chapter2\_2

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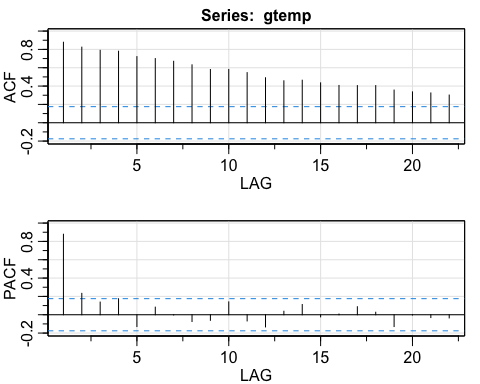
library(astsa)

## 2.6

Judging with our eyes, the time series for gtemp appears non-stationary. The mean is non-constant and there is clearly an upward trend. The variance appears to be pretty consistent however.

We can further check this through the acf2() function. If stationary, the ACF/PACF plots will show a quick drop-off in correlation after a small amount of lag between points.

acf2(gtemp)



## [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]  
## ACF 0.88 0.82 0.79 0.78 0.72 0.70 0.67 0.63 0.58 0.58 0.55 0.49 0.46  
## PACF 0.88 0.23 0.14 0.17 -0.13 0.08 0.00 -0.07 -0.06 0.14 -0.07 -0.13 0.04  
## [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22]  
## ACF 0.46 0.44 0.41 0.40 0.40 0.36 0.34 0.32 0.30  
## PACF 0.11 -0.02 0.01 0.09 0.03 -0.13 0.00 -0.03 -0.03

The dotted blue line details significance threshold for each lag. Clearly this data is non-stationary as a high number of previous observations are correlated with future values.

## 2.7

The time series Xt is weakly stationary because the mean is zero and the Co-variance of the equation is just dependent on time difference **h** and not on time **t**.A close up of text on a white background

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## 

## 2.8

Part a)

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Part c)

Also,  
Time series Xt and Yt are individually time series stationary because their Mean is Constant and not dependent on time.   
Their Variance is also independent of time.

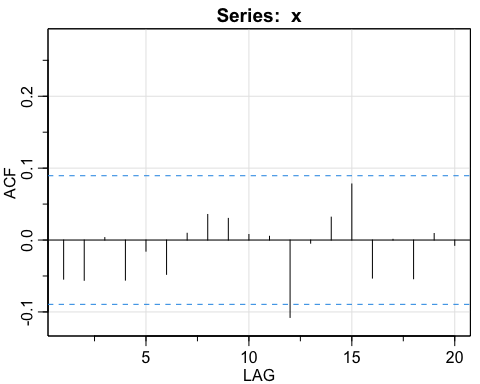
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## 2.11

### part a)

set.seed(123)  
t = 1:500  
x = rnorm(t)  
acf1(x,20)

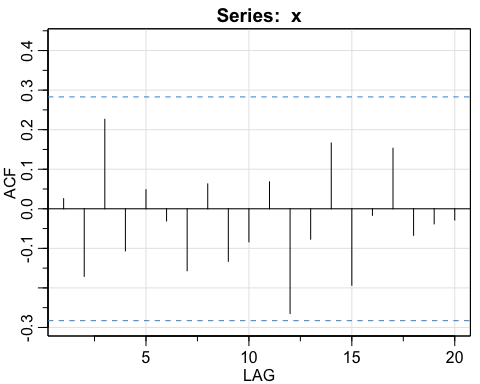


## [1] -0.05 -0.06 0.00 -0.06 -0.02 -0.05 0.01 0.04 0.03 0.01 0.01 -0.11  
## [13] 0.00 0.03 0.08 -0.05 0.00 -0.05 0.01 -0.01

In the Actual ACF, the ACF is 1 when lag = 0 and 0 otherwise but in sample ACF it gives us 5% values out of the bound. Due to which other values are small but not zero.

### part b)

set.seed(123)  
t=1:50  
x = rnorm(t)  
acf1(x,20)



## [1] 0.03 -0.17 0.23 -0.11 0.05 -0.03 -0.16 0.06 -0.13 -0.08 0.07 -0.26  
## [13] -0.08 0.17 -0.19 -0.02 0.15 -0.07 -0.04 -0.03

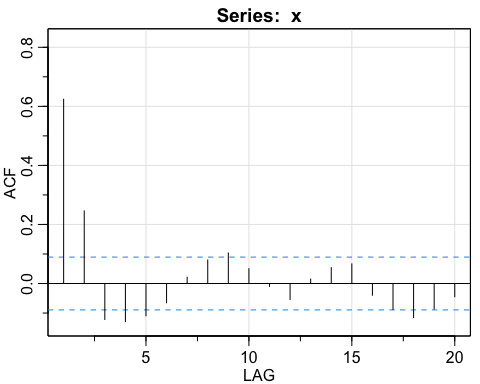
Changing the value of n decreases the number of samples. In the part a) with 500 values, we have all the values in the range between -0.09 and 0.09 which shows that 95% values are within . Whereas in part b) as the number of samples are less, the error is high and we have ACF values bound at (-.29 to 0.29).

As the number of samples decrease the standard error increases.

## 2.12

### part a)

w = rnorm(500)  
x = filter(w,sides=2,filter=rep(1/3,3))  
acf1(x,20)

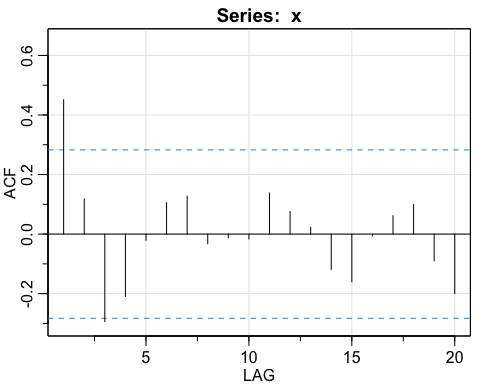


## [1] 0.62 0.25 -0.12 -0.13 -0.11 -0.07 0.02 0.08 0.10 0.05 -0.01 -0.05  
## [13] 0.01 0.05 0.07 -0.04 -0.09 -0.12 -0.09 -0.04

In the Actual ACF, the ACF is not 0 when lag=0 and 1. For all other values ACF=0 but in sample ACF it gives us 5% values out of the bound. Due to which other values are small but not zero.

### part b)

w = rnorm(50)  
x = filter(w,sides=2,filter=rep(1/3,3))  
acf1(x,20)



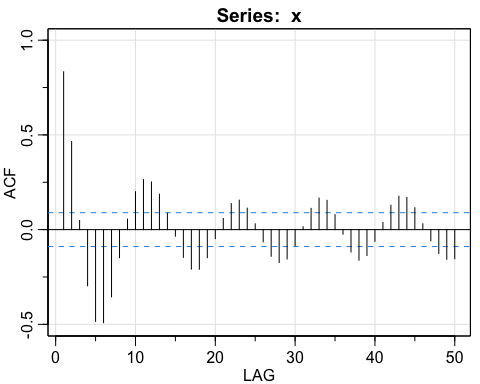
## [1] 0.45 0.12 -0.29 -0.21 -0.02 0.11 0.13 -0.03 -0.01 -0.02 0.14 0.08  
## [13] 0.02 -0.12 -0.16 -0.01 0.06 0.10 -0.09 -0.20

Changing the value of n decreases the number of samples. In the part a) with 500 values, we have all the values in the range between -0.09 and 0.09 which shows that 95% values are within . Whereas in part b) as the number of samples are less, the error is high and we have ACF values bound at (-.29 to 0.29).

As the number of samples decrease the standard error increases.

## 2.13

set.seed(123)  
w = rnorm(500+50)  
x = filter(w,filter=c(1.5,-0.75),method="recursive")[-(1:50)]  
acf1(x,50)

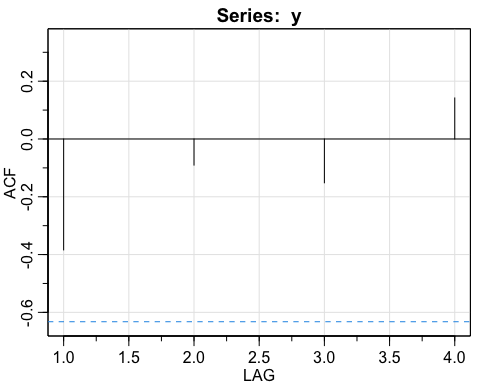


## [1] 0.83 0.47 0.05 -0.30 -0.48 -0.49 -0.35 -0.15 0.06 0.20 0.26 0.25  
## [13] 0.19 0.09 -0.03 -0.15 -0.21 -0.21 -0.15 -0.05 0.06 0.14 0.16 0.11  
## [25] 0.03 -0.06 -0.14 -0.17 -0.16 -0.09 0.02 0.11 0.17 0.15 0.08 -0.02  
## [37] -0.12 -0.16 -0.14 -0.06 0.04 0.13 0.18 0.17 0.12 0.03 -0.06 -0.13  
## [49] -0.16 -0.15

The approximate cyclic behavior is sinusoidal in nature with a periodicity of 12. Also after certain Lag, ACF decreases in amplitude and values becomes less significant.

## 2.15

set.seed(123)  
x = sample(c(-2,2), 11,replace=TRUE)  
y = 5 + filter(x,sides = 1,filter = c(1,-0.5))[-1]  
acf1(y,4)



## [1] -0.38 -0.09 -0.15 0.14A close up of text on a white background

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