Objective

You are acting as a fund manager. The goal is to report on the performance of your mutual fund to your investors. Your fund includes 25 companies that I have chosen for your fund. Please find the list of companies that are assigned to your mutual fund in the file **Company_Student_List.xlsx.** The first sheet includes the ticker of the company and the strategy of your fund. The second sheet includes the names and other information of the companies. All firms are from the S&P500 index.

Deliverables and Output:

1. **Download Data**
   - Download Historical stock prices for all companies in your portfolio at the daily frequency from January 2006 to December 2021 from Yahoo Finance. Save close and adjusted close prices as well as Volume in separate sheets in an excel file; sheet_names "Price_daily", "Adj_Price_daily", and "Volume_daily".
     - **If, for any reason, Yahoo Finance does allow you to access the data for the whole 16 years, download as much as it provides.**
     - The preferred method is to use the **Pandas_datareader** to directly connect to Yahoo finance from **Python**. If you cannot perform this with Pandas_datareader, manually download the data from the Yahoo finance website. Save the output in a .CSV file. Then read these files to Python. Select the Date and Close price columns for each company and merge them all by Date. Save this dataFrame in the output excel file, sheet "Price_daily". Do the same for the adj. close prices and volume data.
   - Download prices for the S&P 500 index (^GSPC) from Yahoo finance similarly and save it in an excel sheet "S&P 500" on the same file. This is our proxy for the market portfolio.
2. **Calculate Firm Information**
   - Calculate the size (i.e. market capitalization) of each firm per year. That is, multiply the number of shares outstanding by the close prices in December of each year to get the total market capitalization of each firm per year. The Nov 2022 shares outstanding data is in sheet S&P 500 Constituents in the **Company_Student_List.xlsx** file. Yahoo Finance does not provide historical data for the outstanding shares, so here, we assume the companies did not issue new shares or had no share splits. Save the total market capitalization of firms in a new sheet and call it "Size" in the excel file.
   - Calculate the sum of daily Volume for each firm per year and save it in the sheet Volume_annual.
   - Resample the daily adjusted close prices at the monthly frequency and compute the monthly returns. Save them in a new sheet. Call it Returns_monthly.

3. **Provide summary statistics for your portfolio holdings (in sheet "Firm_Summary_Stat"):**

- For each firm, report its Minimum, Maximum, Mean, and volatility of returns, annualized.
- For each firm, report the size (market value of equity) at the end of your sample,
- For each firm, report the industry of each company (use the information in sheet S&P 500 Constituents in the Company_Student_List.xlsx file for the industry information of each company).
- Compute and report the market beta for each firm using the last 5 years' (2017:2021) return data, assuming the risk-free rate is 0 at the monthly frequency. Is this close to Beta values for today? Compare with the Beta information in sheet S&P 500 Constituents in the Company_Student_List.xlsx file, which is based on Nov 2022 prices. If they differ by more than 10%, mark them in your excel file.

4. **Portfolio Analysis**

Strategy = Equal: Every January, invest equally in all firms.

- Construct your portfolio by investing in each firm with respect to the fund's strategy from January 2006 to January 2020. Save the monthly returns of your portfolio in the sheet "PortfolioReturn_monthly". For the Equal strategy, first, find how many of the firms had return data in the past year. Then invest equally in them.
  - Using this weight (which is calculated from the previous year's data) and monthly firms' returns (R_j) calculate the fund return ($R_{fund,t}$) from January to December of this year

$$R_{fund,t} = \sum_j w_j * R_{j,t}$$

  - Repeat the above process the next January.
- Report the summary statistics of your portfolio and S&P 500 index return in sheet "Fund_summary":
  - Report the average, standard deviation, minimum, and maximum of these portfolio returns in annual percentage rates,
  - Calculate and report their Alpha, Beta, R2, with respect to S&P 500 index, using the whole length of data (i.e. since 2007)
  - Calculate and report their Sharpe ratio, Treynor ratio.,
- Report industry composition in sheet "Funds_Holdings_Composition"
  - In Excel, report at the end of the sample, how much you've invested in each firm, in percentage.
  - In the same sheet, plot a pie chart which shows, at the end of the sample, how much you've invested in each industry, in percentage.
- Plot the fund's performance

- Plot the histogram for your funds return as well as the S&P 500 index returns with 20 bins.
- Plot the cumulative return of your portfolio and S&P 500 from January 2007 to December 2021. This is equivalent to calculating the value of your fund if you start the fund with $1 in January 2007. For the S&P 500, find its monthly return similar to the other stocks.
- Plot the annual return of your fund (i.e. the sum of monthly returns per year) and the S&P 500 using bar plots, on the same graph.