
Welcome to Python Boot Camp!
2012!

Objectives

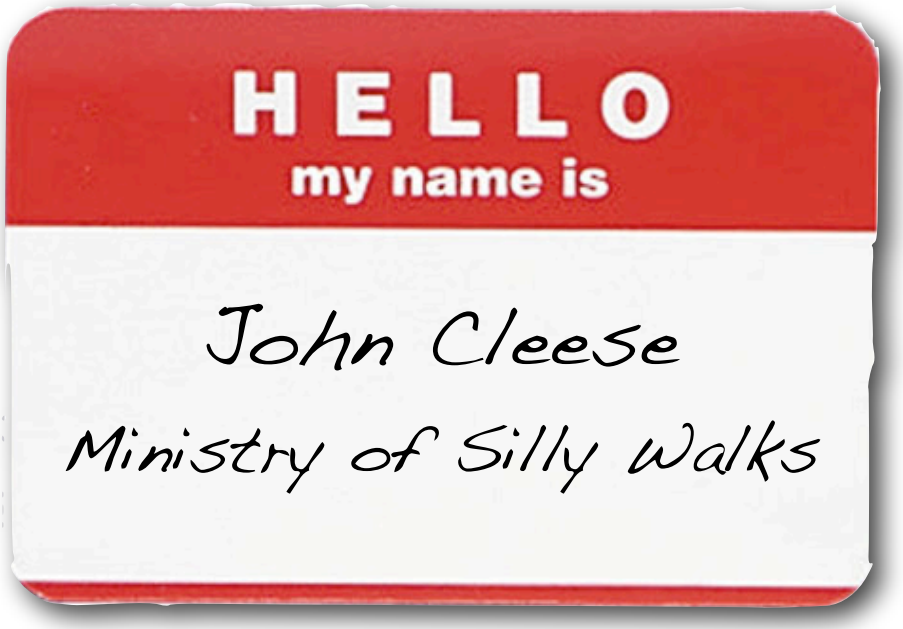
- Introduce you to the Python language
- Get you writing Python code. Build Python hacking muscle memory
- Convince you of its utility in your research life
- Instill good coding and curation practices
- We try not to proselytize, but sometimes it's too hard to resist

Organization

- 3 days of modules (1-1.5 hr) lectures + demos
  http://www.pythonbootcamp.info/lectures/
- Breakout coding sessions (supervised) after each module
- Lunch + Caffeine provided
- Homework (small code projects)
- Blood, sweat, tears → a more productive you

Connecting

In person



Wirelessly

UC Berkeley AirBears Wireless Network
Guest Account

Username
Password: [redacted]

Use of this account denotes acceptance of the terms and policies set forth in the following websites:

http://ist.berkeley.edu/airbears/fineprint - AirBears Notice
http://technology.berkeley.edu/policy/ - Campus IT Policy
https://security.berkeley.edu/MinStds/ - Minimum Standards for Networked Devices

Account valid: 08-23-2010 - 08-26-2010

Something you should know about us...

Introduction

- What is Python?
- Why Python?
- Getting Started...

What is Python?

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

http://www.python.org/doc/essays/blurb/

What is Python?

interpreted	no need for a compiling stage
object-oriented	programming paradigm that uses objects (complex data structures with methods)
high level	abstraction from the way machine interprets & executes
dynamic semantics	can change meaning on-the-fly
built in	core language (not external)
data structures	ways of storing/manipulating data
script/glue	programs that control other programs
typing	the sort of variable (int, string)
syntax	grammar which defines the language
library	reusable collection of code
binary	a file that you can run/execute

Development History

- started over the Christmas break 1989, by Guido van Rossum (now at Google)
- developed in the early 1990s
- name comes from **Monty Python's Flying Circus**
- Guido is the Benevolent Dictator for Life (BDFL), meaning that he continues to oversee Python's development.

Development History

- Open-sourced development from the start (BSD licensed now)
  http://www.opensource.org/licenses/bsd-license.php
- Relies on large community input (bugs, patches) and 3rd party add-on software
- Version 2.0 (2000), 2.6 (2008), 2.7 (2010). We're using **2.7.2** in this class
- Version 3.X (2008) is not backward compatible with 1.X & 2.X. But 2.7 code is easily migrated to 3.X

Why Python?

Some of the Alternatives

C, C++, FORTRAN

Pros: great performance, backbone of legacy scientific computing codes

Cons: syntax not optimized for causal programming, no interactive facilities, difficult visualization, text processing, etc.

Mathematics, Maple, Matlab, IDL

Pros: interactive, great visuals, extensive libraries

Cons: costly, proprietary, unpleasant for large-scale programs and non-mathematical tasks.

Perl: http://www.strombergers.com/python/

Why Python?

- Free (BSD license), highly portable (Linux, OSX, Windows, lots...)
- Interactive interpreter provided.
- Extremely readable syntax ("executable pseudo-code").
- Simple: non-professional programmers can use it effectively
  - great documentation
  - total abstraction of memory management
- Clean object-oriented model, but not mandatory.
- Rich built-in types: lists, sets, dictionaries (hash tables), strings, ...
- Very comprehensive standard library (batteries included)
- Standard libraries for IDL/Matlab-like arrays (NumPy)
- Easy to wrap existing C, C++ and FORTRAN codes.

Why Python?

Amazingly Scalable

Interactive experimentation
build small, self-contained scripts or million-lines projects.
From occasional/novice to full-time use (try that with C++).

The Kitchen Sink (in a good way)

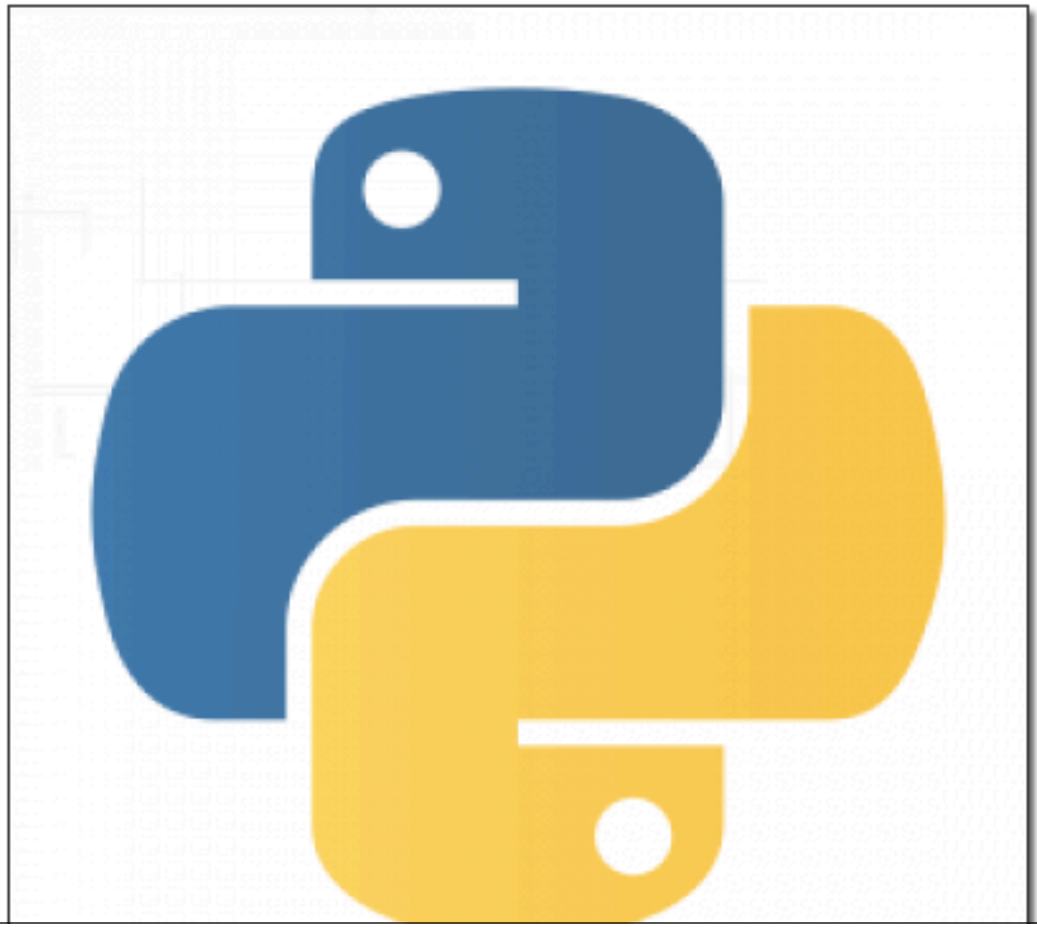
really can do anything you want, with impressive simplicity

Performance, if you need it

As an interpreted language, Python is slow.
But...if you need speed you can do the heavy lifting in C or FORTRAN
or you can use a Python compiler (e.g. Cython)

Readers' Choice Awards 2011

Dec 01, 2011 By Shawn Powers



Best Programming Language

Python

Runner-up: C++

A three-time winner in our best programming category, Python continues to dominate. Close on its heels this year, however, is C++. In fact, a scant 6% separated the two. It's quite obvious, however, that our readers don't suffer from ophidiophobia in the least —*hiss*.

My group uses it for....

Running a robotic telescope

- interfacing with legacy hardware device drivers
- talking over serial & parallel lines to telescope control hardware
- oversee functioning of all sub-systems (themselves written in Python)
- sending email and pager alerts when distressed
- writing real-time web pages (for data display, weather)
- moving image data over the network
- interacting with databases

http://pairitel.org

My group uses it for....

Data reduction & Analysis

- processing FITS images quickly
- wrapping around 3rd party software

A Handy & Quick Calculator

Prototyping new algorithms/ideas

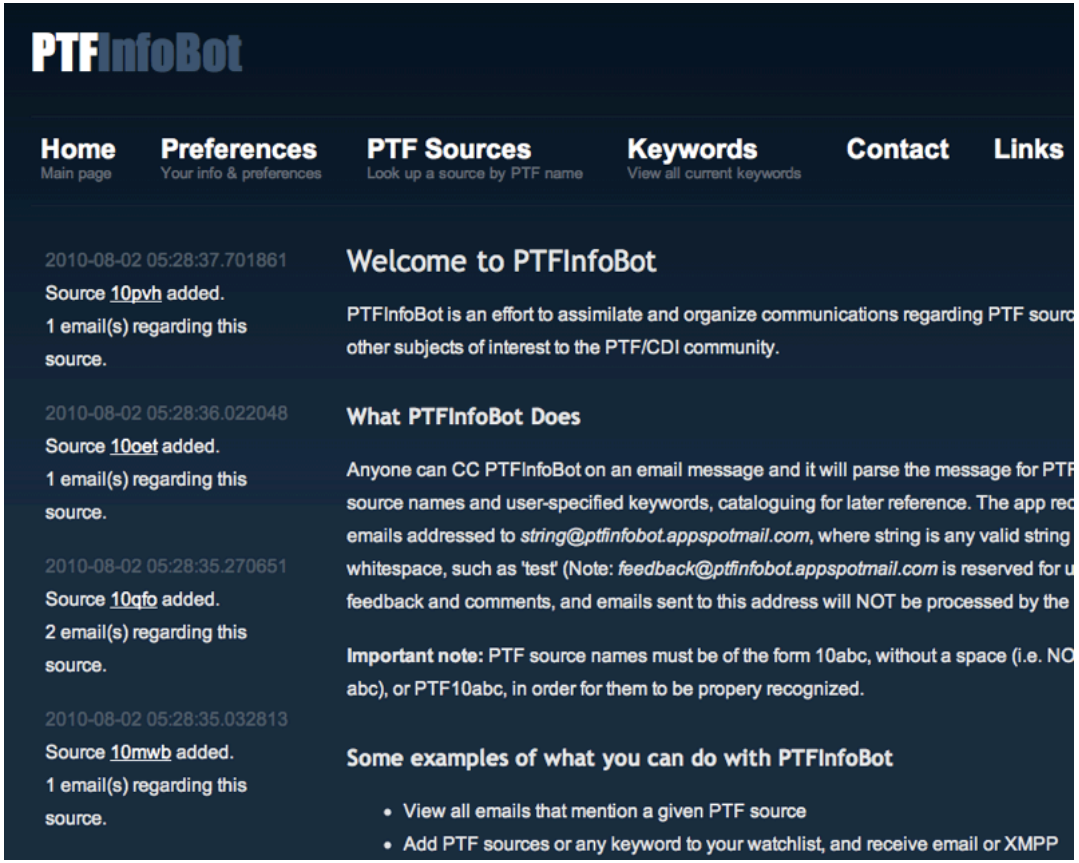
Making plots for papers

Making fast, parallel, and efficient webservices

http://dotastro.org

My group uses it for....

Writing Google-hosted (cloud-based) websites that we use for research (& collaboration)



Many Others Use it Too

Google

Honeywell

REALESTATEAGENT.com

resolver systems ltd

devis

YouTube
Broadcast Yourself

EVE ONLINE

USA
United Space Alliance

INDUSTRIAL LIGHT & MAGIC

AstraZeneca

Quora

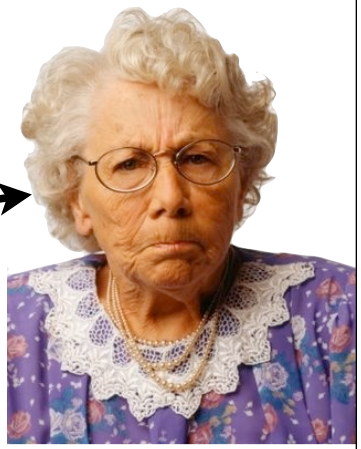
PollenationInternet

PHILIPS

NASA NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Verity

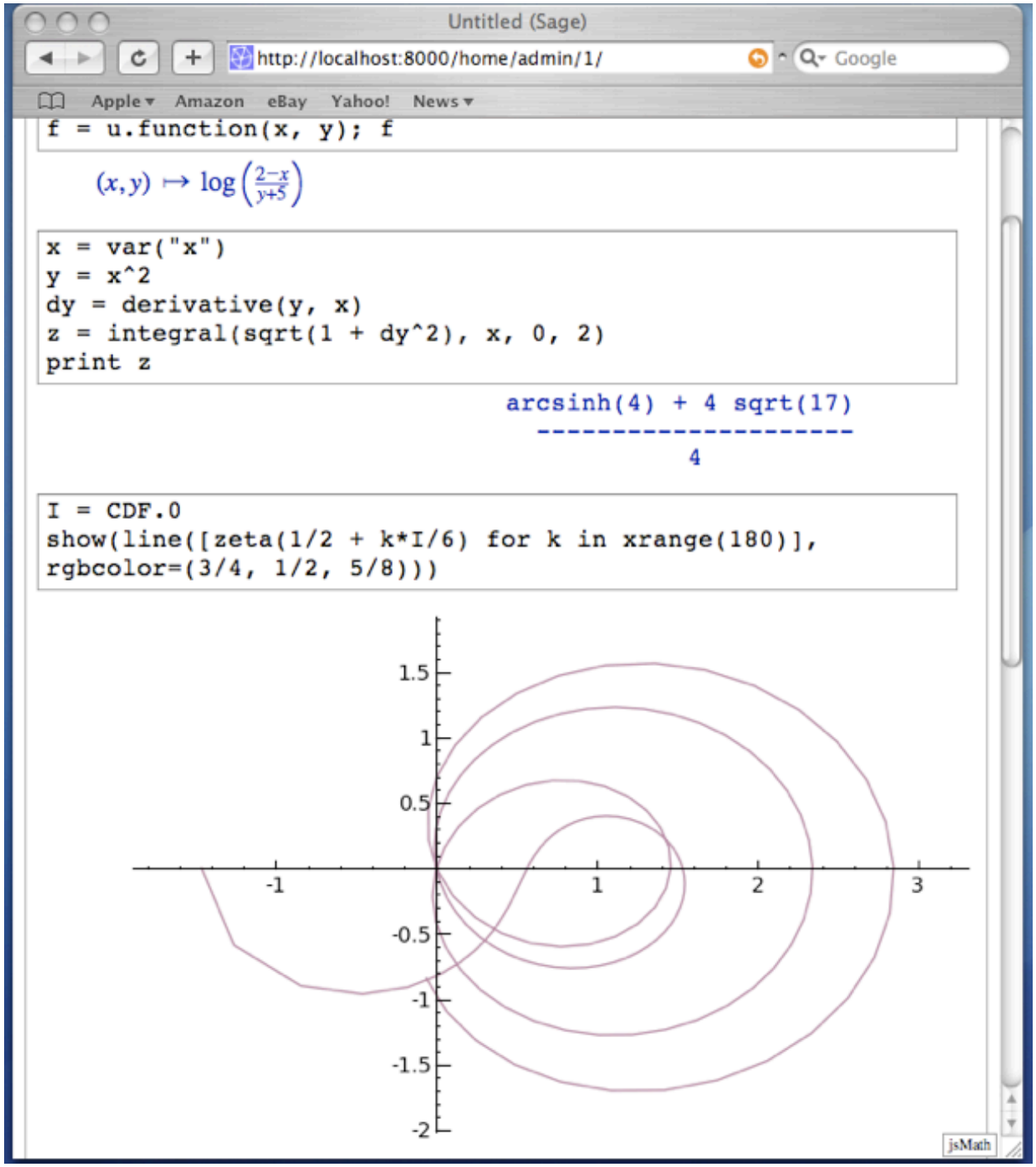
your grandmother



Dropbox

GravityZoo

Interactive Notebooks



Sage

127.0.0.1:8888/bdfa2fd0-5df7-4c66-a205-8c9aa2b1a109

IP[y]: Notebook

Untitled0 Save QuickHelp

Notebook

Actions: New Open Download ipynb Print

Cell

Actions: Delete

Format: Code Markdown

Output: Toggle ClearAll

Insert: Above Below

Move: Up Down

Run: Selected All

Autoindent:

Kernel

Actions: Interrupt Restart

Kill kernel upon exit:

Help

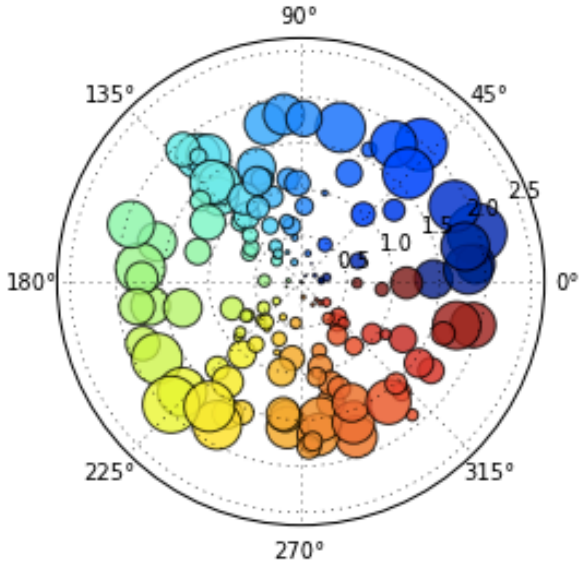
Links: Python IPython NumPy SciPy MPL SymPy

Shift-Enter : run selected cell

Ctrl-Enter : run selected cell in-place

Ctrl-m h : show keyboard shortcuts

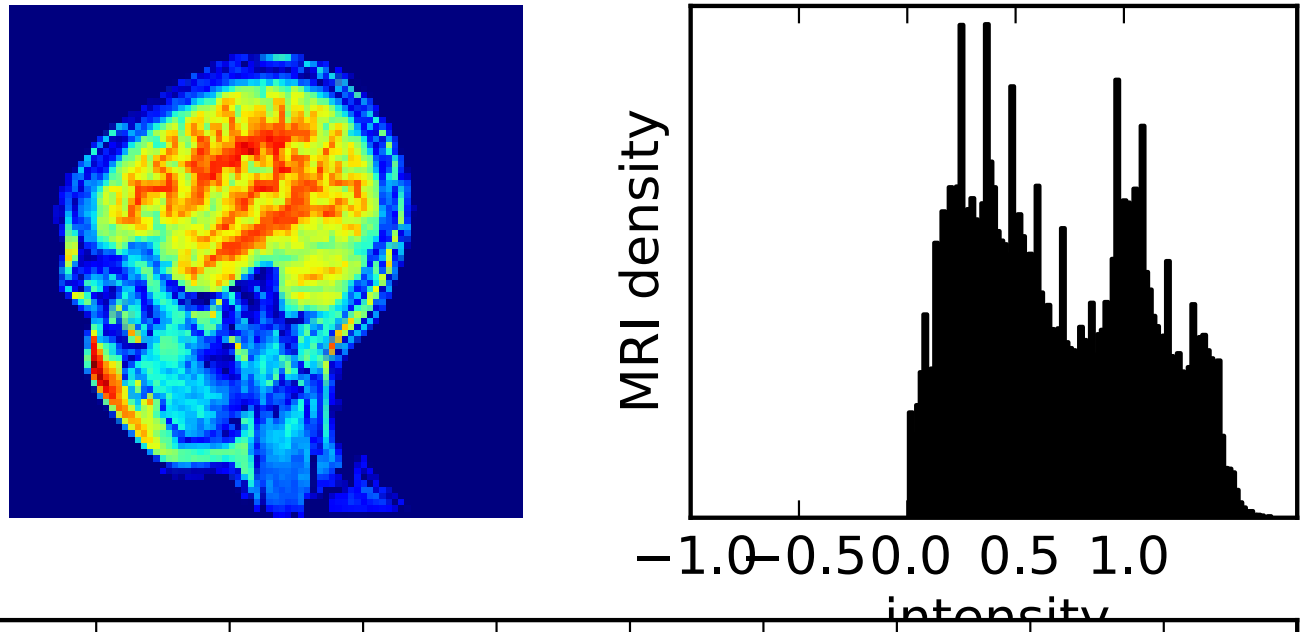
In [1]:
```
num_bootcampers=142
# note: rand not Ron
r = 2*rand(num_bootcampers)
theta = 2*pi*rand(num_bootcampers)
area = 200*r**2*rand(num_bootcampers)
colors = theta
ax = subplot(111, polar=True)
c = scatter(theta, r, c=colors, s=area)
c.set_alpha(0.75)
```



In [ ]:

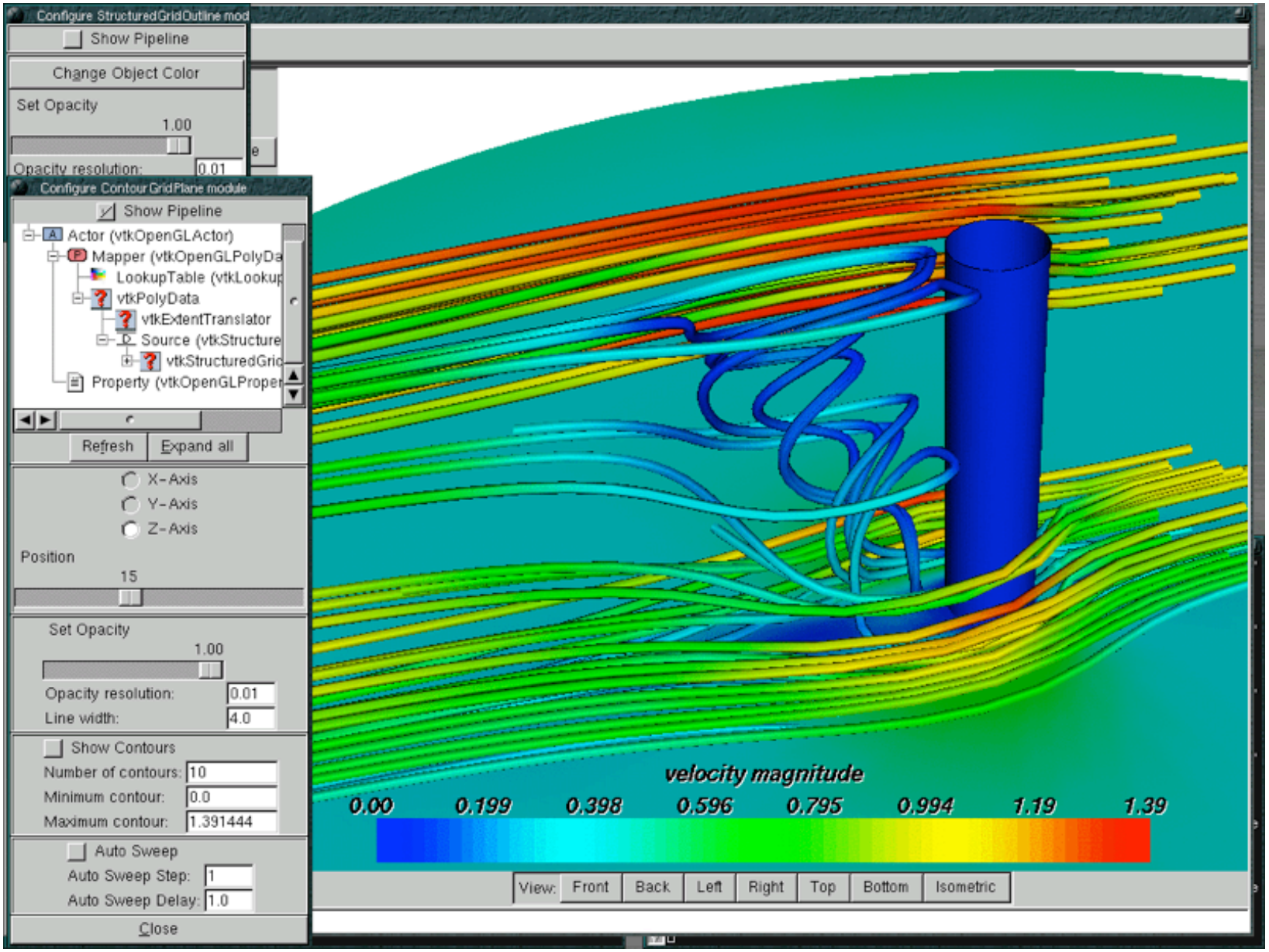
iPython notebook

Visualization



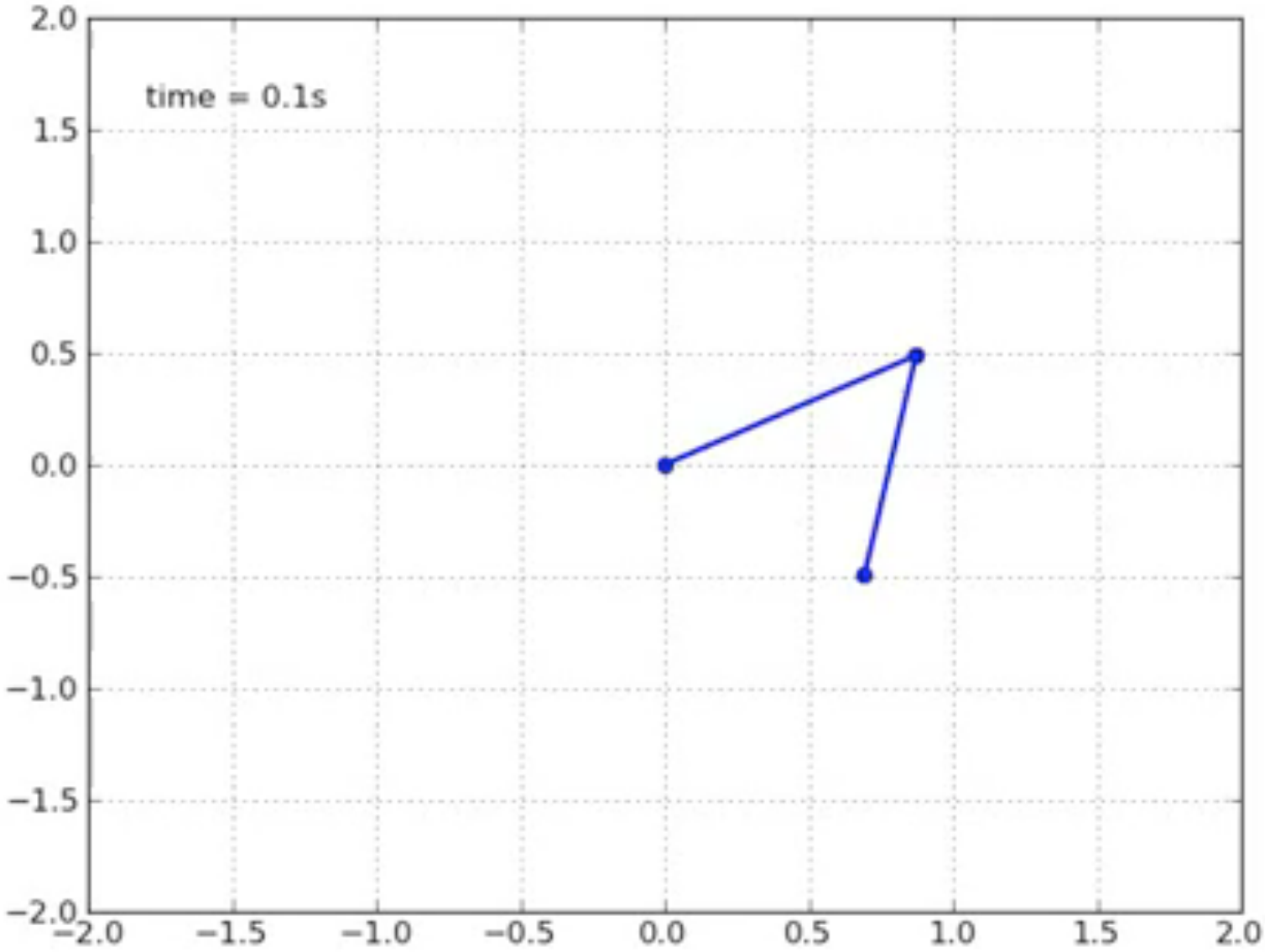
matplotlib

Visualization



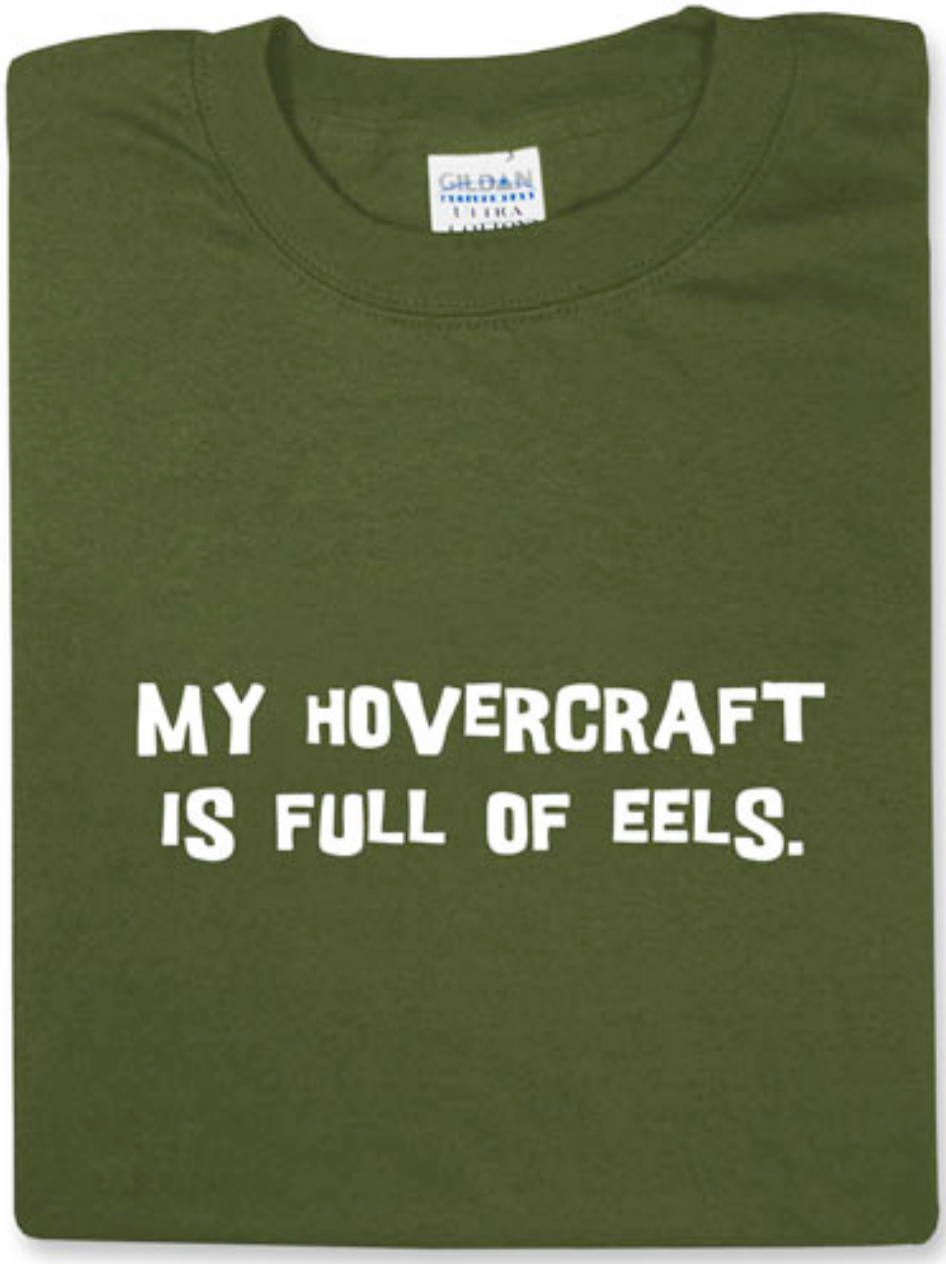
Mayavi

Animation



http://matplotlib.sourceforge.net/examples/animation/double_pendulum_animated.html

Tackling Python: Let's Get Started


GILDAN
ULTRA
MY HOVERCRAFT
IS FULL OF EELS.

Asking Questions during Module presentations

- Speak up - Raise your hand

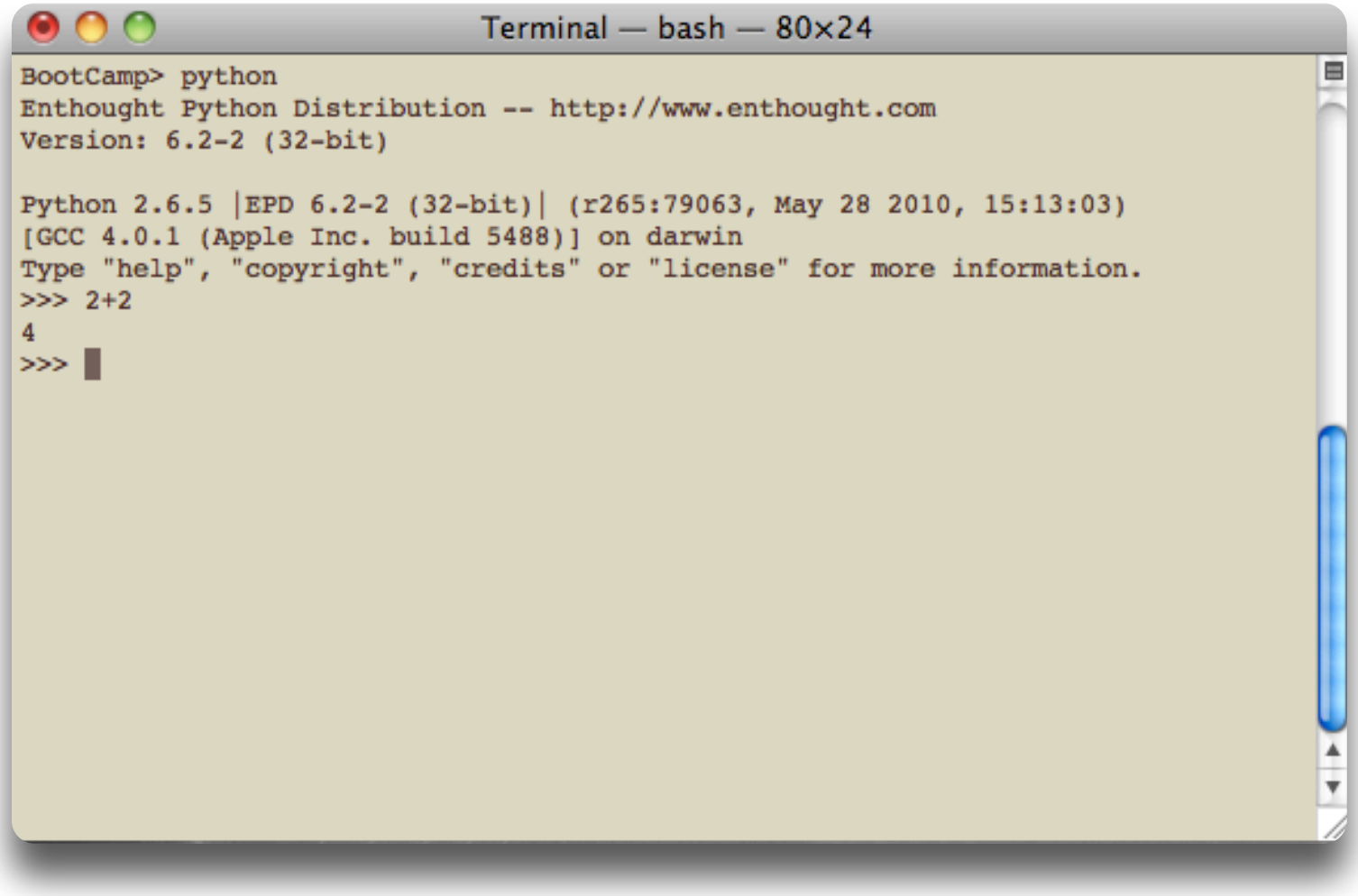
Getting Help at Any Time

- Raise your hand and make eye contact with a counselor

- Join the IRC chat (#pyboot)

- Send email ucbpythonclass+bootcamp@gmail.com

Firing up the Interpreter

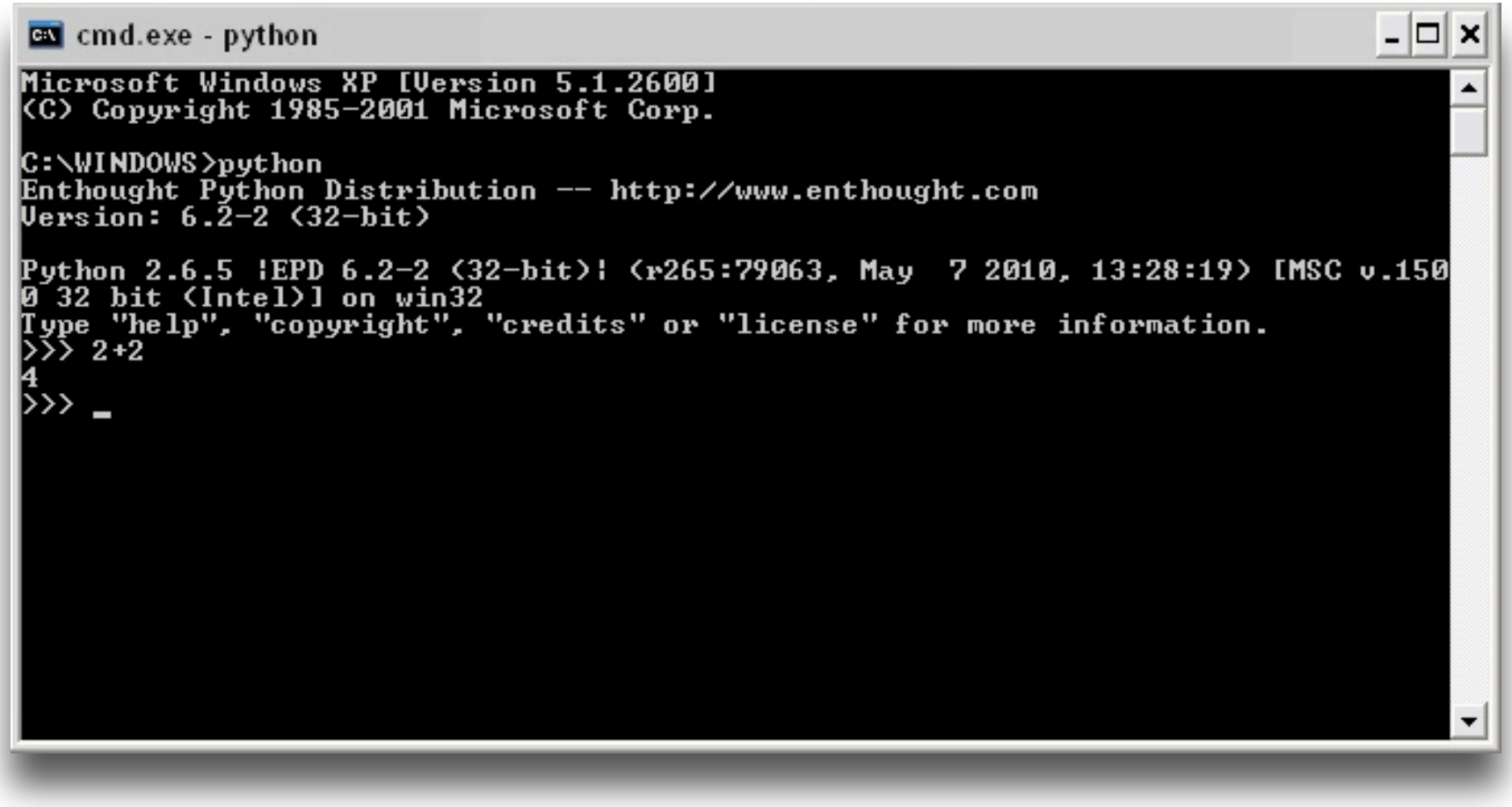


Mac OS X (Terminal)

Firing up the Interpreter

Linux/UNIX/Mac OS X (X11/Xterm)

Firing up the Interpreter

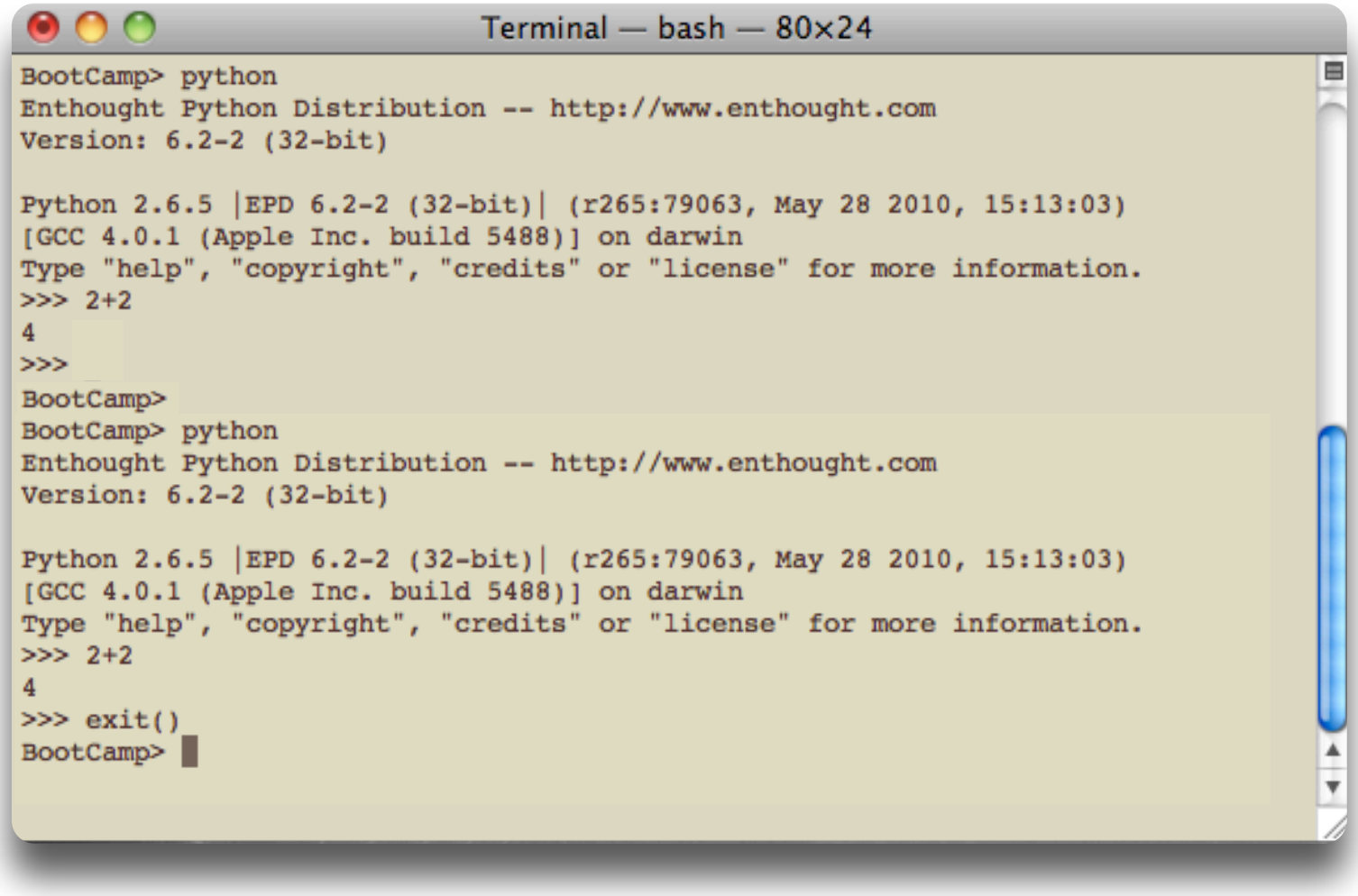


Windows

Firing up the Interpreter

to exit: either `control-D` or `exit()`

Firing up the Interpreter



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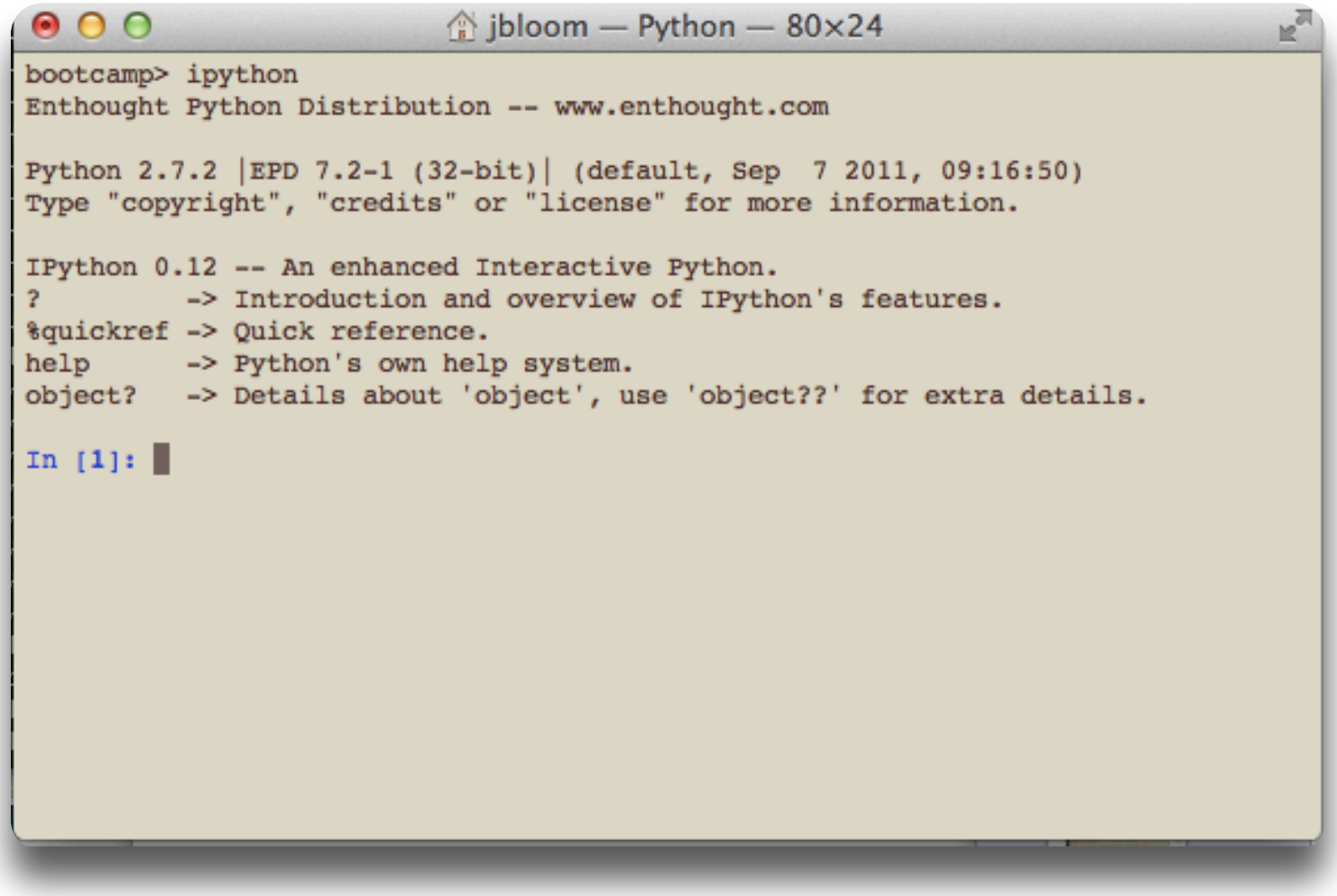
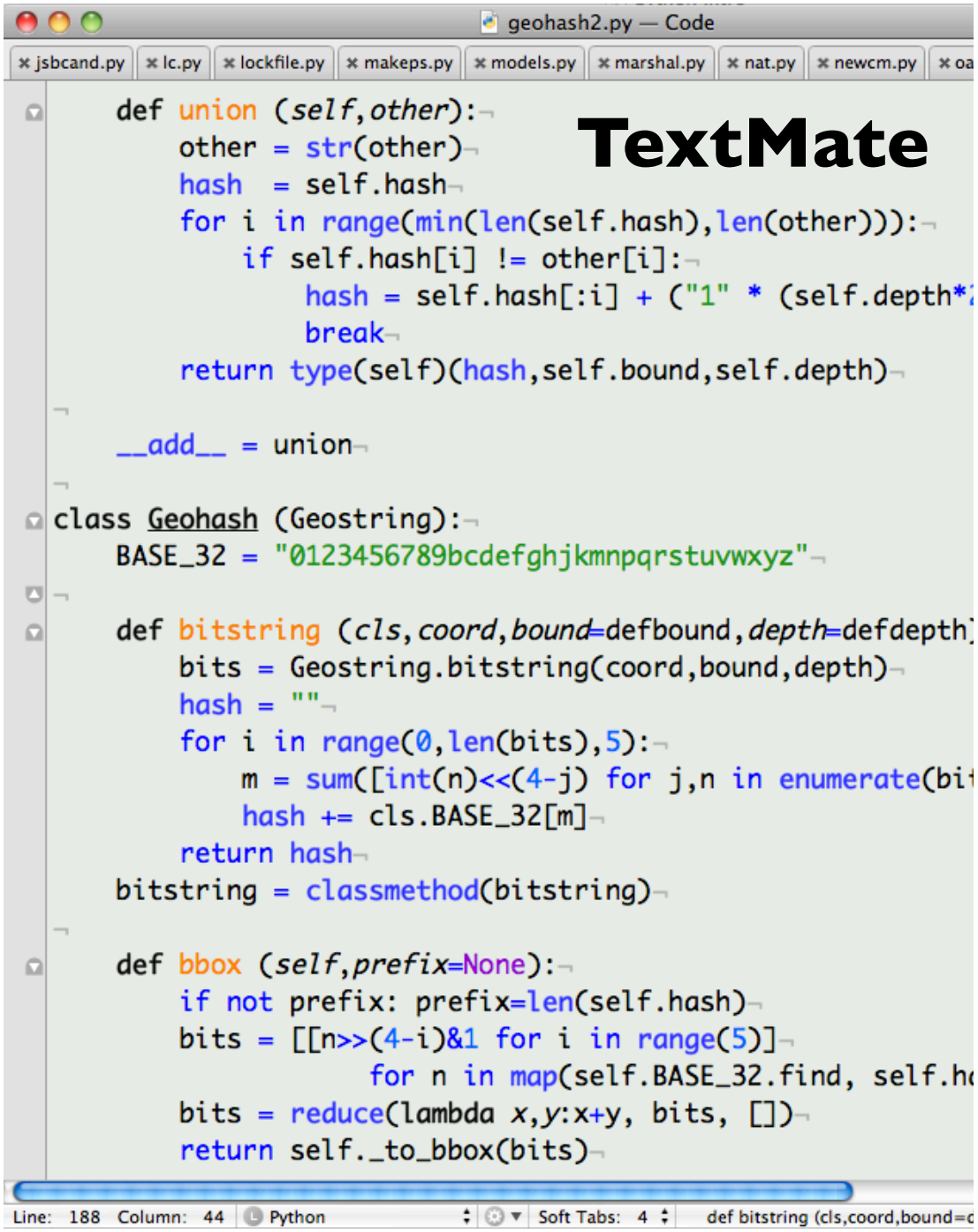
Firing up the Interpreter



`ipython`

Editing Python Files



usually we name python files with a **.py** suffix

- snazzy GUI-based editors:

BBEdit, TextWrangler (Mac); NotePad++, SublimeText (Windows); KWrite, Scribes, eggy (linux)

- old/powerful editors:

vim, emacs, nano, ...

http://bit.ly/ucb-textmate

http://wiki.python.org/moin/PythonEditors