

# ASSIGNMENT 6

STAT 485/685 E100/G100: Applied Time Series Analysis

Fall 2020

Simon Fraser University

This week's assignment will be based on an introduction to model specification. The topics here have been covered in the Week 8 videos, as well as § 6.1 - 6.2 of the textbook *Time Series Analysis with Applications in R (2nd ed.)* by Cryer & Chan.<sup>1</sup>

Due date: **Friday, Nov. 6th at 11:59 pm (end of day)** (Pacific Time).

Marks: 10.

**Please include your R code for each of questions that requires it below.** Some ideas for how you can most easily do this:

- Copy-paste your code/plots into a Word document along with your responses to the questions, and save as a PDF.
- Take images of your code/plots and upload to Crowdmark, along with your responses to the questions.
- Save your code and responses together in an RMarkdown document and save as PDF (if you've worked with RMarkdown before).

Other important policies on assignment submissions:

- Please write each question on a **separate page!**
- Please **show all your code and work**, in order to get full marks.
- Upload your complete answers as PDF files or high-resolution images.
- If you're hand-writing answers, please make sure they are **neat and clearly readable**, and that the photo is high resolution.
- Please **clearly label the question numbers**.

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<sup>1</sup>Cryer, J. D., & Chan, K. S. (2008). *Time series analysis: with applications in R*. Springer Science and Business Media.

For this assignment, we will be using some datasets and functions in the **TSA** package in R. For instructions on how to install and load the package, please see the Week 1 module on Canvas.

1. (4 marks) Suppose that a certain time series dataset has the following sample ACF values:  $r_1 = 0.3$ ,  $r_2 = 0.4$ ,  $r_3 = -0.04$  and  $r_4 = 0$ . Obtain the following sample PACF values. Show all your work.

(a)  $\hat{\phi}_{11}$

(b)  $\hat{\phi}_{22}$

(c)  $\hat{\phi}_{33}$

(d)  $\hat{\phi}_{44}$  (*This one will take a bit more work!*)

2. (2 marks) Suppose that a time series dataset, of size  $n = 100$ , has the following sample PACF values:  $\hat{\phi}_{11} = 0.3$ ,  $\hat{\phi}_{22} = 0.9$ ,  $\hat{\phi}_{33} = -0.4$  and  $\hat{\phi}_{44} = 0.1$ . Based on this information alone, which model do you believe might be appropriate for this dataset? Justify your decision using an argument about the standard errors of the estimates.
3. (4 marks) The dataset `robot` gives the final position (in the x-direction) of an industrial robot put through a series of planned exercises many times. Read in this dataset, and use it to answer the following questions.

**Remember to include all code, plots and tables in your answers below.**

- (a) Create a sample ACF plot for this dataset. Explain what you see, and any conclusions you might be able to make from this plot.
- (b) Create a sample PACF plot for this dataset. Explain what you see, and any conclusions you might be able to make from this plot.
- (c) Create a sample EACF table for this dataset. Explain what you see, and any conclusions you might be able to make from this table.
- (d) Based on the above results, make a conclusion about a model that may be appropriate for this dataset. Explain your reasoning.