Document title

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1 Chapter 1: Computing with Python

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Source code listings for Numerical Python - A Practical Techniques Approach for Industry (ISBN 978-1-484205-54-9).

The source code listings can be downloaded from http://www.apress.com/9781484205549

1.1 Interpreter

```
In [1]: %%writefile hello.py
        print("Hello from Python!")

Overwriting hello.py

In [2]: !python hello.py

Hello from Python!

In [3]: !python --version

Python 2.7.10 :: Continuum Analytics, Inc.
```

1.2 Input and output caching

```
In [1]: 3 * 3

Out[1]: 9

In [2]: In[1]

Out[2]: u'3 * 3'

In [3]: Out[1]

Out[3]: 9

In [4]: In

Out[4]: ['', u'3 * 3', u'In[1]', u'Out[1]', u'In']

In [5]: Out

Out[5]: {1: 9,
         2: u'3 * 3',
         3: 9,
         4: ['', u'3 * 3', u'In[1]', u'Out[1]', u'In', u'Out']}
```

```
In [6]: 1+2
Out[6]: 3
In [7]: 1+2;
In [8]: x = 1
In [9]: x = 2; x
Out[9]: 2
```

1.3   Documentation

```
In [10]: import os
In [11]: # try os.w<TAB>
In [12]: import math
In [13]: math.cos?
```

1.4   Interaction with System Shell

```
In [14]: !touch file1.py file2.py file3.py
In [15]: !ls file*
file1.py file2.py file3.py
In [16]: files = !ls file*
In [17]: len(files)
Out[17]: 3
In [18]: files
Out[18]: ['file1.py', 'file2.py', 'file3.py']
In [19]: file = "file1.py"
In [20]: !ls -l $file
-rw-r--r--  1 rob  staff  0 Aug 30 17:03 file1.py
```

1.5   Running scripts from the IPython console

```
In [21]: %%writefile fib.py

         def fib(N):
             """
             Return a list of the first N Fibonacci numbers.
             """
             f0, f1 = 0, 1
             f = [1] * N
             for n in range(1, N):
                 f[n] = f0 + f1
                 f0, f1 = f1, f[n]

             return f

         print(fib(10))
```

```
Overwriting fib.py
```

In [22]: `!python fib.py`

```
[1, 1, 2, 3, 5, 8, 13, 21, 34, 55]
```

In [23]: `%run fib.py`

```
[1, 1, 2, 3, 5, 8, 13, 21, 34, 55]
```

In [24]: `fib(6)`

Out[24]: `[1, 1, 2, 3, 5, 8]`

1.6 Debugger

In [25]: `fib(1.0)`

```
        ---------------------------------------------------------------------------

        TypeError                                 Traceback (most recent call last)

        <ipython-input-25-ccc1774a65b9> in <module>()
  ----> 1 fib(1.0)


        /Users/rob/Desktop/apress-numerical-python-review/code/fib.py in fib(N)
      5       """
      6       f0, f1 = 0, 1
  ----> 7       f = [1] * N
      8       for n in range(1, N):
      9           f[n] = f0 + f1


        TypeError: can't multiply sequence by non-int of type 'float'
```

In [26]: `%debug`

```
> /Users/rob/Desktop/apress-numerical-python-review/code/fib.py(7)fib()
      6       f0, f1 = 0, 1
----> 7       f = [1] * N
      8       for n in range(1, N):

ipdb> print(N)
1.0
ipdb> q
```

1.7 Timing and profiling code

In [27]: `%timeit fib(100)`

```
100000 loops, best of 3: 18.2 μs per loop
```

In [28]: `result = %time fib(100)`

3

```
CPU times: user 38 μs, sys: 22 μs, total: 60 μs
Wall time: 47 μs

In [29]: len(result)

Out[29]: 100

In [30]: import numpy as np

        def random_walker_max_distance(M, N):
            """
            Simulate N random walkers taking M steps, and return the largest distance
            from the starting point achieved by any of the random walkers.
            """
            trajectories = [np.random.randn(M).cumsum() for _ in range(N)]
            return np.max(np.abs(trajectories))

In [31]: %prun random_walker_max_distance(400, 10000)
```

1.8   IPython nbconvert

```
In [36]: !ls ch01-code-listing.ipynb

ch01-code-listing.ipynb

In [38]: !ipython nbconvert --to html ch01-code-listing.ipynb

[NbConvertApp] Converting notebook ch01-code-listing.ipynb to html
[NbConvertApp] Writing 228866 bytes to ch01-code-listing.html

In [40]: !ipython nbconvert --to pdf ch01-code-listing.ipynb

[NbConvertApp] Converting notebook ch01-code-listing.ipynb to pdf
[NbConvertApp] Writing 34370 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running pdflatex 3 times: [u'pdflatex', u'notebook.tex']
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 122056 bytes to ch01-code-listing.pdf

In [41]: %%writefile custom_template.tplx
         ((*- extends 'article.tplx' -*))

         ((* block title *)) \title{Document title} ((* endblock title *))
         ((* block author *)) \author{Author's Name} ((* endblock author *))

Writing custom_template.tplx

In [42]: !ipython nbconvert ch01-code-listing.ipynb --to pdf --template custom_template.tplx

[NbConvertApp] Converting notebook ch01-code-listing.ipynb to pdf
[NbConvertApp] Writing 34393 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running pdflatex 3 times: [u'pdflatex', u'notebook.tex']
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 122927 bytes to ch01-code-listing.pdf

In [43]: !ipython nbconvert ch01-code-listing.ipynb --to python

[NbConvertApp] Converting notebook ch01-code-listing.ipynb to python
[NbConvertApp] Writing 3228 bytes to ch01-code-listing.py
```

2 Versions

```
In [22]: %reload_ext version_information
         %version_information numpy
```

Out[22]:

Software	Version
Python	2.7.10 64bit [GCC 4.2.1 (Apple Inc. build 5577)]
IPython	3.2.1
OS	Darwin 14.1.0 x86_64 i386 64bit
numpy	1.9.2