

# Homework Assignment 6

Deadline: March 11, 11:59 pm

1. Consider three separate AR(1) models:  $\phi = 0.1$ ,  $\phi = 0.5$ , and  $\phi = 0.8$ .
  - (a) For each model, calculate  $\rho_1$  and  $\rho_7$ .
  - (b) For each model, calculate  $Var(r_1)$  and  $Var(r_7)$ .
  - (c) For each model, use the `arima.sim` function to simulate a time series of length  $n = 60$ . Then use the `acf` function to calculate  $r_1$  and  $r_7$ . Remember to set up a random seed for your simulation.
  - (d) Based on your results in parts (a) and (b), are  $r_1$  and  $r_7$  from part (c) within 2 standard deviations of  $\rho_1$  and  $\rho_7$  respectively?
  - (e) Repeat part (c) for 1000 times. Draw histograms for  $r_1$ 's and  $r_7$ 's for each model. What proportion of  $r_1$ 's and  $r_7$ 's are within 2 standard deviations of  $\rho_1$  and  $\rho_7$ ?
2. Consider an AR(1) model with  $\phi = 0.6$ .
  - (a) Use the `arima.sim` function to simulate three time series of lengths  $n = 15, 75$ , and  $150$ .
  - (b) For each set of simulated data, calculate  $r_1$ .
  - (c) For each  $n$ , what is  $Var(r_1)$ ? Is  $r_1$  within 2 standard deviations of  $\rho_1$  for each sample?
  - (d) Repeat part (a) for 1000 times. For each  $n$ , draw a histogram of the 1000  $r_1$ 's, and find what proportion of  $r_1$ 's are within 2 standard deviations of  $\rho_1$ .
3. Consider an MA(1) model with  $\theta = 0.6$ .
  - (a) Use the `arima.sim` function to simulate three time series of lengths  $n = 15, 75$ , and  $150$ . Note that R uses the negative of the MA coefficients.
  - (b) For each set of simulated data, calculate  $r_1$ .
  - (c) For each  $n$ , what is  $Var(r_1)$ ? Is  $r_1$  within 2 standard deviations of  $\rho_1$  for each sample?
  - (d) Repeat part (a) for 1000 times. For each  $n$ , draw a histogram of the 1000  $r_1$ 's, and find what proportion of  $r_1$ 's are within 2 standard deviations of  $\rho_1$ .
4. The dataset `days` contains accounting data. The data is the number of days it took to receive payment for 130 consecutive orders from a particular distributor.
  - (a) Plot the times series. Are there any unusual values?
  - (b) Draw the sample ACF and sample PACF plots. What do you find?
  - (c) Replace the unusual values with a value of 35 days. Redraw the sample ACF and sample PACF plots. Are they different from part (b)?
  - (d) What ARMA model would you specify for this series after removing the outliers? Explain.