Assignment:

1. Consider some monthly simple returns of the CRSP Decile portfolios. The portfolios consist of NYSE/AMEX/NASDAQ stocks based on market capitalization and rebalanced annually. See CRSP (via WRDS) for more information. The file “m-deciles08.txt” contains the returns of Deciles 1, 2, 9, and 10 from January 1970 to December 2008. See the column names to identify the portfolios.

   (a) Compute the first 24 lags of ACF and PACF of the simple return series of Decile 1 portfolio.

   (b) Test the hypothesis that the first 12 lags of ACF are zero. That is, $H_0 : \rho_1 = \ldots = \rho_{12} = 0$ versus $H_a : \rho_i \neq 0$ for some $1 \leq i \leq 12$. Draw your conclusion.

   (c) Focus on the ACF at lag 12, i.e., $\rho_{12}$. Test the hypothesis $H_0 : \rho_{12} = 0$ versus the alternative hypothesis $H_a : \rho_{12} \neq 0$. Draw your conclusion.

   (d) Focus on the PACF at lag 12, i.e., $\phi_{12,12}$ (see page 40 of the text). Test the hypothesis $H_0 : \phi_{12,12} = 0$ versus the alternative hypothesis $H_a : \phi_{12,12} \neq 0$. Draw your conclusion.

   Remark: The serial correlation at lag 12 of Decile 1 returns leads to the discussion of January effect of small-cap stocks in finance. You check the returns of Decile 2. They also have January effects.

2. Consider the monthly simple returns of the CRSP Decile 9 portfolio in Problem 1.
(a) Test the hypothesis that the lag-12 ACF is zero. That is, \( H_0 : \rho_{12} = 0 \) versus the alternative hypothesis \( H_a : \rho_{12} \neq 0 \). Draw your conclusion. Remark: Comparing with Problem 1, we see that there is no January effect in the large-cap stocks. The same holds for Decile 10 returns.

(b) Consider the absolute simple returns of Decile 10 portfolio. Test the hypothesis that the first 12 ACFs are zero. That is, \( H_0 : \rho_1 = \ldots = \rho_{12} = 0 \) versus the alternative hypothesis \( H_a : \rho_i \neq 0 \) for some \( i \), \( 1 \leq i \leq 12 \). Draw your conclusion.

3. Consider the daily closing, open, asking-high, and bidding-low prices of Boeing stock from January 2, 2001 to December 31, 2008. The data are in the file “d-bacohl0108.txt”, which contains headings for each columns. Compute the daily log price range as \( r_t = \ln(H_t) - \ln(L_t) \), where \( H_t \) and \( L_t \) denote asking-high and bidding-low prices, respectively. Daily range can be used to measure volatility of the stock log price. Answer the following questions:

(a) Compute the first 10 lags of ACF of \( r_t \). Test the null hypothesis that the first 10 lags of ACF are zero. Draw your conclusion. [Note: 10 lags correspond to the number of trading days in two weeks.]

(b) Compute the first 20 lags of PACF of \( r_t \). Suppose you like to fit an AR model to \( r_t \). What order would you use based on the PACF? Why? [You do not need to fit the model.]

4. The U.S. unemployment rate went up recently. We shall consider the monthly series from 1948 to March 2009. The data are in “m-unrate.txt”. The data are available from the Federal Reserve Bank at St Louis.

(a) Plot the monthly unemployment rate series and its ACFs (16 lags).
(b) Identify an AR model for the series, fit the model, and write down the result.
(c) Does the fitted AR model indicate existence of business cycles? Why?
(d) Compute 1-step to 4-step ahead forecasts of the fitted model at the end of the data, i.e. the March 2009. Write down the forecasts and their standard errors.

5. Consider the monthly simple return of CRSP Decile 9 portfolio from January 1970 to December 2008 of Problem 1.

(a) Since there is only a “large” acf at lag 1, fit an MA(1) model to the series. Write down the fitted model.
(b) Compute 1-step to 4-step ahead forecasts of the fitted MA(1) model using the last observation as the forecast origin. Write down the forecasts and their standard errors. Why are the 2-step to 4-step forecasts the same?

Reading assignments: Chapter 2 of the textbook.