**Submit this assignment in a Word document or a pdf to Canvas Homework 2.**

**1.** Consider the following short time series data set:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *t* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| *xt* | 58 | 29 | 46 | 56 | 53 | 61 | 52 | 67 | 76 | 56 | 48 | 48 | 57 | 65 | 57 | 49 | 60 | 59 | 52 | 54 |

Evaluate each of the following expressions (i.e., give a numerical answer):

1. 
2. 
3. 
4. 
5. 
6. 

**2.** Write out the autoregressive and moving average polynomials for the following model:

$$x\_{t}=.35x\_{t-1}-.5x\_{t-2}+w\_{t}+.7w\_{t-1}+.46w\_{t-2}$$

Hint: The key structure for this answer is (AR polynomial)xt = (MA polynomial)wt .

**3**. Consider the MA(1) model  with the wt assumed to be iid N(0,).

A. Give a numerical value for the first lag autocorrelation.

B. Give a numerical value for the second lag autocorrelation.

C. Describe the appearance of the ACF for this model.

D. Use R to sketch the ACF for this model. The commands are:

 acfprob3=ARMAacf(ma=c(.6), lag.max=10)

 plot(seq(0,10), acfprob3, xlim=c(1,10), xlab="lags", type="h")

(In the plot command, the type="h" causes projections from the value to the axis as we usually do in an ACF. The xlim option removes the unnecessary lag 0 ACF.)

E. To get the PACF of this model, modify the command by adding the pacf option:

 pacfprob3 = ARMAacf(ma=c(.6), lag.max=10, pacf=TRUE)

 plot(pacfprob3, type="h")

**4**. Consider the AR(1) model 

A. Give a numerical value for the first lag autocorrelation. (You might want to look back at the Lesson 1 notes.)

B. Give a numerical value for the second lag autocorrelation.

C. Give a numerical value for the third lag autocorrelation.

D. Describe the appearance of the PACF for this model.

E. Use R to sketch the ACF for this model. The commands are:

 acfprob4=ARMAacf(ar=c(-.6), lag.max=10)

 lags=0:10 #creates a variable named lags that ranges from 0 to 10.

 plot(lags, acfprob4, xlim=c(1,10), type="h")

F. To get the PACF of this model, modify the command by adding the pacf option:

 pacfprob4 = ARMAacf(ar=c(-.6), lag.max=10, pacf=TRUE)

 plot(pacfprob4, type="h")

**5.** The time series for this problem is stride length measured every 30 seconds for a runner on a treadmill moving at pace of 7 minutes per mile.

Following are the ACF and PACF for the series. Briefly describe what model(s) may be suggested by these plots (and explain why).



