Advanced Programming

Federico Bruzzone

19 settembre 2022

Indice

1 Python

1.1 Python's whys & hows

1.1.1 What is Python

Python is a general-purpose high-level programming language

- it pushes code readability and productivity;
- it best fits the role of scripting language.

Python support multiple programming paradigms

- imperative (function, state, ...);
- object-oriented/based (objects, methods, inheritance, ...);
- functional (lambda abstractions, generators, dynamic typing, ...).

Python is

- interpreted, dynamic typed and object-based;
- open-source.

1.1.2 How to use Python

We are condidering Python 3+

- version > 3 is incompatible with previus version;
- version 2.7 is the current version.

A python program can be:

- edited in the python shell and executed step-by-step by the shell;
- edited and run through the iterpreter.

1.2 Overview of the Basic Concepts

1.2.1 Our first Python program

```
1 SUFFIXES = {1000: ['KB', 'MB', 'GB', 'TB', 'PB', 'EB', 'ZB', 'YB'],
2             1024: ['KiB', 'MiB', 'GiB', 'TiB', 'PiB', 'EiB', 'ZiB', 'YiB']}
3 def approximate_size(size, a_kilobyte_is_1024_bytes=True):
4   ''' Convert a file size to human-readable form. '''
5   if size < 0:
6     raise ValueError('number must be non-negative')
7   multiple = 1024 if a_kilobyte_is_1024_bytes else 1000
8   for suffix in SUFFIX[multiple]:
9     size /= multiple
10    if size < multiple:
11      return '{0:.1f} {1}'.format(size, suffix)
12    raise ValueError('number too large')
13
14 if __name__ == '__main__':
15   print(approximate_size(1000000000000, False))
16   print(approximate_size(1000000000000))
```

Listing 1: humanize.py

1.2.2 Declaring function

Python has function

- no header files à la C/C++;
- no interface/implementation à la Java.

```
1 def approximate_size(size, a_kilobyte_is_1024_bytes=True):
```

1. **def**: function definition keyword;
2. **approximate_size**: function name;
3. **a_kilobyte_is_1024_bytes**: comma separate argument list;
4. =**True**: default value.

Python has function

- no return type, it always return a value (**None** as a default);
- no parameter types, the interpreter figures out the parameter type.

1.2.3 Calling Functions

```
1 if __name__ == '__main__':
2   print(approximate_size(1000000000000, False))
3   print(approximate_size(1000000000000))
```

2 in this call to **approximate_size()**, the **a_kilobyte_is_1024_bytes** parameter will be **False** since you explicitly pass it to the function;

3 in this row we call **approximate_size()** with only a value, the parameter **a_kilobyte_is_1024_bytes** will be **True** as defined in the function declaration.

Value can be passed by name as in :

```
1 def approximate_size(a_kilobyte_is_1024_bytes=True, size=1000000000000)
```

Parameters' order is not relevant

1.2.4 Writing readable code

Documentation Strings A python function can be documented by a documentation string (docstring for short).

"' Convert a file size to human-readable form. "'

Triple quotes delimit a single multi-string

- if it immediatly follows the function's declaration it is the doc-string associated to the function;
- docstrings can be retrieved at run-time (they are attributes).

Case-Sensitive All names in Python are case-sensitive

1.2.5 Everything is an object

Everything in Python is an object, functions included

- **import** can be used to load python programs in the system as modules;
- the dot-notation gives access to the the public functionality of the imported modules;
- the dot-notation can be used to access the attributes (e.g., the **__doc__**)
- **humanizeáapproximate_size.__doc__** gives access to the docstring of the **approximate_size()** function; the docstring is stored as an attribute.

1.2.6 Everything is an object (Cont'd)

In python is an object, better, is a first-calss object

- everything can be assigned to a variable or passed as an argument

---

```
1 h1 = humanize.approximate_size(9128)
2 h2 = humanize.approximate_size
```

- **h1** contains the string calculated by **approximate_size(9128**;
- **h2** contains the "function" object **approximate_size()**, the result is not calculated yet;
- to simplify the concept: **h2** can be considered as a new name of (alias to) **approximate_size**.

1.2.7 Indenting code

No explicit block delimiters

- the only delimiter is a column (':') and the code indentation;
- code blocks (e.g., functions, if statements, loops, ...) are defined by their indentation;
- white spaces and tabs are relevant: use them consistently;
- indentation is checked by the compiler.

1.2.8 Exceptions

Exceptions are Anomaly Situations

- C encourages the use of return codes which you check;
- Python encourages the use of exceptions which you handles.

Raising Exceptions

- the **raise** statement is used to rise an exception as in:

```
1 raise ValueError('number must be non-negative')
```

- syntax recalls function calls: **raise** statement followed by an exception name with an optional argument;
- exceptions are relized by classes.

No need to list the exceptions in the function declaration handling Exceptions

- an exception is handled by a **try** ... **except** block.

```
1 try:
2   from lxml import etree
3 except ImportError:
4   import xml.etree.ElementTree as etree
```

1.2.9 Running scripts

Look again, at the bottom of the *humanize.py* program :

```
1 if __name__ == '__main__':
2   print(approximate_size(1000000000000, False))
3   print(approximate_size(1000000000000))
```

Modules are Objects

- they have a built-in attribute **__name__**

The value of __name__ depends on how you call it

- if imported it contains the name of the file without path and extension.