# ISOM 2600 - Assignment 2

In this assignment, it is a consequence study of assignment1. At the end of last assignment, we find that the returns of BH is highly correlated with the returns of SP500. This motivates up to use a regression model to further study their relationship. In the dataset, it contains:

- Date: time indicator
- rBH: monthly returns of Berkshire and Hathaway
- rSP: monthly returns of SP500
- SmB: return of small size (capital) portfolios minus big size portfolios
- HmL: return of high value (book to market ratio) portfolios minus low value portfolios.

Part I: CAPM model
Assuming risk-free rate is 0 all the time, then the CAPM is simplified as a simple linear regression when the response variable is rBH and the explanatory variable is rSP.

Task 1: Set the first 155 monthly returns data as training set and the remaining 12 monthly returns data as test set.

Task 2: Using training set, fit a simple regression model mentioned above (SLR). Report the adjusted R-square of the model.

Part II: A financial researcher suggests adding SmB and HmL to the simple linear regression of above.

Task 3: Using training set, fit a multiple regression model with SmB and HmL explanatory variables in addition to rSP (MLR). Report the adjusted R-square of the model.

Task 4: Checking the multicollinearity problem among rSP, SmB and HmL by i) Scatter plot matrix ii) VIF. Is the multicollinearity problem exist?

Task 5: From the fitted multiple regression model in Task 3 (i.e. MRL), i) Is the model as a whole useful at 5% significant level? ii) Which of them is not an useful explanatory variable at 5% significant level?

Part III: Model Diagnostic
Task 6: Execute model diagnostic on the model fitted from Task3 (i.e. MLR) using the "four_in_one" function. Comment on the normality, constant variance assumption.

Part IV: Model Performance
Task 7: Compare the predictive power (RMSE) between SLR and MLR using the test set. Which one perform better in prediction?

After completion of all task and questions,

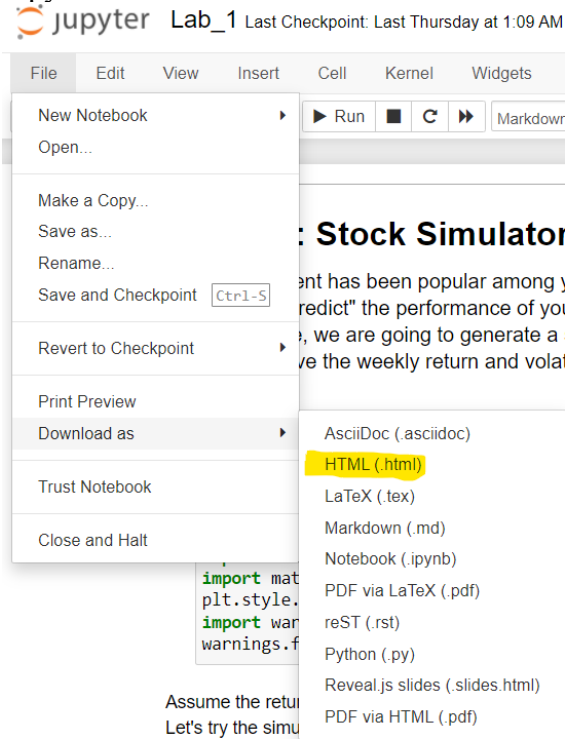
- For Jupyter Notebook/Jupyter lab user: Once you finish implementing all the codes, please export the notebook as HTML (see instruction below) and submit both your notebook and HTML to Canvas.

- For Google Colab user: Once you finish implementing all the codes, please download your .ipynb file (see instruction below). Please submit your .ipynb file with the outputs (Please DO NOT clear the outputs) to Canvas.

For Jupyter Notebook/Jupyter lab user

**Export the code and output as HTML:**

Jupyter Notebook: Go "File" > "Download as" > Choose "HTML"

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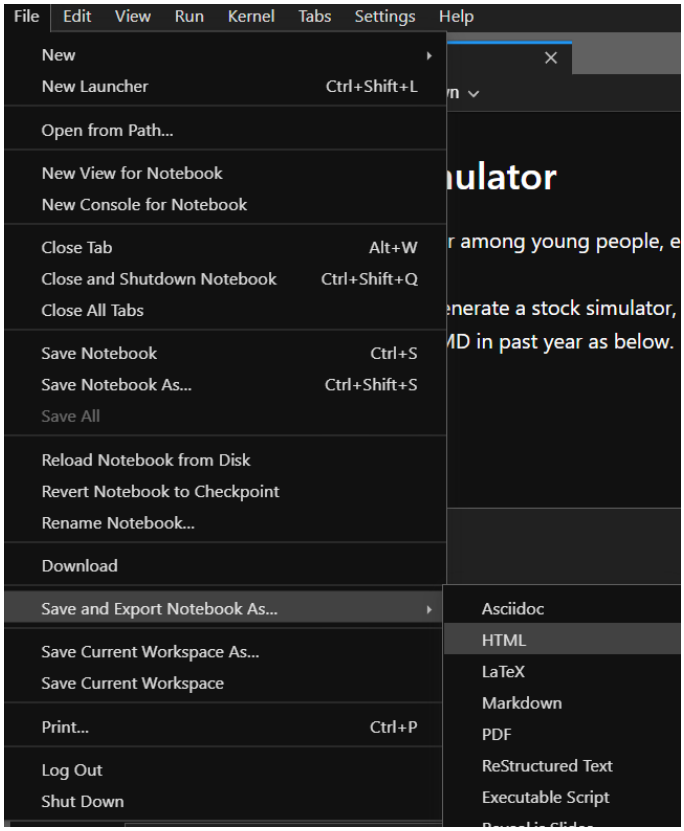


For Google Colab user:

**Export the code and output as ipynb:**