Lab of Applied Computational Intelligence

IST

2024/2025

Introduction to Python

Guide 1

10 Sep 2024

(Week 1)

1 – Objetives

With this work the student should be able to start using (or refresh their knowledge) the Python language. In this lab some examples off python programming will be presented.

2 – The development Environment

In the Labs of Intelligent Computation, we will be using the Python language due to the versality and easy learning curve. Also, the availability of many libraries in the field of Data Science.

You are free to use any IDE you are familiar with. I advise using PyCharm, Eclipse, Spyder or Jupyter Notebook.

The Jupyter Notebook has a different interface than a classical IDE but allows for easy experimentation with small code and is very popular for programmers in this area.

The use of libraries in Python allows the acceleration of development in projects. They can be used as long it is not explicitly said to implement that functionality.

You can use your personal computer to test code out of the class.

3 – Python tutorials

There are many Python tutorials, we leave here some examples.

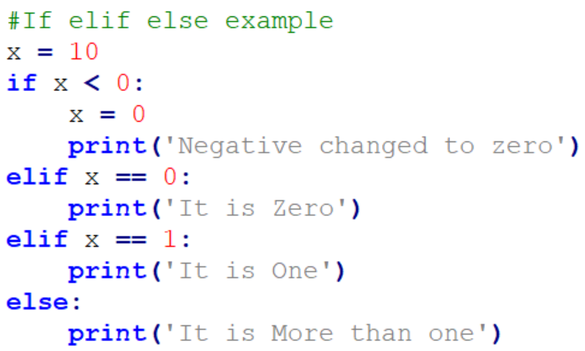
https://docs.python.org/3/tutorial/	python website
https://developers.google.com/edu/python/	google class
https://numpy.org/devdocs/user/quickstart.html	Numpy array tutorial

4 – Execution of the lab work

Now we will run some examples of code to test in the lab that show the usual type of programming in python. Remember that Python uses indentation to delimit blocks of code. Run the next code examples.

4.1 – If Else

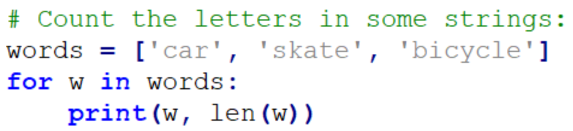
The if else is the more common control flow statement. Notice that there is the ":" at the end of every statement. Next one example.



```
#If elif else example
x = 10
if x < 0:
    x = 0
    print('Negative changed to zero')
elif x == 0:
    print('It is Zero')
elif x == 1:
    print('It is One')
else:
    print('It is More than one')
```

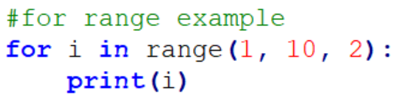
4.2 – For and Range

The `for` statement in Python differs a bit from what you may be used to in C or Pascal. Python's `for` statement iterates over the items of any sequence (a list or a string), in the order that they appear in the sequence.



```
# Count the letters in some strings:
words = ['car', 'skate', 'bicycle']
for w in words:
    print(w, len(w))
```

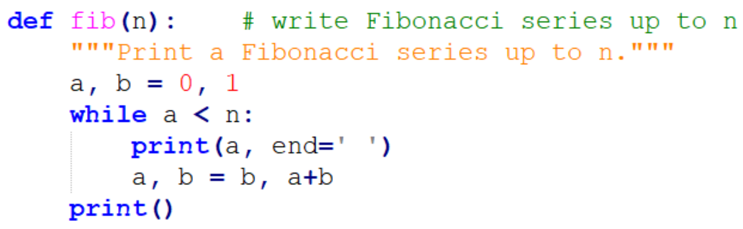
The range function is commonly used in python to iterate over a sequence of numbers. It has 3 parameters, first point, last point not included, and step of the sequence.



```
#for range example
for i in range(1, 10, 2):
    print(i)
```

4.3 –Functions

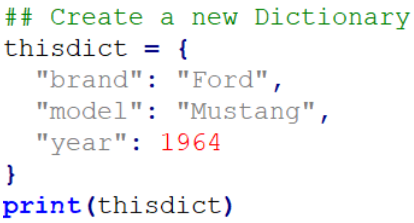
Functions start with the "def" keyword. For example we can create a function that writes the Fibonacci series to an arbitrary boundary:



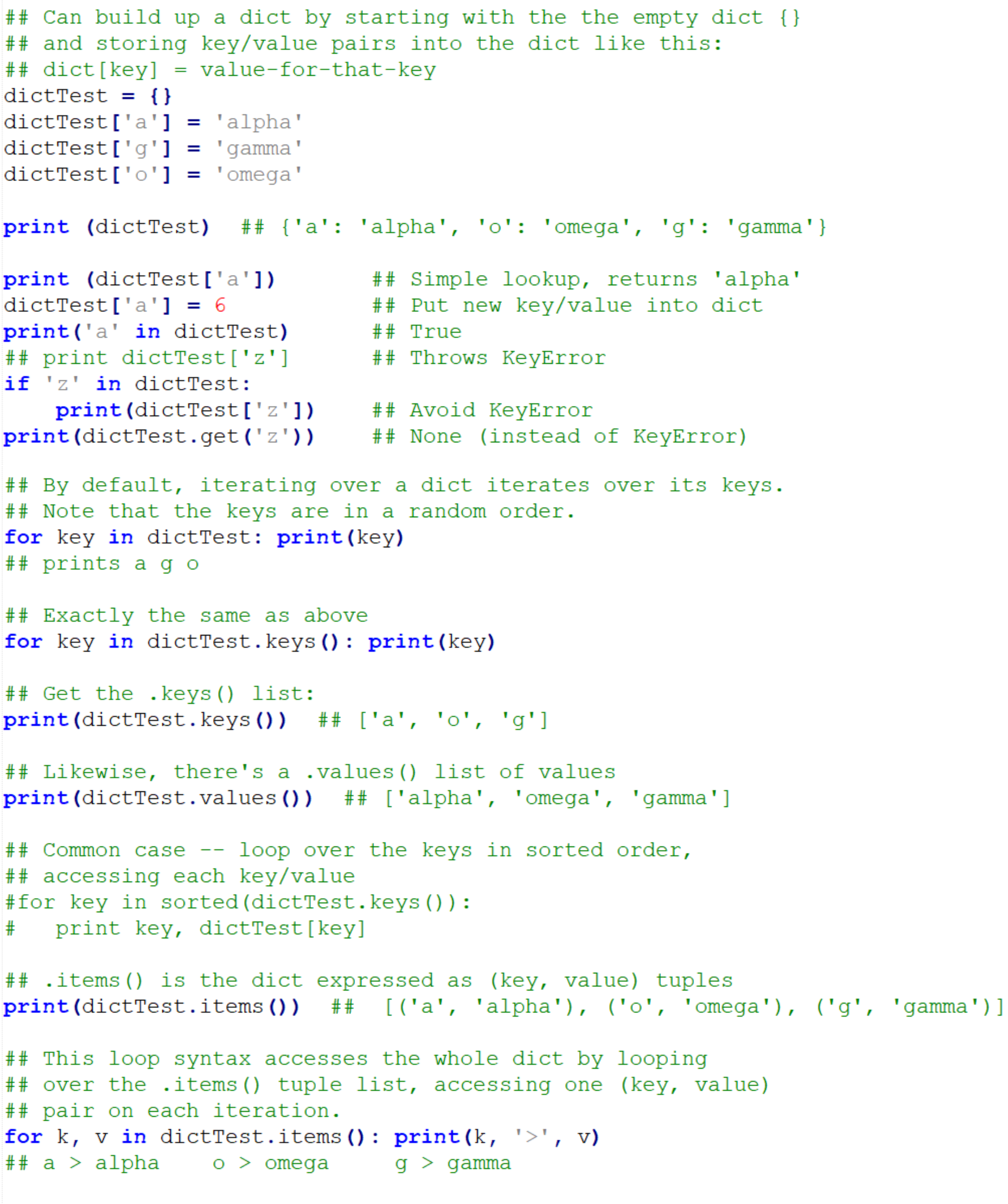
```
def fib(n):    # write Fibonacci series up to n
    """Print a Fibonacci series up to n."""
    a, b = 0, 1
    while a < n:
        print(a, end=' ')
        a, b = b, a+b
    print()
```

4.4 – Dictionaries

A dictionary consists of a collection of key-value pairs. It is useful to store rapidly some values with a key and a respective value. Some code examples are presented next to create a dictionary with several elements from the beginning, to create a dictionary starting empty and adding several elements, and for iterating in a dictionary.



```
## Create a new Dictionary
thisdict = {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}
print(thisdict)
```

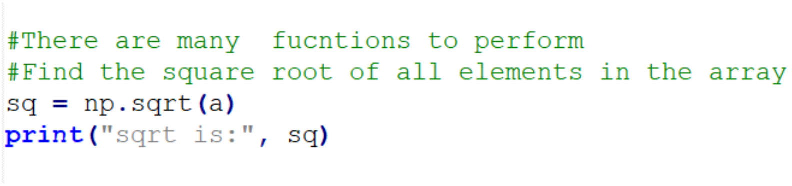


```
## Can build up a dict by starting with the the empty dict {}
## and storing key/value pairs into the dict like this:
## dict[key] = value-for-that-key
dictTest = {}
dictTest['a'] = 'alpha'
dictTest['g'] = 'gamma'
dictTest['o'] = 'omega'

print (dictTest)   ## {'a': 'alpha', 'o': 'omega', 'g': 'gamma'}

print (dictTest['a'])       ## Simple lookup, returns 'alpha'
dictTest['a'] = 6           ## Put new key/value into dict
print('a' in dictTest)      ## True
## print dictTest['z']      ## Throws KeyError
if 'z' in dictTest:
    print(dictTest['z'])    ## Avoid KeyError
print(dictTest.get('z'))    ## None (instead of KeyError)

## By default, iterating over a dict iterates over its keys.
## Note that the keys are in a random order.
for key in dictTest: print(key)
## prints a g o

## Exactly the same as above
for key in dictTest.keys(): print(key)

## Get the .keys() list:
print(dictTest.keys())  ## ['a', 'o', 'g']

## Likewise, there's a .values() list of values
print(dictTest.values())  ## ['alpha', 'omega', 'gamma']

## Common case -- loop over the keys in sorted order,
## accessing each key/value
#for key in sorted(dictTest.keys()):
#   print key, dictTest[key]

## .items() is the dict expressed as (key, value) tuples
print(dictTest.items())  ##  [('a', 'alpha'), ('o', 'omega'), ('g', 'gamma')]

## This loop syntax accesses the whole dict by looping
## over the .items() tuple list, accessing one (key, value)
## pair on each iteration.
for k, v in dictTest.items(): print(k, '>', v)
## a > alpha    o > omega     g > gamma
```

4.5 – Numpy arrays

Python has a library to create arrays called numpy arrays. First you need to import the library and give it a name (np in this case). After that you can use the functions from the library. For more examples see the tutorial. Find out what the following achieves: s = a[: , 1:3]

```
#numpy array creation with elements
import numpy as np
a = np.arange(15).reshape(3, 5)
print(a)
#array([[ 0,  1,  2,  3,  4],
#       [ 5,  6,  7,  8,  9],
#       [10, 11, 12, 13, 14]])

#create a array with zeros
b = np.zeros((3, 4))
print(b)

#Find the shape of the array
sh = a.shape
print("shape is:", sh)

#Find the dimension of the array
nd = a.ndim
print("ndim is:",nd)

#Find the number of elements in the array
sh = a.size
print("size is:",sh)

#Find the type of a variable
tp = type(a)
print("type is:", tp)

#Find the type of a element in the array
tpa = a.dtype
print("dtype is:", tpa)

#Find the sum of all elements in the array
su = a.sum()
print("sum is:", su)

#Find the maximum of all elements in the array
mx = a.max()
```



```
#There are many  fucntions to perform
#Find the square root of all elements in the array
sq = np.sqrt(a)
print("sqrt is:", sq)
```

4.5 – Strings and Lists

If you still have time you can learn many more things in the tutorials, start by trying Strings and Lists and then many more.