Introduction to Python

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What is Programming?

- All computers are stupid.
- All computers are deterministic.
- You have to tell the computer what to do.
- You can tell the computer in any (programming) language) you like.

What is Python?

- Python is a very powerful, but easy language.
- Why easy? You can learn it easily. It is like writing down logic in pseudocode, only that the pseudocode is the real code (Unlike many other programming languages).
- Why powerful? There is nearly nothing you cannot do: Calculate, Draw, Plot, Read data (from anywhere), Simulate, Analyse data, Web applications, Make real executable programs (GUI), interactive programs, ...
- The best thing: Open Source: Probably somebody in the world has already done what you want to do.

Workflow

- Write your code/program.
- No compiling step necessary
- Execute your program.

Other languages: C,C++, Fortran. You have to compile, after writing your code, before executing.

Executing python online

- www.trinket.io
- Sign up.
- Write your code.
- Run it.

Our first line of code

Variable definition
CODE:

- `name = value`

Console Output

CODE:

- `print name`

Variable types

CODE:

- `print type(name)`

Variable types

- `string:` sequence of characters ('Hallo')
- `integer:` positive or negative natural number, inclusive zero (..,-2, -1, 0, 1, 2,..)
- `float:` floating point number (1,2345)
- `bool:` 'True' or 'False'

Math expressions

CODE:

- `a + b`
- `a - b`
- `a * b`
- `a / b`
- `a ** b`

Examples

CODE:

```
i = 2
j = 5
print i, j, i+j
k = 2.5
print k*i
print i*k
```

Logic operations

CODE:

```
if a==1:
    print "a ist 1"
elif a==2:
    print "a ist 2"
else:
    print "a ist irgendwas."
```

Logic operators

- `==` equal
- `<` smaller
- `>` larger
- `<=` smaller or equal
- `>=` larger or equal
- `!=` not equal

CODE:

```
if a <= 5 and a >2:
    print "a ist 3, 4 oder 5"
```

Lists

CODE:

- `list = [1,2,3,4,5]`
- `list = ["ha","he","hi","ho"]`
- `print "erstes Element:  ", list[0]`
- `print "drittes Element:  ", list[2]`

Loops

CODE:

- ```
  for element in list:
      print "Listenelement ist ", element
  ```
- ```
  for element in range(10):
      print "Listenelement ist ", element
  ```
- ```
  while a <= 5:
      print a
      a = a+1
  ```
  ```

Libraries

CODE:

- `import libraryname as othername`

common libraries:
numpy, matplotlib.pyplot, ...

Using libraries

CODE:

- `import libraryname as othername`

common libraries:
numpy, matplotlib.pyplot, ...
USAGE e.g.:

- `import numpy as np`
- `print np.exp(1)`
- `array = np.array([1,2,3])`
- `array_auto = np.linspace(1,10,10)`

Functions

CODE:

- ```
  def func_name(input1, input2):
      print input1, input2
      print input1*input2
      return input1**input2
  ```
  ```

Pseudozufallszahlen

Pseudozufallszahlen sind Zahlenfolgen die durch einen deterministischen Algorithmus (Pseudozufallszahlengenerator) berechnet werden (und somit nicht zufällig sind). Für hinreichend kurze Sequenzen sehen sie jedoch zufällig aus. Bei jedem Start der Zufallszahlen-Berechnung mit gleichem Startwert (seed) wird die gleiche Zahlenfolge erzeugt.

Zufallszahlen in Python

Modul laden:

- `import random`

Zufallszahlengenerator mit seed [x] initialisieren:

- `random.seed([x])`

Zufallszahl zwischen 0.0 und 1.0 aufrufen:

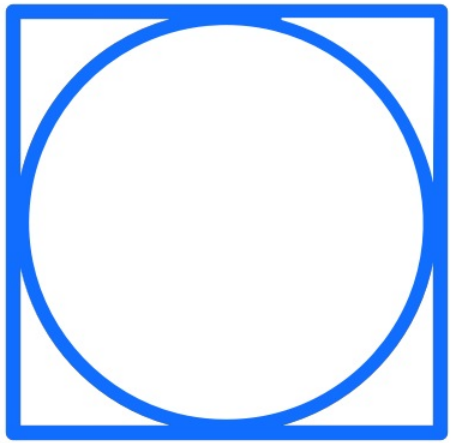
- `random.random()`

Zufallszahl zwischen a und b aufrufen:

- `random.uniform(a, b)`

Ohne random.seed([x]) verwendet Python die Systemzeit um einen Seed zu generieren.

Aufgabe: Berechnen Sie π.



- Wählen sie ein geeignetes Koordinatensystem.
- Rechnen sie zufällige Punkte aus und bestimmen ob diese im Kreis liegen.
- Das Verhältnis der Flächen von Kreis und Quadrat entspricht dem Verhältnis der Zufallswerte in Kreis und Quadrat.