STAT 4848 & 6948 • APPLIED REGRESSION & TIME SERIES • SPRING 2020 • KERNS

Exam II

Name: Trelan Hakeem-Barron

Directions: Answer the questions.

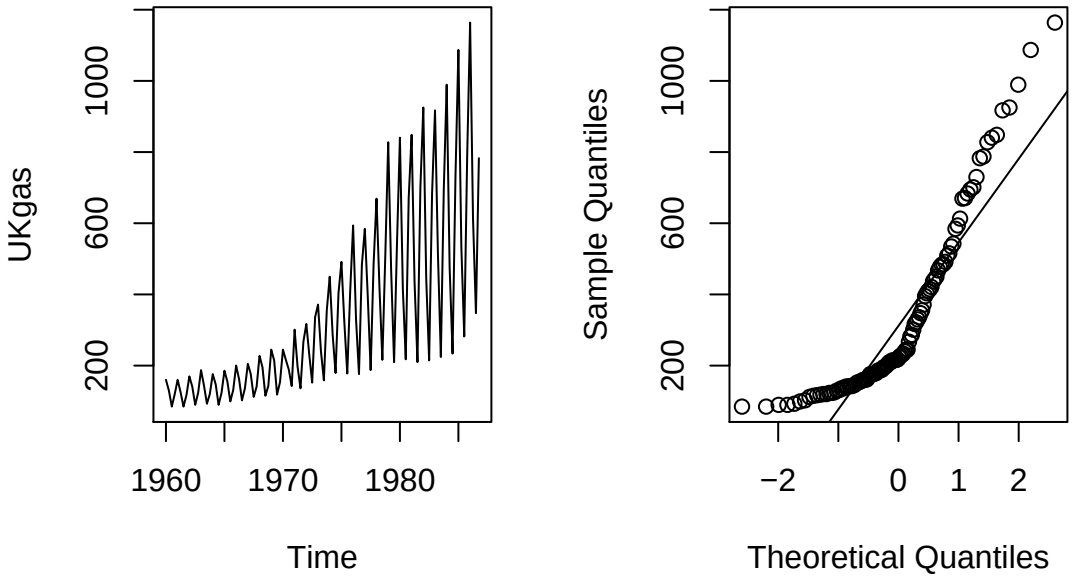
1. Identify the following as specific ARIMA models. That is, what are p, d, and q and what are the values of the parameters (the ϕ's and θ's)?

   (a) $Y_t = 2Y_{t-1} - Y_{t-2} + e_t$

   (b) $Y_t = Y_{t-1} - 0.25Y_{t-2} + e_t - 0.1e_{t-1}$

   (c) $Y_t = 0.5Y_{t-1} - 0.5Y_{t-2} + e_t - 0.5e_{t-1} + 0.25e_{t-2}$

2. The data file `UKgas` contains yearly data for 108 quarters on gas consumption from 1960Q1 to 1986Q4, in millions of therms.



   (a) The graph on the left is a plot of the data in raw form. Do these data appear stationary? If "yes," then justify why you think so. If "no," then detail the ways in which you think stationarity is violated.

   (b) The graph on the right is a normal quantile-quantile plot of the data. What does this display indicate to you?

   (c) Based on these two graphs, what transformation(s) would you use on these data (if any)? In your answer, be specific and complete. And "all possible transformations" is not the right answer.

3. For the ARIMA model below, give values for $\mathbb{E}(Y_t)$ and $\text{Var}(Y_t)$.

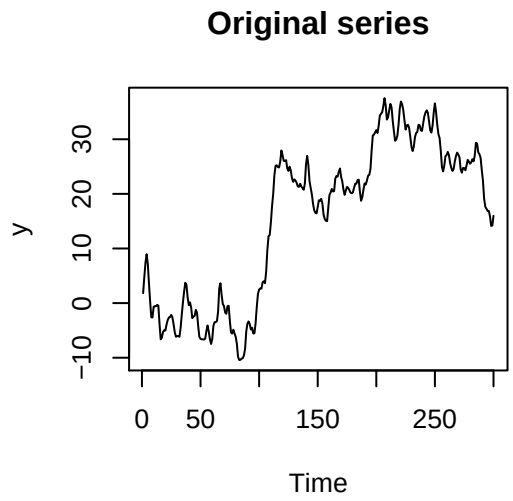
$$Y_t = Y_{t-1} - 0.49Y_{t-2} + e_t - 0.56e_{t-1}$$

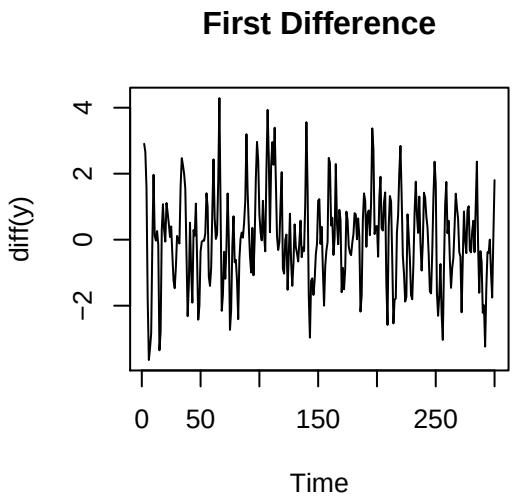
4. Below are assorted plots and output related to a time series $\{Y_t\}$. Use what you learned in class to tentatively identify an ARIMA(p, d, q) model for the data. In the answer I am looking for three (3) things:

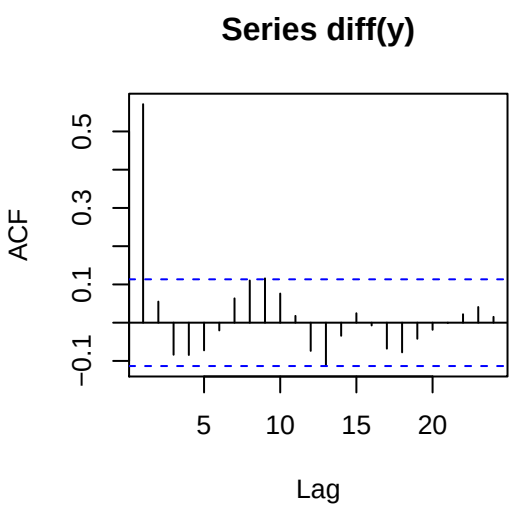
   (a) The model in words, *e.g.,* "Y_t is MA(2) with a nonzero intercept",

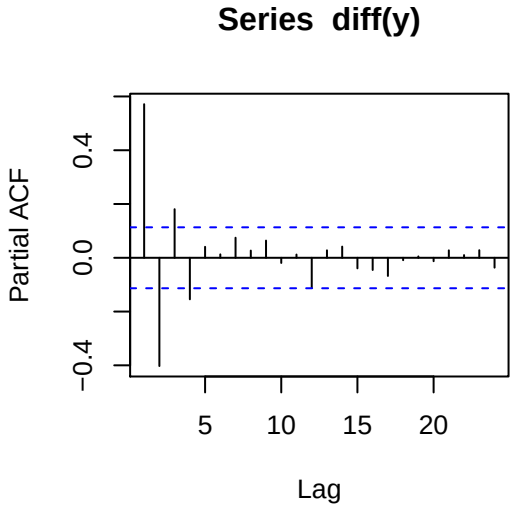
   (b) The correct difference equation mathematical form of your model, *e.g.,* $Y_t = \theta_0 + e_t + \theta_1 e_{t-1} + \theta_2 e_{t-2}$,

   (c) Whatever arguments you have to support your tentative model.










```
> eacf(diff(y))

AR/MA
  0 1 2 3 4 5 6 7 8 9 10 11 12 13
0 x o o o o o o o o o o  o  o  o
1 x x x o o o o o o o o  o  o  o
2 x x x o o o o o o o o  o  o  o
3 x x x x o o o o o o o  o  o  o
4 x x x o x o o o o o o  o  o  o
5 o o x o x x o o o o o  o  o  o
6 o x x o o o o o o o o  o  o  o
7 x x x o o o o o o o o  o  o  o
```