Assignment 8

1. (i) Simulate 100 observations from the following process :
   a. $Z_t = a_t$
   b. $Z_t = a_t - 1.5a_{t-1}$
   where $a_t \sim WN(0, 1)$. Compute the sample ACF of $\{Z_t\}$, i.e, $\hat{\rho}_k$, k = 1, 2, 3.
   (ii) Repeating (i) for 1,000 times to evaluate the mean, variance and covariance of $\hat{\rho}_1, \hat{\rho}_2 \; and \; \hat{\rho}_3$.
   (iii) Compare the results of (ii) with the Bartlett's formula.

2. Suppose that the daily log return of a security follows the model
   $$r_t = 0.01 + 0.2r_{t-2} + a_t$$
   where $\{a_t\}$ is a Gaussian white noise series with mean zero and variance 0.02. What are the mean and variance of the return series r_t ? Compute the lag-1 and lag-2 autocorrelations of r_t. Assume that r_{100} = −0.01, and r_{99} = 0.02. Compute the 1- and 2-step-ahead forecasts of the return series at the forecast origin $t = 100$. What are the associated standard deviations of the forecast errors?

3. Consider the monthly U.S. unemployment rate from January 1948 to March 2009 in the file m-unrate.txt. The data are seasonally adjusted and obtained from the Federal Reserve Bank of St Louis. Build an AR time series model for the series and use the model to forecast the unemployment rate for the April, May, June, and July of 2009. In addition, does the fitted model imply the existence of business cycles? Why? (Note that there are more than one model fits the data well. You only need an adequate model.)

4. Consider the weekly yields of Moody's Aaa and Baa seasoned bonds from January 5, 1962, to April 10, 2009. The data are obtained from the Federal Reserve Bank of St Louis. Weekly yields are averages of daily yields. Obtain the summary statistics (sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum) of the two yield series. Are the bond yields skewed? Do they have heavy tails? Answer the questions using 5% significance level.