HW0: Math Calibration and Python Setup

This is an optional, ungraded assignment. The first section is intended to help you gauge whether you have an appropriate mathematical background for the course. The second section is to help you setup Python and to help you gauge your programming background.

1 Mathematics Calibration

1. Take the following definite and indefinite integrals:

   - $\int x^3 + 2x \, dx$

   - $\int \sqrt[3]{x} \, dx$

   - $\int_2^3 x^3 + 2x \, dx$

   - $\int_0^\pi \sin x \, dx$

2. Use Bayes' Theorem to solve the following problem. Athletes in the Olympic games are tested for performance-enhancing steroid use. The imperfect test gives positive results (indicating drug use) for 90% of all steroid users, but also false positive results for 2% of those who do not use steroids. The test gives a negative result for all others. Eva tests negative. If 5% of all Olympic athletes use steroids, what is the probability that Eva uses steroids?

2 Python Setup and Calibration

The goal of this section is to get you get Python set up and give you a very brief introduction to the language. We will not be able to fully cover all aspects of the language needed for this course, but there are many references available online. The teaching staff will be happy to entertain specific questions as they come along, and general discussion of Python-related topics are welcome on the Piazza site.

2.1 Installation

The Enthought Python distribution (EPD) is an excellent and well-maintained Python distribution that works on multiple platforms and contains various packages useful for machine learning and general data analysis. The distribution is available for free to students at `http://www.enthought.com`. You must first request an academic license at `http://www.enthought.com/products/edudownload.php`. Then you can download the appropriate version by following the instructions in the email you receive. We recommend EPD, but do not require it.

Precise instructions:

- Sign up for an academic account on the website (then follow email instructions to confirm)

- Go to product > purchase/download (left panel) > subscribers (top ribbon, and NOT academic) > repository login > installers

- Select the installer corresponding to your platform

2.2 Verify Installation

If your installation was successful, you should be able to open a command prompt or a terminal window and run the `ipython` program. You should see a reference to Python 2.7 and should see something like:

```
Enthought Python Distribution -- www.enthought.com

Python 2.7.3 |EPD 7.3-2 (64-bit)| (default, Apr 12 2012, 11:14:05)
Type "copyright", "credits" or "license" for more information.

IPython 0.12.1 -- An enhanced Interactive Python.
?         -> Introduction and overview of IPython's features.
%quickref -> Quick reference.
help      -> Python's own help system.
object?   -> Details about 'object', use 'object??' for extra details.

In [1]:
```

2.3 Calibration Exercises

Download `hw0.tar.gz` from `http://www.seas.harvard.edu/courses/cs181/`.

1. Run `python_basics.py` by executing the following command:

```
python python_basics.py
```

This should generate some output which corresponds to the file `python_basics.py`. This file contains comments. Read through the file to familiarize yourself with basic Python syntax.

2. Run `python exercises_test.py`. What output do you see?

3. The file `exercises_test.py` performs a set of tests to check the functionality of the functions and classes defined in `exercises.py`. We have purposely left the definitions of functions and classes in `exercises.py` empty. Modify this file with the correct functionality so that the tests in `exercises_test.py` pass.

4. A tree is an acyclic connected graph where each node has zero or more children and at most one parent node. Write code that supports the creation of tree data structures with an arbitrary number of children per node. Include the ability to add and delete child nodes.