

**CLASS EXERCISE, March 16, 2023**

1. Let us assume that we explore the ACF plot of some time series and see that the only significant AC is at lag 2 and is positive. Which of the following are true?

- (a)  $\text{Corr}(D_t, D_{t-1})$  is close to zero

*Solution:* This is true since the plot reports statistically significant AC at lag 2.

- (b) If  $D_t$  is lower than average than  $D_{t+1}$  is likely to be higher than average.

*Solution:* False. Because there is no significant AC except at lag 2.

- (c)  $D_t$  should not have any trend

*Solution:* True. If there had been trend, we would have seen significant and high AC at all lags.

- (d)  $D_t$  may have strong seasonality

*Solution:* False. If there had been seasonality, we would have seen the seasonal cycle with high AC at seasonal lags.

2. Consider the data series  $Y_t$  (annual number of significant earthquakes in the world, source: <https://online.stat.psu.edu/stat510/lesson/1/1.2>). Which statements are true?

- (a) A reasonable model for  $Y_t$  is  $Y_t = c + \epsilon_t$

*Solution:* False. This model does not consider AC but there is significant AC in the series.

- (b) A reasonable model for  $Y_t$  is  $Y_t = a_0 + a_1 Y_{t-1} + \epsilon_t$

*Solution:* This might be plausible. There appears to be a geometric decay in the AC starting from lag 1.

- (c) Number of earthquakes in consecutive years are positively correlated

*Solution:* True.

- (d) There might be a strong trend for the series  $Y_t$  *Solution:* False. With strong trend we would have seen higher AC at all lags.
- (e) There might be a strong seasonality in the series  $Y_t$   
*Solution:* False. With strong trend we would have seen the seasonal cycle.
- (f)  $Y_t$  does not have statistically significant correlation with  $Y_{t-6}$   
*Solution:* True.

