Programming in Python[1]

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Lecture V: Using the "naked" interpreter

A function computes a result

- Returns a useful result

```python
def concat_with_a_space(string1: str, string2: str) -> str:
    return string1 + ' ' + string2

# string1 is the _formal_ parameter
# 'foo' is the _actual_ parameter (like an assigment string1 =
↪ 'foo')
print(concat_with_a_space('foo','bar'))
```

- Return None

```python
def repeated_print(string: str, repetitions: int) -> None:
    for i in range(0, repetitions):
        print(string)

repeated_print('Hello, world!', 3)
```

- Recursive call:

```python
def repeatedPrint(string: str, repetitions: int) -> None:
    if repetitions > 0:
        print(string)
        repeatedPrint(string, repetitions - 1)

repeatedPrint('Hello, world!', 3)
```

Functions are objects too

One can assign functions to variables:

```python
def cube(x: int) -> int:
    square = x * x
    return square * x

mycube = cube

print(mycube(3))
print(type(mycube))
```

And short functions can even be expressed as literal expressions (lambda expressions)

```python
cube = lambda y: y*y*y
```

Example: Newton sqrt

Newton's method of successive approximations: whenever we have a guess g for the value of the square root of a number x, we can perform a simple manipulation to get a new guess closer to the actual square root by averaging g with $\frac{x}{g}$.

```python
def newton_sqrt(x: float) -> float:
    guess = 1.0
    while not good_enough(guess, x):
        guess = improve_guess(guess, x)
    return guess
```

The pieces of software

- Python 3.12, with `pip` (on MS Windows be sure to select it): https://www.python.org/downloads/
- You need a text editor: suggested one is https://thonny.org/
- Git 2.30+ https://git-scm.com/downloads
- (optional, Win and Mac only) Github desktop https://desktop.github.com/

Homework assigments will be available via Github Classroom (you will need a Github account).
When you push (hand in) your solution, a suite of tests is run.
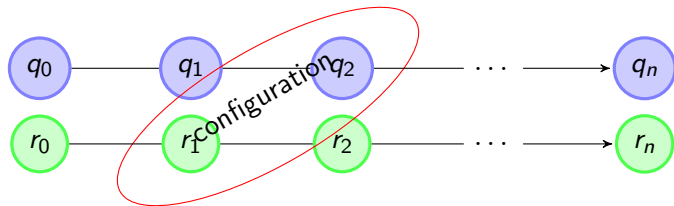
Software Configuration Management

Software Configuration Management like `git` are tools designed to track all the revisions of some set of software artifacts (files).

The system configuration itself evolves in different versions. One can have multiple branches of evolution.
A motivating talk on why you should use tools like these in your scientific work.

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Git

git is a powerful tool to manage all this complexity in a very efficient (and distributed) way. It is not an easy tool, however. A good tutorial is here. But for this course we use a very simplistic workflow:

1. Clone (copy) on your machine a repository `git clone ...` existing on a server (GitHub, probably);
2. Work on the artifacts (files)
3. Add the modified artifacts to the changeset you want to "publish" `git add ...` (this step is important: it makes you think which changes you want to "save" forever)
4. Commit (save) the changeset `git commit -m"message"` providing a comment about what have you done
5. Push the changeset on the origin server `git push`
6. (If someone else is working on the same artifacts you can sync with `git pull`)

All these steps are very easy (almost hidden, especially

Thonny

Programs are data! File extension is conventionally .py

- To edit Python programs you need a text editor: something like Notepad, not Word (a word processor)
- Thonny is an editor designed for beginners and it provides an easy way for executing programs step-by-step
- Other good choices: VS Code Atom Notepad++ or any other universal text editor like EMACS or vi

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https://classroom.github.com/a/ToMoC4Di