Assignment - 7

BSAN 450 (Spring 2023)

**This assignment is due on April 11, 2023 at 9:00 PM Central. The total points possible are 100 and there are two (2) problems, each carrying equal points. You can form groups to attempt these problems. Each group will submit one copy of the assignment on Canvas, either in word or pdf, and the assignment should clearly include the names of the group members**.

1. In this problem the data is chemical concentration readings over consecutive periods. The data is in a file named ChemicalConcentration.csv. The name of the variable in this file is Con.

1. Read this data into R Studio. Plot a time series plot of this data. Does this data appear to be a stationary time series? Justify your answer.
2. Plot the sample autocorrelations and the sample partial autocorrelations for this data. From these plots identify a model that would be appropriate for this data. Justify your choice.
3. Assume that this data follows an AR(2) model. Estimate the parameters in this model. Are all the parameters in this model statistically significantly different from zero? Perform the diagnostic checks for this model. Are there any problems suggested?
4. As part of checking the model estimate the following more general models. (i) An ARMA(2,1) model, and (ii) An ARMA(3, 0) model. Interpret the results. What do these suggest about the best model for this data? For fitting an ARMA(2,1) you may use arima(x = concentration$Con, order = c(2, 0, 1)). The first element is c(2) is the AR order, the second element is something that we will see later (for now this should be 0), and the third element is the MA order of the model. Thus if you want to fit an AR(2) model the expression should be order = c(2,0,0). If you want to fit an MA(2) model the expression should be order = c(0,0,2).
5. Compute and plot forecasts for the model you believe is most appropriate.

2. The data for this example is percent of the time that parts for industrial project available when needed for a sequence of weeks. The data is in a file named time.csv and the name of the time series in that file is Time.

1. Read the data into R Studio. Plot a time series plot of the data, plot the sample ACF,

and plot the sample PACF for this data. Based on this output suggest a model that

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would be appropriate for this time series.

1. Fit the model that you identified in part (a). Perform the diagnostic checks for this model. Note that the first command is appropriate if you want to fit an ARMA(1,1) model in R.
2. Perform the Box-Ljung test on the residuals. The command to do this for an ARMA(1,1) model is given below.

Box.test(residuals(fit),lag=10,type="Ljung",fitdf=2)

The expression lag=10 tells R to use the first 10 autocorrelations in the test. This is a good choice for the models we are currently using in the class. In the expression fitdf=2, the value 2 needs to be set to be the number of AR parameters plus the number of MA parameters in the model you fit. Thus if you fit an ARMA(1,1) model, fitdf=2 because there are 2 AR plus MA parameters. If you fit an AR(1) model the fitdf=1 is appropriate because there is 1 AR parameter.

1. Do the residual plots suggest that there is anything wrong with the model you fit? Why or why not?

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