

The first 4 problems are from §2.4 R Lab and §2.5 Exercises of Ruppert and Matteson 2015 (attached).

1. **2.4.3** Problems 9-11. The codes will produce 9 plots (3×3), these plots will be very difficult to see with the default size of R Markdown. Please change the size by setting the height at the beginning, for example,

```
{r, fig.height=8}
```

You should adjust the value when necessary, "8" may not work for your R Markdown document, you can also combine with a `fig.width` configuration. Also, plot line plots, set `type = "l"` instead of "b" for both line and points.

2. **2.4.4** Problem 17 only. The data in this question can also be downloaded from the [book website](#). The solutions for problems 12-16 are available in the [book website](#), you may find them helpful.
3. **2.5** Question 1
4. **2.5** Question 4.

For the rest of questions, you need to download data using `quantmod`'s `getSymbols()`. There are 3 sets of stock quotes required, ticker symbols are in parentheses.

S&P 500 (^GSPC), Chevron Corp, (CVX), Amazon(AMZN)

- Install and load the package
 - Please download these stock quotes by setting `from = "2005-01-01"`, `to = "2024-08-01"`
 - All the price series should be adjusted closing prices.
 - All the returns should be log returns based on the adjusted closing price.
 - Use `fig.height` or/and `fig.width` at the beginning of a chunk to change the dimensions of plots when necessary.
5. The S&P 500 is one of the two most watched indices for representing the US market. We will focus on the impact of recent events by exploring only the period after Jan 1, 2018. We can subset the stock quotes, for example

```
GSPC["2018-01-01::2024-08-01"]
```

will give the quotes of S&P 500 of the period of interest.

- (a) Plot the adjusted closing price and the daily log returns of S&P 500 of this period. Describe what you see from these plots, you should include the impact of those major events.

```
plot(Ad(GSPC["2018-01-01::2024-08-01"]))
```

```
plot(dailyReturn(Ad(GSPC["2018-01-01::2024-08-01"])), type = "log")
```

You can change a plot title by setting `main`, for example, `main = "GSPC Daily Return"`. Using a 2×1 layout can be helpful, try resizing with `{r, fig.width = 7, fig.asp = 1}`.

- (b) Plots the adjusted closing price and the daily log returns of Chevron and Amazon of the same period. Compare any impact between these two stocks and to the market (the S&P 500 index).

6. Consider only Chevron in this question, use the entire set of stock quotes (do no subset).

- (a) Plot histogram (pages 18-20, Handout 2) and normal probability plot (page 25) for daily-, weekly- and monthly-returns. See Figure 2.3 on page 18 of Handout 2, but we will use a 2×3 multiple plot layout instead of 3×2 with histograms in one row and normal probability plots in another. Some tips for R code.

- The command `par(mfrow = c(2,3))` will plot 6 plots by rows, command `par(mfcol = c(2,3))` will plot 6 plots by columns.
- You can change the title of a plot by setting `main = "title you like"`. Change the labels of x -axis (y -axis) by setting `xlab = "label you like"` (`ylab = "label you like"`).
- It will be convenient to create an R object including the three return series. The three return series have different lengths, can not be put into a matrix. We should use a vector with the "list" mode. For example,

```
Rt = list(Daily = dailyReturn(Ad(CVX), type = "log"),
          Weekly = weeklyReturn(Ad(CVX), type = "log"),
          Monthly = monthlyReturn(Ad(CVX), type = "log"))
```

The command `Rt$Daily` or `Rt[[1]]` will return the daily return of CVX, the command `names(Rt)[1]` will return "Daily". You should be able to retrieve weekly and monthly returns. The 6 plots can be done in one loop. It is also helpful for part(c).

- (b) Compare and comment on the plots you generate in part (a).
- (c) Compute the skewness and kurtosis for each return series of Chevron. Test each return series for normality using the Shapiro-Wilk test. Comment on these statistics, do they agree with your finding from part (b)?

Note: R's `shapiro.test` does not take `xts` object, use `as.vector()` or `as.numeric()` to remove class of an `xts` object. (All data downloaded using `quantmod`'s functions are of `xts` class).

5. Do problems 4,5,6 of RLab §4.10 using the daily returns of the entire S&P 500 (2005-01-01 to 2024-08-01).

For problems 4-5, plot the Q-Q plots as describe on the first paragraph of page 79 with a few changes:

- The code in the book is for plotting 4 series and there are 6 plots for each series. We only have one series, thus we will not need double loops. Carefully modify the code. You should have the value of degrees of freedom as the title for each plot, but the code requires modification (we do not have `index.names[i]`).
- Set `df_grid = 2:7`
- For the plots, both `qqplot()` and `lm()` require changing the daily return to a regular vector using `as.vector()` or `as.numeric()`.

For problems 6, plot the density plots with the code below program 5 in the end of page 79 to 80. Install fGarch package first. Change df in the R code to the best one you chose in problem 5.