1	0	0	1	1	0	= 38
128	64	32	16	8	4	2	1	
1	0	0	0	0	1	0	1	= 133

Each bit (starting from the right), represents a power of 2. If the bit is 1 the power of 2 can be added, if the bit is 0, the power of 2 can be ignored.

The number 133 is 10000101 in binary because $2^0 + 2^2 + 2^7 = 133$ (note here that the most right bit is at position 0)

Ascii

- Ascii is a way to translate letters into numbers

ASCII Code: Character to Binary

0	0011 0000	O	0100 1111	m	0110 1101
1	0011 0001	P	0101 0000	n	0110 1110
2	0011 0010	Q	0101 0001	o	0110 1111
3	0011 0011	R	0101 0010	p	0111 0000
4	0011 0100	S	0101 0011	q	0111 0001
5	0011 0101	T	0101 0100	r	0111 0010
6	0011 0110	U	0101 0101	s	0111 0011
7	0011 0111	V	0101 0110	t	0111 0100
8	0011 1000	W	0101 0111	u	0111 0101
9	0011 1001	X	0101 1000	v	0111 0110
A	0100 0001	Y	0101 1001	w	0111 0111
B	0100 0010	Z	0101 1010	x	0111 1000
C	0100 0011	a	0110 0001	y	0111 1001
D	0100 0100	b	0110 0010	z	0111 1010
E	0100 0101	c	0110 0011	.	0010 1110
F	0100 0110	d	0110 0100	,	0010 0111
G	0100 0111	e	0110 0101	!	0011 1010
H	0100 1000	f	0110 0110	;	0011 1011
I	0100 1001	g	0110 0111	?	0011 1111
J	0100 1010	h	0110 1000	!	0010 0001
K	0100 1011	I	0110 1001	'	0010 1100
L	0100 1100	j	0110 1010	"	0010 0010
M	0100 1101	k	0110 1011	(0010 1000
N	0100 1110	l	0110 1100)	0010 1001
				space	0010 0000

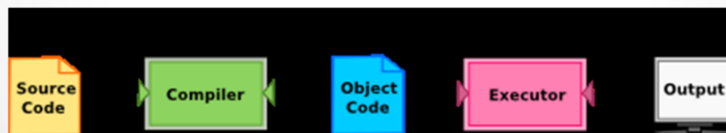
Interpreters

- An interpreter reads a high-level program and executes it, meaning that it does what the program says.
- It processes the program a little at a time, alternately reading lines and performing computations.



Compiler

- A compiler reads the program and translates it completely before the program starts running. In this case, the high-level program is called the **Source code**, and the translated program is called the **object code** or the **executable**. Once a program is compiled, you can execute it repeatedly without further translation.



Python uses both an interpreter and a compiler

Python does both

- Many modern languages use both processes. They are first compiled into a lower level language, called **byte code**, and then interpreted by a program called a **virtual machine**.

Python uses both processes, but because of the way programmers interact with it, it is usually considered an interpreted language.

There are two ways to use the Python interpreter: *shell mode* and *program mode*. In shell mode, you type Python expressions into the **Python shell**. In program mode you type them into a file.

How a program works



A program lives on your hard disk

The instructions of a program get loaded into ram. The machine code is fetched into your CPU

These instructions get decoded and then executed on your CPU

Where to start?

- Download Python 3.5.2:
- <https://www.python.org/downloads/>
- Download Processing 3.2.1:
- <https://processing.org/download/?processing>

For all functionality of python:
<https://docs.python.org/3.5/tutorial/index.html>

For all functionality of processing:
<http://py.processing.org/>

Input Variables and Output

`x = 10`

'x' is the variable

'=' is the assignment operator and sets the value on the left of the equation to be equal to the variable on the right

'10' is the value which is an integer number or a whole number



Variables are types of data stored in containers. Think of them like a box that holds something in it.

Data types

- Basic types:
- Int = 10
- Float = 10.0
- Boolean = true or false (0 or 1)
- String = "a set of words or characters in quotes"

Naming Variables

- A variable can have **any** name but...
- Don't use spaces in your naming
- Don't use special characters: &!\$*+~/, \%^()
- Don't use numbers as the first letter of your name
(recommended: don't use numbers in your names at all)

Other reserved words in Python which you cannot use as variable names:

False True as finally is return None continue for lambda try
Def from nonlocal while and del global not with
As elif if or yield assert else import pass break except in raise

Some Examples

- `Int_MyIntegerVar = 10`
- `String_MyStringVar = "Hello"`
- `Float_MyFloatVar = 1.0`
- We use the type of the variable as the first word in the variable name so that it is immediately clear what kind of type we are working with (note that this is not necessary, it is just a code convention which helps us writing good code)

Print Something

- Print is a function in python. A function is a set of instructions that does something. You sometimes put things into it. Sometimes it returns a value.
- Functions are like little machines
- I don't really care how a coffee pot works. All I know is if I put water and coffee grinds into it, it makes coffee and I can take coffee out of it



Hello World!

- Try typing the following in Processing:
- `print("Hello World!")`
- And press Play, below in the Console, you will see your output stating the words "Hello World!"
- The Console only shows feedback from your program when it runs. It shows errors (mistakes in your program and all of your print- calls.

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First lab is online

- https://github.com/vmujjers/ECTTP/blob/master/Labs/Lab_1.md