Full Stack Development with AI

Lab 6.2 – Variables, Data Types and Operators in Python | Basic Input and Output with Python

Lab Overview

In this lab, you will learn how to work with variables, data types and operators in Python through some basic programming exercises. As part of the computational problem-solving process, you will also be interacting with user to obtain input data and display output results.

In the following programming exercises, you should use the Python 3 environment to write and run the Python source files.

To run a Python source file, you need to use the `python` or `py` command and followed by the filename. For example:

`python ex01.py` or `py ex01.py`

Exercise 1 – Currency Exchange

Assume that the prevailing exchange rate from US Dollar (USD) to Singapore Dollar (SGD) is 1.3100. Write a series of Python statements to prompt user to input the amount of USD to be changed to SGD and then compute the equivalent amount in SGD. Print out the equivalent amount in SGD.

Write another series of Python statements to prompt user to input the amount of SGD to be changed to USD and then compute the equivalent amount in USD. Print out the equivalent amount in USD.

Sample Input	Sample Output
USD to SGD, 100	131.0
USD to SGD, 250	327.5
SGD to USD, 100	76.33587786259541
SGD to USD, 250	190.83969465648855

Exercise 2 – Currency Exchange Rounding

Observe that the floating-point results in Exercise 1 may consist of many fractional digits. How can you round the results to at most 2 fractional digits?

***Hint**: In Python, the built-in `round(num[, digit])` method can be used to perform rounding. Without specifying the number of fractional digits required, the input number will be rounded to the nearest integer by default. Alternatively, you can use formatted output to ensure that the number is displayed correctly. Note that using formatted output does not affect the original value.*

Sample Input	Sample Output
USD to SGD, 100	131.0
USD to SGD, 250	327.5
SGD to USD, 100	76.34
SGD to USD, 250	190.84

***Hint**: If you want a number to be always displayed with two fractional digits even if they are zeros, you can apply both techniques.*

Sample Input	Sample Output
USD to SGD, 100	131.00
USD to SGD, 250	327.50
SGD to USD, 100	76.34
SGD to USD, 250	190.84

Exercise 3 – Temperature Conversion

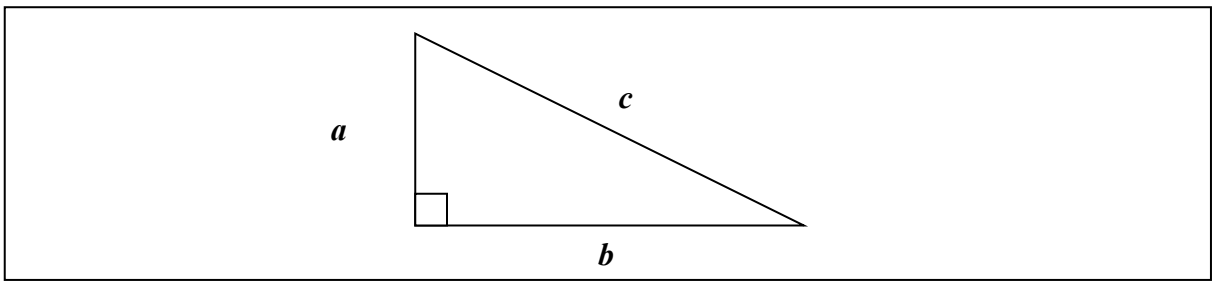
The two most commonly used temperature scales are the Celsius scale (°C) and the Fahrenheit scale (°F). On the Celsius scale, the freezing point of water is defined as 0°C and the boiling point of water is defined as 100°C. On the Fahrenheit scale, the freezing point of water is defined as 32°F and the boiling point of water is defined as 212°F.

Write a series of Python statements to prompt user to input the temperature in Celsius and then compute the equivalent temperature in Fahrenheit. Print out the converted temperature.

Write another series of Python statements to prompt user to input the temperature in Fahrenheit and then compute the equivalent temperature in Celsius. Print out the converted temperature.

Sample Input	Sample Output
Celsius to Fahrenheit, 0	32.0
Celsius to Fahrenheit, 33.3	91.94
Fahrenheit to Celsius, 212	100.0
Fahrenheit to Celsius, 180.5	82.5

Exercise 4 – Pythagoras' Theorem



For any right-angle triangle with three sides *a*, *b* and *c* as shown in the above figure; side c is known as the hypotenuse (i.e., the side opposite the right angle. Pythagoras' Theorem may be written as a mathematical equation relating the lengths of the three sides *a*, *b* and *c*:

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

Using this equation, we can find any unknown side as long as the lengths of the other two sides are known. For instance, we can find the length of side *c* if we know the lengths of sides *a* and *b* using the equation below:

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

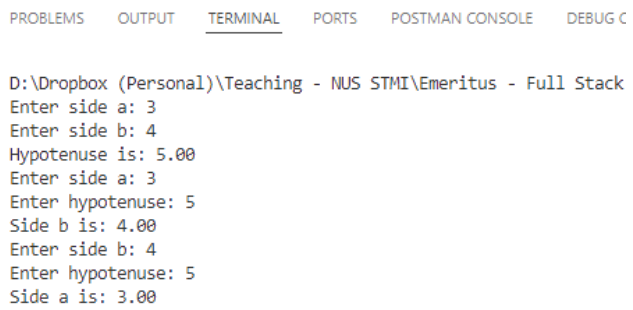
Write a series of Python statements to prompt user to input the lengths of side *a* and *b*. Then compute the hypotenuse or side *c* and print out the result.

***Hint**: Note that length can be a floating-point number. You should not need to use the Python `math` library.*

What happens if we only know the lengths of the hypotenuse and one other side of the right-angle triangle? How do we find the length of the third side? For example, if we know the lengths of sides *a* and *c*, how do we find the length of side *b*? How about if we know the lengths of sides *b* and *c*, how do we find the length of side *a*?

Write a series of Python statements to solve the above problem by prompting user to input the lengths of the required sides of the triangle.

No sample input and output are provided for this question but refer to the screenshot for a sample run of the program:



Exercise 5 – Swapping Two Variables

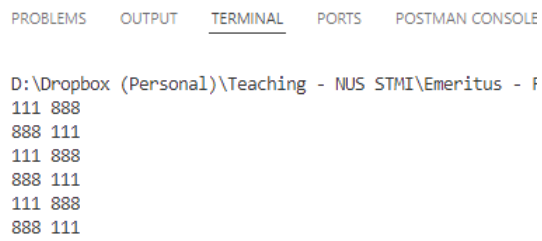
In computational problem solving with programming, swapping the values of two variables is a very common task that you need to perform. The easiest way to swap two variables is to use a third temporary variable.

Write a simple Python that prompts user to input two integer numbers and then swap the variables. Print out the

Think about two other different ways of performing this swap without the use of a third temporary variable.

Write a series of Python statements to implement the two approaches.

No sample input and output are provided for this question but refer to the screenshot for a sample run of the program:



Exercise 6 – Compound Interest and Future Value Calculator

Write a program to calculate the compound interest and future value of an investment using the following formula without the use of any conditional and iterative control flow. Do not use the Python `math` library.

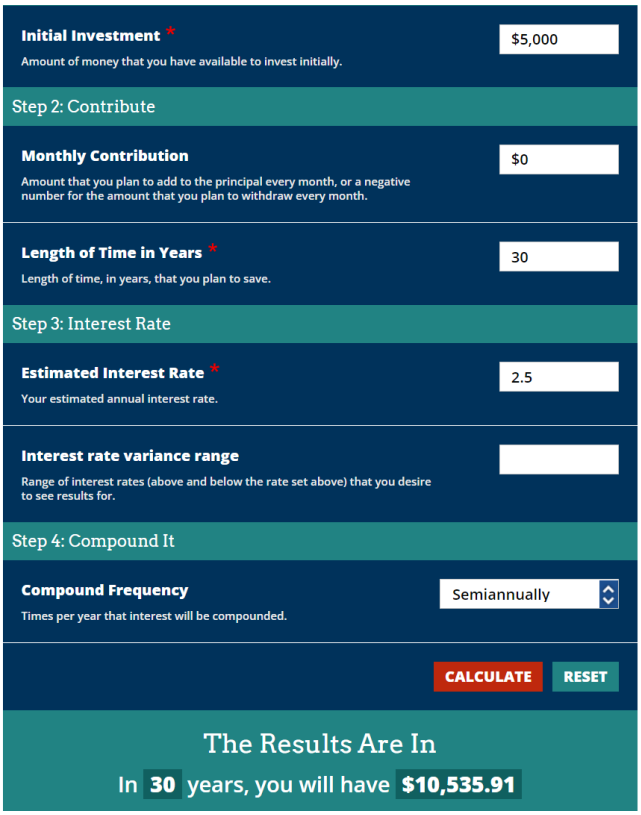
$$P(t) = P_0\left(1 + \frac{r}{n}\right)^{nt}$$

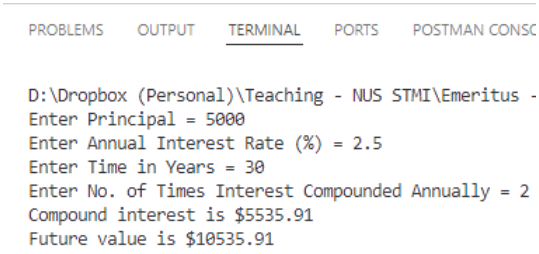
$P(t)$ is the current principal amount at time t and P_0 is the initial principal amount.
r is the annual interest expressed as a decimal, n is the number of compounding period per annum and t is the total amount of time in years.

You should prompt the user to input only the following data and print out the compound interest as well as the future value.

- Principal amount (initial investment)
- Annual interest rate (%)
- Length of time in years
- Number of time interest is compounded annually (compound frequency)

You may use this online calculator to validate your result assuming that monthly contribution is $0 – https://www.investor.gov/financial-tools-calculators/calculators/compound-interest-calculator





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