Programming in Python[1]

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Academic year 2020/21, II semester

Lecture VIII: Object Oriented encapsulation

The huge value of procedural abstraction

It is worth to emphasize again the huge value brought by procedural abstraction. In Python it is not mandatory to use procedures/functions: the language is designed to be used also for *on the fly* calculations.

```
x = 45
s = 0
for i in range(0, x):
  s = s + i
```

This is ok, but it is not encapsulated (in fact, since encapsulation is so important you can at least consider it encapsulated in file which contains it)

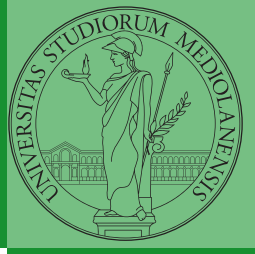
- the piece of functionality is not easily to distinguish

  it could be intertwined with other unrelated code

```
x = 45
a = 67 # another concern
s = 0
for i in range(0, x):
  s = s + i
print(a) # another concern
```

- the goal is not explicit, which data are needed, what computes
- it's hard to reuse even in slightly different contexts

Encapsulate the functionality



```
def sum_to(x: int) -> int:
    assert x >= 0
    r = 0
    for i in range(0, x):
      r = r + i
    return r

s = sum_to(45)
```

- It gives to our mind a "piece of functionality", the interpreter we are programming is now "able" to do a new thing that can be used without thinking about the internal details
- It makes clear which data it needs (an integer, ≥ 0 if we add also an assertion or a docstring)
- It makes clear that the interesting result is another integer produced by the calculation
- It can be reused easily and safely

Object Oriented encapsulation

Encapsulation is so important that it is used also at a higher level: a collection of related procedures.

```
x = 666

def increment():
  x = x + 1

def decrement():
  x = x - 1
```

Again: this is correct Python code, but it has problems:

- Both the functions depends on `x` but this is not clear from their signature: a user must look at the internal details
- The two functions cannot be reused individually, but only together with the other (and `x`)

Classes

A class is a way to package together a collection of related functions. The class is a "mold" to instance new objects that encapsulated the related functionalities.

```
class Counter:
    def __init__(self, start: int):
        self.x = start

    def increment(self):
        self.x = self.x + 1

    def decrement(self):
        self.x = self.x - 1

c = Counter(666)
c.decrement()
d = Counter(999)
d.increment()
```

Homework

- https://classroom.github.com/a/JMlHieUy
- Optional: GitHub has a new assignment on `git` and GitHub basics; try it here https://classroom.github.com/a/KLoZ8Qxl