#### Python workshop

# Week 1: Writing your first program barbera@van-schaik.org





## About me

- During the day I'm a bioinformatician
- In my spare time I ...
  - Go to concerts and festivals
  - Cook (all cuisines)
  - Read (fantasy, popular science/philosophy, Dutch literature)
  - Make things (sewing, electronics, laser cutting, welding, 3d printing)
  - Look into self-hosted cloud services
  - Grow vegetables in my garden







#### Overview of this workshop series

- Week 1: Writing your first program
- Week 2: Make choices and reuse code
- Week 3: Loops and strings
- Week 4: Files and lists
- Week 5: Dictionaries and tuples

#### Acknowledgments

- Charles Severance aka Dr Chuck
  - For teaching me Python
  - For releasing teaching material to the public
  - http://www.pythonlearn.com/
- He gives the course "Programming for <u>everybody</u>"
- Structure of this workshop is based on his book
- Several examples too





## Why shouldn't you learn programming?

- Years of learning (to program really well)
- "Coding is not a goal. It's a tool for solving problems."
- Programming doesn't make you rich
- There are always people better than you http://www.fastcolabs.com/3020126/no-you-dont-need-to-learn-to-code



# Why should you learn programming?

- It is fun and creative
- Because you can
- It is a tool for solving problems
  - Science
  - Apps
  - Games
  - Internet of things
  - Etc





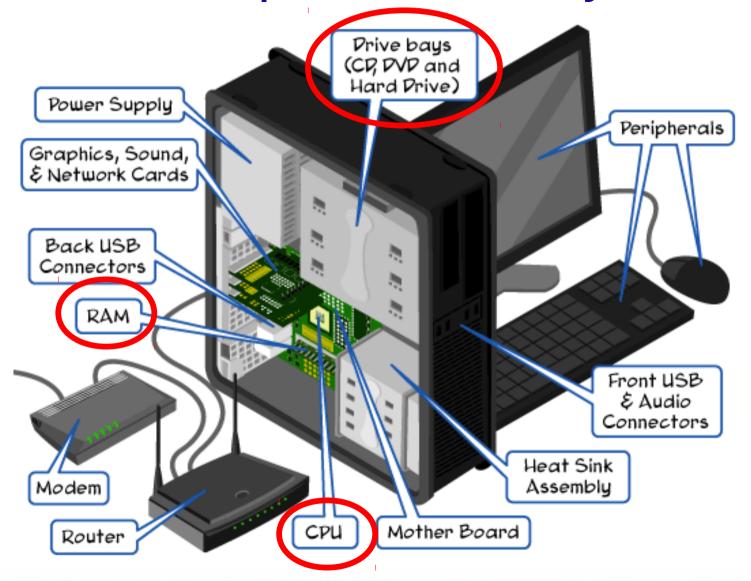




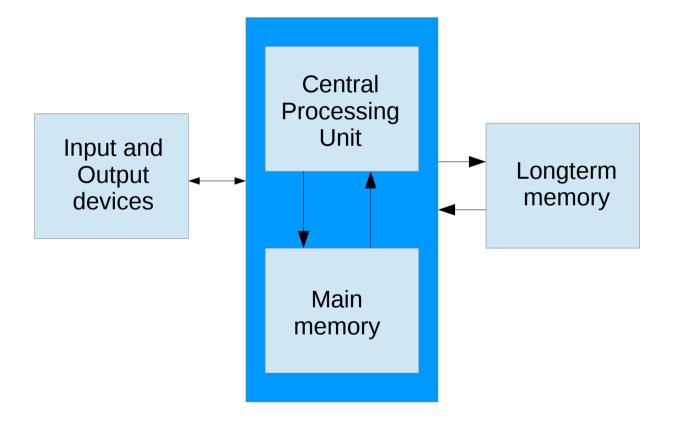
- A computer is fast and good for repetitive work
- There is no existing program for your needs

#### **Computers and language**

#### **Computer anatomy**



#### **Computer anatomy**



### **Programming language**

To give instructions



https://youtu.be/XiBYM6g8Tck

While music is playing: Left hand out and up Right hand out and up Flip left hand Flip right hand Left hand to right shoulder Right hand to right shoulder Left hand to back of head Right ham to back of head Left hand to right hik Right hand to left hik Left hand on left bottom Right hand on right bottom Wiggle Wiggle Jump

#### Programming language



#### Computer language

handle = open(filename, 'r')
song = handle.read()
words = song.split()
counts = dict()

for word in words: counts[word] = counts.get(word, 0) + 1 for word, count in counts.items(): print word, count

## Why Python

- Easy to learn
- Very readable



- No long constructs
- No special cryptic characters
- Indentation is forced (more next week)
- Much code available (e.g. SciPy, NumPy)
- Cross-platform

http://helloworldcollection.de/

#### How smart is a computer?

#### • A computer (or phone) is not smart

- Limited vocabulary
- It needs literal instructions
- It will "complain" when instructions are not clear

out of memory out of disk space syntax error

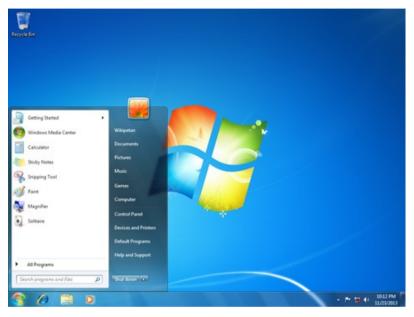
'Compu'er says no'

Usually with a hint to guide you

#### **Reserved words**

and del for is raise assert elif from lambda return break else global not try class except if or while continue exec import pass yield def finally in print

#### Terminal, scripts, Python?





#### Windows



#### Mac OSX

#### Linux (Ubuntu)

## Vroegah...

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#### Even earlier: the black window

#### A:\>dir /w

1:>>

:>>

:>>

Volume in drive A has no label Volume Serial Number is B83C-90D0 Directory of A:\

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52 file(s)

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This is called a:

- Terminal
- Command-line (cmd)

Shell



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/etc/passwd" 17 lines, 677 characters testimage console login: root Password: Mar 29 11:36:16 testimage login: ROOT LOGIN /dev/console Last login: Sat Mar 29 11:04:43 on console Sun Microsystems Inc. SunOS 5.10 Generic January 2005 -bash-3.00#

No fancy windows No icons No clicking

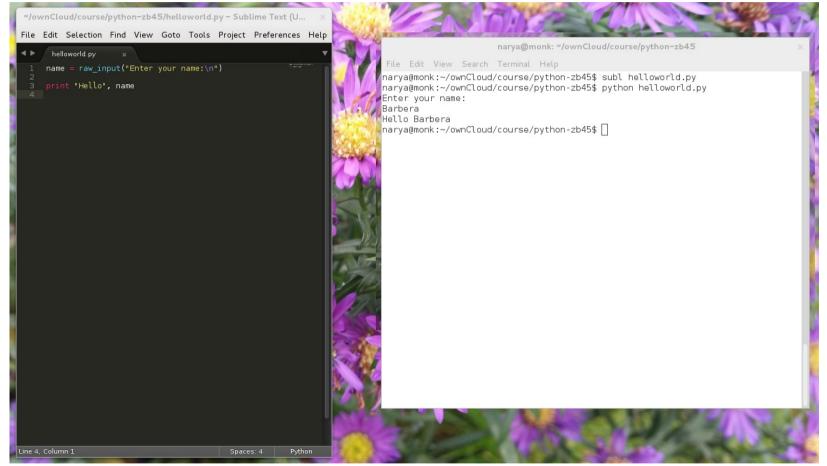
You need to type in commands to the computer

#### **Directories and files**

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cd somedirectoryname (go to directory, or Change Directory)dir(shows content of directory, windows)ls -l(shows content of directory, linux/mac)

#### Starting a program



The program "subl" is started (a text editor) After that the program "helloworld.py" Linux/mac: start "helloworld.py" with "python" before that Windows: you only need to type "helloworld.py"

#### Start the Python program

File Edit View Search Terminal Help narya@monk:~/ownCloud/course/python-zb45\$ python Python 2.7.3 (default, Mar 13 2014, 11:03:55) [GCC 4.7.2] on linux2 Type "help", "copyright", "credits" or "license" for more information. >>> []

> You can also start the interactive python program Linux/Mac: type "python" Windows: start "python commandline" from the start menu

> Note that the "prompt" has changed from blahblah\$ to >>> You are now in the python program

You can type python code, one line at the time

#### Python: first attempt

Open python and type:
 >>> Hi there

- Then type:
  - >>> answer me!



One more try:
 >>> help

### Python: help()

help> keywords
help> if
help> quit

It looks like you are bashing furiously on your keyboard. Do you want me to enable caps lock?

👌 Yes

Die in a fire, Mr Clippy

Û

#### Hello world

>>> print "Hello world"

Try this again without the last quotes

>>> 27+15

>>> x = 7
>>> print x
>>> x = x+2
>>> print x
>>> 1+2=3

>>> 1+2==3



## Scripts

- Like a recipe, a set of instructions
- Open sublime, notepad++ or another editor
- Type the following in the editor and save the file as "myscript.py"
- Do not use spaces in the name of the script
- x = 7

print x

x = x + 2

Start the script from the commandline: cmd> python myscript.py Windows (if the above doesn't work): cmd> myscript.py

#### print x

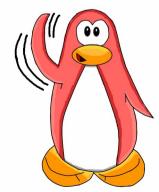
#### Hello <your-name-here>

New script "helloworld.py"

name = raw\_input("Enter your name:\n")

print "Hello", name

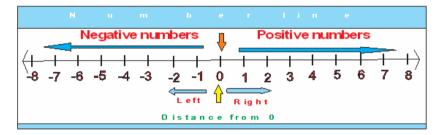
• Start the script from the commandline cmd> python helloworld.py



#### Data types

- Start an interactive Python session
- The basic data types:

>>> type(4)



string

- >>> type(3.141592653)
- >>> type("Yo")
- >>> type('Yo')
- >>> type("13")





float

integer

#### Variables

- Assign values to variables
- >>> message = "hello"
- >>> n = 2
- >>> pi = 3.1415926535897931
- >>> print n
- >>> print message
- >>> type(message)
- >>> type(n)
- >>> type(pi)



#### Variable names

- A combination of letters, numbers and underscores
- No reserved words!
- No special characters!
- Case sensitive!



Name has to start with letter or underscore

• Tip: use meaningful names

#### Variable names

- Doesn't work:
- >>> 7of9 = "borg"
- >>> mail@ = "barbera@van-schaik.org"

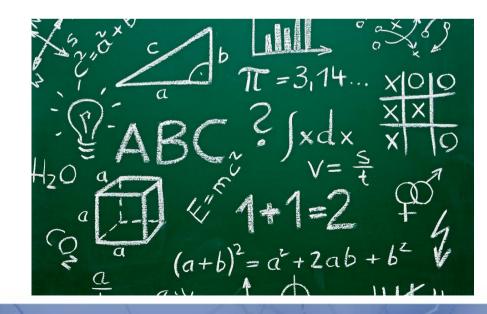
• Works:
>>> city = "Amsterdam"
>>> pin\_code = 1234



#### Calculator

- Operators: +, -, \*, /, \*\*, %
- >>> 20+32
- >>> hour 1
- >>> hour \* 60 + minute
- >>> minute / 60
- >>> 5\*\*2

>>> (5+9)\*(15-7)



#### Python and floats

>>> minute = 59

>>> minute/60

>>> minute/60.0



#### Order of operations

- Parenthesis: (1+2)\*(3+1) = 3\*4 = 12
- Exponentiation:  $2^{**}1+1 = 2+1 = 3$
- Multiplication and division: 2\*3-1 = 6-1 = 5
- Addition and subtraction: 5-3-1 = 2-1 = 1

Same precedence from left to right



#### String operations

- Concatenation
- >>> first = 10
- >> second = 15
- >>> print first + second >>> print n \* word

Multiplication

>>> first = '10' >>> second = '15' >>> print first + second



#### Comments

### blah,blah, blah,whatever

- Programs tend to get long and unreadable
- Solutions:
  - Give meaningful variable names
  - Insert comments

```
# Ask user for input
```

hours = float(raw\_input("How many hours did you work?\n"))

seconds = hours / 3600 # python sees this as correct

#### Next week

Next: Make choices and reuse code

- Want more practice?
  - Exercises in chapter 1 and 2 of the book
- See you next week!!

