Homework 3

The book by Carmona refers to "Statistical Analysis of Financial Data in R"
by René A. Carmona, **2nd edition**; Accessible at
`https://lbdiscover.ust.hk/bib/991003455739703412`

I. Problem 4.8 on page 273 of the book by Carmona (In both questions 1 and 5, when conducting LS regressions, check whether the predictors are statistically significant at 5% significance level; as to the residuals, compute the *studentized* residuals instead of the raw residuals.)

The data *hills.csv* can be downloaded from Canvas.

II. Download the dataset "Google" from the course website. The dataset contains:

- First and second column (rGoog): Date and Alphabet Inc. (GOOG)'s monthly return from 2010.01 to 2021.08.
- Third column(rf): Monthly risk free rate of the same period.
- Fourth to sixth column (rM_{ex}, rSmB, rHmL): Fama-French Three-factor monthly returns of the same period.

Conduct the following analysis parallel to what we did in class for Berkeshire Hathaway Inc. (BRK-A). Set the significance level to be 5%.

1. Fit a single factor model for the excess return of GOOG with one predictor "rM_{ex}" using LS regression. Report the summary of the fit. (cf. Lect 8 p.5)

2. Based on the single factor model result, for GOOG stock data during the period tested (cf. Lect 8 p.9-17),

   (i). Is the market (excess) return significant in explaining the variation in the return of GOOG?

   (ii). Is α significantly different from 0? If so, in which direction?

   (iii). Is β significantly different from 1? If so, in which direction?

   (iv). Use the standardized/studentized residuals to conduct model diagnostics and comment.

3. Fit the Fama-French Three-factor model for GOOG using LS regression. Report the summary of the fit.(cf. Lect 8 p.21)

4. Are the three factors as a whole statistically significant? Is any single one of the factors statistically significant?(cf. Lect 8 p.22)

5. How much can the single factor explain the variation in the GOOG returns? How much can the three factors explain the variation in the GOOG returns? (cf. Lect 8 p.13)

6. Does the 3-factor model explain statistically significantly more variation than the single factor model (cf. Lect 8 p.24)?