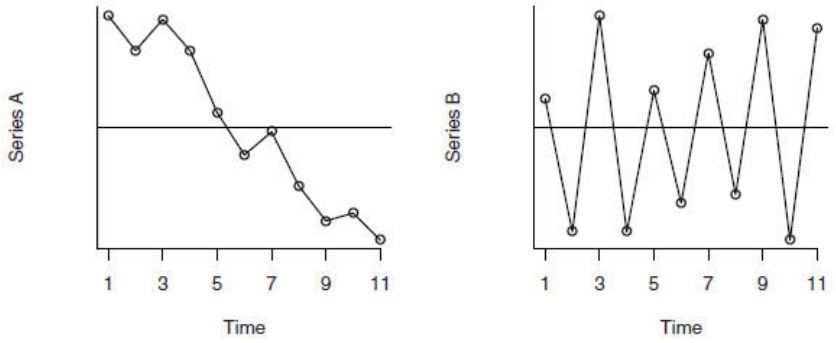
FINM3133 Time Series for Finance and Macroeconomics

Chapter 6 Exercises

1. Verify Equation (6.1.6) on page 7 of lecture notes for the AR(1) process.
2. From a time series of 100 observations, we calculate $r_1 = -0.49, r_2 = 0.31, r_3 = -0.21, r_4 = 0.11$, and $|r_k| < 0.09$ for $k < 4$. On this basis alone, what ARIMA model would we tentatively specify for the series?
3. For a series of length 169, we find that $r_1 = 0.41, r_2 = 0.32, r_3 = 0.26, r_4 = 0.21$, and $r_5 = 0.16$. What ARIMA model fits this pattern of autocorrelations?
4. The time plots of two series are shown below.
   (a) For each of the series, describe r_1 using the terms strongly positive, moderately positive, near zero, moderately negative, or strongly negative. Do you need to know the scale of measurement for the series to answer this?
   (b) Repeat part (a) for r_2.



5. Simulate an AR(1) time series of length $n = 36$ with $\phi = 0.7$.
   (a) Calculate and plot the theoretical autocorrelation function for this model. Plot sufficient lags until the correlations are negligible.
   (b) Calculate and plot the sample ACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (a)?
   (c) What are the theoretical partial autocorrelations for this model?
   (d) Calculate and plot the sample PACF for your simulated series. How well do the values and patterns match the theoretical PACF from part (c)? Use the large-sample standard errors to quantify your answer.

6. Simulate an MA(1) time series of length $n = 48$ with $\theta = 0.5$.

   (a) What are the theoretical autocorrelations for this model?

   (b) Calculate and plot the sample ACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (a)?

   (c) Calculate and plot the theoretical partial autocorrelation function for this model. Plot sufficient lags until the correlations are negligible. (Hint: $\phi_{kk} = -\frac{\theta^k(1-\theta^2)}{1-\theta^{2(k+1)}}$ for $k \geq 1$)

   (d) Calculate and plot the sample PACF for your simulated series. How well do the values and patterns match the theoretical ACF from part (c)?

7. The data file named **deere2** contains 102 consecutive values for the amount of deviation (in 0.0000025 inch units) from a specified target value that another industrial machining process produced at Deere & Co.

   (a) Display the time series plot of this series and comment on its appearance. Would a stationary model seem to be appropriate?

   (b) Display the sample ACF and PACF for this series and select tentative orders for an ARMA model for the series.

8. The data file named **robot** contains a time series obtained from an industrial robot. The robot was put through a sequence of maneuvers, and the distance from a desired ending point was recorded in inches. This was repeated 324 times to form the time series.

   (a) Display the time series plot of the data. Based on this information, do these data appear to come from a stationary or nonstationary process?

   (b) Calculate and plot the sample ACF and PACF for these data. Based on this additional information, do these data appear to come from a stationary or nonstationary process?

   (c) Calculate and interpret the sample EACF.

   (d) Use the best subsets ARMA approach to specify a model for these data. Compare these results with what you discovered in parts (a), (b), and (c).