2022 Spring -- CSCI 1300L
Lab 02: Computing with Python code

Introduction

In this lab, you will learn how to use Python to do simple calculation tasks. Python can be used as a calculator when you write the mathematical expressions. You will also learn how to assign values to variables before you write mathematical expressions. After you complete all tasks in the lab, you will submit the Python code into a source code file (.py).

Lab objectives

After completing this lab, you will be able to:
(1) understand how Python handles numeric calculations,
(2) construct mathematical expressions using variables, numbers, and operators,
(3) assign numbers to variables, and
(4) make Python program display calculated results in the terminal.

Assignment

Python can be used to do mathematical calculations. Please take a look at the following example to understand the process.

Assume that there is a physical object with three dimensions. The values of the three dimensions are 10 for length, 20 for width, and 30 for height, respectively. If one wants to calculate the volume of that object, there is a function *V = length x width x height*, V as the volume. A programmer may write the Python code as follows:

```
length = 10
width = 20
height = 30
V = length * width * height
print(V)
```

After all the 5 lines of code above are completed written, run the Python code. There will be the displaying of 6000 as the calculated result, i.e. the volume of that object.

In this example, the first three lines of code are about the assignment of variables. After the assignment, variables length, width, height will have each value stored (10, 20, 30). The fourth line is the volume calculation function. After that line, V will save the calculated result from the multiplication of these three variables. Finally, the last line “print” function will display the result in the terminal.

It is important for a programmer to follow the syntax of a programming language in order to make the code work. It is also important to write the Python code with a correct logical sequence (e.g. you should first assign values to variables, then write the calculation function, and finally write the print value statement). This lab assignment will challenge you if you can code in Python to do computations.

Write the Python code for each question (#1 to #7) from (A) to (E), to solve these problems in mathematics and physics.

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(A) In a right triangle, where a, b, and c are the length of each side (the Pythagorean theorem).

$$a^2 + b^2 = c^2,$$

In order to calculate c,

$$c = \sqrt{a^2 + b^2}.$$

1. Assign 150 to a, 200 to b, and then write the Python code to calculate c.

In order to calculate a,

$$a = \sqrt{c^2 - b^2}$$

2. Assign 1300 to c, 1200 to b, and then write the Python code to calculate a.

(B) Given the quadratic formula $ax^2 + bx + c = 0$, and the functions

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a},$$

which are used to solve two unknown variables x1 and x2, where a, b, c are the constants. Assume that x1 is smaller than x2.

3. Assign 2 to a, 6 to b, 4 to c, and then write the Python code to solve x1.
4. Write the Python code to solve x2.

(C) In geometry, Heron's formula is used to calculate the area of a triangle when the lengths of all three sides are known. The formula states:

$$A = \sqrt{s(s-a)(s-b)(s-c)},$$

where *A* is the area, and *s* is the semi-perimeter of the triangle, which is $s = \frac{a+b+c}{2}$.

5. Assign 50, 60, 70 to a, b, c of the triangle, respectively. Write the Python code to calculate the area A of that triangle.

(D) In physics, consider the equation for free fall, the distance d for an object to free fall for the time t is calculated as $d = \frac{1}{2}gt^2$, where g is the gravitational acceleration (9.8 m/s).

6. Assign 3.0 to t (i.e. 3.0 seconds), 9.8 to g. Then write the Python code to calculate the distance d.

(E) According to Albert Einstein's mass–energy equivalence that describes the relationship between mass and energy, the formula states

$$E = mc^2,$$

where E is the energy, m is the mass, and c is the speed of light.

7. Assign 0.0000050 to m, 299792458 to c. Then write the Python code to calculate the value of energy E.

Note: you may use an imported package and its embedded function for calculating the square root of a number; however, there is a way that you do not have to use that embedded function from that package. The square root of a number is equivalent to the number to the power of 0.5.

Follow the provided example: first assign values to variables, then write the function, and finally have the print statement for result display, for each # of questions. After the completion of this assignment (from #1 to #7), save all lines of Python code into one Python source code file. Name such a file as *Lab02.py* . Make sure that your code can work when you re-open the file and run the program later. Finally, upload the file into eLC as the lab assignment submission.

Submission instruction

After you have completed the assignment, upload and submit the Python source code file *Lab02.py* to eLC. Always double check that your submission was successful on eLC.

Grading

A score between 0 and 5 will be assigned, with a minimum of 0.5 point increment.

1. Each function is correctly written and each calculated result is correct. (0.5 * 7 = 3.5 points)
2. Correct file format is used in the submission. (0.5 point)
3. Only the single source code file is submitted and no other file is submitted. (0.5 point)
4. The entire Python program can be executed without any additional error. (0.5 point)

Special notice regarding the submission:

Late submission penalty. Points will be deducted from the original grade. If your submission is after the posted deadline…

(1) within 24 hours: -2
(2) between 24 hours and 48 hours: -3
(3) between 48 hours and 72 hours: -4
(4) after 72 hours: assignment will not be accepted.