Due Date: April 23 (Campus) & April 24 (Weekend)

Note: Unless specifically assigned, all tests are based on the 5% significance level. All data are on the course web.

1. Consider the quarterly earnings of Coca Cola Company from the first quarter of 1983 to the third quarter of 2009. Take transformation if necessary. (a) Build a time series model for the series. Write down the model, including model checking. (b) Perform 1-step to 5-step point forecasts of the earnings at the forecast origin 2009.III.

2. Consider the monthly simple returns of the CRSP Decile 10 portfolio from January 1967 to December 2009. See Problem 5 of HW#2. The goal of this and the next two questions is to demonstrate ways to handle the January effect in the stock market. In HW#2, you fit the model \( r_t = \mu + (1 - \theta_1 B - \theta_{12} B^{12}) a_t \). Here we consider two seasonal time series models.

   (a) Fit the multipliative model \( ARIMA(0,0,1)(0,0,1)_{12} \) using the command
   
   \[
   \text{m2=arima(d10,order=c(0,0,1),seasonal=list(order=c(0,0,1),period=12))}
   \]
   
   where “d10” denote the series of Decile 10 portfolio returns. Perform model checking using 36 lags of the residual ACF. Is the model adequate? Why? Write down the fitted model.

   (b) As a third model, you can consider another multiplicative model as
   
   \[
   \text{m3=arima(d10,order=c(0,0,1),seasonal=list(order=c(1,0,1),period=12))}
   \]
   
   Again, perform model checking using 36 lags of residual ACF. Is the model adequate? Why? Write down the fitted model. Comment on the model.

3. As a fourth model, you can use the dummy variable for January, resulting in employing a regression model with time-series errors. The command \( x1=\text{rep(c(1,rep(0,11)),43)} \) generates the dummy variable for January. Now, consider the model

   \[
   \text{m4=arima(d10,order=c(0,0,1),xreg=x1)}
   \]

   Again, perform model checking using 36 lags of residual ACF. Is the model adequate? Why? Write down the fitted model.

4. Including the model of Problem 5, HW#2, we consider four models for the Decile 10 returns. Are there differences between the four models? Do you have any preference? Why? Describe methods that can be used to compare these four models.
5. The weekly initial jobless claims might be helpful in predicting the U.S. monthly unemployment rate. To this end, I have constructed a monthly initial jobless claims based on the weekly data. Specifically, I add all the jobless claims in a given month to obtain the jobless claims number of that month. I then divide the number by 1,000,000. Note that there are many ways to make use of the information of initial jobless claims. This exercise is just a simple illustration.

The monthly initial jobless claims and the unemployment rate from January 1967 to February 2010 are in the files m-claims.txt and m-unrate.txt, respectively. Reserve the last 14 data points for forecasting comparison. That is, use the data up to December 2008 in modeling. Perform the following analysis.

(a) Build a ARIMA time series model for the unemployment rate. Write down the fitted model, including some model checking statistics.

(b) Build a regression model with time series error for the unemployment rate series. Here the independent variable is $x_{t-1}$, where $x_t$ denotes the monthly initial jobless claims. Write down the fitted model, including some model checking statistics. Did the unemployment rate depend significantly on the initial jobless claims of the previous monthly?

(c) Use the program backtest to compute the mean squared forecast errors of 1-step ahead predictions for the two models in Parts (a) and (b). The initial forecast origin is December 2008.

(d) Based on the result of backtest, select a model for the unemployment rate.

[Hint: There is no true model for the series. The objective is for you to gain some experience in analyzing real time series. Make sure that the models you build pass model checking.]