

4CS001 - Coding Challenge 1

Variables and Expressions

Due: Friday 29th January 2021 at 23:59

This assignment is worth 20% of the overall module grade

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Introduction

This coding challenge will assess your knowledge of Python variables, expressions and string formatting. Make sure you've completed the proceeding workshop exercises first.

The marking scheme for this task is on Canvas, make sure you check back on a regular basis as you work through the assessment. **There is an additional challenge segment that can earn you extra credit, which you will need to complete to achieve the highest possible mark. Students who do not attempt this cannot achieve grades above 80% for this task.**

Getting Started

Start by downloading the file `compound_interest.py` from Canvas. Add your name and student number to the top of the file. Read the included documentation.

Task Overview

A new Wolverhampton based challenger bank called Wolving is launching in a few short months. They are in the process of building their website and have asked you to develop a program for prospective customers to show them how their savings could grow over time. The bank has asked that you incorporate compound interest so that the calculation is more accurate.

The idea behind compound interest is that the interest you earn each year is added to your principal (starting amount), so that the balance doesn't just grow, it grows at an increasing rate. This is one of the most useful concepts in finance. It is the basis of everything from personal saving plans to long term growth in the stock market and accounts for the effects of inflation. It is thought to have originated in the 17th century and can be thought of as 'interest on interest'.

The rate at which compound increases is determined by the number of compounding periods (the number of times interest is paid per year). Your software will showcase the effects of compound interest to potential customers, highlighting the fact that **Wolving pay interest quarterly** compared to many other banks that pay on a yearly basis.

There are a few ways to calculate compound interest. The example below illustrates an investment of £2000 over 4 years, compounding annually at 4.3% interest:

Year	Starting Balance	Interest	Ending Balance
1	£2000	$£2000 * 4.3\% = \text{£}86$	£2086
2	£2086	$£2086 * 4.3\% = \text{£}89.70$	£2175.70
3	£2175.70	$£2175.70 * 4.3\% = \text{£}93.56$	£2269.26
4	£2269.26	$£2269.26 * 4.3\% = \text{£}97.58$	£2366.84

However, this isn't very practical, instead we can use the following formulae:

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

Where

- P is the principal amount (the amount you start with).
- r is the annual rate of interest (as a decimal).
- t is the number of years the amount is invested.
- n is the number of times the interest is compounded per year.
- A is the amount at the end of the investment.

Here is an example calculation:

£1500 invested over 5 years, compounding 4 times per year (quarterly) at 4.3% interest.

$$1500 * (1 + 0.043 / 4)^{(4 * 5)} = 1938.84$$

Requirements:

You will develop a program to calculate compound interest.

1. Print a welcome message explaining the purpose of the program.
2. Prompt the user for the necessary inputs (see formulae and brief)
3. Convert input values to suitable data types.
4. Perform the compound interest calculation.
5. Print the result to the terminal using appropriate formatting.

Constraints:

- Ensure that the interest rate is entered as a percentage and not a decimal.
- Ensure that all monetary values are formatted to two decimal places.

Hints:

- Think about what data types are the most appropriate for each input value.
- The order of operations is important, make sure you use parenthesis.
- Review lecture two for more information on string formatting.
- Your programs output should be as close as possible to the example below.

Example Implementation (user input in red)

```
Welcome to the Wolving compound interest calculator.
This program calculates your potential returns when you invest with us

How much would you like to invest? 1500
What is the interest rate on your account? 4.3
How long are you planning to invest (in years)? 6
£1500 invested at 4.3% for 6 years compounded 4 times per year is: £1938.84
```

Challenge (Extra Credit)

Wolving believe that the compound interest calculator you've developed will help to draw in lots of new customers. However, it is a little limited in the sense that users only get to see their final balance and not the individual interest payments. Therefore, you've been asked to update your program to display this information. You should display the year, period, interest paid and the current balance in a tabular format. This will allow customers to clearly see each individual interest payment and the growth in their balance over time.

Note: You should continue to follow the constraints specified in the previous task.

Hints:

- You will need to be familiar with control structures to complete this challenge. These will be covered during lecture three, feel free to read ahead.
- Interest should be distributed evenly across the course of a year. Therefore, if there are four payments windows in a year only $\frac{1}{4}$ of the interest is paid at each stage.

Example Implementation (user input in red)

```
What is the principal amount? 1500
What is the rate? 4.3
What is the number of years? 6
What is the number of times the interest is compounded per year? 4
```

Year	Period	Old Balance	Interest	New Balance
1	1	£1500.00	£16.12	£1516.12
	2	£1516.12	£16.30	£1532.42
	3	£1532.42	£16.47	£1548.90
	4	£1548.90	£16.65	£1565.55
2	5	£1565.55	£16.83	£1582.38
	6	£1582.38	£17.01	£1599.39
...				

```
£1500 invested at 4.3% for 6 years compounded 4 times per year is: £1938.84
```