Homework 1 for Math 480A
Due Wednesday April 9, 2008.

Each problem has equal weight, and parts of problems are worth the same amount as each other.

1. (a) Make a list of 5 free open source programs you have used.
   (b) For each program, write down a corresponding commercial program, if it exists.
   (c) List some of the pros *and cons* from your perspective of the free program versus the commercial version.

2. (a) Using the Sage command line, compute $123 + 456$.
   (b) Using the Sage notebook, compute $456 + 789$.

3. Add paranthesis to change the value of the following expression from 15 to 7:

```
2 + 3* 5-4 + 2
```

4. Compute the last 4 digits of $7^{2008} = 9054497\ldots$.

5. Use Sage to find the number of positive integers up to one million that leave a remainder of 3 when divided by 7. (The remainder of n divided by 7 is `n % 7` in Python.)

6. The following Python code is supposed to output the Fibonacci series but gives the wrong answer. Fix it.

```
a, b = 0, 1
while b < 100:
   print b
   a = b
   b = a+b
```

7. Make up a line of input to Sage that takes at least two seconds to evaluate.

8. Consider the following code:

```
if x < y:
    print x, "is less than", y
elif x > y:
    print x, "is greater than", y
else:
    print x, "and", y, "are equal"
```

   Make a function with two input variables that has the above code as the body of the function. Then call the function three times, where the first argument is less than, greater than, and equal to the second argument.

9. (a) Create an example of a Python *list*.
   (b) Create an example of a Python *tuple*.

(c) Create an example of a Python *dict*.

(d) Create an example of a Python *str*ing.

(e) Create an example of a Python *set*.

10. The following code has a bug in it. First try out this code:

```
def f(a, L=[]):
    L.append(a)
    return L

print f(1)
print f(2)
print f(3)
```

This will print

```
[1]
[1, 2]
[1, 2, 3]
```

but we *want* it to print out

```
[1]
[2]
[3]
```

Fix this problem (the solution is in the official Python tutorial).