Homework Assignment 7

Due date: Wednesday, February 27, 2019, at 9:30 AM.

Objective: To write and run a python script that approximates the square root of a real number.

Problem: The Babylonian algorithm to compute the square root of a number x is as follows:

(1) Make a guess at the answer. Call the initial guess x_0. You can take $x/2$ as your initial guess.
(2) Compute $r = x/x_0$.
(3) Set $x_0 = (x_0 + r)/2$.
(4) Go back to step 2 for as many iterations as necessary. The more times that steps 2 and 3 are repeated, the closer x_0 will become to the square root of x.

Your program should do the following: Use the method of Homework Assignment 1 to scan in a value for x and convert it to a floating point number. If $x < 0$, display a warning and stop. Iterate through the Babylonian algorithm until x_0 is within 1 percent of the previous value of x_0. Print out your answer. Using the square root function from the math module, print out `math.sqrt(x)`.

This algorithm is a special case of Newton's tangent-line method for iteratively approximating a solution to an equation $f(x) = 0$. For Newton's method, the recurrence relation is

$$x_{n+1} = x_n - f(x_n)/f'(x_n)$$

where x_0 is an initial guess. Can you determine the function $f(x)$?