Useful_libraries

June 1, 2016

```
In [1]: # Just to know last time this was run:
        import time
        print time.ctime()

Wed Jun  1 17:07:36 2016
```

```
In [2]: import numpy as np
```

1 F Some useful libraries that make life easier

This is part of the Python lecture given by Christophe Morisset at IA-UNAM. More informations at: http://python-astro.blogspot.mx/

This lecture will give some insights to the most useful python libraries. It is NOT exhaustive, you have to read the corresponding manual pages to find the best use you can have of them. The list of all python-included libraries is here: https://docs.python.org/2/library/

1.0.1 time, datetime and timeit

- https://docs.python.org/2/library/time.html
- https://docs.python.org/2/library/datetime.html

```
In [3]: import time
        import datetime
```

```
In [4]: print time.ctime() # current time, in a string format

Wed Jun  1 17:07:39 2016
```

```
In [5]: lt = time.localtime()
        print lt

time.struct_time(tm_year=2016, tm_mon=6, tm_mday=1, tm_hour=17, tm_min=7, tm_sec=39
```

```
In [6]: time.strftime("%a, %d %b %Y %H:%M:%S",lt)

Out[6]: 'Wed, 01 Jun 2016 17:07:39'
```

```
In [7]: print datetime.datetime.today()

2016-06-01 17:07:43.853257


In [8]: today = datetime.date.today()
        philae_landing = datetime.date(2014, 11, 11)

In [9]: time_to_landing = philae_landing - today

In [10]: if philae_landing > today:
             print('Philae landing in {} days.'.format(time_to_landing.days))
         else:
             print('Philae landed since {} days.'.format(-time_to_landing.days))

Philae landed since 568 days.


In [11]: start = time.time()
         for i in np.arange(1000):
             t = np.math.factorial(i)
         end = time.time()
         print('1000 factorials done in {0:.3f} secs.'.format(end-start))

1000 factorials done in 0.096 secs.


In [12]: from timeit import Timer
         command = """\
         for i in np.arange(1000):
             t = np.math.factorial(i)
         """
         t = Timer(command, setup='import numpy as np')
         print t.timeit(number=1)

0.096764087677
```

in ipython, one can use the magic timeit function:

```
In [13]: %timeit np.math.factorial(50)

100000 loops, best of 3: 2.55 µs per loop
```

or for the whole cell:

```
In [14]: %%timeit
         for i in np.arange(1000):
             t = np.math.factorial(i)

10 loops, best of 3: 95.9 ms per loop
```

1.0.2 os

https://docs.python.org/2/library/os.html This module provides a portable way of using operating system dependent functionality. If you just want to read or write a file see open(), if you want to manipulate paths, see the os.path module, and if you want to read all the lines in all the files on the command line see the fileinput module. For creating temporary files and directories see the tempfile module, and for high-level file and directory handling see the shutil module.

```python
In [15]: import os
```

```python
In [16]: # os.environ is a dictionnary containing the environment variables and val
         print os.environ['HOME']

/Users/christophemorisset
```

```python
In [17]: # if variable doesn't exists, getenv returns None
         print os.getenv('HOME2')

None
```

```python
In [18]: # get current working directory
         cwd = os.getcwd()
         print cwd

/Users/christophemorisset/Google Drive/Pro/Python-MySQL/Notebooks/Notebooks
```

```python
In [19]: new_dir = '/tmp/test3456'
         if not os.path.exists(new_dir):
             os.mkdir(new_dir)
             print('Dir {} created'.format(new_dir))
         else:
             print('Dir {} exists'.format(new_dir))

Dir /tmp/test3456 created
```

```python
In [20]: # list all the files from a directory
         os.listdir(new_dir)

Out[20]: []
```

```python
In [21]: os.chdir(cwd)
         os.getcwd()

Out[21]: '/Users/christophemorisset/Google Drive/Pro/Python-MySQL/Notebooks/Noteboo
```

3

```
In [22]: # Renaming files in a directory
         cwd = os.getcwd()
         os.chdir(new_dir)
         for filename in os.listdir('./'):
             print filename
             base_file, ext = os.path.splitext(filename)
             #print base_file, ext
             if ext == '.exe':
                 newname = base_file + '.txt'
                 os.rename(filename, newname)
                 print('file {0} renamed to {1}'.format(filename, newname))
         os.chdir(cwd)
```

1.0.3 sys

https://docs.python.org/2/library/sys.html This module provides access to some variables used or maintained by the interpreter and to functions that interact strongly with the interpreter. It is always available.

The sys.argv list contains the arguments passed to the script, when the interpreter was started. The first item contains the name of the script itself.

```
In [23]: %%writefile sys_text.py
         import sys
         for arg in sys.argv:
             print arg

Overwriting sys_text.py


In [24]: ! python sys_text.py tralala

sys_text.py
tralala


In [25]: %%writefile fact.py
         import sys
         import numpy
         print numpy.math.factorial(int(sys.argv[1]))

Overwriting fact.py


In [26]: ! python fact.py 6

720
```

A more complete managment of the argument (especially those like –v) is available using the argparse library. https://docs.python.org/2/library/argparse.html

1.0.4 Talking to the OS subprocess

The os.popen method is deprecated, subprocess is prefered. A good tutorial is here: http://pymotw.com/2/subprocess/

```
In [27]: import subprocess

In [28]: ls -l

total 67920
-rw-------  1 christophemorisset  staff    89353 Oct 26  2015 0040000_6.00_33_50_02
-rw-------  1 christophemorisset  staff    89971 May 31 15:31 0090000_6.00_33_50_02
-rw-------  1 christophemorisset  staff    90544 Oct 26  2015 0100000_6.00_33_50_02
-rw-------  1 christophemorisset  staff    89170 Oct 26  2015 0140000_6.00_33_50_02
-rw-------  1 christophemorisset  staff    88591 Oct 26  2015 0190000_6.00_33_50_02
-rw-------  1 christophemorisset  staff   466800 Sep 18  2015 BPT1.pdf
-rw-------  1 christophemorisset  staff    45181 Sep 18  2015 BPT1.png
-rw-------  1 christophemorisset  staff  4229587 Sep  9  2015 CALIFA_ah7.dat.gz
-rw-------  1 christophemorisset  staff    21143 Oct 26  2015 Calling Fortran.ipynb
-rw-------  1 christophemorisset  staff   111397 Nov 25  2015 Calling Fortran.pdf
-rw-------  1 christophemorisset  staff      384 Jun  1 16:57 Demo.pickle
-rw-------  1 christophemorisset  staff      211 Jun  1 16:57 Demo.pklz
-rw-------  1 christophemorisset  staff  2222331 Jun  1 16:57 Demo2.pickle
-rw-------  1 christophemorisset  staff     7717 Sep  9  2015 Ex1.ipynb
-rw-------  1 christophemorisset  staff   381664 Sep 22  2015 Ex1_done.ipynb
-rw-------  1 christophemorisset  staff   315341 Sep 14  2015 Ex1_with_res.ipynb
-rw-------@ 1 christophemorisset  staff   352680 Oct 16  2015 Fig1.eps
-rw-------  1 christophemorisset  staff   116888 Jun  1 17:02 Fig1.pdf
-rw-r--r--@ 1 christophemorisset  staff        0 May 31 15:55 Icon?
-rw-------  1 christophemorisset  staff   171041 Jun  1 16:59 Interact with files.i
-rw-r--r--@ 1 christophemorisset  staff   199526 Jun  1 16:59 Interact with files.p
-rw-------  1 christophemorisset  staff   131497 Aug 12  2015 Intro_1.odp
-rw-------  1 christophemorisset  staff   174202 Aug 12  2015 Intro_1.pdf
-rw-------  1 christophemorisset  staff   130234 Aug 12  2015 Intro_2014.odp
-rw-r--r--  1 christophemorisset  staff  2210409 Oct 23  2015 MySQL.pdf
-rw-------  1 christophemorisset  staff  1270918 Sep 21  2015 MySQL.pdf.gz
-rw-------  1 christophemorisset  staff   746328 Sep 28  2015 OOP.ipynb
-rw-------  1 christophemorisset  staff   620880 Nov 25  2015 OOP.pdf
-rw-------  1 christophemorisset  staff   687289 Oct 26  2015 Optimization.ipynb
-rw-------  1 christophemorisset  staff   454804 Nov 25  2015 Optimization.pdf
-rw-------  1 christophemorisset  staff    48953 Sep 22  2015 Useful_libraries.ipyn
-rw-------  1 christophemorisset  staff   129753 Nov 25  2015 Useful_libraries.pdf
-rw-------  1 christophemorisset  staff   535011 May 31 17:42 Using_PyMySQL.ipynb
-rw-------  1 christophemorisset  staff   366991 Nov 25  2015 Using_PyMySQL.pdf
-rw-------  1 christophemorisset  staff   208832 Sep 25  2014 Using_astropy.ipynb
-rw-------  1 christophemorisset  staff       64 Jun  1 16:56 data1.dat
-rw-------  1 christophemorisset  staff       14 Jun  1 16:57 data10.dat
-rw-------  1 christophemorisset  staff       32 Jun  1 16:57 data11.dat
-rw-------  1 christophemorisset  staff       88 Jun  1 16:57 data12.dat
```

```
-rw-------   1 christophemorisset   staff        148 Jun   1 16:57 data2.dat
-rw-------   1 christophemorisset   staff        166 Jun   1 16:57 data3.dat
-rw-------   1 christophemorisset   staff       1189 Jun   1 16:57 data4.dat
-rw-------   1 christophemorisset   staff       1185 Jun   1 16:57 data5.dat
-rw-------   1 christophemorisset   staff        136 Sep 14  2015 data_ex1.dat
-rw-------   1 christophemorisset   staff        298 Oct 26  2015 dcumsum.f
-rw-------   1 christophemorisset   staff       1401 Jun   1 16:45 ex1.html
-rw-------   1 christophemorisset   staff        154 Jun   1 16:45 ex1.py
-rw-------   1 christophemorisset   staff        284 Jun   1 16:45 ex1.pyc
-rw-------   1 christophemorisset   staff          8 Sep 18  2014 ex1.txt
-rw-------   1 christophemorisset   staff         68 Jun   1 17:07 fact.py
-rw-r--r--   1 christophemorisset   staff       4214 May 31 22:52 grep.py
-rw-------   1 christophemorisset   staff       4995 Nov 10  2015 grep2.py
-rw-------   1 christophemorisset   staff       6319 Nov 10  2015 grep3.py
-rw-------   1 christophemorisset   staff         49 Oct   8  2014 hello.py
-rw-------   1 christophemorisset   staff       1090 Oct   8  2014 hellofortran.c
-rw-------   1 christophemorisset   staff        178 Oct   8  2014 hellofortran.f
-rw-------   1 christophemorisset   staff      33976 Oct   8  2014 hellofortran.so
-rw-r--r--   1 christophemorisset   staff        150 Feb   3 23:59 index.html
-rw-------   1 christophemorisset   staff    2184772 Jun   1 17:02 intro_Matplotlib.ipyn
-rw-r--r--@  1 christophemorisset   staff    1497041 Jun   1 17:02 intro_Matplotlib.pdf
-rw-------   1 christophemorisset   staff     326924 Aug 28  2014 intro_Python.html
-rw-r--r--   1 christophemorisset   staff      76760 Jun   1 16:46 intro_Python.ipynb
-rw-r--r--@  1 christophemorisset   staff     118317 Jun   1 16:46 intro_Python.pdf
-rw-------   1 christophemorisset   staff     179449 Aug 28  2014 intro_Python_2.pdf
-rw-------   1 christophemorisset   staff     103229 Aug 28  2014 intro_Python_3.pdf
-rw-------   1 christophemorisset   staff     747717 Jun   1 17:07 intro_Scipy.ipynb
-rw-r--r--@  1 christophemorisset   staff     586109 Jun   1 17:07 intro_Scipy.pdf
-rw-------   1 christophemorisset   staff      92829 Jun   1 16:54 intro_numpy.ipynb
-rw-------   1 christophemorisset   staff     140493 Nov 25  2015 intro_numpy.pdf
-rw-------   1 christophemorisset   staff    8830080 Sep   3  2014 n10017o.fits
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-rw-------   1 christophemorisset   staff         45 Jun   1 17:07 sys_text.py
-rw-------   1 christophemorisset   staff        352 Sep 25  2014 tab1.dat
-rw-------   1 christophemorisset   staff        763 Sep 25  2014 tab_cds1.ascii
-rw-------   1 christophemorisset   staff      43200 Sep 25  2014 tab_cds1.fits
-rw-------   1 christophemorisset   staff       1265 Sep 25  2014 tab_cds1.tex
-rw-------   1 christophemorisset   staff       1826 Sep 25  2014 tab_cds2.ascii
-rw-------   1 christophemorisset   staff       7033 Nov   2  2015 test1.pdf
-rw-------   1 christophemorisset   staff         72 Sep 27  2015 test1.test
-rw-------   1 christophemorisset   staff         45 Sep 27  2015 test2.test
-rw-------   1 christophemorisset   staff     176673 Oct 16  2014 test_1-po
-rw-------@  1 christophemorisset   staff     441740 Oct 26  2015 test_1-prof.png
-rw-------   1 christophemorisset   staff     264259 Oct 26  2015 test_1_prof.prof
-rw-------   1 christophemorisset   staff       6805 Oct 26  2015 test_1_prof.py
-rw-------   1 christophemorisset   staff       6833 Oct 26  2015 test_2_prof.py
```

```
-rw-------  1 christophemorisset  staff       515 Oct 26  2015 test_2_prof.py.lprof
-rw-------  1 christophemorisset  staff      6566 Oct 26  2015 test_3_prof.py
-rw-------  1 christophemorisset  staff      6524 Oct 26  2015 test_5_pdb.py
drwx------@ 5 christophemorisset  staff       170 May 31 15:55 tt/
```

In [29]: subprocess.call(['ls -l'], shell=True)
         # The results is not visible in Notebook. In command line, the files are l

Out[29]: 0

In [30]: output = subprocess.check_output(['ls', '-l'])
         print output
         print type(output)

```
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-rw-------   1 christophemorisset   staff      6524 Oct 26  2015 test_5_pdb.py
drwx------@ 5 christophemorisset   staff       170 May 31 15:55 tt
```

`<type 'str'>`

```
In [31]: command = 'ls -l'
         popen = subprocess.Popen(command, shell=True)
         # The same apply here, no output in Notebook
         print popen
```

`<subprocess.Popen object at 0x10c9161d0>`

```
In [32]: popen = subprocess.Popen(command, stdout=subprocess.PIPE, shell=True)
         res = popen.communicate()[0]
         print res
         print type(res)
```

```
total 67920
-rw-------   1 christophemorisset   staff     89353 Oct 26  2015 0040000_6.00_33_50_02
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```
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-rw-------  1 christophemorisset  staff   687289 Oct 26  2015 Optimization.ipynb
-rw-------  1 christophemorisset  staff   454804 Nov 25  2015 Optimization.pdf
-rw-------  1 christophemorisset  staff    48953 Sep 22  2015 Useful_libraries.ipyr
-rw-------  1 christophemorisset  staff   129753 Nov 25  2015 Useful_libraries.pdf
-rw-------  1 christophemorisset  staff   535011 May 31 17:42 Using_PyMySQL.ipynb
-rw-------  1 christophemorisset  staff   366991 Nov 25  2015 Using_PyMySQL.pdf
-rw-------  1 christophemorisset  staff   208832 Sep 25  2014 Using_astropy.ipynb
-rw-------  1 christophemorisset  staff       64 Jun  1 16:56 data1.dat
-rw-------  1 christophemorisset  staff       14 Jun  1 16:57 data10.dat
-rw-------  1 christophemorisset  staff       32 Jun  1 16:57 data11.dat
-rw-------  1 christophemorisset  staff       88 Jun  1 16:57 data12.dat
-rw-------  1 christophemorisset  staff      148 Jun  1 16:57 data2.dat
-rw-------  1 christophemorisset  staff      166 Jun  1 16:57 data3.dat
-rw-------  1 christophemorisset  staff     1189 Jun  1 16:57 data4.dat
-rw-------  1 christophemorisset  staff     1185 Jun  1 16:57 data5.dat
-rw-------  1 christophemorisset  staff      136 Sep 14  2015 data_ex1.dat
-rw-------  1 christophemorisset  staff      298 Oct 26  2015 dcumsum.f
-rw-------  1 christophemorisset  staff     1401 Jun  1 16:45 ex1.html
-rw-------  1 christophemorisset  staff      154 Jun  1 16:45 ex1.py
-rw-------  1 christophemorisset  staff      284 Jun  1 16:45 ex1.pyc
-rw-------  1 christophemorisset  staff        8 Sep 18  2014 ex1.txt
-rw-------  1 christophemorisset  staff       68 Jun  1 17:07 fact.py
-rw-r--r--  1 christophemorisset  staff     4214 May 31 22:52 grep.py
-rw-------  1 christophemorisset  staff     4995 Nov 10  2015 grep2.py
-rw-------  1 christophemorisset  staff     6319 Nov 10  2015 grep3.py
-rw-------  1 christophemorisset  staff       49 Oct  8  2014 hello.py
-rw-------  1 christophemorisset  staff     1090 Oct  8  2014 hellofortran.c
-rw-------  1 christophemorisset  staff      178 Oct  8  2014 hellofortran.f
-rw-------  1 christophemorisset  staff    33976 Oct  8  2014 hellofortran.so
-rw-r--r--  1 christophemorisset  staff      150 Feb  3 23:59 index.html
-rw-------  1 christophemorisset  staff  2184772 Jun  1 17:02 intro_Matplotlib.ipyr
-rw-r--r--@ 1 christophemorisset  staff  1497041 Jun  1 17:02 intro_Matplotlib.pdf
-rw-------  1 christophemorisset  staff   326924 Aug 28  2014 intro_Python.html
-rw-r--r--  1 christophemorisset  staff    76760 Jun  1 16:46 intro_Python.ipynb
-rw-r--r--@ 1 christophemorisset  staff   118317 Jun  1 16:46 intro_Python.pdf
-rw-------  1 christophemorisset  staff   179449 Aug 28  2014 intro_Python_2.pdf
-rw-------  1 christophemorisset  staff   103229 Aug 28  2014 intro_Python_3.pdf
-rw-------  1 christophemorisset  staff   747717 Jun  1 17:07 intro_Scipy.ipynb
-rw-r--r--@ 1 christophemorisset  staff   586109 Jun  1 17:07 intro_Scipy.pdf
-rw-------  1 christophemorisset  staff    92829 Jun  1 16:54 intro_numpy.ipynb
-rw-------  1 christophemorisset  staff   140493 Nov 25  2015 intro_numpy.pdf
```

```
-rw-------  1 christophemorisset  staff  8830080 Sep  3  2014 n10017o.fits
-rw-------  1 christophemorisset  staff     5760 Jun  1 16:58 new.fits
-rw-------  1 christophemorisset  staff   435801 Nov  9  2015 query_res.dat
-rw-------  1 christophemorisset  staff  1059840 Sep  3  2014 swp04345.mxhi
-rw-------  1 christophemorisset  staff       45 Jun  1 17:07 sys_text.py
-rw-------  1 christophemorisset  staff      352 Sep 25  2014 tab1.dat
-rw-------  1 christophemorisset  staff      763 Sep 25  2014 tab_cds1.ascii
-rw-------  1 christophemorisset  staff    43200 Sep 25  2014 tab_cds1.fits
-rw-------  1 christophemorisset  staff     1265 Sep 25  2014 tab_cds1.tex
-rw-------  1 christophemorisset  staff     1826 Sep 25  2014 tab_cds2.ascii
-rw-------  1 christophemorisset  staff     7033 Nov  2  2015 test1.pdf
-rw-------  1 christophemorisset  staff       72 Sep 27  2015 test1.test
-rw-------  1 christophemorisset  staff       45 Sep 27  2015 test2.test
-rw-------  1 christophemorisset  staff   176673 Oct 16  2014 test_1-po
-rw-------@ 1 christophemorisset  staff   441740 Oct 26  2015 test_1-prof.png
-rw-------  1 christophemorisset  staff   264259 Oct 26  2015 test_1_prof.prof
-rw-------  1 christophemorisset  staff     6805 Oct 26  2015 test_1_prof.py
-rw-------  1 christophemorisset  staff     6833 Oct 26  2015 test_2_prof.py
-rw-------  1 christophemorisset  staff      515 Oct 26  2015 test_2_prof.py.lprof
-rw-------  1 christophemorisset  staff     6566 Oct 26  2015 test_3_prof.py
-rw-------  1 christophemorisset  staff     6524 Oct 26  2015 test_5_pdb.py
drwx------@ 5 christophemorisset  staff      170 May 31 15:55 tt

<type 'str'>


In [33]: popen = subprocess.Popen(command, stdout=subprocess.PIPE, shell=True)
         for line in iter(popen.stdout.readline, ""):
             lspl = line.split()
             if len(lspl)> 4:
                 if int(lspl[4]) > 100000:
                     print lspl[8]

BPT1.pdf
CALIFA_ah7.dat.gz
Calling
Demo2.pickle
Ex1_done.ipynb
Ex1_with_res.ipynb
Fig1.eps
Fig1.pdf
Interact
Interact
Intro_1.odp
Intro_1.pdf
Intro_2014.odp
MySQL.pdf
MySQL.pdf.gz
```

```
OOP.ipynb
OOP.pdf
Optimization.ipynb
Optimization.pdf
Useful_libraries.pdf
Using_PyMySQL.ipynb
Using_PyMySQL.pdf
Using_astropy.ipynb
intro_Matplotlib.ipynb
intro_Matplotlib.pdf
intro_Python.html
intro_Python.pdf
intro_Python_2.pdf
intro_Python_3.pdf
intro_Scipy.ipynb
intro_Scipy.pdf
intro_numpy.pdf
n10017o.fits
query_res.dat
swp04345.mxhi
test_1-po
test_1-prof.png
test_1_prof.prof
```

1.0.5 glob

https://docs.python.org/2/library/glob.html

No tilde expansion is done, but *, ?, and character ranges expressed with [] will be correctly matched.

```
In [34]: import glob

In [35]: ipynb_files = glob.glob('*.ipynb')
         print ipynb_files

['Calling Fortran.ipynb', 'Ex1.ipynb', 'Ex1_done.ipynb', 'Ex1_with_res.ipynb', 'Int
```

1.0.6 re

The re module provides regular expression tools for advanced string processing. For complex matching and manipulation, regular expressions offer succinct, optimized solutions:

```
In [36]: import re
         re.findall(r'\bf[a-z]*', 'whifch foot or hand fell fastest')

Out[36]: ['foot', 'fell', 'fastest']

In [37]: re.sub(r'(\b[a-z]+) \1', r'\1', 'cat in the the hat')
```

```
Out[37]: 'cat in the hat'
```

More in https://docs.python.org/2/library/re.html

1.0.7 urllib2

```
In [38]: import urllib2

In [39]: for line in urllib2.urlopen('http://dev.on-rev.com/myip.irev'):
             if 'IP' in line:
                 IP = line.split(':')[1][:-5]
         print IP

187.207.153.114
```