Homework 4:
Shake, Rattle and Roll

Due date: March 12 by the end of the lab period.

Overview

In this assignment you will write a program that compares the relative strengths of two earthquakes, given their magnitudes using the *moment magnitude scale.*[1] You will submit your solution to Zybooks Lab 6.13, and if the test cases on that lab succeed, you can show your TA for credit on the assignment.

Earthquakes

The amount of energy released during an earthquake – corresponding to the amount of shaking – is measured using the "moment magnitude scale". We can compare the relative strength of two earthquakes given the magnitudes m_1 and m_2 using this formula:

$$f = 10^{1.5(m_1 - m_2)}$$

If $m_1 > m_2$, the resulting value f tells us how many times stronger m_1 was than m_2; if the opposite is true, then the reciprocal of f ($\frac{1}{f}$) tells us how many times stronger m_2 was than m_1.

Program Flow

Your Python program will ask the user to input two earthquake magnitudes, validating that each value entered is positive and looping if it is not. Once the magnitudes are validated, you will decide which earthquake had the higher magnitude, then use the formula above to compute f. You will output a message indicating which magnitude was stronger, and how many times stronger it was than the second magnitude. You **must** print three values in this output: the magnitude of the stronger earthquake, the value of f, and the magnitude of the weaker earthquake.

After printing the output, ask the user if they want to try again, and loop the program as long as they answer "1" (for "yes").

Functions

You **must** break your program up into the following functions:

1. `get_magnitude(number)`: this function asks the user to input an earthquake magnitude. The `number` parameter is an integer that identifies which earthquake (1 or 2) the user is being asked about; you must include the earthquake number in your output. The user will enter the magnitude, which you **must** validate is positive; note that magnitudes do not need to be whole numbers. Once you have a positive value from the user, **return** it.

   For example, calling `get_magnitude(1)` should print "`Please enter the magnitude for earthquake 1:`". If the user types in "5", then the value `5` would be returned from the function.

2. `compare_magnitudes(magnitude1, magnitude2)`: this function takes two magnitude values as parameters. It calculates and returns f using the formula above. **It does not print or gather input from the user.** Note that the value that gets returned is *from the perspective of magnitude 1*; if magnitude 1 is smaller than magnitude 2, the value you compute and return will be less than 1, indicating that the first earthquake was weaker than the second. **Seek help and do not continue** if you don't understand what this means.

[1] The "Richter scale" hasn't been used since 2002, no matter what you hear in the news.

3. `get_run_again()`: this function asks the user if they want to compare 2 more earthquakes; it is called from the main to determine if the main should loop again. The user must enter a `1` to continue; any other value means "quit".

   This function **returns** the value `True` if and only if the user enters a `1`; any other value causes the function to return `False`. **You cannot return a string, integer, or any other value from this function**; only a `True` or `False`.

4. "`__main__`" block using an `if` statement: the main "drives" the application, by performing the steps in the "Program Flow" section above. It calls `get_magnitude` twice and stores the results of the function in variables, then determines which variable is larger and calls `compare_magnitudes`, **passing the larger magnitude** as the first parameter. It then prints the results of the comparison, **always printing the larger magnitude first**.

   The main then calls `get_run_again`. If the user wants to run the program again, the main loops; otherwise it terminates.

   This function **cannot** call `input()`. In addition, it can only call `print` **three times**.

Example Output

User input is in *italics*.

```
Please enter the magnitude of earthquake 1: -5
Please enter the magnitude of earthquake 1: 5.8
Please enter the magnitude of earthquake 2: 7.5

An earthquake of magnitude 7.5 is 354.8 times more powerful than an earthquake of
magnitude 5.8.
Try again? Type 1 for yes: 1

Please enter the magnitude of earthquake 1: 7
Please enter the magnitude of earthquake 2: -6
Please enter the magnitude of earthquake 2: 6

An earthquake of magnitude 7.0 is 31.6 times more powerful than an earthquake of
magnitude 6.0.

Try again? Type 1 for yes: 0

Bye!
```

Turning in the Assignment

As a reminder, you **must** submit your solution to Zybooks Lab 6.13 and pass all the test cases, **and then** show your accepted solution to the instructor or TA. The TA will check that you follwed the rules about printing and input statements. You will **only** get credit for the assignment when the instructor/TA checks your answer and says that you are finished.