Introduction to Python

Artificial Intelligence TN I (YS 02) - Fall 2023

Course links

- Course Material: Course page
- Project Submission: Eclass page
- Announcements, questions, etc: Piazza page

Course grading

- 5 homework projects (90%)
- Final exam (10%)

Download Python

Download:

- https://www.python.org/downloads/

  or

- https://www.anaconda.com/products/individual

  Version: Python 3.6.x

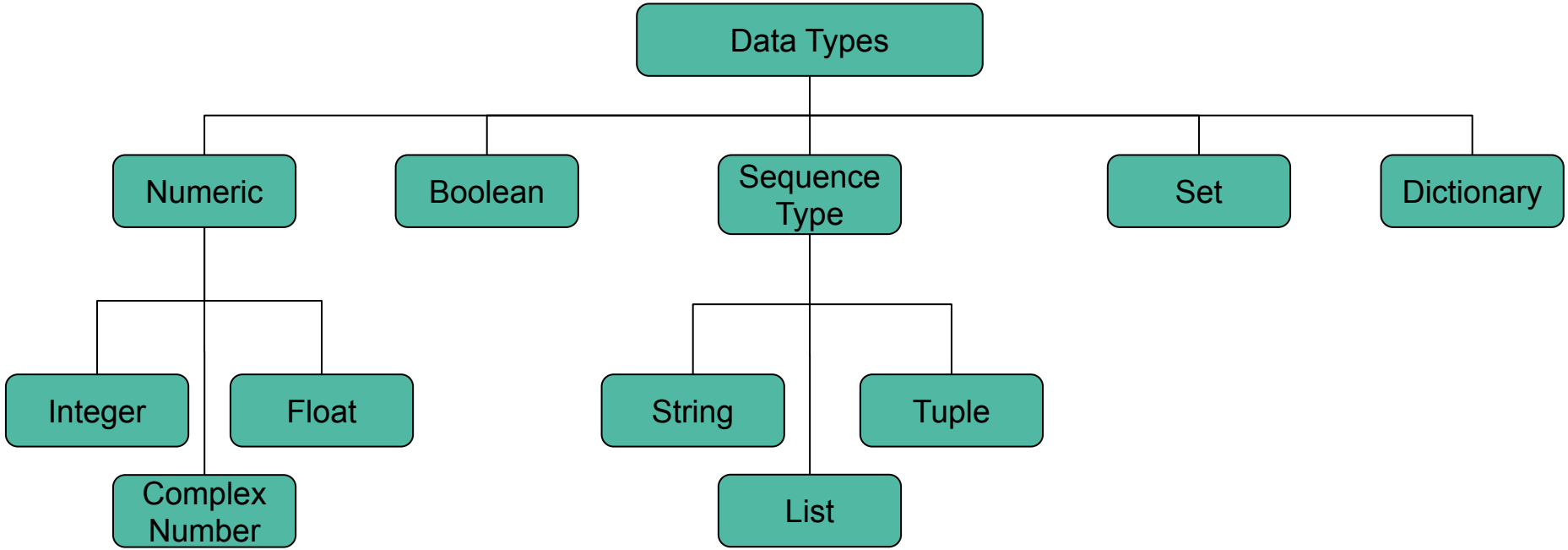
Editors:

1) GEdit (text)
2) Notepad++ (text)
3) Idle (text)
4) Spyder (IDE)
5) VSCode (IDE)
6) Atom (IDE)
7) Python shell
8) PyCharm

My first program

```
>>> print("Hello World!")
Hello World!
```

What are my Data Types?



Data Types - Known

Integer

```
>>> x = 3
>>> y = 5
>>> z = x+y
>>> z * z
64
```

Float

```
>>> x = 3.4
>>> y = 5.6
>>> z = x+y
>>> z * z
81.0
```

Boolean

```
>>> x = True
>>> y = False
>>> z = (x and y) or x
>>> z
True
```

Data Types - Strings

Ordered Sequence of characters (Immutable)

```
>>> x = “Hello ”
>>> y = “Everyone”
>>> z = x+y
>>> z
Hello Everyone
>>> x[4] + “ ” + y[0]
o E
>>> x[-1] + y[2:] + y[4:6]
 eryoneyo
```

H	e	l	l	o	
0	1	2	3	4	5

E	v	e	r	y	o	n	e
0	1	2	3	4	5	6	7

```
>>> print("Hello ", "World!")
Hello World!
>>> s = "World!"
>>> print(f"Hello {s}")
Hello World!
>>> print("Hello {}".format(s))
Hello World!
>>> print("Hello %s"% s)
Hello World!
```

Data Types - List

Ordered Sequence of items (Mutable) - Indexing same as strings

```
>>> l1 = [0,1,2,3,4,5]
>>> l2 = ['a', '2', 'b', True, 2.4, [2]]
>>> len(l1)       #Number of items in l1
6
>>> l2.index('b')       #Find index of ‘b’
2
>>> min(l1)       #Minimum item of l1
0
>>> sum(l1)       #Sum of elements of l1
15
>>> list(range(2,10)) #Generate list of
sequential items
[2, 3, 4, 5, 6, 7, 8, 9]
```

```
>>> l1 = [0,1,2,3,4,5]
>>> l1.append(-1)       #Add 1 item at end of list
>>> l1
[0, 1, 2, 3, 4, 5, -1]
>>> l1 += [-2, 15, 3, 27]     #Concatenate lists
[0, 1, 2, 3, 4, 5, -1, -2, 15, 3, 27]
>>> l1.sort()     #Sort list inplace
>>> l1
[-2, -1, 0, 1, 2, 3, 3, 4, 5, 15, 27]
>>> l1.reverse()  #Sort list inplace different order
>>> l1
[27, 15, 5, 4, 3, 3, 2, 1, 0, -1, -2]
>>> l1.pop()      #Remove last item
-2
```

Data Types - Tuples

Ordered Sequence of items (Immutable) - Indexing same as before

```
>>> l1 = ('a', '2', 'b', True, 2.4, [2])
>>> len(l1)
6
>>> l1[0]
‘a’
>>> l1[0] = 0     #Error
```

Data Types - Set

Unordered collection of items (Mutable) - No Indexing, unique items

```
>>> s1 = {'a', 'b', 'b'}
>>> s1
{‘a’, ‘b’}
>>> s1.update(['c', 'd', 'a', 'b'])
>>> s1
{‘a’, ‘b’, ‘c’, ‘d’}
```

Data Types - Dictionary

Map of items (Mutable) - Unique Keys, possibly duplicate Values

```
>>> d1 = {'a': 1, 'b': 10, 'c': 1}
>>> d1['a']
1
>>> del d1['b']
>>> d1
{'a': 1, 'c': 1}
>>> d1['a'] = 2
>>> d1
{'a': 2, 'c': 1}
```

```
>>> d1 = {'a': 1, 'b': 10, 'c': 1}
>>> d1.keys()
dict_keys(['a', 'b', 'c'])
>>> d1.values()
dict_values([1, 10, 1])
>>> d1.items()
dict_items([('a', 1), ('b', 10), ('c', 1)])
```

Functions

```
def square(x):
   return x*x

>>> square(9)
81
>>> square(15)
225
```

Note: No brackets, we use indentation (tabs or spaces)!

Control Flows - If

```
def foo(x):
   if x % 2 == 0:
      print(f'{x} is even!')
   elif x % 2 != 0:
      print(f'{x} is odd!')
   else:
      print(Did you typed a
number?')

>>> foo(15)
15 is odd!
>>> foo(228)
228 is even!
```

```
invited = ["Alice", "Bob", "Carol"]
guest = 'David'
if guest in invited:
   print(f"Welcome, {guest}")
else:
   print(f"You are not invited, {guest}")

You are not invited, David
```

in works for string, list, tuple, set and dict (keys)

Control Flows - Iterations

For Loop

```
invited = ["Alice", "Bob", "Carol"]

def is_invited(guest):
   if guest in invited:
      print(f"Welcome, {guest}")
   else:
      print(f"You are not invited, {guest}")

guests = ["Alice", "David"]
for guest in guests:
   is_invited(guest)

Welcome, Alice
You are not invited, David
```

While Loop

```
invited = ["Alice", "Bob", "Carol"]

def is_invited(guest):
   if guest in invited:
      print(f"Welcome, {guest}")
   else:
      print(f"You are not invited, {guest}")

guests = ["Alice", "David"]
while len(guests) != 0:
   guest = guests.pop()
   is_invited(guest)

You are not invited, David
Welcome, Alice
```

Note: No do - while in Python!

Control Flows - List Comprehension

```
>>> l = list(range(10))
>>> l
[0, 1, 2, 4, 5, 6, 7, 8, 9]
>>> squares = [x * x for x in l]
>>> squares
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

```
def factorial(x):
   fact = 1
   if x< 0:
      fact = -1
   elif x== 0:
      pass
   else:
      for i in range(1,x + 1):
         fact = fact*i
   return fact

>>> l = [1, 5, 10]
>>> facts = [factorial(x) for x in l]
>>> facts
[1, 120, 3628800]
```

Useful Functionalities & Libraries

Try - Catch - Finally

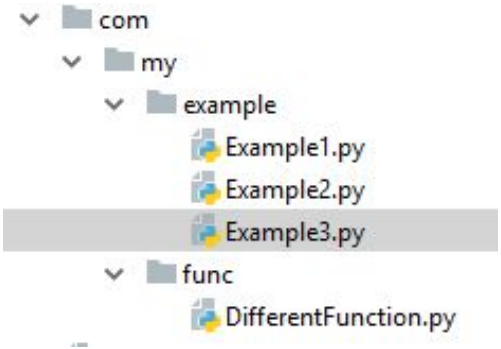
```
try:
   main()

catch Exception as e:
    print(e)

finally:
    print("Program finished")
```

DOCSTRINGS
Google docstrings

```
Import numpy as np
Import pandas as pd
From src.py_functions import * -> (wildcard)
```



Useful Functionalities & Libraries (2)

DOCSTRINGS

Google docstrings for Python style

```
"""_Summary_

   _Args_:
       param1 (int): The first parameter.
       param2 (str): The second parameter.

   _Returns_:
         bool: The return value. True for success, False
  otherwise.
"""
```

Example

```
def hello_user(name:str) -> str:
"""This function will salut a user.

    Args:
        name (str): A string with a name.

    Returns:
          str: The salutation to a user name.
"""
     return print("Hello",name)
```

Classes

```
class Person:
   def __init__(self, name, inv):
      self.name = name
      self.inv = inv

    def is_invited(self):
      if self.inv:
         msg = f"Welcome, {self.name}"
      else:
         msg = f"You are not invited, {self.name}"
      return msg
```

```
persons = {}
guests = ["Alice", "Bob", "Carol", "David" ]
invites = [1] * 3 + [0]
for no, (guest, inv) in enumerate(zip(guests, invites)):
   persons[no] = Person(guest, inv)

for no, person in persons.items():
   print(f'Guest {no}: {person.is_invited()}')

Guest 0: Welcome, Alice
Guest 1: Welcome, Bob
Guest 2: Welcome, Carol
Guest 3: You are not invited, David
```

Call python script from Shell

```
If __name__ == “__main__”:
   my_main()
```

Useful links

- https://medium.com/fintechexplained/everything-about-python-from-beginner-to-advance-level-227d52ef32d2
- https://towardsdatascience.com/tagged/python
- https://scikit-learn.org/stable/ **-> Data Science, Machine Learning**
- **Stackoverflow**

Project 0

https://cgi.di.uoa.gr/~ys02/siteAI2023/projects.html

Deliverables:

- Exercise 1: addition.py, buyLotsOfFruit.py & shopSmart.py
- Exercise 2: parentheses.py