Project 4 CS 261

Save your program for this project as `<emailID>_project4.py` *where* `<emailID>` *is the part of your Hampden-Sydney e-mail address before the @ symbol. When you are finished, e-mail your program to* `blins@hsc.edu`. *Your solution is due by noon on Friday, September 27.*

Roots of Quadratic Polynomials

A quadratic polynomial is a mathematical expression

$$ax^2 + bx + c$$

where the coefficients a, b, and c are numbers. The roots of the polynomial are

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

In this project you will do the following.

1. Write a function `is_perfect_square(n)` to determine whether a positive integer n is a perfect square. Your function should return a boolean value (`True` or `False`).

2. Write a function called `integer_sqrt(n)` that returns the integer square root of n, if n is a perfect square. Make sure your function returns an `int` not a `float`.

3. Write a function called `has_rational_roots(a,b,c)` that returns `True` if $ax^2 + bx + c$ has rational number roots, and `False` otherwise. Hint: You can tell if the roots are rational or not by checking if the expression $b^2 - 4ac$ is a perfect square.

4. Write a function called `analyze_quadratic(a,b,c)`. This function should print the following information about the polynomial.

   (a) It should print a sentence about whether or not the polynomial has rational roots.

   (b) If the roots are rational, it should print them as fractions. You can import the `fractions` module and use the function

   ```
   str(fractions.Fraction(top, bottom))
   ```

   to convert a fraction with numerator (`top`) and denominator (`bottom`) to a string.

   (c) If the roots are irrational, it should print floating point approximations for the roots.