DIT gentle introduction to Python
v 2.2 (PhD) January 2023

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16/01/2023

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Basics

What is a programming language?

A programming language is just another language...

A formal language comprising a set of instructions that produce various kinds of output [given an input]
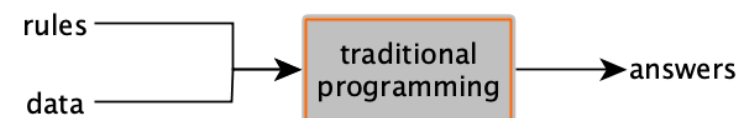
https://en.wikipedia.org/wiki/Programming_language

Diagram borrowed from L. Moroney's Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning

What is a programming language?

Programming languages are used in computer programming to implement an *algorithm**

https://en.wikipedia.org/wiki/Programming_language

* derived from the 9th century Persian Mathematician Muhammad ibn Mūsā al-Khwārizmī

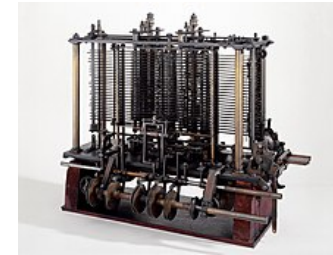1983 USSR stamp commemorating al-Khwārizmī's (approximate) 1200th birthday

The *first* programmer

Ada Lovelace[a] (Mathematician) published the first algorithm for Charles Babbage's analytical engine

[a]Lord Byron's daughter

A. Lovelace by 1840

Algorithms

Algorithm

A finite sequence of *well-defined computer-implementable* *instructions, typically to solve a class of problems or to perform a computation*

https://en.wikipedia.org/wiki/Algorithm

Algorithm Example: Find out if a number is odd or even*

Definitions

- ▶ A number is even if it can be divided by 2 without remainder
- ▶ A number is odd if it leaves a remainder when divided by 2

Examples

Even numbers: 2, 4, 6, 8, etc.

Odd numbers: 1, 3, 5, 7, etc.

Silly (useless) solution:

- ▶ Fill a bag with all even numbers and a second bag with all odd numbers
- ▶ Given an input number, look for it in both bags and return the label of the one in which you found it

*Adapted from https://www.c-programming-simple-steps.com/algorithm-examples.html

Algorithm Example: Find out if a number is odd or even
Problem Definition

Input/Output
→ an integer (data)
← even or odd (more data)
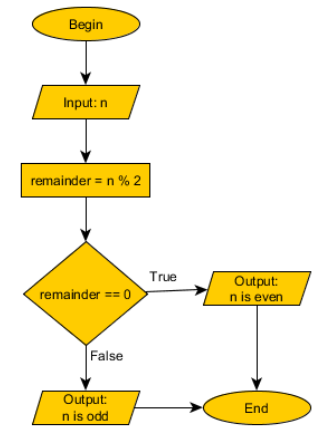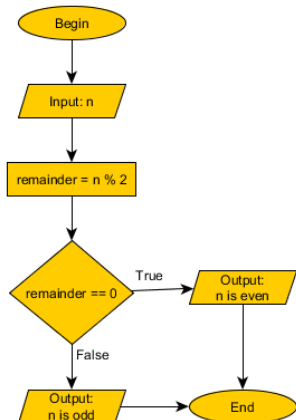
Process
A series of instructions and routines

Diagram borrowed from https://www.c-programming-simple-steps.com/algorithm-examples.html

Algorithm Example: Find out if a number is odd or even
From the algorithm to the implementation


```
if n%2 == 0:
    print('even')
else:
    print('odd')
```

Programming languages

History of (some) flagship languages (1/2)

year	language	highlights
1957	Fortran	Compiled, imperative
1959	Lisp*	Object-oriented, popular in AI, recursive functions
1964	Basic*	Procedural, object-oriented ("goto")
1970	Pascal*	Imperative, procedural, lists, trees
1972	C*	Procedural, recursion, static type system
1983	C++*	Object-oriented, compiled, functional

* language I "speak" (or "spoke" at some point in time)

History of (some) flagship languages (2/2)

year	language	highlights
1989	Python*	Interpreted, object-oriented, code readability
1995	Java*	Compiled, object-oriented
1995	Javascript	Just-in-time-compiled, object-oriented, WWW
1995	PHP*	Scripting, Web-oriented
2001	V. Basic.NET	Object-oriented, .NET framework
2009	Go	Compiled, C-like (safer)

* language I "speak" (or "spoke" at some point in time)

Python
(Among other things), python is. . .

General-purpose
Applicable across application domains

High-level
Strong abstraction from the computer (hardware)

Interpreted
No previous compilation into machine-level instructions necessary

(Not-necessarily) object-oriented paradigm
An object contains data (attributes) and procedures (methods)

Python
Some notable features

- ► Elegant syntax (indentation-based) $\rightarrow$ easy to read
- ► Simple and ideal for prototyping
- ► It has a large standard library for diverse tasks (e.g., web servers, text search and processing, file reading/modifying)
- ► Interactive mode $\rightarrow$ continuous snippet testing
- ► Extendable with modules in compiled languages (e.g., C++)
- ► Multi-platform (e.g., Mac OS X, GNU Linux, Unix, MS Windows)
- ► Free: zero-cost to download/use; open-source license
- ► Large and friendly community

https://wiki.python.org/moin/BeginnersGuide/Overview
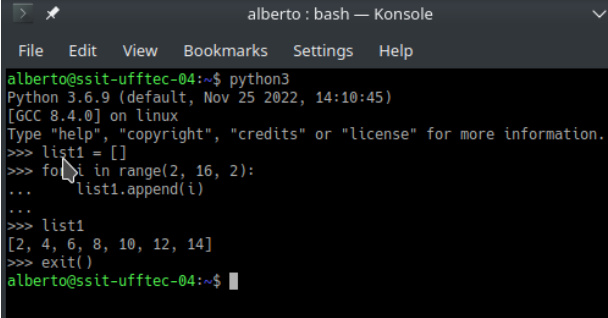
Python

Some programming-language features

- A variety of basic data types are available:[1]
  - numbers (floating point, complex, integers)
  - strings (both ASCII and Unicode)
  - Lists
  - Dictionaries
- It supports object-oriented programming
- Code can be grouped into modules and packages

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[1]Later today

Python

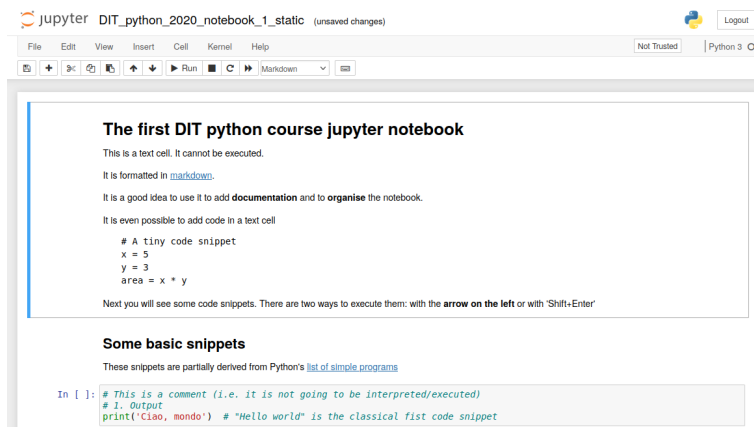Some ways to code/launch a python program

UNIX / GNU Linux / Windows terminal

Python

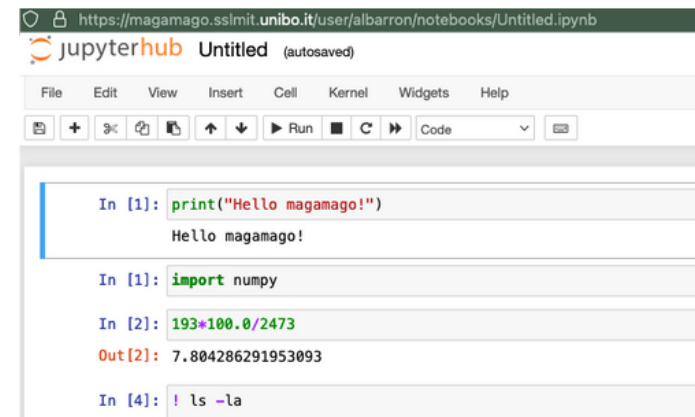Some ways to code/launch a python program

Web browser: local, online, on Google's colab

Python

Some ways to code/launch a python program

From your web browser on DIT's magamago (remotely online)[2]

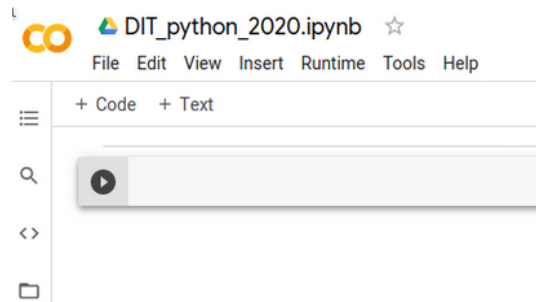---

[2]Open to advanced students only

Enough! Let us look at some code!

Baby steps into coding

Google's colab

a free Jupyter notebook environment that runs in the cloud and stores its notebooks on Google Drive
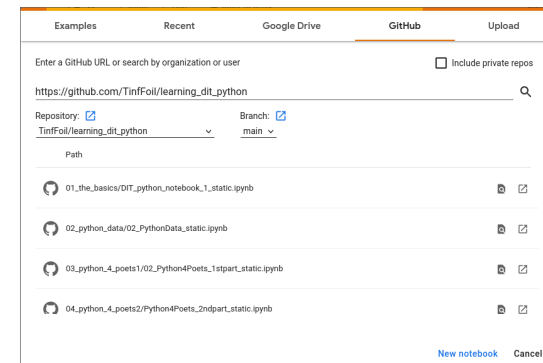
https://colab.research.google.com

Our first jupyter notebook

Google's colab: baby steps

1. Visit `https://colab.research.google.com`
2. Click on Github
3. Type
   `https://github.com/TinfFoil/learning_dit_python`
4. Press search
5. Select **DIT_python_notebook_1_static.ipynb**

Baby Steps

input/output

- ► print() displays stuff to the screen
- ► input() captures information from the user

variables

x = 5	x is a variable
	we assign values to a variable with =
x = 5	is an integer
x = 5.5	is a float
x = 'ciao'	is a string
x = "ciao"	is also a string
x = '5'	is what?
x = x * 3	we can apply operators to variables
	we can assign the output to a variable

Baby Steps
What we know so far

flow control − conditionals

```
if (condition):
   execute something
elif (condition):
   execute something
else:
   execute something
```

```
if (condition):
   execute something
if (condition):
   execute something
else:
   execute something
```

Only one of these three snippets is executed

How is this different?

flow control − loops

The code snippet will be executed during a number of iterations
Danger: a loop could run forever if there is an error

```
for (iterator):
   execute something
```

```
while (condition):
   execute something
```

Baby Steps
What we know so far

Basic formatting

```
# my code
x = 0
while x < 50:
  for i in range(x):
    print('x', end=""
        )
  print()
  x += 1
```

- ► Comments start with #
- ► A line break is enough to close an instruction (in Java or C, we need ;)
- ► Colon opens a special code snippet
- ► Indentation is crucial

You know a lot already!

It is your turn to play with the notebook