Data624 - Homework6

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Exercise 8.1

Figure 8.31 shows the ACFs for 36 random numbers, 360 random numbers, and 1,000 random numbers.

a

Explain the differences among these figures. Do they all indicate that the data are white noise?
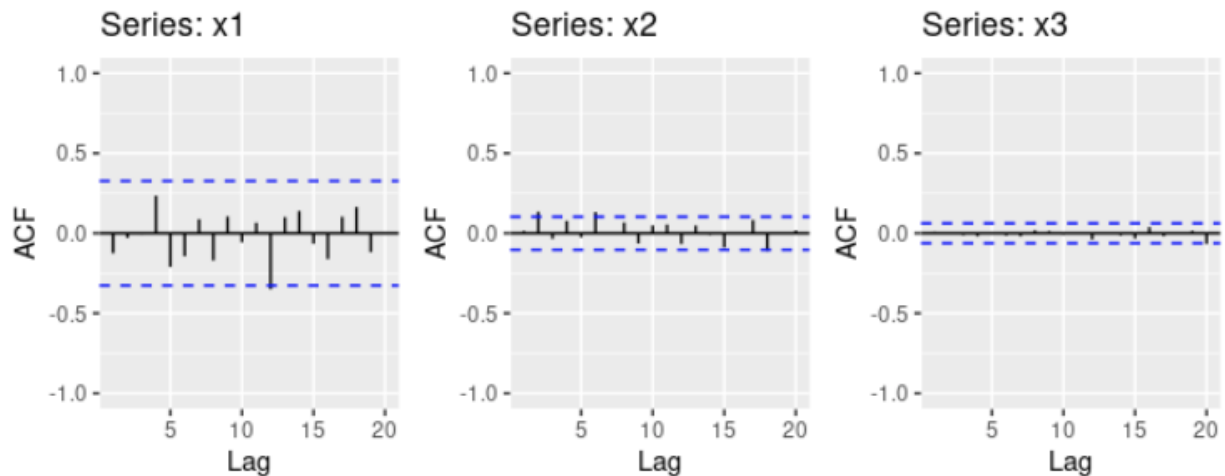
Figure 8.31: Left: ACF for a white noise series of 36 numbers. Middle: ACF for a white noise series of 360 numbers. Right: ACF for a white noise series of 1,000 numbers.

b

Why are the critical values at different distances from the mean of zero? Why are the autocorrelations different in each figure when they each refer to white noise?

Exercise 8.2

A classic example of a non-stationary series is the daily closing IBM stock price series (data set `ibmclose`). Use R to plot the daily closing prices for IBM stock and the ACF and PACF. Explain how each plot shows that the series is non-stationary and should be differenced.

Exercise 8.3

For the following series, find an appropriate Box-Cox transformation and order of differencing in order to obtain stationary data.

a

usnetelec

b

usgdp

c

mcopper

d

enplanements

e

`visitors`

Exercise 8.5

For your retail data (from Exercise 3 in Section 2.10), find the appropriate order of differencing (after transformation if necessary) to obtain stationary data.

Exercise 8.6

Use R to simulate and plot some data from simple ARIMA models.

a

Use the following R code to generate data from an AR(1) model with $\phi_1 = 0.6$ and $\sigma^2 = 1$. The process starts with $y_1 = 0$.

b

Produce a time plot for the series. How does the plot change as you change ϕ_1?

c

Write your own code to generate data from an MA(1) model with $\theta_1 = 0.6$ and $\sigma^2 = 1$.

d

Produce a time plot for the series. How does the plot change as you change θ_1?

e

Generate data from an ARMA(1,1) model with $\phi_1 = 0.6$, $\theta_1 = 0.6$ and $\sigma^2 = 1$.

f

Generate data from an AR(2) model with $\phi_1 = -0.8$, $\phi_2 = 0.3$ and $\sigma^2 = 1$. (Note that these parameters will give a non-stationary series.)

g

Graph the latter two series and compare them.

Exercise 8.7

Consider `wmurders`, the number of women murdered each year (per 100,000 standard population) in the United States.

a

By studying appropriate graphs of the series in R, find an appropriate ARIMA(p,d,q) model for these data.

b

Should you include a constant in the model? Explain.

d

Fit the model using R and examine the residuals. Is the model satisfactory?

e

Forecast three times ahead. Check your forecasts by hand to make sure that you know how they have been calculated.

f

Create a plot of the series with forecasts and prediction intervals for the next three periods shown.

g

Does `auto.arima()` give the same model you have chosen? If not, which model do you think is better?