

# Midterm Exam

ST565 Winter 2014

February 13, 2014

Name: \_\_\_\_\_

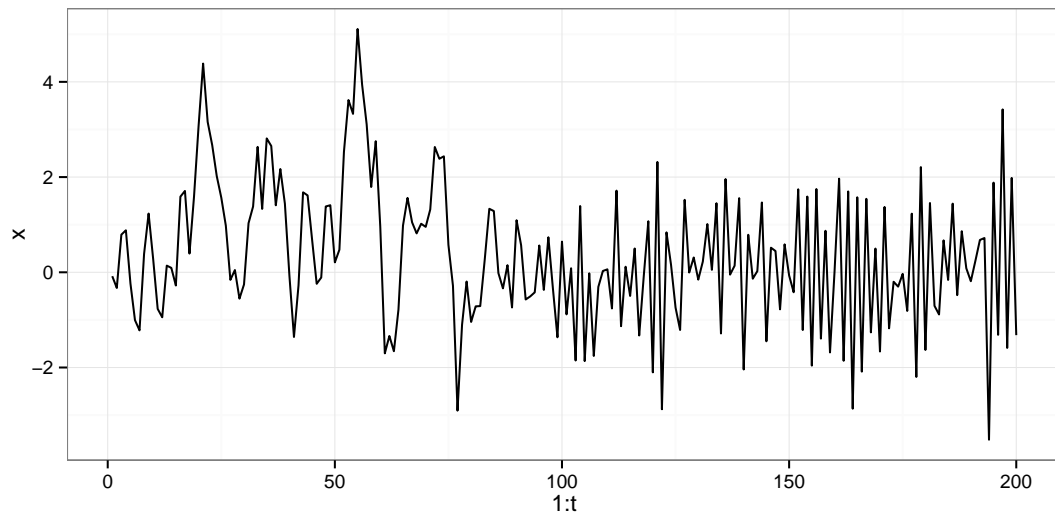
- You have 80 minutes to complete the exam.
- There are 5 questions, answer all of the questions.
- You may assume  $Z_t$  always refers to a white noise process with mean zero and variance  $\sigma^2$ .
- Show your working.

Question	Points	Out of
1		8
2		5
3		6
4		7
5		6
Total		32

1. (a) Define (weak) stationarity. (4 pts)

(b) Give an example of a non-stationary process. (2 pts)

(c) Does this series appear stationary? (Justify your answer) (2 pts)



2. Consider the process  $X_t = 0.5X_{t-1} - Z_{t-2} + Z_t$ , where  $Z_t$  is a white noise process.

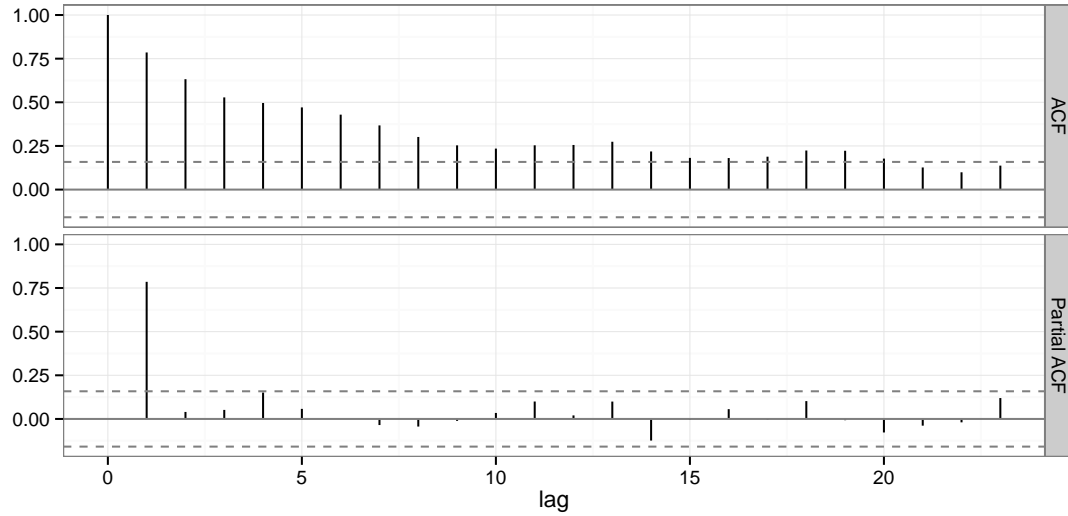
(a) Is the process  $X_t$  invertible? (2 pts)

(b) Is the process  $X_t$  stationary? (2 pts)

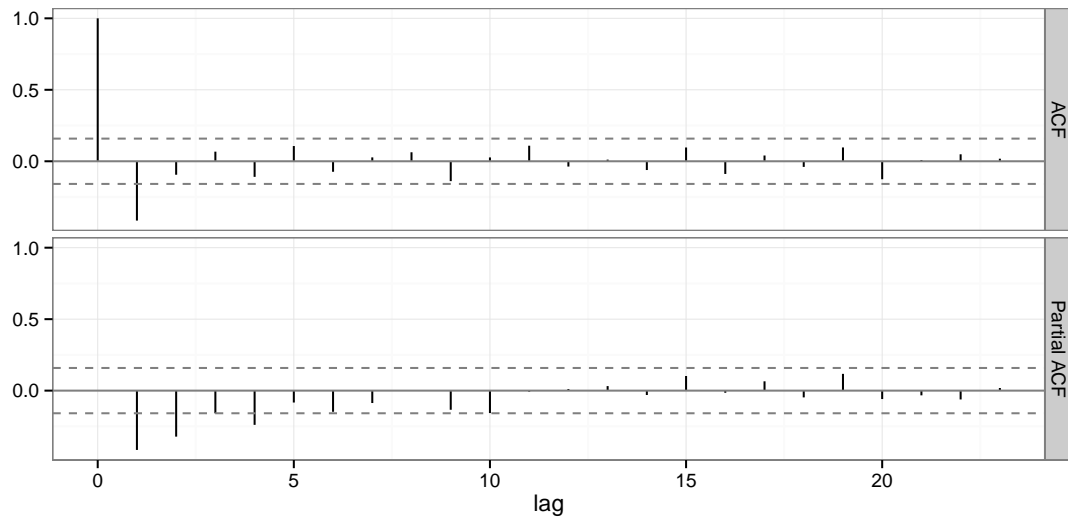
(c) Classify the model  $(1 - B)(1 - 0.2B)X_t = (1 - 0.5B)Z_t$  as an ARIMA model, i.e. state p, d and q. (1 pts)

3. Below are the ACF and PACF for three time series. For each series, state whether it is autoregressive or moving average, and the order ( $p$  or  $q$ ).

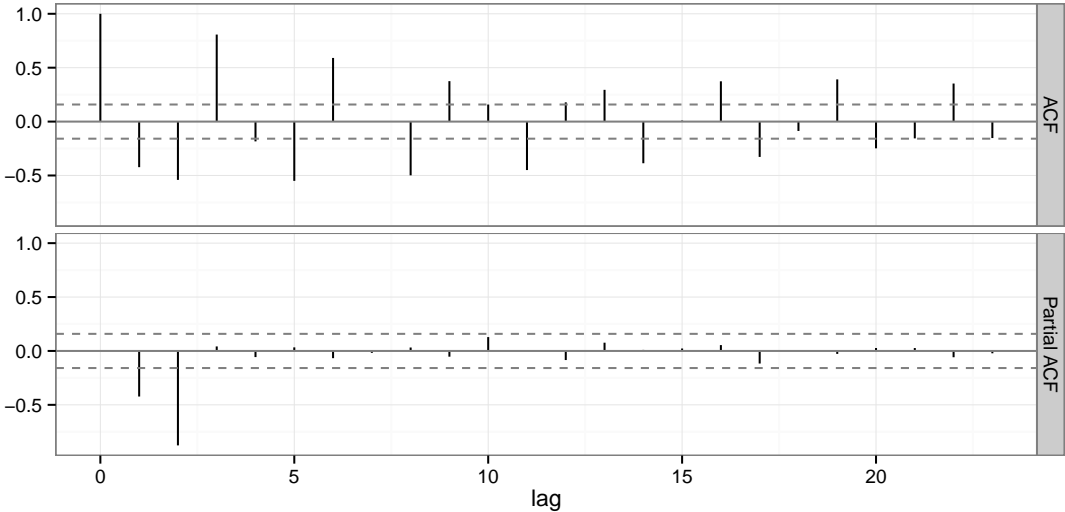
(a) AR or MA (circle one),  $p = \underline{\hspace{1cm}}$ ,  $q = \underline{\hspace{1cm}}$ ? (2 pts)



(b) AR or MA (circle one),  $p = \underline{\hspace{1cm}}$ ,  $q = \underline{\hspace{1cm}}$ ? (2 pts)



(c) AR or MA (circle one),  $p = \underline{\hspace{1cm}}$ ,  $q = \underline{\hspace{1cm}}$ ? (2 pts)

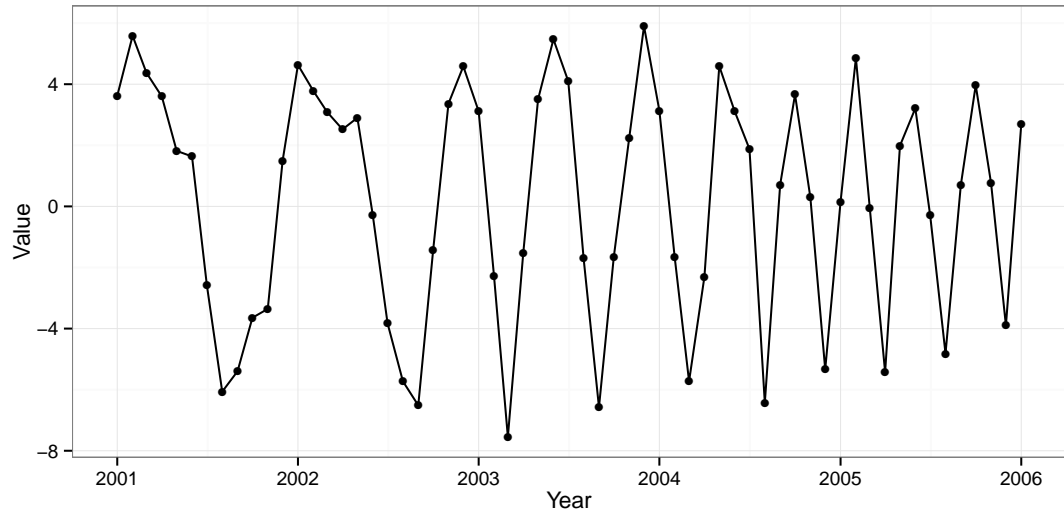


4. (a) Describe in non-technical terms (i.e. for a non-statistician) what the autocorrelation function is. (3 pts)

(b) What is the autocorrelation at lags 0, 1 and 2, for the series  $X_t = \alpha X_{t-1} + Z_t$ ? (2 pts)

(c) An observed time series has a sample autocorrelation coefficient at lag 1 of 0.2, give an estimate of  $\alpha$  for the model in (b) and state what kind of estimate it is. (2 pts)

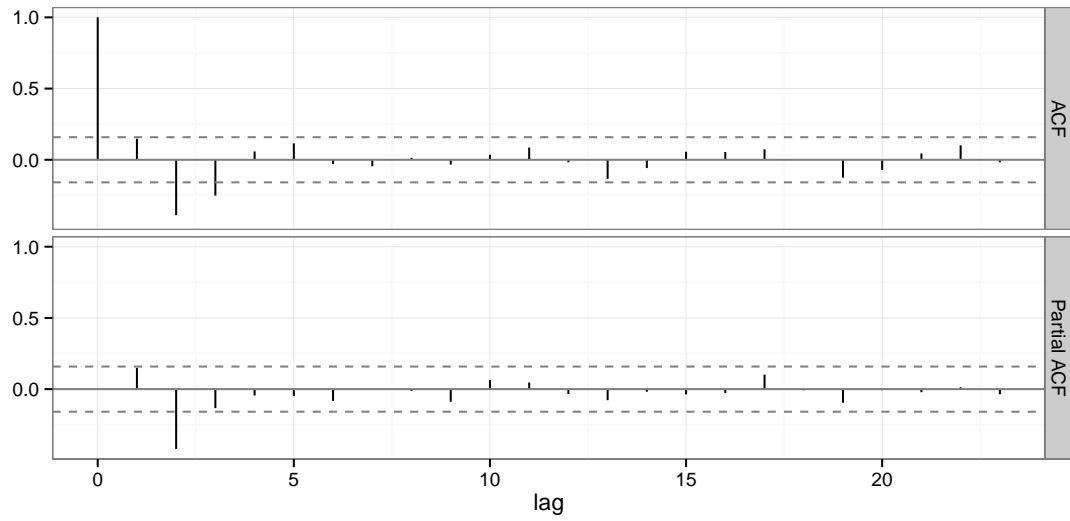
5. (a) Below is a plot of a monthly time series.



Why would a seasonal model be inappropriate for this time series? (2 pts)



(b) Below are the acf and pacf plots from the residuals of an AR(1) model fit to an observed time series.



i. Was the AR(1) model adequate? (Justify your answer) (2 pts)

ii. What would you suggest as a next step? (2 pts)