Function, Class, Regular expressions & other tools

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Week 3: Learning objectives

Get to know:

1. Functions and Modules
2. Class (OOP basics)
3. Regex
4. Additional
   - One-liner lambda
   - Exception handling
   - Debugging

Function

Function - not to repeat one action again and again

```
def functionName(input1, input2, ...):
    """ this function is ... """

    expression

    return output(s)


import numpy as np
```

Documenting a function is crucial!

Docstring prototype

```
13
14  def my_function(name, age):
15      """
16
17
18      Parameters
19      ----------
20      name : str
21          name of person.
22      age : int
23          age of person.
24
25      Returns
26      -------
27      Grades
28
29      """
30
31
32  help(my_function)
33  print(my_function.__doc__)
34
```

Function arguments

- Positional (“input”)
- Keyword (“input=value”) - with a default value
- Optional positional (*args)
- Optional keyword (**kwargs)

Scope of variable

```
93
94  # variable scope
95
96  x = 20 # global by default
97
98  def my_func(ageby=5):
99
100     x = 5 # local by default
101
102     # global x # use global variable inside a function
103
104     x = x + ageby
105
106     return x
107
108
109
110
111
```

```
IPython 7.22.0 -- An enhanced Interactive Python.

In [1]: x = 20 # global by default
   ...:
   ...: def my_func(ageby=5):
   ...:
   ...:     x = 5 # local by default
   ...:
   ...:     # global x # use global variable inside a function
   ...:
   ...:     x = x + ageby
   ...:
   ...:     return x

In [2]: my_func()
Out[2]: 10

In [3]: x
Out[3]: 20
```

```
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In [1]: x = 20 # global by default
   ...:
   ...: def my_func(ageby=5):
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   ...:     # x = 5 # local by default
   ...:
   ...:     global x # use global variable inside a function
   ...:
   ...:     x = x + ageby
   ...:
   ...:     return x

In [2]: my_func()
Out[2]: 25

In [3]: x
Out[3]: 25
```

Module

As your program gets longer, you may want

- to split it into several files for easier maintenance
- to use also a handy function that you have written in several programs without copying its definition into each program.

To support this, Python has a way to put definitions in a file and use them. Such a file is called a *module*; definitions from a module can be imported into other modules or script.

Class – OOP philosophy

Def: Object-oriented programming (OOP) is a computer programming model that organizes software design around data, or objects, rather than functions and logic. An object can be defined as a data field that has unique attributes and behavior.

Important concepts:

- Object (instance)
- Method
- Inheritance (super, child classes)
- Setters and getters
- Variable accessibility – Public/Private/Protected

One liner and Lambda

Helpful for writing concise codes

```
257
258  # one liner
259  lst = [i if np.mod(i,2)==0 else 5 for i in range(0,10)]
260  # Output - [0, 5, 2, 5, 4, 5, 6, 5, 8, 5]
261
262  # lambda
263  func = lambda a : a + 10
264  func(5)
265  # Output - 15
266
267  my_list = [1, 5, 4, 6, 8, 11, 3, 12]
268  new_list = list(filter(lambda x: (x%2 == 0) , my_list))
269  # Output - [4, 6, 8, 12]
```

Exception handling

Exceptions occur from time to time in any sort of job. If you know what kind of errors potentially could occur and implement "remedy(ies)" on it beforehand

```
373
374 try:
375     # do main job
376 except:
377     # do another - Hereby, you are handling an exception!
378
```

Debugging

In IDEs (VSCode):

- Actions at breakpoints: continue, step over, step into, step out
- Additional actions at breakpoints - expression, hit count, log message
- Watch
- Exceptions

Hand inputted breakpoint:

- import pdb, pdb.set_trace()

Regular expressions

Search "pattern"from text and do an action Package “re”:

- compile
- findall – find all matches
- match – match at the beginning of string
- search – first match anywhere in string
- split – split string into pieces at pattern points
- sub – replace match by user input
- group
- special characters

Regular expressions special characters

Regular Expressions Cheat Sheet by DaveChild

A quick reference guide for regular expressions (regex), including symbols, ranges, grouping, assertions and some sample patterns to get you started.

Anchors

^	Start of string, or start of line in multi-line pattern
\A	Start of string
$	End of string, or end of line in multi-line pattern
\Z	End of string
\b	Word boundary
\B	Not word boundary
\<	Start of word
\>	End of word

Character Classes

\c	Control character
\s	White space
\S	Not white space
\d	Digit
\D	Not digit
\w	Word
\W	Not word
\x	Hexadecimal digit
\O	Octal digit

POSIX

[:upper:]	Upper case letters

Quantifiers

*	0 or more	{3}	Exactly 3
+	1 or more	{3,}	3 or more
?	0 or 1	{3,5}	3, 4 or 5

Add a ? to a quantifier to make it ungreedy.

Escape Sequences

\	Escape following character
\Q	Begin literal sequence
\E	End literal sequence

"Escaping" is a way of treating characters which have a special meaning in regular expressions literally, rather than as special characters.

Common Metacharacters

^	[	.	$
{	*	(	\
+	)	|	?
<	>		

The escape character is usually \

Special Characters

\n	New line

Groups and Ranges

.	Any character except new line (\n)
(a|b)	a or b
(...)	Group
(?:...)	Passive (non-capturing) group
[abc]	Range (a or b or c)
[^abc]	Not (a or b or c)
[a-q]	Lower case letter from a to q
[A-Q]	Upper case letter from A to Q
[0-7]	Digit from 0 to 7
\x	Group/subpattern number "x"

Ranges are inclusive.

Pattern Modifiers

g	Global match
i *	Case-insensitive
m *	Multiple lines
s *	Treat string as single line
x *	Allow comments and whitespace in pattern
e *	Evaluate replacement
U *	Ungreedy pattern

* PCRE modifier

String Replacement

Additional reading: Why is “class” useful?

Please read most upvoted answer by "dantiston":
`https://stackoverflow.com/questions/33072570/when-should-i-be-using-classes-in-python`

Homework

1. Task 1
2. Task 2
3. Task 3
4. Task 4
5. Task 5
6. Task 6

- Submit your result as a Github repository
- Deadline: 15 January, 2022

Note: Create a github repo from the start and populate it with your results step by step.

Task 1: Function arguments

Jupyter notebook дээр зөвхөн args, зөвхөн args=value, зөвхөн *args, зөвхөн **kwargs аргументуудтай (4 тусдаа функц) болон эдгээрийн холимог (2 функц) байгуулж, ажиллуулж үзүүл. Нийт 6 функц.

Task 2: Class

Create a bank deposit class which you can

- withdraw money
- deposit
- check the balance

Show on Jupyter notebook how it works

Examples:

- https://www.engineeringbigdata.com/python-atm-code-for-account-balance-withdraw-and-deposit-functions/
- https://www.geeksforgeeks.org/python-program-to-create-bankaccount-class-with-deposit-withdraw-function/
- https://www.vtupulse.com/python-programs/python-program-using-classes-and-objects-to-deposit-and-withdraw-money-in-a-bank-account/
- Tkinter GUI - https://www.youtube.com/watch?v=SF-enJWjekY&list=PLtMugc7g4GapTtbhzODIjw7FJK-xJEBEE&index=16

Task 3: Exception

1. Generate array of 1000 random integers in numpy and create an array with only the negative even numbers.
2. Loop one by one through this array . . .
3. . . . when negative odd, then raise "odd error" and continue to next loop,
4. . . . when even but positive, raise "sign error" and continue to next loop . . .
5. . . . when "negative even", then append your list.

Task 4: Debugging

- Debugging гэж юу вэ?
- Breakpoint – ийн ямар 3 төрөл (log message г.м) Vscode дээр байдаг вэ?
- Debug-ийн step into, step over, stop out – ийн ялгааг тайлбарла

Task 5: Regex

Өөрөө зохиох эсвэл бэлэн текст интернетээс олж regex-ийн дараах үйлдлүүдийг ашиглан текстүүд гаргаж авах жишээнүүд үзүүл (нэг бүр дээр нь бус хамтад нь ашиглаж болно. Гэхдээ доорх бүх тэмдгээс ядаж 1 удаа ашиглаарай)

- [a-zA-Z0-9], [a-z],[A-Z],[0-9]
- \d, \D, \w, \W, \s
- ^, $, ?, *, +, .
- {m,n}, {,n}, {m,}, {n}
- Look behind, Look ahead, Negative look behind, Negative look ahead

Task 6: Module

- Өгсөн тоон list-ний нийлбэр, ялгавар, үржвэрийг олдог 3 тусдаа функц бүхий модуль файл үүсгэ.
- Дээрх модульд “main” гэдэг функц нэм. Уг функц нь “жишээ” list-ний хувьд дээрх 3 функцийг ажиллуулан үр дүн гарч буйг хэвлэн гаргаж харуулдаг байна.
- if __name__ == '__main__': дотор main() функцийг ажиллуулна (do something-ийн оронд байршин)
- python “yourModuleName”.py гэж terminal дээр уншуулахад гарах үр дүн юу вэ? (screenshot байхад болно)
- Өөр файл дотроос “import yourModuleName” гэж импортлоход өмнөх хэсгийн үр дүнгүүд хэвлэгдэж гарахгүй байгаа. Яагаад?

Check out on (answer of Fooz) "if __name__ == '__main__'":
https://stackoverflow.com/questions/419163/what-does-if-name-main-do

Thank you!