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# Computational Finance and FinTech – Exercises 2

**Exercise 1.** Write a program that finds all numbers that are divisible by 7 but are not multiples of 5 betweeen 2000 and 3200 (both included). The numbers obtained should be printed in a comma-separated sequence on a single line.

**Exercise 2.** Write a function that computes the present value of a growing annuity:

$$\mathrm{PV} = \frac{C}{r-g}\left(1 - \frac{(1+g)^n}{(1+r)^n}\right),$$

where $r$ is the discount rate, $g$ is the growth rate, $C$ is the amount paid and $n$ is the number of periods (years).
Use the function to calculate the PV of an annuity that pays 100 annually for ten years using a discount rate of 5%.

**Exercise 3.** Using the function from the previous exercise, build a mortgage calculator that prints out the monthly mortgage payment given an annual percentage rate (note: $r = \mathrm{APR}/12$), the loan amount and the number of years (note: $n = \text{years} \cdot 12$).
Use the function to calculate the monthly payment on a loan of €100,000 at an APR of 2.5%. Verify that the PV is indeed €100,000 by calculating the sum of the discounted loan payments.

**Exercise 4.** Write a Python program to combine two dictionares adding values for common keys.
Example: Let

```
d1 = {'a': 100, 'b': 200, 'c':300}
d2 = {'a': 300, 'b': 200, 'd':400}
```

Sample output:

```
{'a': 400, 'b': 400, 'd': 400, 'c': 300}
```

**Exercise 5.** Generate a random walk path starting in 0 by accumulating normally distributed random numbers. Use a `Data Frame` object indexed by days (365 days) to accomodate the path. Plot the result.
Extend the `DataFrame` of random numbers to accomodate more paths and fill it with 5 paths.
Find out what the seed of a random number generator is and how you can set the seed in Python. Why would this be useful?
Hint: Use `numpy.random`.