NORTHERN ARIZONA UNIVERSITY

School of Informatics, Computing, and Cyber Systems

INF502

Lecture: Introduction to Python

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Welcome to Python

KICKING OFF

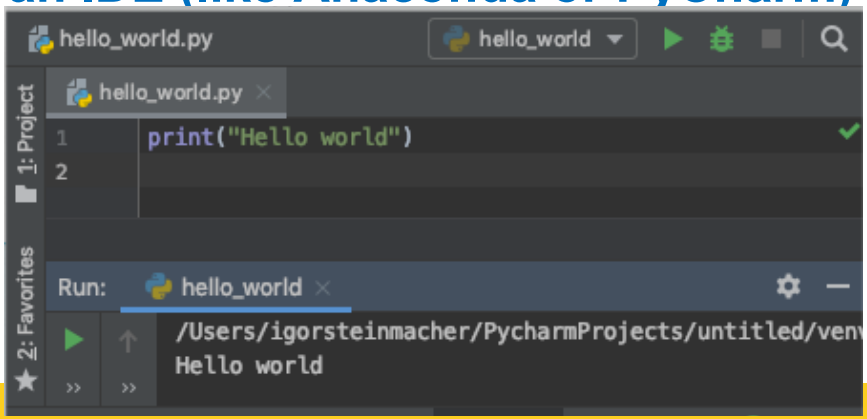
- Python: Interpreted language
  - **Interactive editor**

```
MacBook-Pro-de-fapesp:~ igorsteinmacher$ python3
Python 3.7.4 (default, Jul  9 2019, 18:13:23)
[Clang 10.0.1 (clang-1001.0.46.4)] on darwin
Type "help", "copyright", "credits" or "license"
>>> x = 2
>>>
```

  - **Running from a file**

```
MacBook-Pro-de-fapesp:examples igorsteinmacher$ python3 hello_world.py
Hello world
MacBook-Pro-de-fapesp:examples igorsteinmacher$
```

  - **Using an IDE (like Anaconda or PyCharm)**



FORMATTING

- Python uses **indentation** to delimit blocks of code
- Comments start with #
- Colons ":" are used to start a new block for different constructs

```
#function that answers if a number is even or not
def isEven (number):
    #is the remainder when dividing number by 2 equals to 0
    if (number % 2 == 0):
        #yes, the number is even
        return True
    return False
```

VARIABLES

- Variables are created when they are assigned a value

  - **Type-binding is associated 'on-the-fly'**

```
>>> x = 2         #x is an integer
>>> y = 'Igor' #y is a String
>>> y = 2.5       #y is now a floating point
>>> z = [1,2,3] #z is a list
>>> #each position in z is an integer
>>> type (z)
<class 'list'>
>>> x = y = z = 4 #chained assignment
```

ARITHMETIC

- Mathematics apply

```
>>> a = 2+3     #a is 5
>>> b = 7-4     #b is 3
>>> c = 2*2.5   #c is 5.0 (float!!)
>>> d = 2**4.   #d is 16
>>> e = 5%2     #e is 1
>>> f = 7/2     #f is 3.5
>>> g = 7//2    #g is ...
```

STRINGS

- Strings are delimited by single or double quotation marks

```
>>> single_quote = 'python'
>>> double_quote = “python”
>>> I_want_the_quote = 'It\'s python'
>>> yes_the_quote = “It's python”
>>> multi_line = 'this is a multi line \
sentence. It is possible to break it in \
multiple lines.’
```

STRINGS

- Operations using Strings

```
#operations using strings
>>> salutation = ”Hello”
>>> name = ”John”
>>> complete_salut = salutation + ', ' + name + '!'
>>> print (complete_salut)
Hello, John!

>>> real_long_string = ('this is a long string. '
‘It has multiple parts, '
‘but all in one line.‘)
```

How to Input??

- Getting user inputs is usually important

```
#input() function waits for an input from the keyboard
>>> salutation = ”Hello”
>>> name = input(“Tell me your name: “)
Tell me your name: <INPUT + ENTER>
>>> complete_salut = salutation + ', ' + name + '!'
>>> print (complete_salut)
Hello, <NAME ENTERED>!

>>> weight = input(“Enter your weight in lb: ”)
Enter your weight in lb: 200
>>> weight = int(weight) #what am I doing here???
>>> weight_kg = weight/2.205
>>> print (weight_kg)
90.70294784580499
```

4-MINUTE MADNESS

- **Write a program to prompt the user for hours and rate per hour to compute gross pay.**
  - **Enter Hours: 35**
  - **Enter Rate: 2.75**
  - **Pay: 96.25**

- **Write a program which prompts the user for a Celsius temperature, convert the temperature to Fahrenheit, and print out the converted temperature.**

CONDITIONAL

- if – else (and more…)

```
if (x > y):
   print (“x is greater than y”)
elif (y < x):
   print (“y is greater than x”)
else:
   print (“they are equal!”)
```

```
parity = "even" if x % 2 == 0 else "odd"
```

Comparison Operations

Operation	Meaning
<	strictly less than
<=	less than or equal
>	strictly greater than
>=	greater than or equal
==	equal
!=	not equal
is	object identity
is not	negated object identity

LESS SUFFERING

- Let's use files instead of Interactive Prompt

- Create a file with the extension ".py"
  - To run:
  - python3 <filename>.py

3-MINUTE MADNESS

- **Write a program to prompt the user age and returns:**
  - **“You are a kid” → in case the person is 12 or younger**
  - **“Teenager around” → If the age is from 13 to 19**
  - **“An adult, eh?” → If older than 19**

- Do it in a file called age.py and run it

LISTS

- A Python list is an ordered, mutable sequence of objects
- Lists can contain a mixture of any sort of object: numbers, Booleans, strings, other lists, …
- Lists can grow or shrink

```
>>> list_of_numbers = [1,2,3,4,5]
>>> len(list_of_numbers)
5
>>> list_of_numbers[0]
1
>>> list_of_numbers[4]
5
>>> list_of_numbers[-2]
4
```

LISTS

```
#extending it
>>> list_of_numbers.extend([6,7,8])
>>> print(list_of_numbers)
[1,2,3,4,5,6,7,8]
#slicing it
>>> piece = list_of_numbers[:4] #beginning to 4
>>> print (piece)
[1,2,3,4]
>>> piece = list_of_numbers[2:6] #from position 2 to 6
>>> print (piece)
[3,4,5,6]
#shrinking it
>>> del list_of_numbers [2:5]
>>> print(list_of_numbers)
[1,2,6,7,8]
```

LISTS

```
#merging
>>> list1 = [1,2,3]
>>> list2 = [4,5,6]
>>> list3 = list1 + list2
>>> print(list3)
[1,2,3,4,5,6]
>>> list1.extend(list2)
>>> print(list1)
[1,2,3,4,5,6]
#sorting
>>> list1 = [-1,4,0,9,2,7]
>>> list1.sort()
>>> print (list1)
[-1,0,2,4,7,9]
```

```
#other functions
>>> list1.append(<value>)
>>> list1.insert(<pos>,<value>)
>>> list1.remove(<value>)
>>> list1.clean()
>>> list1.remove(<value>)
>>> list1.index(<value>)
>>> list1.reverse()
>>> <value> in list1
```

TUPLES

- A Python tuple is an ordered, **immutable** sequence of objects
- Like lists, but cannot be altered
  - **Do not have methods like reverse(), sort()**

```
>>> my_tuple = (6,34,6,7,2)
>>> len(mytuple)
5
>>> my_tuple[3]
7
>>> my_tuple[1:4]
[34, 6, 7]
>>> my_tuple[2]=8
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: 'tuple' object does not support item assignment
```

ITERATIONS (LOOPS)

- Starting with the **for** (highly used with iterable objects)

```
list_of_numbers = [1,2,3,4,5]

for element in list_of_numbers:
    print (element)
```

- But… also for counting

```
for x in range(10): #will iterate from 0 to 9
    if (x%3==0):
        continue
    print (x)

#what is the output?
```

ITERATIONS (LOOPS)

- Now iterating over a list of lists

```
# grades is a list that stores the name and the grade
# of students. Each position of the list has one list
# with two positions. The first stores the name, and
# the second stores the grade

grades = [["John",60],["Paul", 84],[”Ben", 70], ["Tony",35]]
for entry in grades:
   if (entry[1]>60):
      print(entry[0] + ": approved")
   else:
      print(entry[0] + ": talk to the instructor")
```

ITERATIONS (LOOPS)

- Now iterating over a list of lists

```
# grades is a list that stores the name and the grade
# of students. Each position of the list has one list
# with two positions. The first stores the name, and
# the second stores the grade

grades = [["John",60],["Paul", 84],[”Ben", 70], ["Tony",35]]
for name, grade in grades:
   if (entry[1]>60):
      print(entry[0] + ": approved")
   else:
      print(entry[0] + ": talk to the instructor")
```

10-MINUTE MADNESS

- Write a program which repeatedly reads integers until the user enters “done”. Once “done” is entered, print out the total, count, and average of the numbers. If the user enters anything other than an integer, print an error message and skip to the next number.
  - **Hint: isinstance (variable, int) → returns True if the variable is an integer**

- Rewrite the program above to use the following list instead of prompting the user:
  - **list_numbers=[2,6,2,5,8,2,7,3,5,3,5,7]**

DICTIONARIES

- A dictionary associates values with unique keys

```
>>> grades = {"John": 60, "Paul": 84, "Ben": 70, "Tony": 35}
>>> print(grades["John"])
60
>>> grades["Kate"] = 100                # adds another entry
>>> grades["John"] = 90                 # changes John's grade
>>> print(grades)
{'John': 90, 'Paul': 84, 'Ben': 70, 'Tony': 35, 'Kate': 100}
```

DICTIONARIES

```
>>> "John" in grades
True
>>> ”Igor" in grades
False
>>> grades.get("Joel", -1) # will return -1 (avoid errors)
>>> grades.get(”John", -1) # will return 90 (exists)

>>> all_keys = grades.keys().    # return a list of all keys
>>> all_values = grades.values() # return a list of all values
>>> all_pairs = grades.items()   # a list of (key, value) tuples
```

DICTIONARIES

```
# Nested structures... why not?
family = {"John": {"age": 30, "weight": 170, "city": "Flagstaff"},
          "Paul": {"age": 45, "weight": 200, "city": "Buenos Aires"},
          "Anna": {"age": 26, "weight": 130, "city": "Paris"}}
# Lazy iteration
for member in family:
   print(member)

for member in family:
   print(family[member])
```