Applied Regression and Time Series Analysis Homework 5

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Instructions

The weekly assignment serves two purposes: (1) Extend the materials taught in the asynchronized materials; some new concepts or techniques are introduced in the weekly assignment. (2) Ensure that you have learned the concepts, techniques, theories, statistical models covered in a specific week. Below are some guidelines:

- **Submission: Submit 2 files. Missing one of the two files will result in a 50% reduction in grade.**

    1. A report (in pdf format) detailing your answers and all the steps to arrive at your answers

    2. A well-documented R-script, jupyter notebook, or Rmd file detailing all of the codes used to arrive at your answers.

- **Late submission will not receive any credit.**

- Answers need to be typed. Latex, which you will likely have to use in R markdown, is great for typesetting documents with mathematical symbols.

- All the steps used to arrive at your final answers need to be shown clearly. These steps are as important as the final answer.

- The final answer of each question needs to be very easy identified; the use of bold fonts, highlights, or circling will help.

- This is a group project. Form a group with 3 or 4 people.

- Although this is a group project, we encourage you to attempt all of the exercises before discussing with your teammates. Do not use the "division-of-labor" approach. Each of the students in a group is expected to make sufficient contribution to the lab. If any of your teammate does not make sufficient contribution, please contact your instructor.

- DO NOT copy and paste or even leverage on the solutions we gave to the students in previous semesters. Violation will be reported to the Director of the MIDS program and the Office that oversees UC Berkeley Academic Integrity. In any case, the lab has various subtle changes that make those answers not directly applicable.

Question 1

1. Install the library "astsa" using the function: install.packages("astsa")

2. Load the library: library(astsa)

3. Use the function str() to see the information of a particular data series, such as str(EQ5) for the Seismic Trace of Earthquake number 5 series

4. Plot the time series plots and histograms of the following 3 series. Feel free to use the codes provided in the R scripts. Make sure that each of your graph has a title, the axis ticks are clear, the axes are well-labelled, and use color intelligently.

5. Write a few sentences to describe each of the series.

   - EQ5
   - flue
   - gas

Question 2:

Describe 3 examples you have used in your work or encounter in real life. Ideally, you can even load at least one of these time series, plot it, and the write a few statements to describe its characteristics.

Question 3:

Simulate a white noise series with 1000 random draws and plot (1) a time series plot and (2) a histogram. The usual reqirements on graphics (described) in Question 1) applied.

Question 4:

Simulate (with 1000 random draws) two the following two zero-mean autoregressive model with order 1 (i.e. AR(1)) models:

$$yt = 0.9y_{t1} + w$$
$$y_t = 0.2y_{t1} + w$$

Plot a time plot for each of the simulated series. Graph a histogram for each of thes simulated series. Write a few statements to compare the two series.

Question 5:

Simulate (with 1000 random draws) the following 3 models:

1. A deterministic linear (time) trend of the form: $y_t = 10 + 0.5t$

2. Random walk without drift

3. Random walk with drift = 0.5

Plot a time plot for each of the simulated series. Graph a histogram for each of thes simulated series. Write a few statements to compare the two series.