Programming
Programming and Python basics

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Recap

During our last lecture we talked about:

- Organization of the course
- What is a programming language
- What is ChatGPT
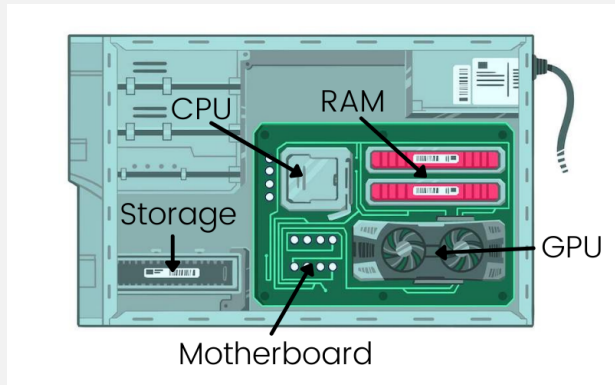- Building programs with Scratch

Computer architecture

Overview of Python

Anaconda, Qt Console, & Jupyter

Python Basics

What is a computer?

- A computer is an electronic machine that can process and store information
- It executes tasks by running the instructions stored in its memory
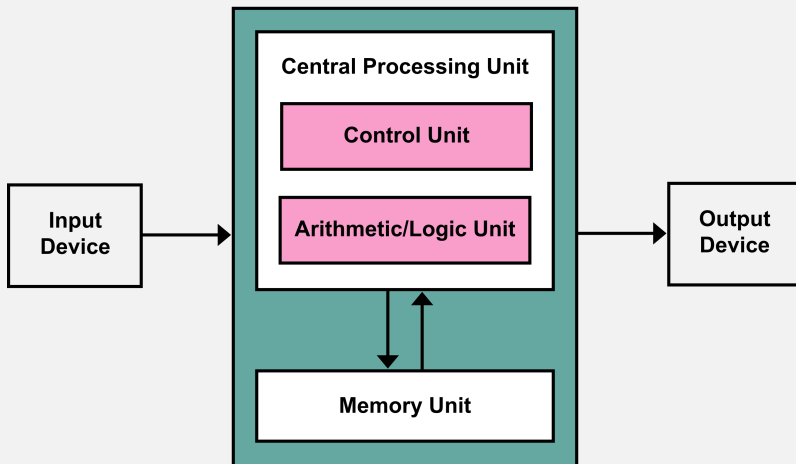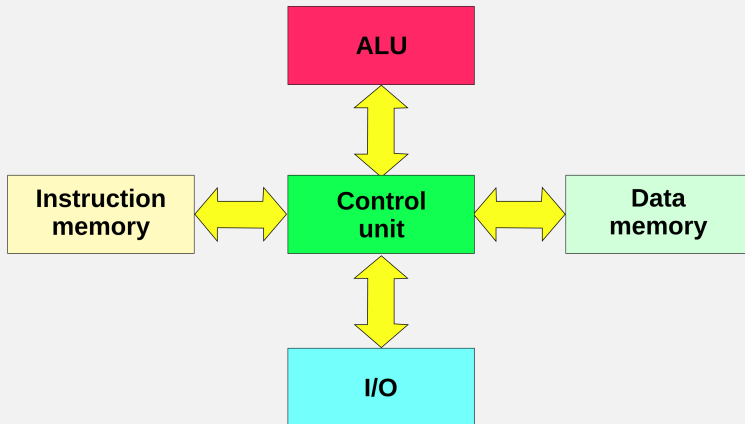- Computers do not *understand*

What's inside a computer, source: https://tinyurl.com/5n7ayzew

Computer architecture

- The description of the structure of a computer system made from component parts
- The parts interact with each other to help the computer execute instructions

Computer architecture - Von Neumann's style

Central Processing Unit

Control Unit

Arithmetic/Logic Unit

Input
Device

Output
Device

Memory Unit

Computer architecture - Harvard's style

Compiler vs Interpreter

Compiler

- "Translates" the whole source code at once
- Compiling is slower
- Compiled code runs faster

Interpreter

- "Translates" the source code one line at a time
- Interpreting is faster
- Interpreted code runs slower

What about Python?

Python, as other programming languages, is not fully interpreted nor fully compiled:

If you're curious, take a look at this great video: https://www.youtube.com/watch?v=BkHdmAhapws
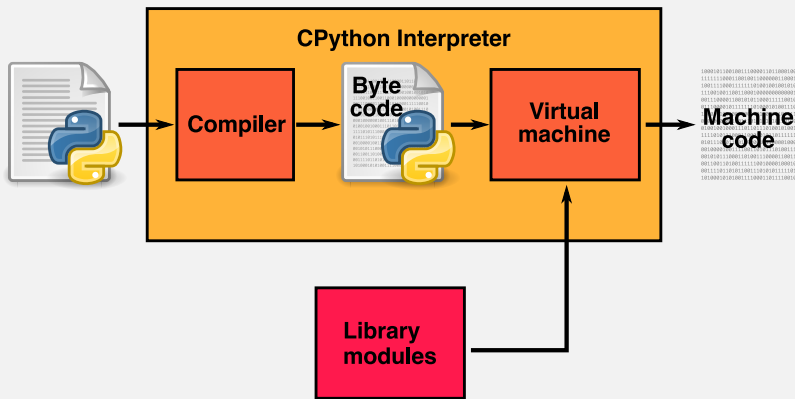
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Python Basics

Python

Originally developed by Guido van Rossum in the late 1980s.

- Open-source and actively maintained
- Applicable to a wide range of applications
- Extremely popular in the data science community

But: There are alternative programming languages. Make sure to use the right one for the task.

Guido van Rossum, source: `https://gvanrossum.github.io`, ©Michael Cavotta, license: CC BY-NC-ND 4.0

Which Python version?

- Python 2: still common, although no longer maintained
- Python 3: modernized, *backwards-incompatible* version of the language
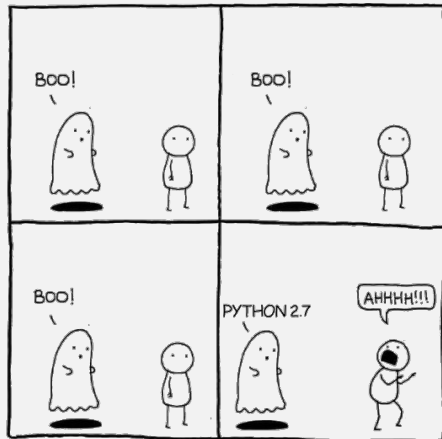
source: https://www.reddit.com/r/ProgrammerHumor/
comments/91vtas/python_27/

Why Python?
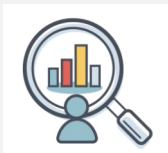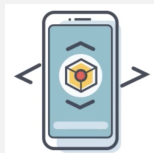
Data analysis   Web scraping   Big data   Finance
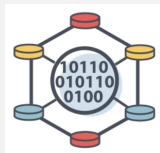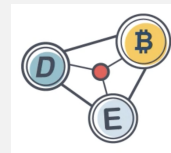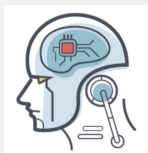
Computer vision   NLP   Machine learning   Deep learning

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Python Basics

Development environment: Anaconda

Python Data Science Distribution
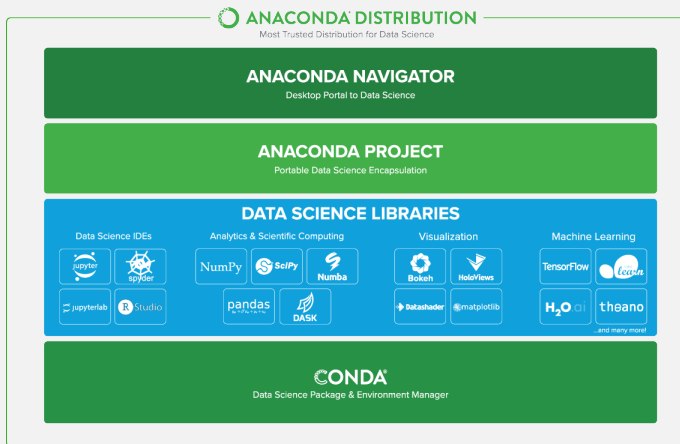
Download Anaconda

Download Now

For installation assistance, refer to Troubleshooting.

Download Anaconda Distribution or Miniconda by choosing the proper installer for your machine. Learn the difference from our Documentation.

Anaconda Installers

[Download for Mac ▾]

Windows	Mac	Linux
Python 3.12	**Python 3.12**	**Python 3.12**
⤓ 64-Bit Graphical Installer (912.3M)	⤓ 64-Bit (Apple silicon) Graphical Installer (704.7M)	⤓ 64-Bit (x86) Installer (1007.9M)
	⤓ 64-Bit (Apple silicon) Command Line Installer (707.3M)	⤓ 64-Bit (AWS Graviton2 / ARM64) Installer (800.6M)
	⤓ 64-Bit (Intel chip) Graphical Installer (734.7M)	⤓ 64-bit (Linux on IBM Z & LinuxONE) Installer (425.8M)
	⤓ 64-Bit (Intel chip) Command Line Installer (731.2M)	

`https://www.anaconda.com/download/success`

Anaconda navigator

Jupyter Notebook

The Jupyter Notebook is a
web-based interactive computing
platform.
Why use Jupyter Notebook in
Data Science?

- Simultaneous documentation
  & analysis
- Step-by-step processing
- Ensures reproducibility

https://docs.jupyter.org/en/latest/

Launching Python

Launching Python

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Quiz

- *True* or *false*?

    - "Python is a low level programming language."
    - "Python is the only language used in data science analysis."
    - "The university has bought Python licenses for this course."

Quiz

* *True* or *false*?

    * "Python is a low level programming language."   false
    * "Python is the only language used in data science analysis."   false
    * "The university has bought Python licenses for this course."   false

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Python Basics

Arithmetic in Python

Numeric types:

- Integer: `int`   42
- Real valued numbers: `float` 42.0
- Complex numbers: `complex` 42+0j

Operators

- Addition and subtraction   + -
- Multiplication and division * / // %
- Exponentiation   **

Variables

Variable assignment

- `a = 42`
- `b = a - 6.0`

`type`(«name of the variable»): returns type of variable

Libraries

Importing libraries

- `import numpy as np`
- `import matplotlib.pyplot as plt`

import «name of the library»**as** «alias»: loads the requested library under the alias' name

Quiz

- What are types numeric types of the following calculations?
    - `type(42 / 3)`
    - `type(42 // 3)`
    - `type(3.14 + 2.71+8j)`
    - `type(42 // 3.14)`
    - `a = 1`
      `a - 10 * 1.0`
      `type(a)`

Quiz

» What are types numeric types of the following calculations?

» `type(42 / 3)`	**float**
» `type(42 // 3)`	**int**
» `type(3.14 + 2.71+8j)`	**complex**
» `type(42 // 3.14)`	**float**

» `a = 1`
  `a - 10 * 1.0`
  `type(a)`
	int

Python Documentation

Recap

Summary

- Computer architecture
- Overview of Python
- Anaconda, Qt Console & Jupyter Notebooks
- First steps in Python

What comes next?

- Go to the course website (`https://gds.techfak.de/teaching/2024winter/prog`) or Moodle (`https://moodle.uni-bielefeld.de/course/view.php?id=6494`)and download this week's exercise sheet
- Due date for this week's exercises is ***Wednesday, October 23, 2024***.

Next lecture: Data types, mutability, conditions & comparisons …