STAT 485/685

Assignment 3

1. Use the `R` command `arima.sim` to generate four time series of length 200: white noise, an AR(1) with $\phi = 0.8$; an MA(1) process with $\theta = 0.79$; and an ARMA(1,1) process with $\phi = 0.8$ and $\theta = 0.79$. Use `acf` to plot the autocorrelations of these 4 series and describe any differences and similarities you see. WARNING: in `R` I think you will need to use the parameter -0.79 to match the text books definition of θ. You should check this by looking at the autocorrelation function of your MA series.

2. Use `arima.sim` to generate 100 MA(1) processes with $\theta = -0.8$. For each series use `lm` to fit a linear trend to the mean; save the estimated slope. Compute the sample deviation of the 100 estimated slopes. Compare this standard deviation to the 100 standard errors computed by lm. This questions will require you to write a loop in `R` (or do something more sophisticated).

3. Generate 100 time series of length 200 which are just white noise. For each series fit a linear trend to the mean; save the residuals as a new time series. Apply the runs test to that time series and save the P-value. Plot a histogram of the P-values and report how many of the P values are smaller than 0.05. Interpret the histogram and the count to tell me if the runs test appears to work properly.

4. From the text 4.2. By "sketch" I mean plot in `R`.

5. From the text 4.5. By "sketch" I mean plot in `R`.

6. From the text 4.6.

7. Use `curve` in `R` to plot the autocorrelation at lag 1 (that is, ρ_1) of an MA(1) process as a function of θ for θ running from -3 to 3.

8. Look at Question 3.16 in the text; it gives a formula for the variance of $\bar{Y}$ for an AR(1) series. For $n = 100$ plot the standard deviation corresponding to this variance as a function of ϕ from -0.9 to 0.9; again `curve` can help.