CS 112 Lab Assignment

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Lab: For Loops (and a little math)

Overview

This lab will help you understand how to use for loops. You will compute an estimated value for the square root of a number to a specific accuracy given from the user.

To calculate the square root of a number manually you can use the Babylonian method. In this method you perform the following steps:
1. Estimate the answer
2. Divide the target number by the estimate
3. Make the average of that quotient and the current estimate the new guess
4. Repeat from step 2.

For example, to determine the estimate of the square root of 20:

Estimate	Divide	Answer	Find Average
1	20 / 1	20	(20+1)/ 2 = 10.5
10.5	20 / 10.5	1.90476	(10.5 + 1.90476) / 2 = 6.2023809
6.2023809	20/6.2023	3.2256	4.7134745
4.7134745	20/4.7134	4.24315	4.4783144
4.4783144	20/4.47831	4.465966	4.47214

So, after 5 iterations our estimate is 4.47214. Using the function on a calculator the answer is: 4.472135955.

The accuracy is thus: absolute value (4.472135955 - 4.47214) = 0.000004045

Algorithm taken from:
http://www.homeschoolmath.net/teaching/square-root-algorithm.php

Assignment

You will write a Python program to:
1. Ask the user for a number to estimate the square root

2. Ask the user for a required accuracy
3. Estimate the value of the square root using the algorithm described in the overview. (You can always start with an estimate of 1.)
4. Display the results to the user as noted below.

Requirements

1. You **must have a for-loop that runs 5 iterations**, BUT **stops calculating** if the required accuracy is achieved before the 5th loop.
2. Print out your output in columns using the print statement using parameters. See class notes for examples printing in columns.
3. Use the math module to determine Python's value for the square root. This is the base to compare your estimate against for accuracy.
    a. Use "`import math`" at the beginning of your program and
    b. `math.sqrt(value)` to compute the square root
4. At the end print out a message stating if you did or did not make the required accuracy.

Sample Output

```
Enter the number to find square root of >20
What is the required accuracy >0.01

Loop     Estimate              Answer              Accuracy
0.       10.500000             20.000000           6.027864
1.       6.202381              1.904762            1.730245
2.       4.713475              3.224568            0.241339
3.       4.478314              4.243154            0.006178
We got the needed accuracy in loop  3
>>> ================================ RESTART
================================
>>>
Enter the number to find square root of >20
What is the required accuracy >0.000000000001

Loop     Estimate              Answer              Accuracy
0.       10.500000             20.000000           6.027864
1.       6.202381              1.904762            1.730245
2.       4.713475              3.224568            0.241339
3.       4.478314              4.243154            0.006178
4.       4.472140              4.465966            0.000004
We did not get the required accuracy
>>>
```

What to turn in:

1. Python source code
2. A screen shot (or cut-n-paste text document) of your program run with the following two sets of input:
    a. Case 1
        i. Square root of: 102
        ii. Accuracy: 0.1
    b. Case 2
        i. Square root of: 102
        ii. Accuracy: 0.0001