Python programming basics

Till Korten

With material from Robert Haase

@TillKorten

May 2022

Who has programming experience?

I have never programmed

I have adjusted existing scripts/macros

I have written my own script

Working with variables

- Variables can hold numeric values and you can do math with them

```
# initialize parameters
room_width = 5
room_length = 6

# run algorithm on given parameters
room_area = room_width * room_length

print(room_area)
```

```
30
```

Working with variables and string values

- Also text (called strings) as values for variables are supported

Single and double quotes allowed

```
first_name = "Robert"
last_name = 'Haase'

print("Hello " + first_name + " " + last_name)
```

```
Hello Robert Haase
```

f-Strings

- String formatting is made easy using f-strings.

```
f"This is an f-string. a's value is {a}. Doubling the value of a gives {2*a}."
```

```
"This is an f-string. a's value is 5. Doubling the value of a gives 10."
```

Comments

PoL Physics of Life TU Dresden

Comments should contain additional information such as

- User documentation
  - What does the program do?
  - How can this program be used?
- Your name / institute in case a reader has a question
- Comment why things are done.
- Do not comment what is written in the code already!

```
#
# This program sums up two numbers.
#
# Usage:
# * Run it in Python 3.8
#
# Author: Robert Haase, PoL TUD
#         Robert.haase@tu-dresden.de
# April 2021

# initialise program
a = 1
b = 2.5

# run complicated algorithm
final_result = a + b

# print the final result
print( final_result )
```

PoL
Physics of Life
TU Dresden

CENTER FOR
SYSTEMS BIOLOGY
DRESDEN

Handling many items: lists

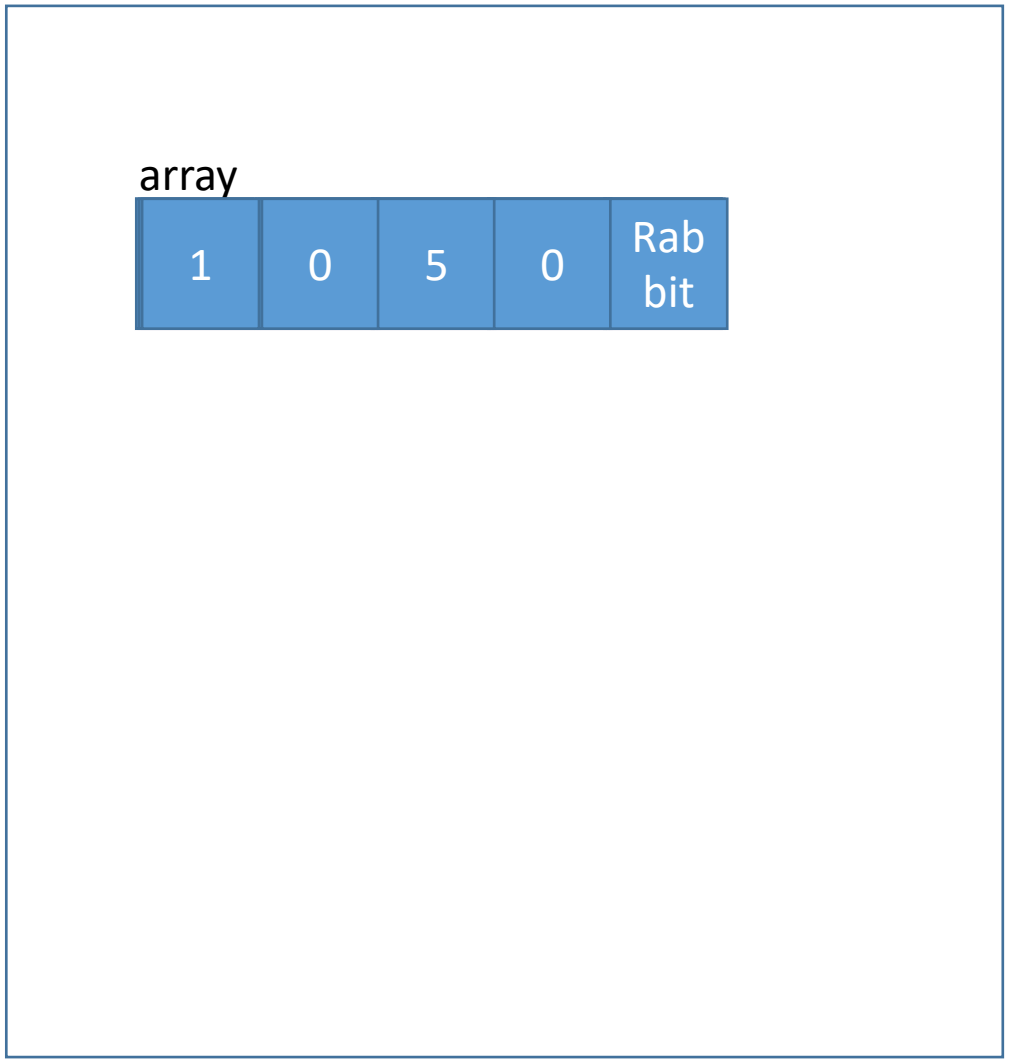
Lists

- Lists are variables, where you can store multiple values

Give me a “0”, five times!

```
array = [0] * 5
```

Computer memory



Arrays in Python

- Modifying lists entries

```
numbers = [0, 1, 2, 3, 4]

# write in one array element
numbers[1] = 5

print(numbers)
```

```
[0, 5, 2, 3, 4]
```

Note: The first element has index 0!

- Creating lists of defined size

What?

How many?

```
zeros = [0] * 10
print(zeros)
```

```
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```

- Concatenating lists

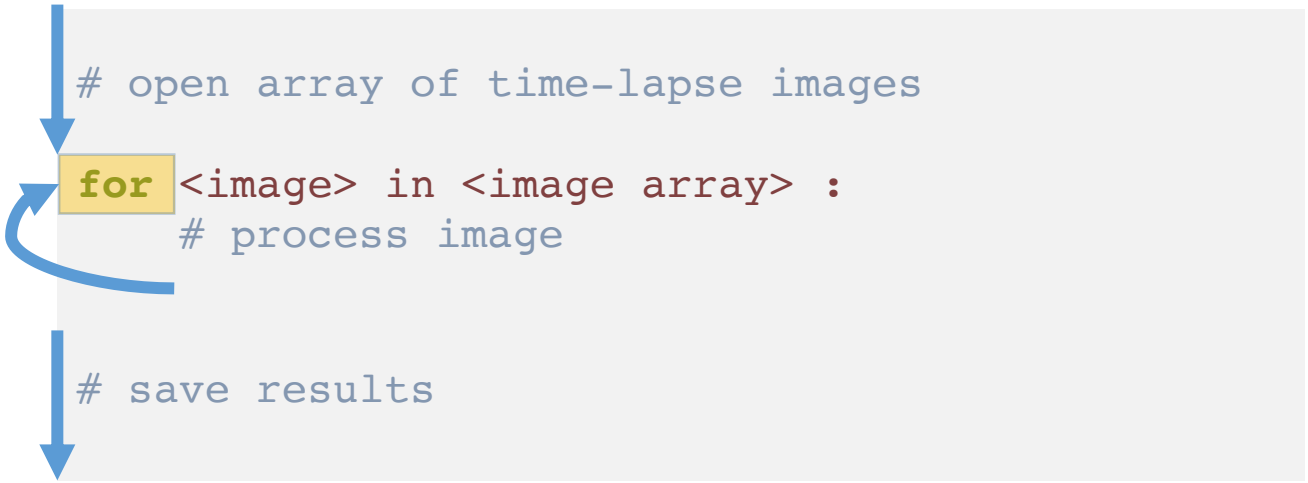
```
ones = [1, 1, 1]
twos = [2, 2, 2, 2]

# concatenate arrays
numbers = ones + twos

print(numbers)
```

```
[1, 1, 1, 2, 2, 2, 2]
```

+ means appending

`for`: execute some lines of code *for* a number of times

- typically for all items in an array-like thing (lists, tuples, images)



`for-in`: Loop over items of a list

- Example list :

```
animal_set = ["Cat", "Dog", "Mouse"]

for animal in animal_set:
    print(animal)
```

```
Cat
Dog
Mouse
```

`range` creates numbers on the fly:

`range(start, stop, step)`

```
# for loops
for i in range(0, 5):
    print(i)
```

```
0
1
2
3
4
```

`for`-loop syntax pitfalls

- Indent the code within the `for` loop
  remember: indentation *means* combining operations to a block

```
# for loops
for i in range(0, 5):
print(i)
```

```
  File "<ipython-input-15-59c457ae0ac9>", line 3
    print(i)
        ^
IndentationError: expected an indented block
```

Don't forget to indent!

- Colon necessary

```
# for loops
for i in range(0, 5)
    print(i)
```

```
  File "<ipython-input-13-23157c0ed137>", line 2
    for i in range(0, 5)
                       ^
SyntaxError: invalid syntax
```

Don't forget the colon!