Portfolio Analysis

In this assignment, you will investigate the best combination of two securities "spy" - SP-500 index and one security of your choice. This other security can be:

1. a stock like Microsoft (ticker: MSFT). You can refer to the link below for suggestions:

   `https://www.nasdaq.com/screening/company-list.aspx`

2. index like biotechnology (ticker: ^BTX)
3. conventional currency like Euro/US dollar exchange (ticker: "EURUSD-X")
4. cryptocurrency like Bitcoin (ticker "BTC-USD")
5. a commdity like Crude Oil (ticker: CL=F)

The basic requirement that you must have daily data for at least the last 5 years.

1. **Preliminary Task 1:** take "spy" and one security of your choice.

2. **Preliminary Task 2:** use the script
   "read_and_save_stock_data_updated.py"
   to download daily stock data (last 5-years from Jan 1, 2015 to Dec 31, 2020) for spy and your ticker into two CSV files (using Pandas Yahoo stock market reader or yfinance). In this script, you would need to change the location of the directory for the CSV files and change the ticker to the name that you have chosen in Task 1. This script downloads historical data and computes additional fields for time (week, day, month) and prices (daily returns, 14- and 50-day moving price averages).

3. **Preliminary Task 3:** use the script
   "read_stock_data_from_file.py"
   to read your saved CSV files into a list of lines to answer questions below.

You will investigate the performance of a portfolio consisting of S&P=500 index (spy) and your ticker. You start with $100 dollars in the beginning. Let α and β be the weights that you allocate to your securitites ($\alpha + \beta = 1$). For example, if $\alpha = 0.2$ and $\beta = 0.8$ then you spend $20 to purchase spy and $80 to purchase your stock.

Consider day i. For this day, the daily return of spy is $r_i^{(1)}$ and the daily return of the second security is $r_i^{(2)}$. The daily

return of your portfolio for that day is $R_i = \alpha r_i^{(1)} + \beta r_i^{(2)}$. If you start with \$100 dollars, the total portfolio value after k days will be

$$\text{amount after k days} = 100(1 + R_1)(1 + R_2) \cdots (1 + R_k)$$

We want to investigate the performance of your portfolio for the following combinations of α and β:

1. $\alpha = 0$, $\beta = 1$
2. $\alpha = 0.2$, $\beta = 0.8$
3. $\alpha = 0.4$, $\beta = 0.6$
4. $\alpha = 0.5$, $\beta = 0.5$
5. $\alpha = 0.6$, $\beta = 0.4$
6. $\alpha = 0.8$, $\beta = 0.2$
7. $\alpha = 1.0$, $\beta = 0$

Questions: For each combination of α and β above, assume that you start with \$100 at the beginning of each year. Compute the final, maximum and minimum amount of your portfolio after each year and summarize your results in 5 tables (one table for each year) like this:

α	β	Final	Max	Min
0	1	...	...	...
0.2	0.8	...	...	...
...	...	...	...	...
...	...	...	...	...
0.8	0.2	...	...	...
1	0	...	...	...

In each table, for each of the columns "Final", "Max" and "Min", color the largest value by green and smallest by red. Examine your table carefully and briefly describe if you see any patterns.