**CS21 Chapter 3 Lab**

1. Pondering how to determine if a year is a leap year or not, we asked Wikipedia. Wikipedia was nice enough to provide an algorithm in pseudo code. You can find it here:
   http://en.wikipedia.org/wiki/Leap_year

a) (*leapyear.py*) Write a program that prompts the user for a year and indicates whether the year is a leap year or not. Four sample runs are provided for reference (why four?). Your prompts and output should match exactly:

```
>>>
Welcome to my leap year calculator.
If you give me a year, I can tell you if it is a leap year or not.
What year? 2000
The year 2000 IS a leap year.

>>>
Welcome to my leap year calculator.
If you give me a year, I can tell you if it is a leap year or not.
What year? 2005
The year 2005 is NOT a leap year.
>>>

>>>
Welcome to my leap year calculator.
If you give me a year, I can tell you if it is a leap year or not.
What year? 1800
The year 1800 is NOT a leap year.
>>>

>>>
Welcome to my leap year calculator.
If you give me a year, I can tell you if it is a leap year or not.
What year? 1492
The year 1492 IS a leap year.
>>>
```

*Food for thought: Why does it make sense to test these four particular year values?*

b) *(leapyear2.py)* Once you have your program fully functional, add an if statement to be sure the user has entered a non-negative year. If the user enters a year < 0, simply issue a message and do nothing further.

2. In algebra class, you learned about the quadratic formula to solve a quadratic equation. The quadratic formula is:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

As an example, to find the roots of the equation $2x^2 + 6x - 8 = 0$, first define a = 2, b = 6 and c = -8, then substitute these values into the equation above as follows:

$$x = \frac{-6 \pm \sqrt{6^2 - 4(2)(-8)}}{2(2)}$$

$$x = \frac{-6 + 10}{4} \qquad\qquad x = \frac{-6 - 10}{4}$$

The roots of the equation are -4 and 1. To convince yourself, substitute each value back into the original equation and demonstrate that $2x^2 + 6x - 8$ does, in fact, equal 0.

While the purpose of this assignment is to learn conditionals, and not math, if you would like more information about the quadratic equation, you can find it here:

(http://www.purplemath.com/modules/quadform.htm).

Taking a closer look at the quadratic formula, observe the following:

- If the quantity inside the radical (called the discriminant) is equal to 0, there is only one root, $\frac{-b}{2a}$
- If the quantity is negative, there are no real roots.
- If the quantity is positive, you will find two roots: $\frac{-b-\sqrt{b^2-4ac}}{2a}$ *and* $\frac{-b+\sqrt{b^2-4ac}}{2a}$

(*quadform.py*) Write a program that will prompt the user for the values of a,b,and c, then display an appropriate output. Sample runs are shown below. Be sure your output is well-labelled and formatted to 1 digit after the decimal point.

Helpful hints: Python provides a function for you to calculate the square root. One page 218 in your textbook, you will see an example of how to use it. To use this function, you will need to take two steps:

1. At the top of your program, you'll need to state that you want to use a function that is stored in the math module:

```
import math
```

2. Secondly, to use it, you need to tell the interpreter to look in math to find sqrt, e.g.,

```
x = math.sqrt(15.5)
```

**Sample Run #1**

```
Rally's Quadratic Equation Solver
You'll be prompted for the coefficients of the equation ax^2 + bx + c = 0.
The roots will be computed and displayed.
a = ? 1
b = ? 2
c = ? 3
There are no real roots to this equation
```

**Sample Run #2**

Rally's Quadratic Equation Solver
You'll be prompted for the coefficients of the equation ax^2 + bx + c = 0.
The roots will be computed and displayed.
a = ? 1.1
b = ? 1.5
c = ? -1.7
The two roots of the equation are -2.1 and 0.7

**Sample Run #3**

Rally's Quadratic Equation Solver
You'll be prompted for the coefficients of the equation ax^2 + bx + c = 0.
The roots will be computed and displayed.
a = ? 1
b = ? 2
c = ? 1
The one root of the equation is -1.0