

ENV 790.30 - Time Series Analysis for Energy Data | Spring 2021

Assignment 6 - Due date 03/16/22

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Directions

You should open the .rmd file corresponding to this assignment on RStudio. The file is available on our class repository on Github. And to do so you will need to fork our repository and link it to your RStudio.

Once you have the project open the first thing you will do is change “Student Name” on line 3 with your name. Then you will start working through the assignment by **creating code and output** that answer each question. Be sure to use this assignment document. Your report should contain the answer to each question and any plots/tables you obtained (when applicable).

When you have completed the assignment, **Knit** the text and code into a single PDF file. Rename the pdf file such that it includes your first and last name (e.g., “LuanaLima_TSA_A06_Sp22.Rmd”). Submit this pdf using Sakai.

Questions

This assignment has general questions about ARIMA Models.

Packages needed for this assignment: “forecast”, “tseries”. Do not forget to load them before running your script, since they are NOT default packages.\

```
#Load/install required package here
library(forecast)
```

```
## Warning:   'forecast' R 4.1.2
```

```
## Registered S3 method overwritten by 'quantmod':
##   method              from
##   as.zoo.data.frame zoo
```

```
library(tseries)
```

```
## Warning:   'tseries' R 4.1.2
```

Q1

Describe the important characteristics of the sample autocorrelation function (ACF) plot and the partial sample autocorrelation function (PACF) plot for the following models:

(a) AR(2)

> Answer: For autoregression model with order of 2, the ACF will decay exponentially with time, while the PACF will show a cutoff (huge decrease to insignificance) at lag=2.

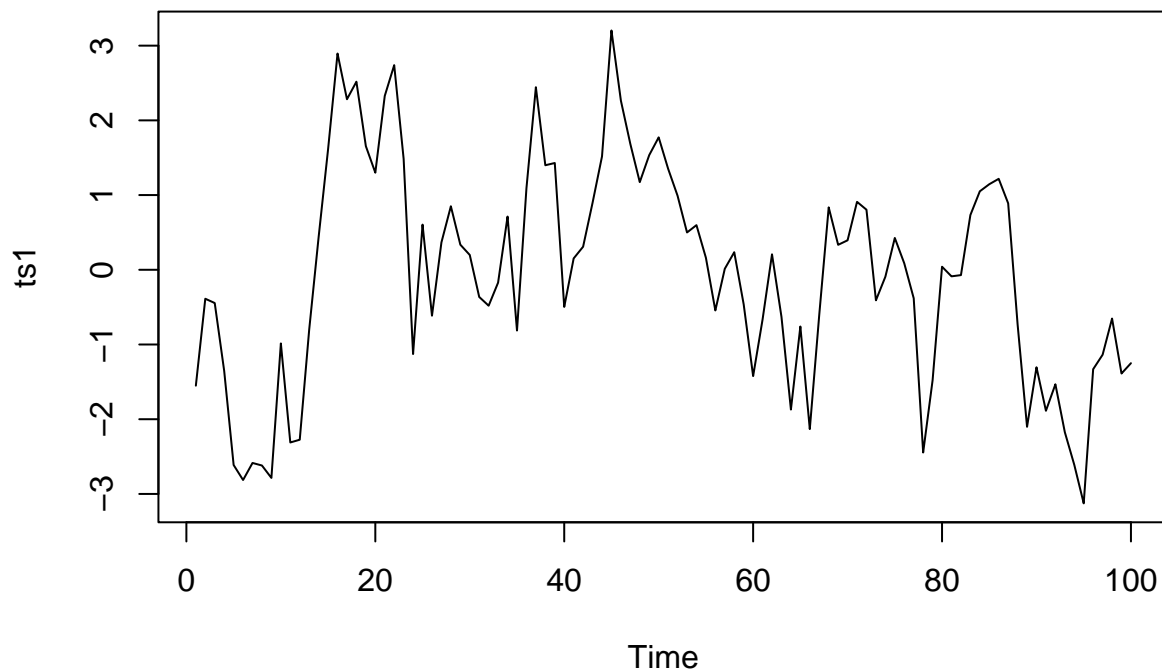
(b) MA(1)

> Answer: For moving average model with order of 1, the ACF will show a cutoff at lag=1, while the PACF will decay exponentially with time.

Q2

Recall that the non-seasonal ARIMA is described by three parameters $ARIMA(p, d, q)$ where p is the order of the autoregressive component, d is the number of times the series need to be differenced to obtain stationarity and q is the order of the moving average component. If we don't need to difference the series, we don't need to specify the "I" part and we can use the short version, i.e., the $ARMA(p, q)$. Consider three models: $ARMA(1,0)$, $ARMA(0,1)$ and $ARMA(1,1)$ with parameters $\phi = 0.6$ and $\theta = 0.9$. The ϕ refers to the AR coefficient and the θ refers to the MA coefficient. Use R to generate $n = 100$ observations from each of these three models

```
ts1 <- arima.sim(list(order = c(1,0,0), ar = 0.6), n = 100)
ts2 <- arima.sim(list(order = c(0,0,1), ma = 0.9), n = 100)
ts3 <- arima.sim(list(order = c(1,0,1), ar = 0.6, ma=0.9), n = 100)
ts.plot(ts1)
```



(a) Plot the sample ACF for each of these models in one window to facilitate comparison (Hint: use command `par(mfrow = c(1,3))` that divides the plotting window in three columns).