

Python “Cheat Sheet”

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Abstract

This is my (NPR's) version of a ~Python “Cheat Sheet”, (including some parts for folks that want to migrate from IDL).

1 Real basics

1.1 iPython

\$ conda update ipython

1.2 Versions

\$ python3

```
Python 3.5.2 (v3.5.2:4def2a2901a5, Jun 26 2016, 10:47:25)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more
information.
>>> import numpy
>>> print (numpy.__version__)
1.11.1

>>> import astropy
>>> print (astropy.__version__)
1.2.1

>>> import sys
>>> print (sys.version)
3.5.2 (v3.5.2:4def2a2901a5, Jun 26 2016, 10:47:25)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)]
```

1.3 iPython from Fernando Perez

Try: tmpnb.org **VERY USEFUL**

<http://www.pythonforbeginners.com/basics/ipython-a-short-introduction>

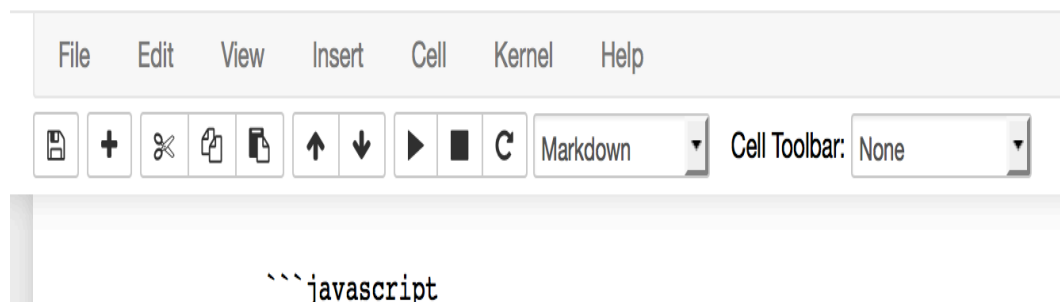


Figure 1: Clicking on the Cell Toolbar “Code”, “Markdown” etc. will power what happens in the Cells!!!

1.4 Notebook

Click on the NBviewer...

Then you can see the e.g. html of the notebook.

But to change/execute it, then all you have to do is click the download button...

Then put it on gitHub/Dropbox etc...

(I need to learn about “Tmux” and “SCreen” Terminal emulators...)

Run a code cell using **Shift-Enter** or

Alt-Enter runs the current cell and inserts a new one below. Ctrl-Enter run the current cell and enters command mode.

Google: “ipython beyond plain python”

<http://nbviewer.ipython.org/github/fperez/cit2013/blob/master/06-IPython%20beyond%20plain%20Python.ipynb>

iPython NB power = power of python + power of the command line with “!” + “%” and “%%” “magics”...

<http://nbviewer.ipython.org/github/ipython/ipython/blob/1.x/examples/notebooks/Part%204%20Markdown%20Cells.ipynb>

<https://github.com/profjsb/python-bootcamp>

2 Data Types

```
>>> n = 123
>>> f = 123.
>>> L = [1,2,3]
>>> a = (1,2,3)
>>> s = '1,2,3'
```

```
>>> type(n)
<class 'int'>
>>> type(f)
<class 'float'>
>>> type(L)
<class 'list'>
>>> type(a)
<class 'tuple'>
>>> type(s)
<class 'str'>
```

3 Britton's Classes :-)

3.1 "If lost in the desert..."

```
>>> dir(thing)
>>> dir(thing)
```

3.2 Lists

```
>>> super_list = [0, [3,4,5], "Hello World!", range(5)]
>>> print super_list
```

```
[0, [3, 4, 5], 'Hello World!', [0, 1, 2, 3, 4]]
```

```
>>> print super_list[1]
```

```
[3, 4, 5]
```

```
>>> print super_list[-1]
```

```
[0, 1, 2, 3, 4]
```

```
>>> print super_list[1][0]
```

```
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
```

```
TypeError: 'int' object is not subscriptable
```

```
>>> print super_list[1][0]
```

```
3
```

```
>>> c = range(10)
```

```
>>> print c
```

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
```

```
>>> c.append(range(3))
```

```
>>> print c
```

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, [0, 1, 2]]
```

```
>>> c.extend(range(3))
```

```
>>> print c
```

```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, [0, 1, 2], 0, 1, 2]
```

```
>>> del c[4]
```

```
>>> print c
```

```
[0, 1, 2, 3, 5, 6, 7, 8, 9, [0, 1, 2], 0, 1, 2]
```

```
>>> z = [42]*5
```

```
>>> [42, 42, 42, 42, 42]
```

```
>>> print super_list
```

```
[0, [3, 4, 5], 'Hello World!', [0, 1, 2, 3, 4]]
```

```
>>> print len(super_list)
```

```
4
```

```
>>> print len(super_list[-1])
```

```
5
```

4 Key packages

matplotlib
numpy
pyds9
pyFITS
yt

5 Class vs. an Instance

Difference between a class and an instance is an Object Oriented (OO) concept.

Python and Ruby both recommend **UpperCamelCase** for class names, **CAPITALIZED_WITH_UNDERSCORES** for constants, and **lowercase_separated_by_underscores** for other names.

And **snake_case** for variable names, function names, and method names.

Generally speaking, instance variables are for data unique to each instance and class variables are for attributes and methods shared by all instances of the class:

Definitions: from http://www.tutorialspoint.com/python/python_classes_objects.htm

- **Class:** A user-defined prototype for an object that defines a set of attributes that characterize any object of the class. The attributes are data members (class variables and instance variables) and methods, accessed via dot notation.
- **Instance variable:** A variable that is defined inside a method and belongs only to the current instance of a class.
- **Inheritance:** The transfer of the characteristics of a class to other classes that are derived from it.

6 IDL to Python

Key links:

IDL to Numeric/numarray Mapping

NumPy for IDL users

<http://mathesaurus.sourceforge.net/idl-numpy.html>

<http://mathesaurus.sourceforge.net/idl-python-xref.pdf>

IDL code	Python code
.run 'foo.pro'	exec(open("../findSecondLargestNo.py").read())
data=READFITS('file',header)	data=pyfits.open('file')
tdata = mrdfits('SpIESch1ch2.fits',0, hdr)	tdata = data[0].data
tbdata = mrdfits('SpIESch1ch2.fits',1, hdr)	tdata = data[1].data
help, tbdata, /str	info(tbdata)
print, size(tbdata)	shape(tbdata)
print, tbdata[0].flux_aper_1	print tbdata.FLUX_APER_1[0]
help, tbdata.flux_aper_1	tbdata.FLUX_APER_1?
fluxaper = tbdata.flux_aper_1[2]	fluxaper = ???
(<i>using fitsio</i>)	d = fitsio.read('SpIESch1ch2.fits',1)

Table 1: IDL to Python

7 INPUT

Just some general ways to get variables read-in and different 'tricks' to Python3 input.

```

>>> s = eval(input())
>>> s = input().split()
asdf asdfasdf ddddf aa
>>> s
['asdf', 'asdfasdf', 'ddddf', 'aa']

>>> x, y, z, n = int(eval(input())), int(eval(input())),
                int(eval(input())), int(eval(input()))
>>> x, y, z, n = (int(eval(input())) for _ in range(4))

```

8 OUTPUT

For the “write” statement, I think you have to put everything into a string format, otherwise it just barfs...

```
outfile = open('WISE_spectra_triples_4wget_temp.dat', 'w') \\
for i in range(len(ra)):
    print i, ra[i]
    plate_out = str(plate[i])
    mjd_out = str(mjd[i])
    fiberid_out = str(fiberid[i])

    outfile.write(plate_out+"/spec-"+plate_out+"-"+mjd_out+"-"+fiberid_out.zfill(4)+".fits
\\n")
```

9 IDL Where...

10 v2 vs. v3

<https://docs.python.org/3/howto/pyporting.html>

10.1 print

`print a` vs. `print (a)` Thus, just use `()` all the time!!

10.2 Division

`/` = truncating (integer floor) division in P2.x when using ints; float division in P3.x
`//` = truncating div in P2.x, P3.x

11 Linear Algebra

<http://docs.scipy.org/doc/scipy/reference/tutorial/linalg.html>

```
import numpy as np
from scipy import linalg
A = np.array([[1,2],[3,4]])
linalg.inv(A)
A.dot(linalg.inv(A)) #double check
```

<https://twitter.com/SciPyTip/status/756510468160774144> You can solve a linear system $\mathbf{Ax} = \mathbf{b}$ with `linalg.solve(A, b)`.

12 Gotchas

“follow up: PYTHONPATH is a hazardous environment variable, and should never include one Python’s site-packages”

See 429 in history_20150113.txt and onwards... :-)

13 A few General Notes

13.1 What's the difference between `raw_input()` and `input()`?

The difference is that `raw_input()` does not exist in Python 3.x, while `input()` does. Actually, the old `raw_input()` has been renamed to `input()`, and the old `input()` is gone (but can easily be simulated by using `eval(input())`). Reference: <http://stackoverflow.com/questions/4915361/whats-the-difference-between-raw-input-and-input-in-python3-x>.

13.2 Loops

```
n = eval(input())
for _ in range(n):
    <indented code here>
```

13.3 List Comprehensions

```
>>> ListOfNumbers = [ x for x in range(10) ] # List of integers
      from 0 to 9
>>> ListOfNumbers

>>> ListOfThreeMultiples = [x for x in range(100) if x % 3 == 0]
      # Multiples of 3 below 10
>>> ListOfThreeMultiples
[0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48,
 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90, 93,
 96, 99]
>>>
```

13.4 String Manipulation

```
s = 'ababababababababab'
>>> print(*s)
a g a f g a s d g a s d f a s d f a s d f a s d f
>>> type(s[1::2])
<class 'str'>
>>> s[::2]
'aaaaaaaaaa'
>>> s[1::2]
'bbbbbbbbbb'
>>>
```

14 A few general notes and commands

14.1 join()

Description: The method `join()` returns a string in which the string elements of sequence have been joined by str separator.

Syntax: Following is the syntax for `join()` method: `str.join(sequence)`.

Parameters: sequence – This is a sequence of the elements to be joined.

Example:

```
s = "-";
seq = ("a", "b", "c"); # This is sequence of strings.
print s.join( seq )
a-b-c
```

14.2 eval()

The eval function lets a python program run python code within itself.

```
x = 1
eval('x + 1')
2
eval('x')
1
```

```
l
[5, 5]
cmd
'insert(0,5)'
eval("l."+cmd)
print l
[5, 5, 5]
```

14.3 map()

`map(function, iterable, ...)`

Return an iterator that applies function to every item of iterable, yielding the results.

```
>>> def cube(x): return x*x*x
...
>>> map(cube,range(1,11))
<map object at 0x101c182e8>
>>> list(map(cube,range(1,11)))
[1, 8, 27, 64, 125, 216, 343, 512, 729, 1000]
>>>
```

The `list()` is needed in Python 3.x.

```
def f(x): return x % 2 != 0 and x % 3 != 0
...
>>> filter(f,range(2,25))
<filter object at 0x101c18390>
>>> list(filter(f,range(2,25)))
[5, 7, 11, 13, 17, 19, 23]
>>>
```

14.4 `strip()`

```
>>> str = "0000000this is string example...wow!!!0000000";
>>> print (str.strip( '0' ))
this is string example...wow!!!
```

14.5 `exec()`

Run whole programs from the python3 command prompt (see also 1

```
>>> exec(open("./findSecondLargestNo.py").read())
```

15 Statistics

```
>>> import statistics as s
>>> s.mean([1, 2, 3, 4, 4])
2.8
```

General Wee Tips

Need points that are evenly spaced on a log scale? Use `np.logscale(start, stop, base)`

By convention, matplotlib is imported as `mpl`. Also by convention, `matplotlib.pyplot` is imported as `plt`.

Useful Resources

Borrows, begs and steals from:

IDL to Python

<http://www.astro.umd.edu/~simmbk/idl-numpy.html>
http://www.johnny-lin.com/cdat_tips/tips_array/idl2num.html
<http://www.astrobetter.com/idl-vs-python/>
<http://www.astrobetter.com/wiki/tiki-index.php?page=Python+Switchers+Guide>
<http://mathesaurus.sourceforge.net/>
<http://mathesaurus.sourceforge.net/idl-numpy.html>
<http://www.scicoder.org/mapping-idl-to-python/>
<http://mathesaurus.sourceforge.net/idl-python-xref.pdf>

Teaching yourself Python

<http://www.tutorialspoint.com/python/>
http://www.tutorialspoint.com/python/python_classes_objects.htm
<http://codingbat.com/python>
<https://wiki.python.org/moin/ProblemSets>
<https://www.hackerrank.com/>
<http://docs.python.org/3.5/tutorial/>

<http://www.thelearningpoint.net/computer-science/learning-python-programming-and-data-structures/learning-python-programming-and-data-structures-tutorial-15-generators-and-list-comprehensions>

<https://jeffknupp.com/blog/2014/06/18/improve-your-python-python-classes-and-object-oriented-programming/>
<http://learnpythonthehardway.org/>
<http://learnpythonthehardway.org/book/ex40.html>

Also, http://www.cv.nrao.edu/~aleroy/pytut/topic2/intro_fits_files.py