Problem Set 1

Handed out: Friday, Jan 27, 2023.

Due: 11:59 PM, Thursday, Jan 31, 2023

Part 0: Getting Ready

Write a program that does the following in order:

1. Asks the user to enter a number "x"
2. Asks the user to enter a number "y"
3. Prints out number "x", raised to the power "y".
4. Prints out the log (base 2) of "x".

Part A: House Hunting

You have graduated and now have a great job! You move to the Zayed and decide that you want to start saving to buy a house. As housing prices are very high in this Area, you realize you are going to have to save for several years before you can afford to make the down payment on a house. In Part A, we are going to determine how long it will take you to save enough money to make the down payment given the following assumptions:

1. Call the cost of your dream home **total_cost**.
2. Call the portion of the cost needed for a down payment **portion_down_payment**. For simplicity, assume that portion_down_payment = 0.25 (25%).
3. Call the amount that you have saved thus far **current_savings**. You start with a current savings of $0.
4. Assume that you invest your current savings wisely, with an annual return of **r** (in other words, at the end of each month, you receive an additional **current_savings*r/12** funds to put into your savings – the 12 is because **r** is an annual rate). Assume that your investments earn a return of r = 0.04 (4%).
5. Assume your annual salary is **annual_salary**.
6. Assume you are going to dedicate a certain amount of your salary each month to saving for the down payment. Call that **portion_saved**. This variable should be in decimal form (i.e. 0.1 for 10%).
7. At the end of each month, your savings will be increased by the return on your investment, plus a percentage of your **monthly salary** (annual salary / 12).

Write a program to calculate how many months it will take you to save up enough money for a down payment. You will want your main variables to be floats, so you should cast user inputs to floats.

Your program should ask the user to enter the following variables:

1. The starting annual salary (annual_salary)
2. The portion of salary to be saved (portion_saved)
3. The cost of your dream home (total_cost)

Try different inputs and see how long it takes to save for a down payment. **Please make your program print results in the format shown in the test cases below.**

Test Case 1

```
>>>
Enter your annual salary: 120000
Enter the percent of your salary to save, as a decimal: .10
Enter the cost of your dream home: 1000000
Number of months: 183
>>>
```

Test Case 2

```
>>>
Enter your annual salary: 80000
Enter the percent of your salary to save, as a decimal: .15
Enter the cost of your dream home: 500000
Number of months: 105
>>>
```

Part B: Saving, with a raise

Background

In Part A, we unrealistically assumed that your salary didn't change. But you are a Route graduate, and clearly you are going to be worth more to your company over time! So, we are going to build on your solution to Part A by factoring in a raise every six months.

In **ps1b.py**, copy your solution to Part A (as we are going to reuse much of that machinery). Modify your program to include the following

1. Have the user input a semi-annual salary raise **semi_annual_raise** (as a decimal percentage)
2. After the 6^{th} month, increase your salary by that percentage. Do the same after the 12^{th} month, the 18^{th} month, and so on.

Write a program to calculate how many months it will take you save up enough money for a down payment. Like before, assume that your investments earn a return of r = 0.04 (or 4%) and the required down payment percentage is 0.25 (or 25%). Have the user enter the following variables:

1. The starting annual salary (annual_salary)
2. The percentage of salary to be saved (portion_saved)
3. The cost of your dream home (total_cost)
4. The semi-annual salary raise (semi_annual_raise)

Hints

To help you get started, here is a rough outline of the stages you should probably follow in writing your code:

- Retrieve user input.
- Initialize some state variables. You should decide what information you need. Be sure to be careful about values that represent annual amounts and those that represent monthly amounts.
- Be careful about when you increase your salary – this should only happen **after** the 6^{th}, 12^{th}, 18^{th} month, and so on.

Try different inputs and see how quickly or slowly you can save enough for a down payment. **Please make your program print results in the format shown in the test cases below.**

Test Case 1

```
>>>
Enter your starting annual salary: 120000
Enter the percent of your salary to save, as a decimal: .05
Enter the cost of your dream home: 500000
Enter the semi-annual raise, as a decimal: .03
Number of months: 142
>>>
```

Test Case 2

```
>>>
Enter your starting annual salary: 80000
Enter the percent of your salary to save, as a decimal: .1
Enter the cost of your dream home: 800000
Enter the semi-annual raise, as a decimal: .03
Number of months: 159
>>>
```

Test Case 3

```
>>>
Enter your starting annual salary: 75000
Enter the percent of your salary to save, as a decimal: .05
Enter the cost of your dream home: 1500000
Enter the semi-annual raise, as a decimal: .05
Number of months: 261
>>>
```