Homework 7

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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:

- 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.
- 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:

1.1 Load hw07_series1.csv

1.2 Describe the basic structure of the data and provide summary statistics of the series

1.3 Plot histogram and time-series plot of the series. Describe the patterns exhibited in histograrm and time-series plot. For time series analysis, is it sufficient to use only histogram to describe a series?

1.4 Plot the ACF and PACF of the series. Describe the patterns exhibited in the ACF and PACF.

1.5 Estimate the series using the *ar()* function.

1.6 Report the estimated AR parameters, the order of the model, and standard errors.

Question 2:

2.1 Simulate a time series of lenght 100 for the following model. Name the series x.

$$x_t = \frac{5}{6}x_{t-1} - \frac{1}{6}x_{t-2} + \omega_t$$

2.2 Plot the correlogram and partial correlogram for the simulated series. Comments on the plots.

2.3 Estimate an AR model for this simulated series. Report the estimated AR parameters, standard erros, and the order of the AR model.

2.4 Construct a 95% confidence intervals for the parameter estimates of the estimated model. Do the "true" mode parameters fall within the confidence intervals? Explain the 95% confidence intervals in this context.

2.5 Is the estimated model stationary or non-stationary?

2.6 Plot the correlogram of the residuals of the estimated model. Comment on the plot.