MTHSTAT 564/564G/764–Time Series Analysis
Spring 2024
Problem Solving Set 7

Please think about the following problems from the textbook in advance of our problem solving sessions on them:

Problem Solving 7

1. Suppose that $\{Y_t\}$ is generated according to $Y_t = e_t + ce_{t-1} + ce_{t-2} + ce_{t-3} + \ldots + ce_0 for t > 0$.
   (a) Find mean and autocovariance functions for $\{Y_t\}$. Is $\{Y_t\}$ stationary?
   (b) Find the mean and autocovariance functions for $\{\nabla Y_t\}$. Is $\{\nabla Y_t\}$ stationary?
   (c) Identify $\{Y_t\}$ as a specific ARIMA process.
2. Using the simulated white noise values in Exhibit 5.2, page 88, verify the values shown for the explosive process Y_t.
3. Consider a stationary process $\{Y_t\}$. Show that if $\rho_1 < \frac{1}{2}$, ∇Y_t has a larger variance than does Y_t.
4. Verify Equation (5.1.10) on Page 90.
5. The data file "airpass" contains international airline passenger monthly totals (in thousands) flown from January 1960 through December 1971. This is a classic time series analyzed by Box and Jenkins (1976).
   (a) Display and interpret the time series plot for these data.
   (b) Now take natural logarithms of the monthly values and display the time series plot of the transformed values. Describe the effect of the logarithms on the behavior of the series.
   (c) Calculate the fractional relative changes $(Y_t - Y_{t-1})/Y_{t-1}$, and compare them to the differences of the natural logarithms $\nabla \log(Y_t)$?. How do they compare for smaller and larger values?
6. Quarterly earnings per share for the Johnson and Johnson Company are given in the data file named "JJ." The data cover the years from 1960 through 1980.
   (a) Display a time series plot of the data. Interpret the plot and mention any interesting features.

(b) Use software to produce a Box-Cox transformation plot and determine the "best" value of λ for a power transformation of these data.

(c) Display a time series of the transformed values. Does this plot suggest that a stationary model might be appropriate.

(d) Display a time series plot of the differences of the transformed values. Does this plot suggest that a stationary model might be appropriate for the differences?