

Programming with Python

EOAS Software Carpentry Workshop

September 24nd, 2015

Python

For our Python introduction we're going to pretend to be a researcher named Harold Bridge (user id `hbridge`) who is studying inflammation in patients who have been given a new treatment for arthritis. Use

Mercurial to grab the files from Bitbucket and put them in an `hbridge` directory in your SWC workspace:

```
$ cd  
$ cd Desktop/swc  
$ hg clone https://bitbucket.org/kramosmu/swc-hbridge-files  
hbridge
```

You can copy and paste the `hg clone` command from the Etherpad.

Launching Jupyter Notebook

There are several ways that we can use Python. We're going to start with tool called Jupyter Notebook that runs in the browser. In a shell window enter these commands:

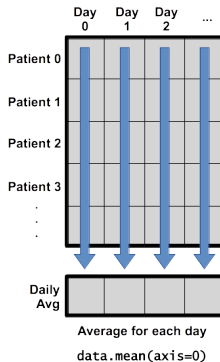
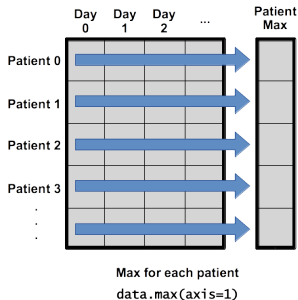
```
$ cd  
$ cd Desktop/swc/  
$ ipython notebook
```

The shell window is now running a local web server for you. Don't close it. You will need to open another shell window to do other command line things. Your browser should open to an "IP[y]: Notebook" page showing a list of directories. If it doesn't, Open a new tab and enter the address 127.0.0.1:8888.

Analyzing patient data

1. Explain what a library is, and what libraries are used for.
2. Load a Python library and use the things it contains.
3. Read tabular data from a file into a program.
4. Assign values to variables.
5. Select individual values and subsections from data.
6. Perform operations on arrays of data.
7. Display simple graphs.

Operations across an axis



What does the following program print out?

```
first, second = 'Grace' , 'Hopper'  
third, fourth = second, first  
print (third, fourth)
```

A subsection of an array is called a slice. We can take slices of character strings as well:

```
element = 'oxygen'
print 'first three characters:', element[0:3]
print 'last three characters:', element[3:6]
```

1. What is the value of `element[:4]`? What about `element[4:]`? Or `element[:]`?
2. What is `element[-1]`? What is `element[-2]`? Given those answers, explain what `element[1:-1]` does.
3. The expression `element[3:3]` produces an empty string, i.e., a string that contains no characters. If `data` holds our array of patient data, what does `data[3:3, 4:4]` produce? What about `data[3:3, :]`?

1. Why do all of our plots stop just short of the upper end of our graph? Why are the vertical lines in our plot of the minimum inflammation per day not vertical?
2. Create a plot showing the standard deviation of the inflammation data for each day across all patients.

Modify the program to display the three plots on top of one another instead of side by side.

Python has a built-in function called `range` that creates a list of numbers: `range(3)` produces `[0, 1, 2]`, `range(2, 5)` produces `[2, 3, 4]`, and `range(2, 10, 3)` produces `[2, 5, 8]`. Using `range`, write a function that prints the first three natural numbers:

```
1  
2  
3
```

Exponentiation is built into Python:

```
print 5**3  
125
```

Write a loop that calculates the same result using multiplication
(without exponentiation)