Computer Trading Strategies

Homework 1: Due 2/4/2024

This course is designed for all of us to collectively learn from one another. Homework is no exception. As such, all homework assignments, are team assignments that are to be completed as tutorials and they will be shared with the rest of the class. That is, the assignments will require you to put together a guide that carefully explains the what's, why's, and how's, in order to accomplish the assignment. Importantly, the skills, concepts, and techniques required to answer the questions should be clearly specified in terms of learning outcomes.

This homework assignment is no exception. On the due date, you will electronically submit (via email) to me both the tutorial (as a PDF file) and an *R* script that contains the *R* programming code to complete each of the assigned questions. For the tutorial, you should submit two versions: one that is completely anonymous (no team or student identifiers and another that contains your team number and team member names in the header of the document. The subject heading of your email should specify "Computer Trading, Homework #, Team #." Only one email submission per team. Following these instructions exactly will make your instructor happy and act kindly towards you.

You may find it helpful to develop your tutorial as an *R* Markdown file, but this is not required. The code to answer each individual question should be stand alone, so that there is no reliance on code or results from the answers to prior questions. That is, your answer to question 2 should not rely on anything required for question 1 and that includes setting directories, clearing the work environment, loading data sets, etc. Note that you may use whatever R functionality (covered in class or found on your own) that you feel is best to answer a question and points will be awarded for simplicity and efficiency of the code, in addition to its absolute correctness. While the code must be stand alone, the tutorial itself, however, may build on previous concepts and discussions – there is no need to re-explain or repeat prior discussions. If you have questions regarding the tutorial or any other aspect of the assignment, please raise them in class so your classmates can benefit as well.

This assignment requires manipulating stock data in R. The primary data file is named OHLC.rdata and accompanies this post. The data file contains the full year of daily open, high, low, close, and volume for each of the S&P 500 stocks over the calendar year of 2019. A separate csv file named sector.csv, that identifies the sector to which each stock (symbol) belongs will also be needed to answer some of the questions. The specific assignment questions are:

1. (25 points) Identify the top 10 stocks and bottom 10 stocks in terms of total annual return (open-to-close) for the entire year. Report each set of stocks separately, from highest to lowest (in terms of absolute value) return along with the value of the return itself, as a percentage to 1 decimal. Ignore all stocks in which the corresponding data begins after the first trading day of the year or ends prior to the last trading day of the year. Note that there are typically 252 trading days in a year.

2. (25 points) Report the average annual return, across stocks for each financial sector. Use the same reporting style as per question 1.

3. (25 points) Create a matrix or average returns by sector (rows) and month (columns). Use open-to-close for the monthly returns of each stock. Sort rows alphabetically by sector.

4. (25 points) Now, let's assume you would like to know the daily and cumulative returns that would arise if you had day traded Apple stock. Assume you purchase one share every day at the open and sell that same share at the close. Plot the daily return and cumulative return for the entire year. In addition, keep track of and plot the maximum cumulative return achieved through each trading day. So let say the daily return on the first day is 0.9875 (relative to 1.00 so this is a loser day), then the cumulative return is also 0.9875 and so too is the maximum return. Now on the second day, let's say the daily return is 1.0258. Then the cumulative return is 0.9875*1.0258 = 1.013 (with a little rounding). Now the maximum cumulative return is also 1.013 since it is greater than 0.9875. Note that if the daily return in a trading day is less than 1, then the cumulative maximum return will be the same as the prior trading day. In addition to the plot, be sure to provide an explanation of what information this cumulative maximum return provides and how it might be useful in evaluating a trading strategy.