PROJECT 1: INTRO TO PYTHON

Due: 24 Sept 2015 (Thurs)
50 Points

Python is a programming language that was developed in the 1980s by Guido van Rossum with the goal of being general-purpose, concise, intuitive, and open source. Despite the obvious snake reference, Python is actually named after the British comedy group Monty Python.

Over the past decade, Python rose to prominence as a result of interest in the internet. Google, YouTube, and Django (a popular software framework for writing web applications) all use Python.

As a result of its popularity, Python packages have been written for a variety of uses. In particular, we will be making use of what's known as the SciPy stack which is a collection of packages that are helpful in math and science contexts:

NumPy Support for dealing with matrices, with a large library of functions (i.e. – trig functions, exponential function, max/min, floor/ceiling, etc.)

SciPy Support for "scientific computing" (i.e. – numerical integration, interpolation, optimization, signal processing, statistical regression, etc.)

Matplotlib Support for plotting

Sympy Support for working with symbols

pandas Support for data analysis

Many of the commands in the SciPy stack are designed to function similar to MATLAB commands.

Goals

By the end of this project, you should...

- know how to access Python 3.x, preferrably by installing it on your personal computer using the Anaconda distribution and using the Jupyter/IPython frontend.

- understand how basic Python commands work.

- be able to import commands from necessary Python packages.

- have a working knowledge of Python's data structures.

- be able to plot things.

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Instructions

If you are using IPython, then download `Intro to Python.ipynb` from the Project section of Blackboard. If not, then it is also available as a `.html` file in the same location; however you will have to adapt it accordingly. Follow along with the instructions that are contained in that file.

After you've worked through `Intro to Python.ipynb`, complete each of the following tasks:

1. Write a function that serves as a tip calculator. As inputs, it should take the bill total without tip and the percent you'd like to tip. Then it should print the tip and the bill total with tip. Run the function for the following:

    (a) $45.91 with a tip of 18%

    (b) $102.16 with a tip of 16.5%

    (c) $11.87 with a tip of 20.3%

2. Graph the following functions:

    (a) $g(x) = \tan\left(\frac{x}{2}\right)$ for $-2\pi \leq x \leq 2\pi$.

    (b) $f(x) = \left(x + \frac{1}{\pi}\right)^2 - 1$ for $-4 \leq x \leq 3$.

At the beginning of class on the due date, you need to turn in a write up that must include the code you've used to implement the above tasks and the output of that code. (For this assignment, this may mean just printing out the IPython notebook; but be sure to include comments detailing what things are.)

Getting Started with Python

Currently, there are two widely-used versions: Python 2.x and Python 3.x. Obviously, Python 3.x is the newest version; however the community at large has been slow to switch over to it because there are some significant differences. That being said, the final Python 2.x was released in 2010 and its support will end in 2020; so we're going to use Python 3.x.

In order to use Python for this class, you will need:

The Source Code This is the "meat and potatoes" of Python. It contains everything your computer needs to implement the language. (Available from `https://www.python.org/`)

The SciPy Stack As mentioned above, this is a group of packages that we will be using throughout the semester. (Available from `http://www.scipy.org/`)

A Front End Python itself isn't very user friendly because it is command line. Most people prefer to use a frontend editor. There are many available, but for our purposes I recommend using Jupyter/IPython. (Available from `https://ipython.org/`)

If you wish, you can download and install all of these individually; however there is a nice distribution called Anaconda that bundles all of this (and a little bit more) together. It's particularly nice because it also includes a tool called `conda` which can help keep your Python packages up to date. (Available from `http://continuum.io/downloads`).

To help you with all of this, I've made two screencasts which you can find on YouTube:

Installing Anaconda Available at `https://youtu.be/s2ULaSTTqls`

Getting Familiar with IPython Available at `https://youtu.be/3PvS6GlmLfs`

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