1. (To turn in.) (a) Find the ACVF for the time series $x_t = z_t + 0.3z_{t-1} - 0.4z_{t-2}$, where $z_t$ is a white noise time series with mean 0 and variance 1. (b) Find the ACVF for the time series $y_t = w_t - 1.2w_{t-1} - 1.6w_{t-2}$, where $w_t$ is a white noise time series with mean 0 and variance 0.25. (c) Compare your results for the two previous parts.

2. (To turn in.) By borrowing from the R code given in Section 2.4 of the textbook, apply the smoothing techniques from Examples 2.10 to 2.14 to the airline passengers data that we used on the previous homework assignment. Try to obtain an estimate of the deseasonalized trend. For the one smoothing technique that you think does the best job for this data set, turn in (a) the R code that you used to do the smoothing and (b) a plot like Figure 2.11 that shows (i) the original data plotted as open dots and (ii) the smoothed fit plotted as a solid curve. Also turn in (c) some brief comments on why you chose this particular smoothing technique.

3. (To turn in.) Four time series of length 200 are available on the course website. The time series are (1) iid noise, (2) a moving average process, (3) an AR(1) process, and (4) a random walk. Download the time series and, by computing the ACF for each time series in R or Minitab, decide which time series is which. (Doing more than just computing ACFs is also fine.) Carefully explain, possibly by using sketches of the ACF plots, how you reached your conclusions.

4. (Not to turn in.) Suppose that $y_1, \ldots, y_n$ is a sequence of random variables. Define $T$ to be the number of triples $(y_i, y_{i+1}, y_{i+2})$ such that $y_i < y_{i+1} < y_{i+2}$. (a) Using the same sort of ideas that we used in our in-class discussion of testing whether a sequence is iid noise, find the mean and variance for $T$ under the null hypothesis that $y_1, \ldots, y_n$ is iid noise. (Hints: Note that there are $n-2$ triples to consider. When computing $V(T)$, there are variance and covariance terms to consider, but most of the covariance terms are 0. The expected value of a 0-1 random variable is just the probability that the random variable is 1.) (b) Assuming that $T$ is asymptotically normal, explain how one could use $T$ to test whether a sequence is iid noise. For what sorts of departures from iid noise do you think the test would have good power? Please explain. (c) Suppose that $n = 200$ and $T = 36$. Does the test from part (b) reject or retain the null hypothesis of iid noise at level $\alpha = 0.10$?

5. (To turn in.) Suppose that the time series $x_t$ is stationary. Carefully show that $y_t = \nabla x_t$ is also stationary. As part of your demonstration, write the ACVF for $y_t$ in terms of the ACVF for $x_t$. 