CS 112 Lab Assignment

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Lab: 401K Math

Overview

This lab will help you understand the mathematical operators in Python and how to get user input.

Additionally, it will show you the financial benefits of a 401(k) program, and why you should invest in one as soon as you graduate and get your first job!

Assignment

Part one: You will be implementing the future value of money formula for stream of recurring payments:

$$FV = PMT\left(\frac{(1+i)^n - 1}{i}\right)$$

FV = Future value of the payments
PMT = the amount of the payment
i = interest rate (yearly for us)
n = number of years

401(k) case: When you contribute to 401(k), we will assume your employer will match 50% of the contribution. So, if you contribute $10,000 (yearly) your employer will also contribute $5,000. So, in this case the PMT = 10,000 + 5, 000 = $15,000 yearly

Additionally, when you take the money out of the 401(k), you must pay taxes on it. Assuming you do this at retirement, you will not be working, and thus be in a low tax bracket. We'll assume this is 15%.

So, the future value must be multiplied by 1-0.15 = 0.85 to determine the final amount of money you will get when you withdraw from your 401(k).

Non-401(k) case: Assuming you invest in another way that also pays the same interest rate, you will see a few changes. The PMT will be after-tax dollars, so

you need to deduct taxes from each payment. We'll assume you're in a 28% tax-bracket, then non-401(k) PMT = userContribution * (1-0.28). However, you will not need to pay income tax on that money when you take it out.

So, your program will need to ask the user for:
- the amount the user will contribute (userContribution)
- the number of years till retirement
- the interest rate the money will make
- Then the program should output the amount of money you will have at the end if you invested in 401(k) versus non-401(k).

For example:

Given userContribution = 10,000
Number of years = 30
Interest rate = 5%

401(k) Case:
PMT = 10,000 + (0.5 * 10,000) = 15,000
FV = $996,582.71
FV after taxes = 15% of FV = $847,095.31

Non-401(k) case:
PMT = $10,000 * (1-0.28) = $7,200
FV = $478,359.70

Part 2:
Next you will calculate the difference in your paycheck by investing in a 401(k) plan. 401(k) contributions are pre-tax, meaning you do not have to pay income tax on the contributions, until you retire (when you'll be in a lower tax bracket). Thus, investing in 401(k) now reduces the amount of taxes you will pay immediately.

Assuming you're in a 28% tax bracket,
takeHomePay = (grossPay – pretaxDeductions) * (1-taxRate%)

For example, if you make $60,000 / year
grossPay = $60,000 / 12 = $5,000 / month
If you contribute 10% to 401(k), this means your pretaxDeduction :
    preTaxDeduction = ($60,000 * 10%)/12 = $500

So, your takeHomePay is:
with401(k): ($5,000 – 500) * (1 – 0.28) = $3,240
without401(k): ($5,000 - 0) * (1 – 0.28) = $3,600

Difference = $360

So, you have spent $360 to add $500 into your retirement account. That doesn't take into account any employer matching contribution either!

In part two, you need to implement calculations to determine the take-home-pay with and without 401(k) contributions, and the difference between the two.

Your output should look very similar to my sample run below:

Sample run of my program:

```
Enter the user contribution >10000
Enter the number of years to contribute >30
What is the interest rate >0.05
What is your yearly salary >100000
----------------------------
User Contribution = 10000.00
Number of years to contribute = 30
Interest rate = 0.05
 ----------------------------
Contributing to 401(k) yields: 847095.31
Contributing without 401(k) yields: 478359.70
 ----------------------------
Without 401(k) contribution monthly take-home-pay is 5999.76
With 401(k) contribution monthly take-home-pay is 5400.00
Difference in paycheck when contributing to 401(k) is 599.76
>>>
```

What to turn in:

1. lab401k.py
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. User Contribution: 9,500
      ii. Number of years: 25
      iii. Interest rate 5%
      iv. Yearly salary: $75,000
   b. Case 2
      i. User Contribution: 5,000
      ii. Number of years: 30
      iii. Interest rate 7.5%
      iv. Yearly salary: $75,000