FINA3351B Assignment 1
(Due by the end of April 18, 2025, Friday)

This project aims to use Monte Carlo simulation to forecast the individual stock prices and portfolio values based on GBM model.

Stock Selection: We choose three stocks listed in US market: International Business Machines (IBM), Procter & Gamble (PG), Exxon Mobil (XOM)

Part 1: Stock simulation (40 points)

1) Assume today is January 1, 2024.
2) Download 10-year monthly historical price data of three stocks from Yahoo!Finance. Save the stock market data in the submitted Excel file.
3) Assume that prices of three stocks follow geometric Brownian motion (GBM).
4) Write a VBA sub procedure named `Stock_sim` to simulate the prices of three stocks one year later for 5000 times. You should read the stock price data from the spreadsheet into the sub procedure, calculate stock returns, estimate all the parameters of GBM model, conduct the simulation, and write 5000 simulated prices of three stocks into the spreadsheet using this sub.
5) You decide how to measure stock returns.
6) After reporting the simulated stock prices in the spreadsheet, draw histograms to visualize the distribution of simulated stock prices for the three stocks. (You are NOT required to create the histogram using VBA.)

Part 2: Portfolio value simulation (60 points, 5 bonus points)

1) On January 1, 2024, an investor constructs an optimal risky portfolio using the three stocks and invest $100,000 into the portfolio.
2) Assume that there are no constraints on the investment, and no transaction costs.
3) The parameters used to construct the portfolio are based on 10-year monthly historical data of three stocks (which is 01/2014-12/2023).
4) Every 3 months, the investor will re-estimate the parameters using 10-year monthly historical data up to this day, for example, on 01/04/2024, parameters should be estimated using data from 04/2014-03/2024. Then the investor constructs the optimal risky portfolio again based on the newly estimated parameter and rebalances the investment accordingly. The investor holds the portfolio for 3 months and rebalances it again. The investor will liquidate the portfolio on 01/01/2025.

(*Note: the date that the investor re-estimates parameters and rebalances the portfolio should be 01/04/2024, 01/07/2024, 01/10/2024.*)

5) Conduct a Monte Carlo simulation of the liquidation value of the investment on 01/01/2025 for 5000 times.

6) You decide how to measure stock returns.

7) VBA sub procedure named `Portfolio_sim` to simulate the portfolio value on 01/01/2025 for 5000 times. You may calculate stock returns, estimate all the parameters used in GBM model and portfolio construction, and construct the optimal risky portfolios either in the spreadsheet, or in the VBA sub procedure. You can get 5 bonus points if you use VBA to complete these tasks.

   But you must use the VBA sub to simulate the portfolio values and report the simulation results in the Excel spreadsheet.

8) After reporting the simulated portfolio values in the spreadsheet, draw a histogram to visualize the distribution of simulated portfolio values. (You are NOT required to create the histogram using VBA.)

Deliverables:

1) Answer the project questions in one Excel file named "HW2.xlsm".

2) Include the following in the Excel file:

   a. Raw data for the three stocks
   b. Simulation results for stock prices and portfolio values
   c. VBA codes used for the simulations
   d. Design the worksheets for clear presentation of results
   e. Add comments to the VBA codes for clarity

3) You may directly use the VBA codes given in my lectures.

4) No written report.

Grading criteria:

1) Ensure correct downloading of data and inclusion of raw data in the Excel file.

2) Evaluate VBA codes based on:

   a. Accuracy of generated results
   b. Clean and efficient code (easy to modify and reuse, simplicity, well-commented)