

Lab2

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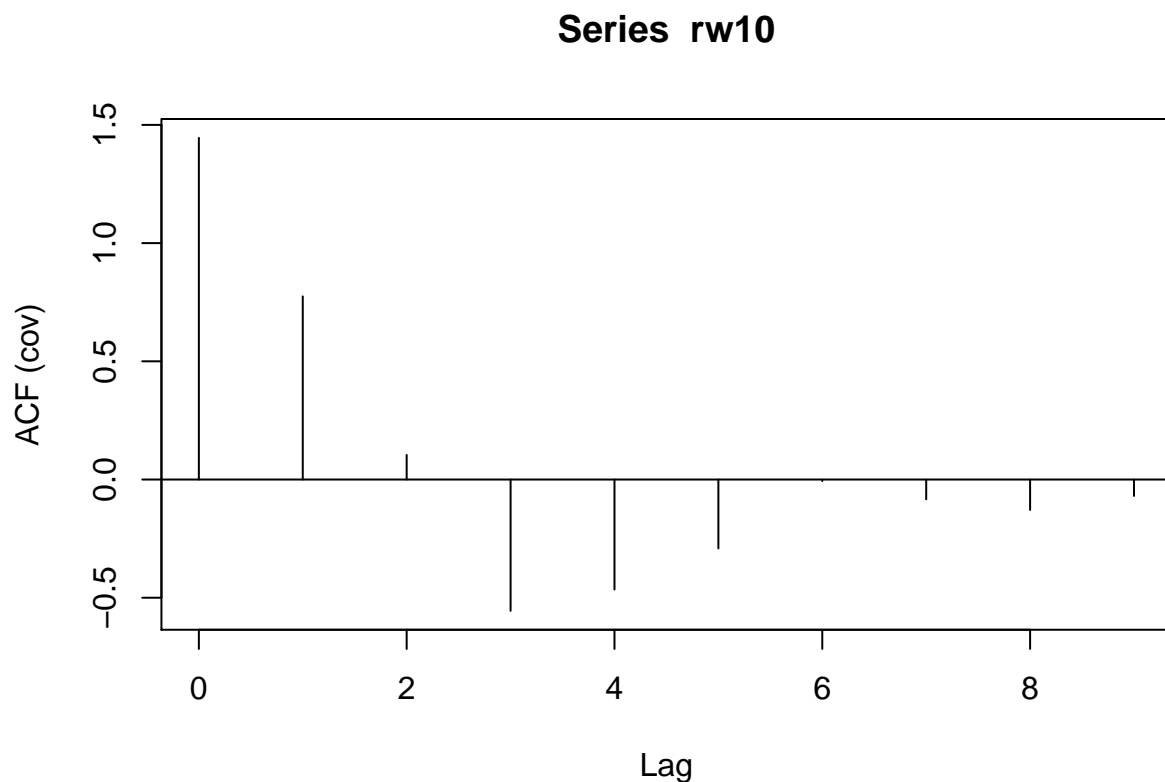
1. Use the random numbers you generated in the previous lab and create a simple random walk process.

```
x10 <- rnorm(10, 0, 1)
x50 <- rnorm(50, 0, 1)
x100 <- rnorm(100, 0, 1)
x1000 <- rnorm(1000, 0, 1)

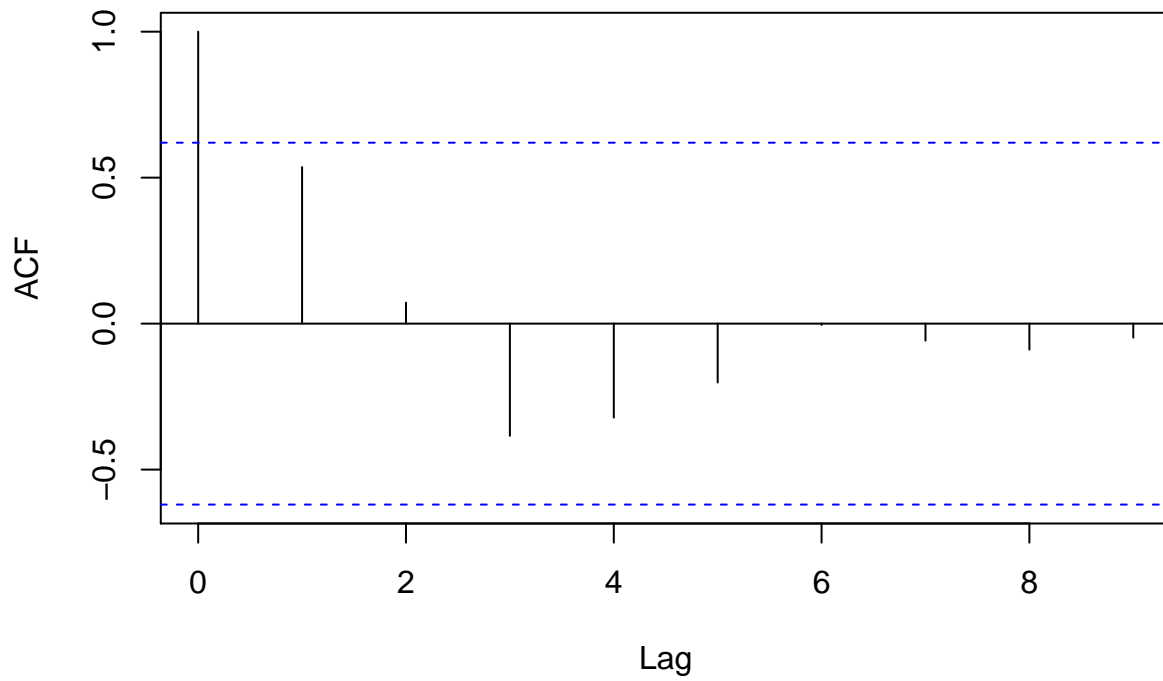
rw10 <- ts(cumsum(x10))
rw50 <- ts(cumsum(x50))
rw100 <- ts(cumsum(x100))
rw1000 <- ts(cumsum(x1000))
```

Estimate the first 10 autocovariance and autocorrelation estimates, and produce a correlogram.

```
acf(rw10, 10, type = "covariance"); acf(rw10, 10, type = "correlation")
```

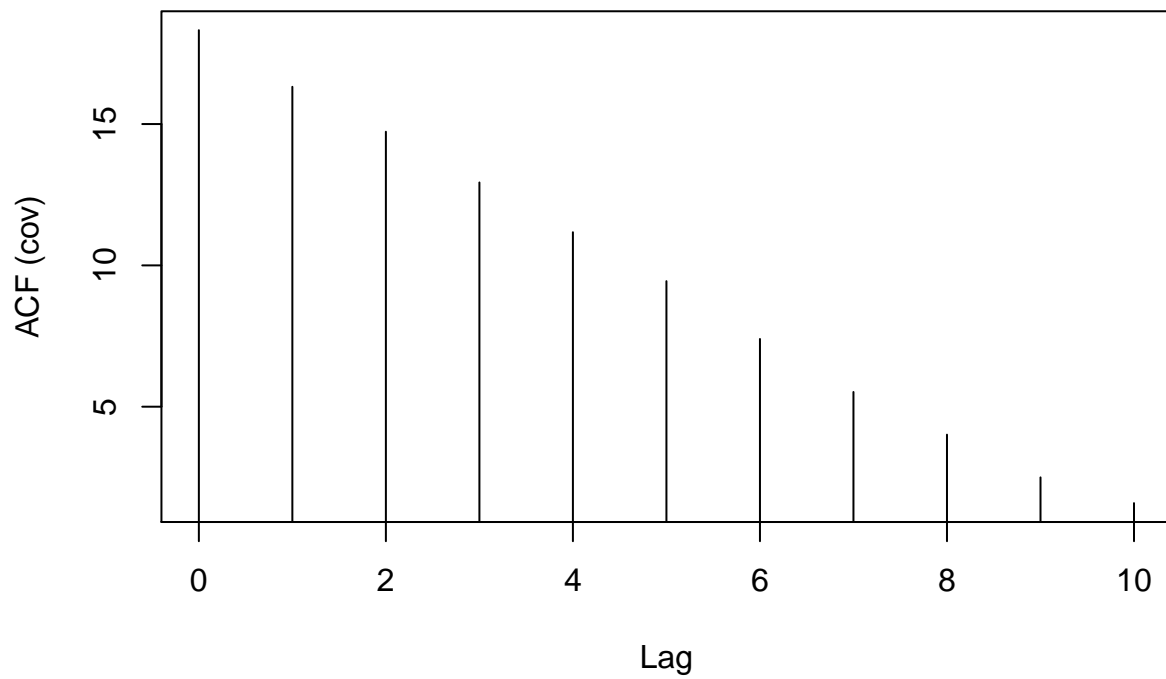


Series rw10

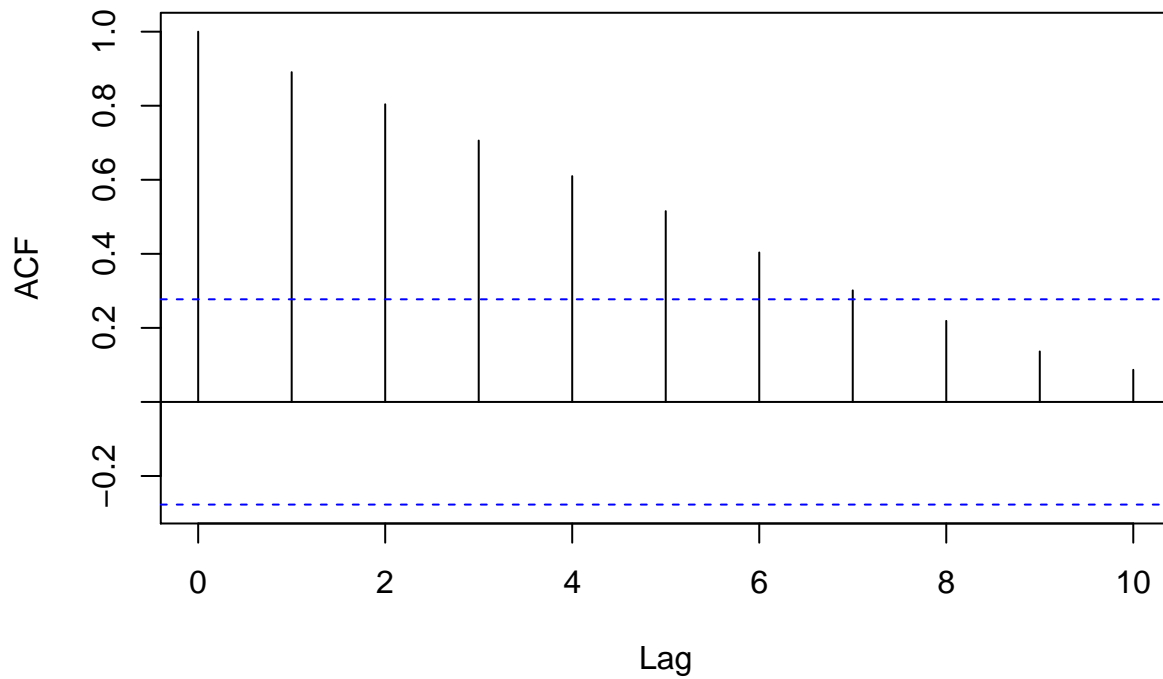


```
acf(rw50, 10, type = "covariance"); acf(rw50, 10, type = "correlation")
```

Series rw50

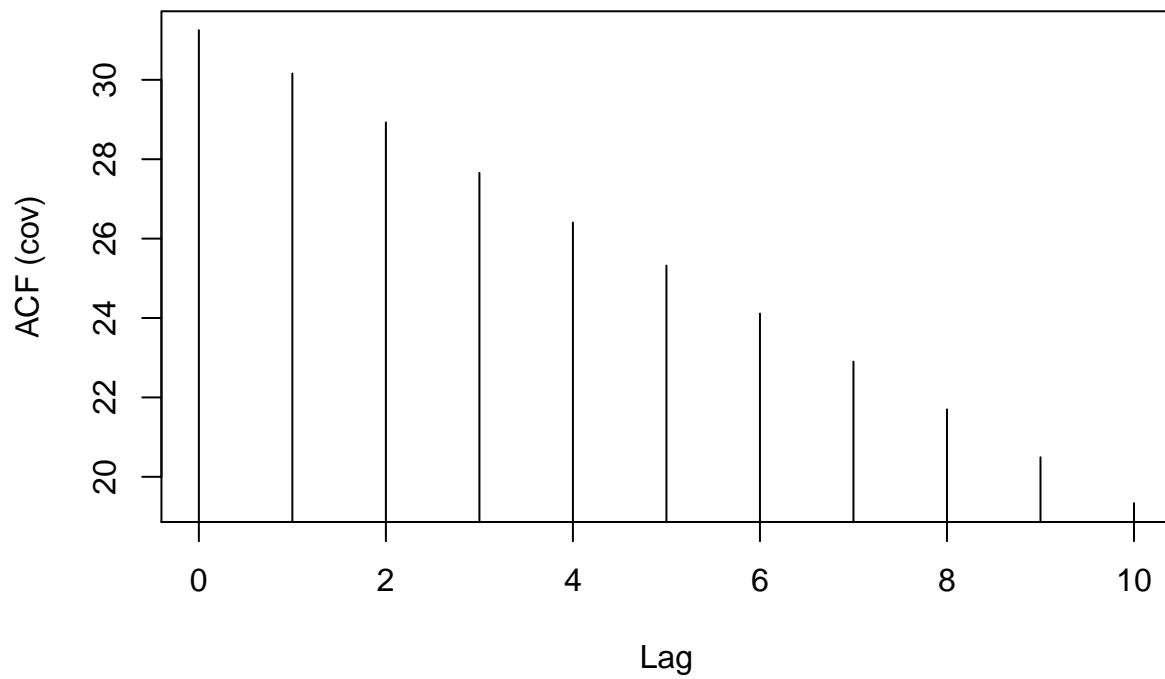


Series rw50

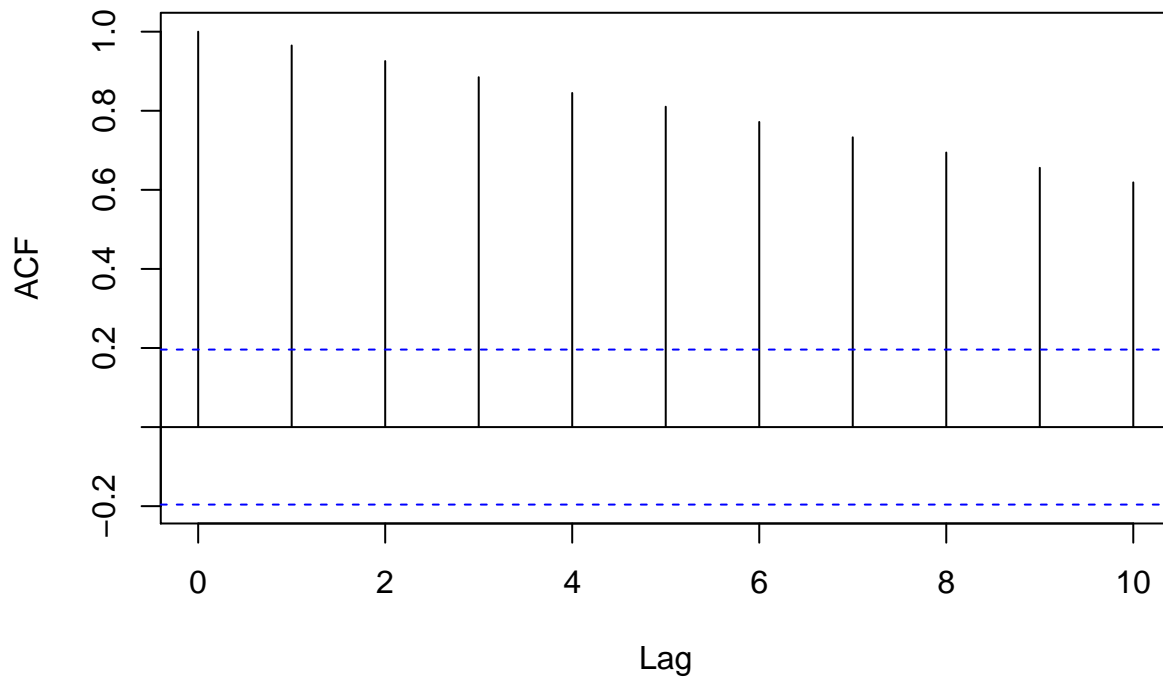


```
acf(rw100, 10, type = "covariance"); acf(rw100, 10, type = "correlation")
```

Series rw100

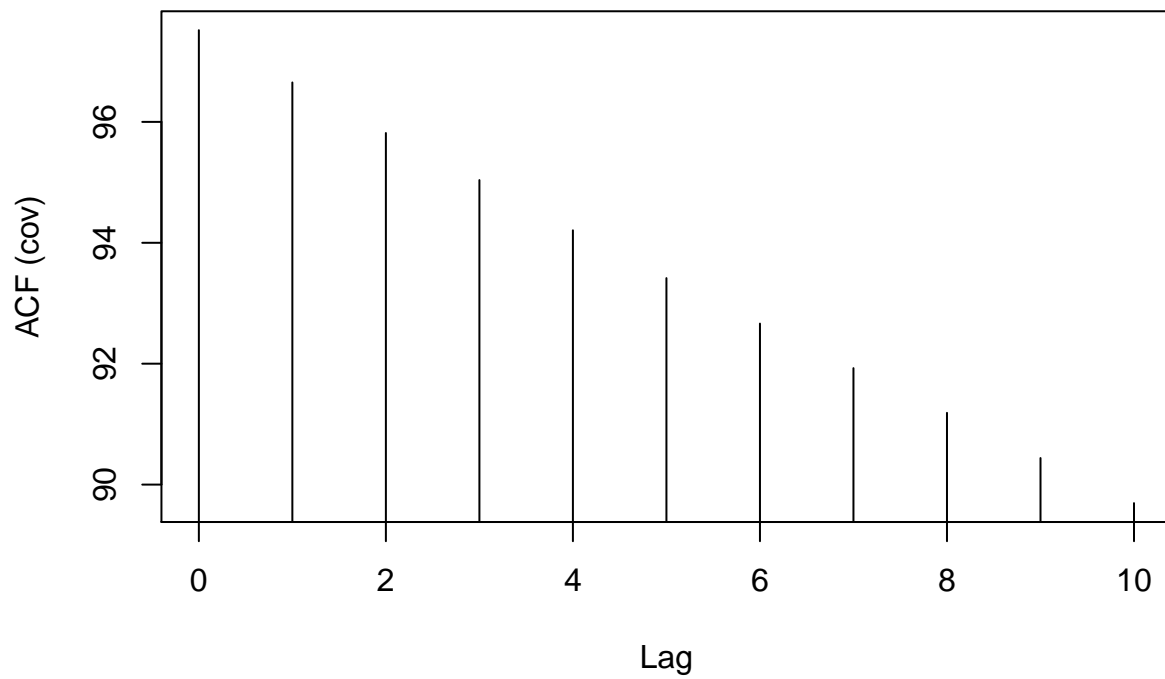


Series rw100

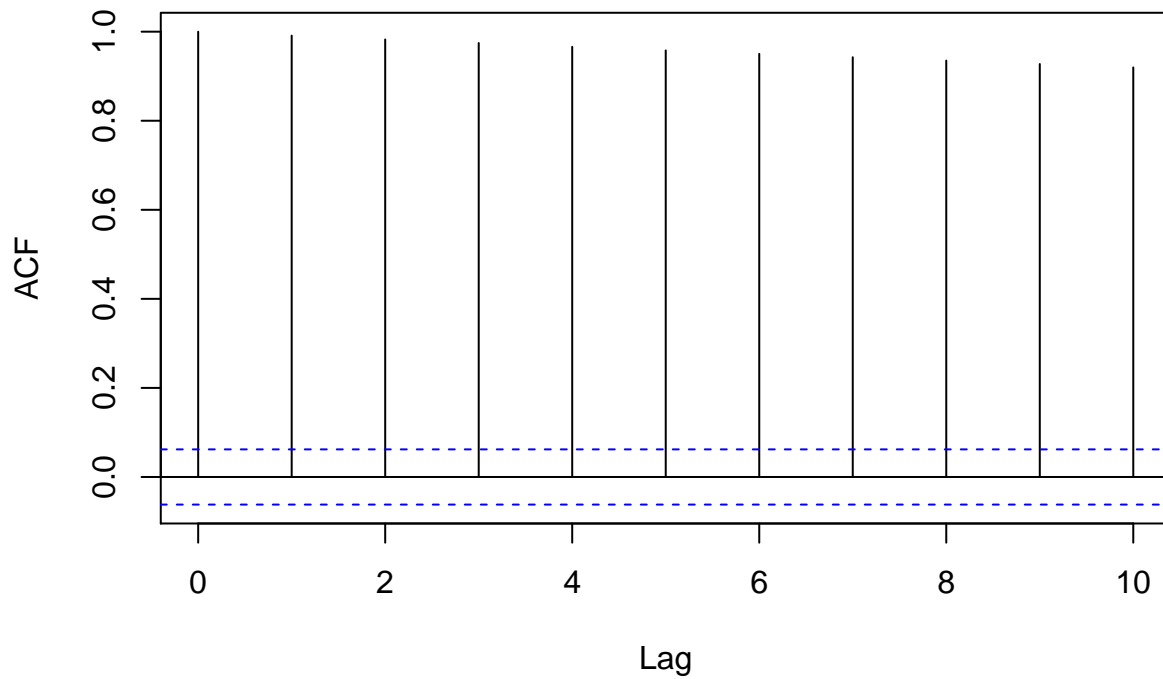


```
acf(rw1000, 10, type = "covariance"); acf(rw1000, 10, type = "correlation")
```

Series rw1000

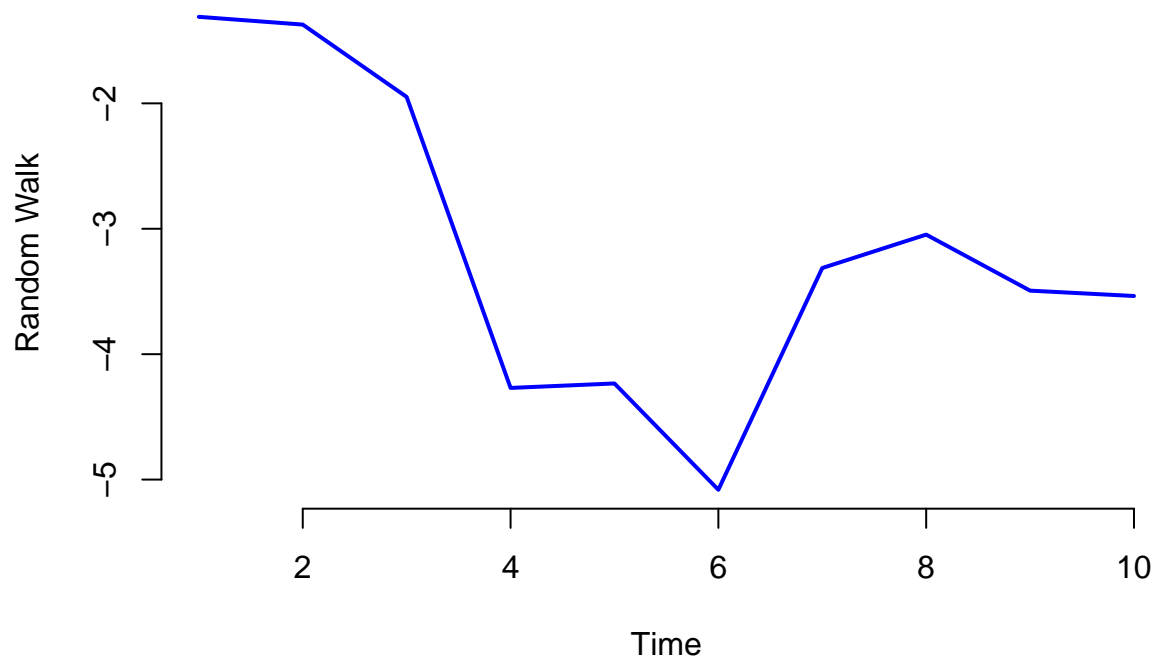


Series rw1000



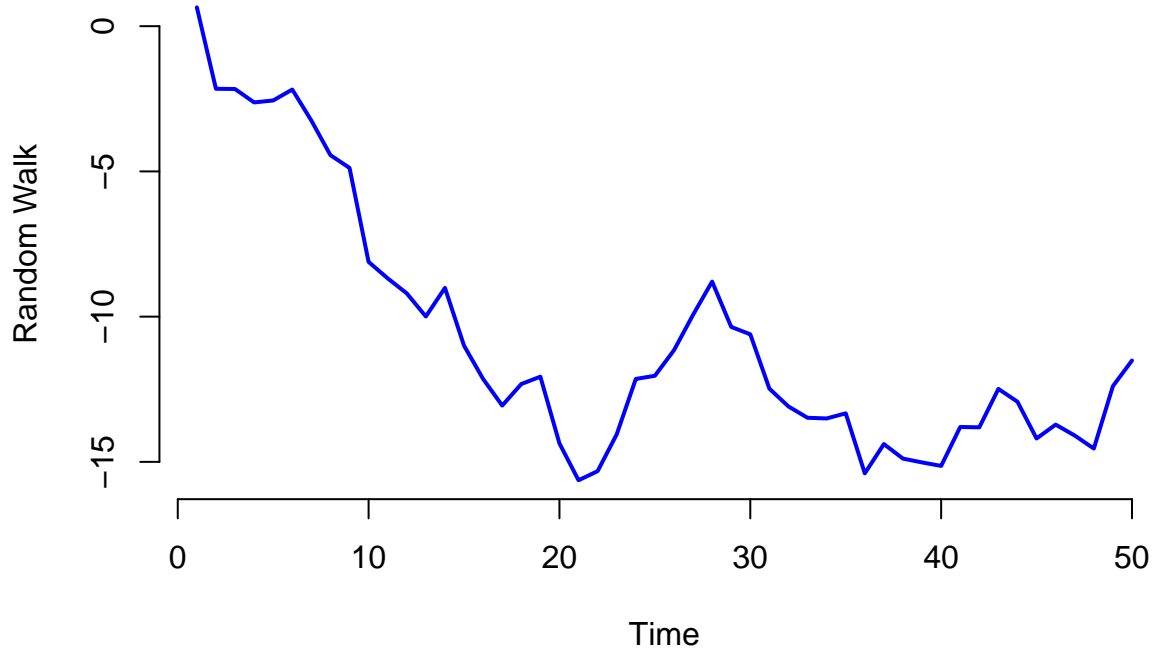
```
plot(rw10,type='l',lwd=2,col="blue",ylab="Random Walk",frame.plot=FALSE,main = paste("n = ",length(x10))
```

n = 10



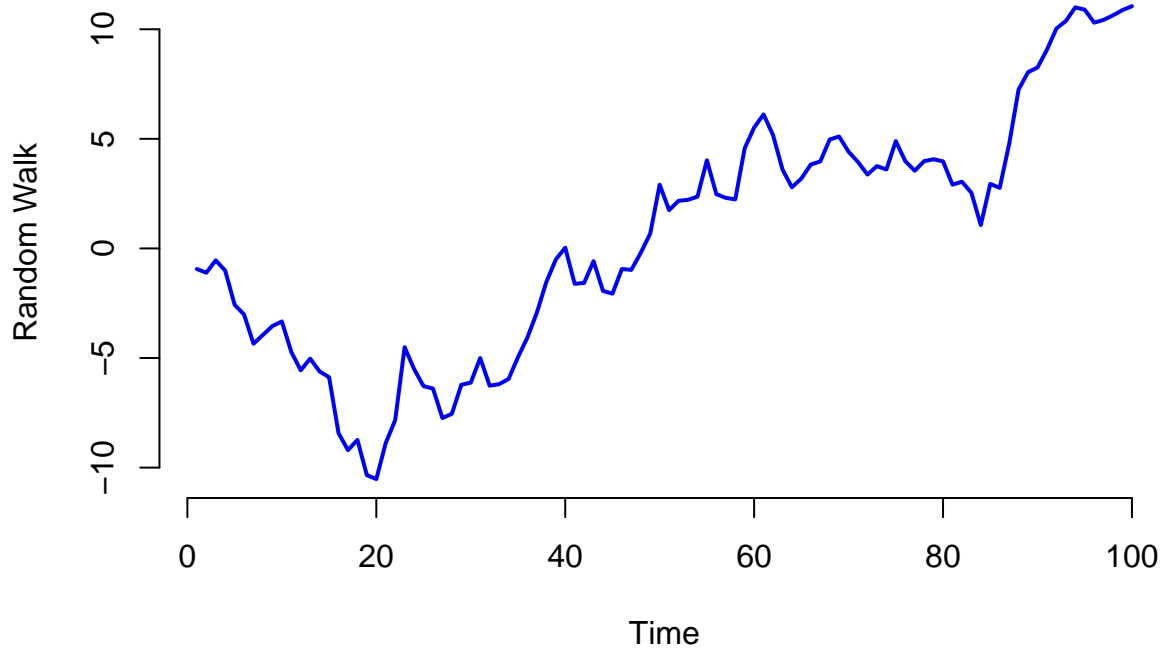
```
plot(rw50,type='l',lwd=2,col="blue",ylab="Random Walk",frame.plot=FALSE,main = paste("n = ",length(x50))
```

n = 50

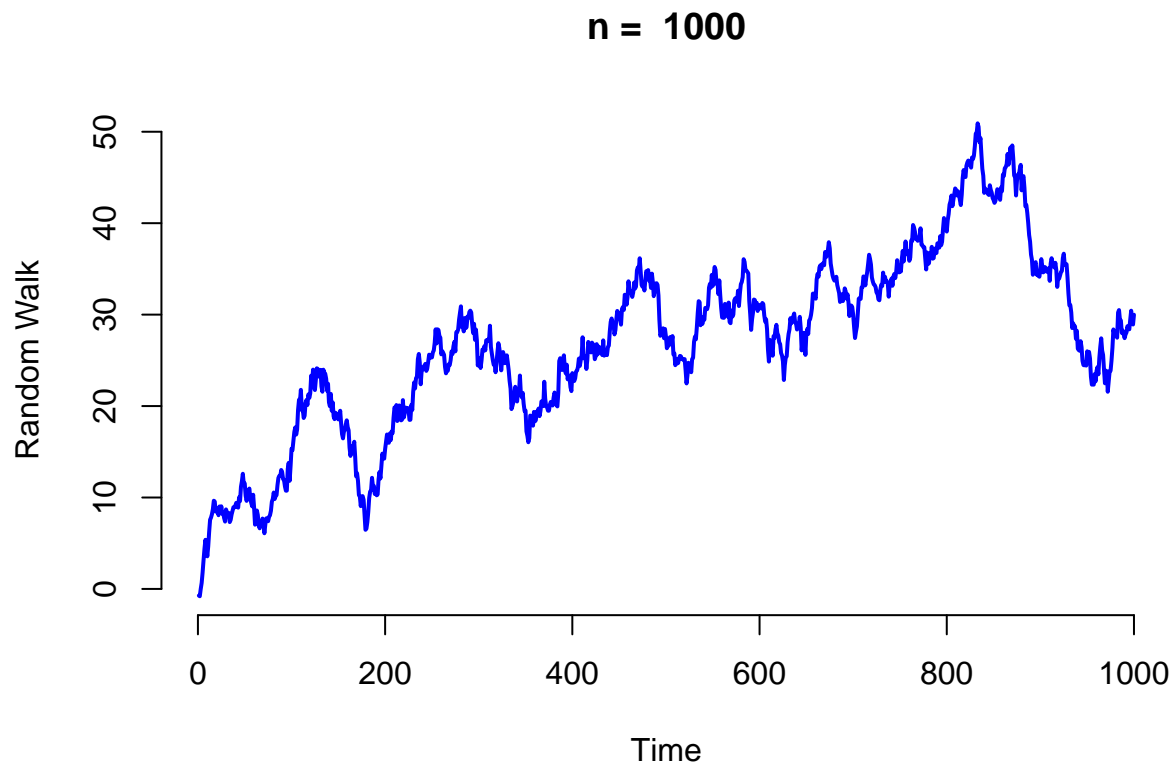


```
plot(rw100,type='l',lwd=2,col="blue",ylab="Random Walk",frame.plot=FALSE,main = paste("n = ",length(x100)))
```

n = 100

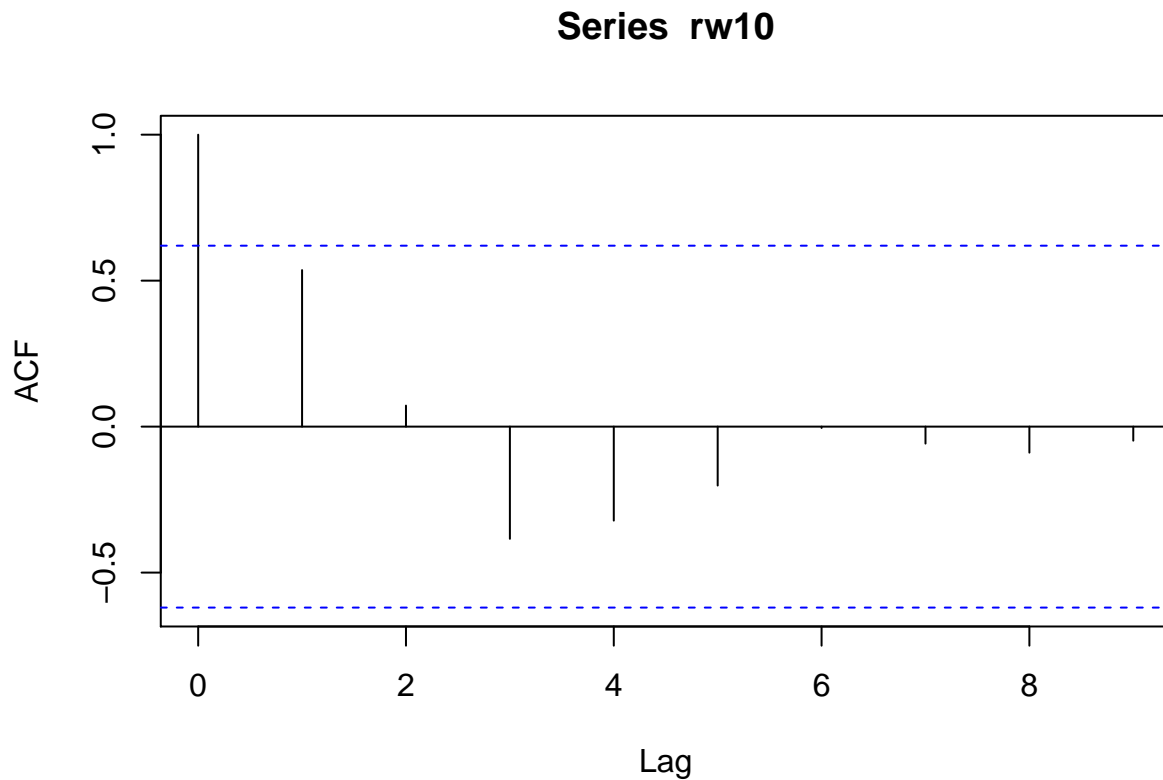


```
plot(rw1000,type='l',lwd=2,col="blue",ylab="Random Walk",frame.plot=FALSE,main = paste("n = ",length(x1000)))
```



Does the ACF die if you increase the lag.max to its maximum value? Describe your results

```
plot(acf(rw10, lag.max = "m"))
```



Yes the ACF dies down (i.e does not change) when lag.max reaches its maximum value.

$$x_t = 0.6w_t + 0.3w_{t-1}$$

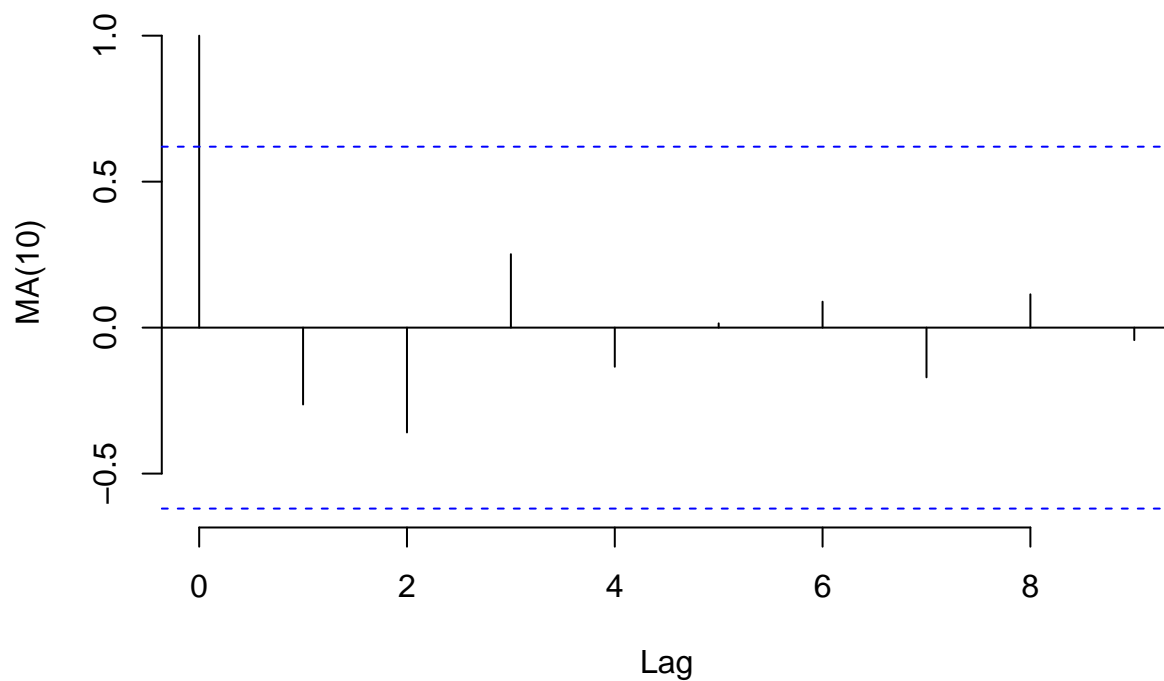
2. Generate an MA series and $n = 10, 30, 100, 10000$. Produce correlograms and interpret.

```
x10 <- rnorm(10, 0, 1)
x30 <- rnorm(30, 0, 1)
x100 <- rnorm(100, 0, 1)
x10000 <- rnorm(10000, 0, 1)

ma10 <- filter(x10, filter = c(0.6, 0.3), method = "convolution", sides = 1, circular = TRUE)
ma30 <- filter(x30, filter = c(0.6, 0.3), method = "convolution", sides = 1, circular = TRUE)
ma100 <- filter(x100, filter = c(0.6, 0.3), method = "convolution", sides = 1, circular = TRUE)
ma10000 <- filter(x10000, filter = c(0.6, 0.3), method = "convolution", sides = 1, circular = TRUE)

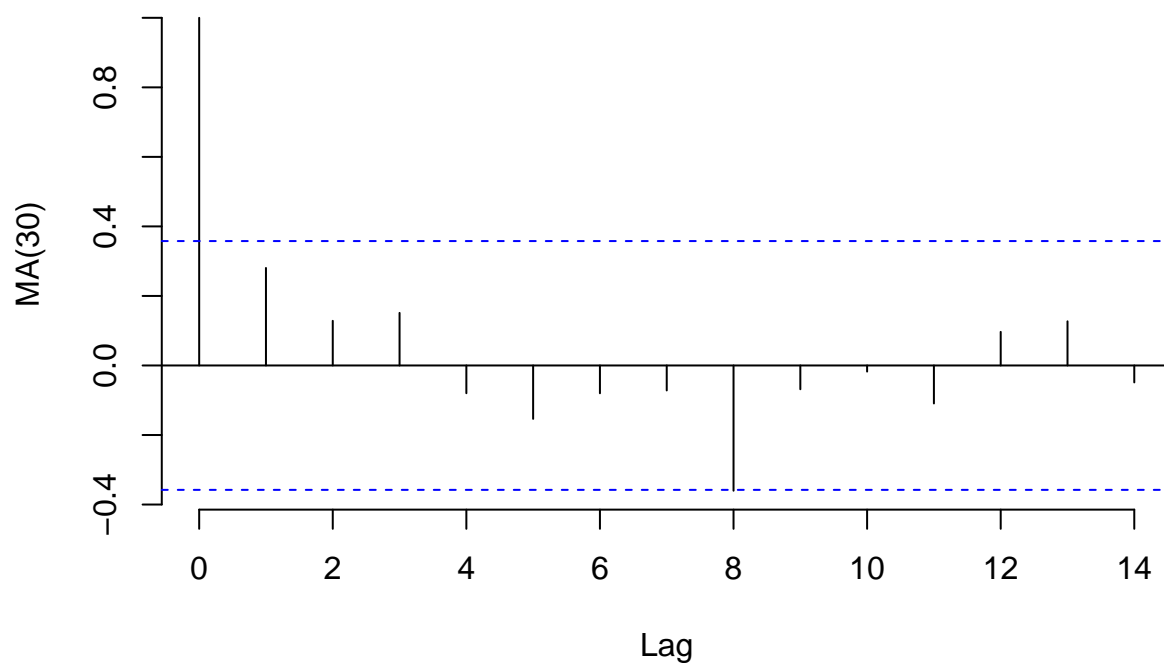
acf( ma10
  ,ylab = 'MA(10)'
  ,frame.plot=FALSE
  ,type = "correlation")
```


Series ma10



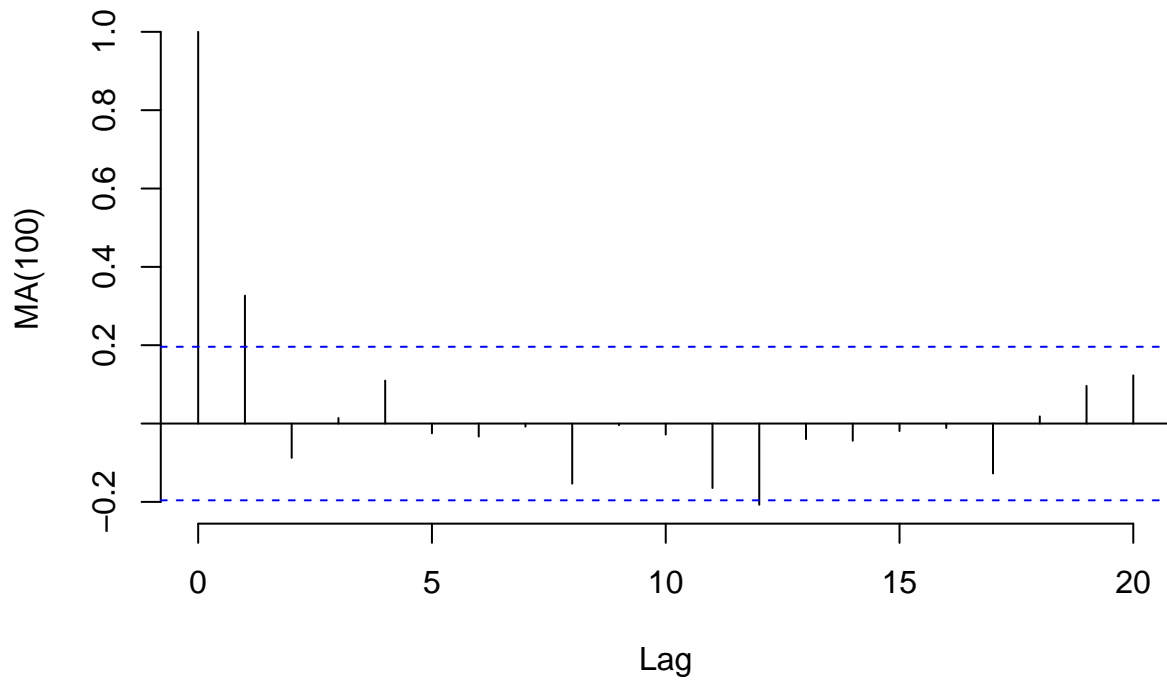
```
acf( ma30
,ylab = 'MA(30)'
,frame.plot=FALSE
,type = "correlation")
```

Series ma30



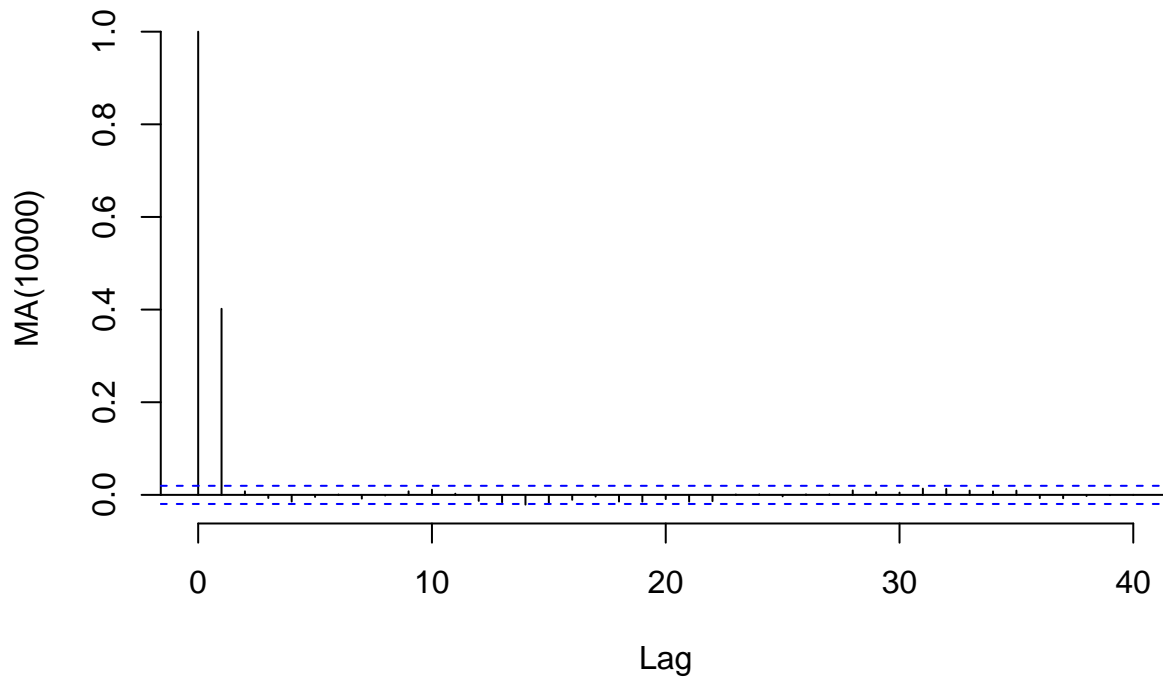
```
acf( ma100
     ,ylab = 'MA(100)'
     ,frame.plot=FALSE
     ,type = "correlation")
```

Series ma100



```
acf( ma10000
     ,ylab = 'MA(10000)'
     ,frame.plot=FALSE
     ,type = "correlation")
```

Series ma10000



As n increase from 10 to 10000, the significance band (ie confidence interval) shrinks. Lag 1 and Lag 2 also exceeds the significance bands at some point.

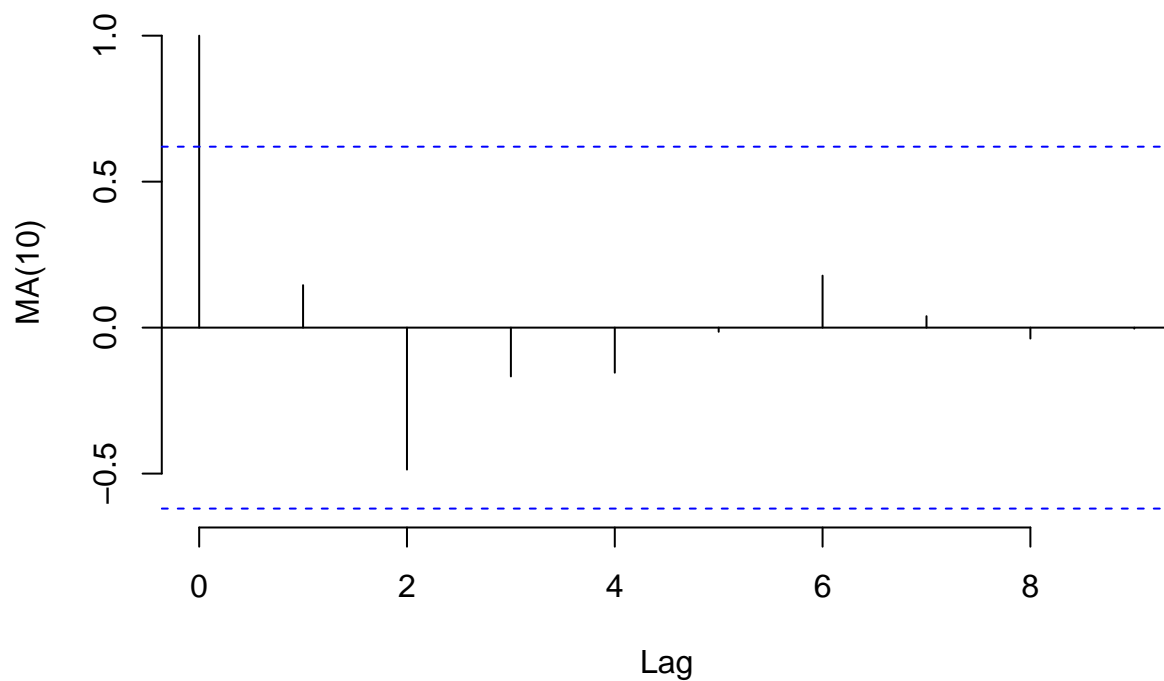
$$x_t = 0.2w_{t-1} + 0.5w_t + 0.3w_{t+1}$$

3. Generate an MA series and $n = 10, 30, 100, 10000$. Produce correlograms and interpret.

```
ma10 <- filter(x10, filter = c(0.2, 0.5, 0.3), method = "convolution", sides = 2, circular = TRUE)
ma30 <- filter(x30, filter = c(0.2, 0.5, 0.3), method = "convolution", sides = 2, circular = TRUE)
ma100 <- filter(x100, filter = c(0.2, 0.5, 0.3), method = "convolution", sides = 2, circular = TRUE)
ma10000 <- filter(x10000, filter = c(0.2, 0.5, 0.3), method = "convolution", sides = 2, circular = TRUE)

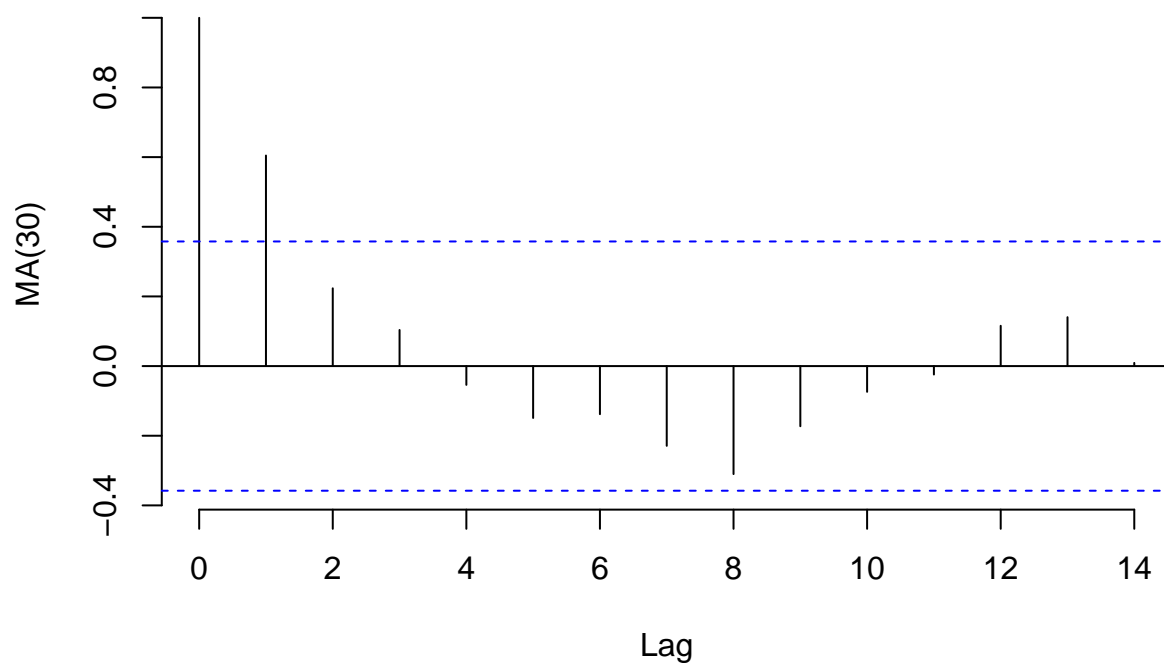
acf( ma10
     ,ylab = 'MA(10)'
     ,frame.plot=FALSE
     ,type = "correlation")
```

Series ma10



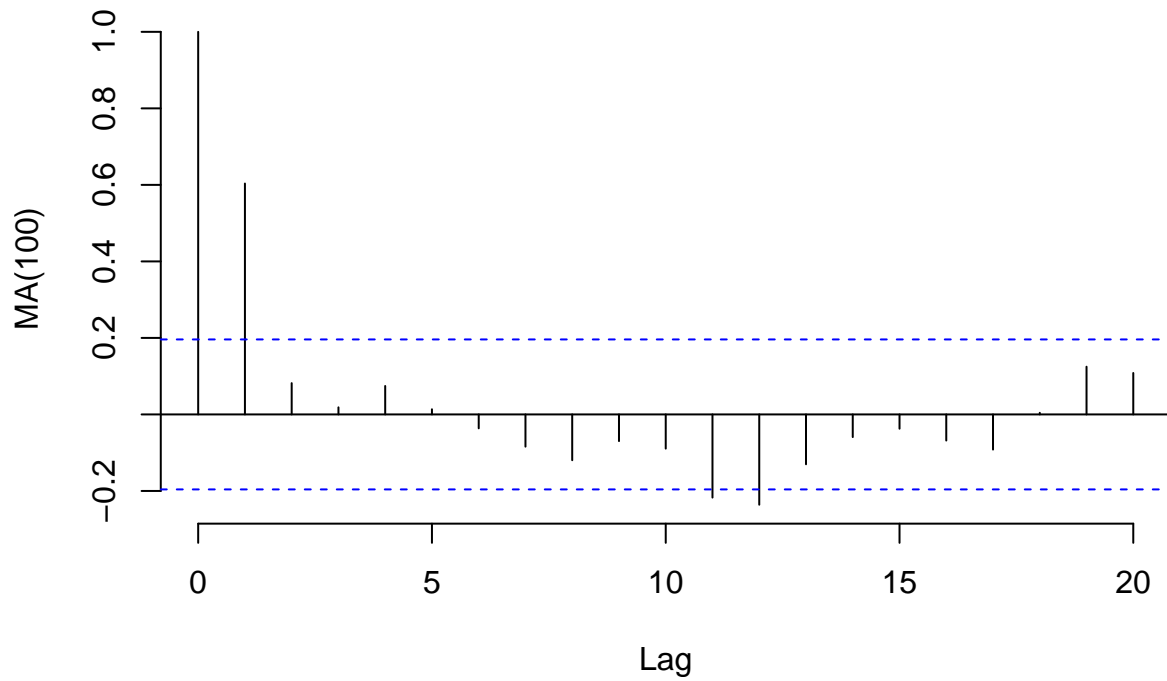
```
acf( ma30
,ylab = 'MA(30)'
,frame.plot=FALSE
,type = "correlation")
```

Series ma30



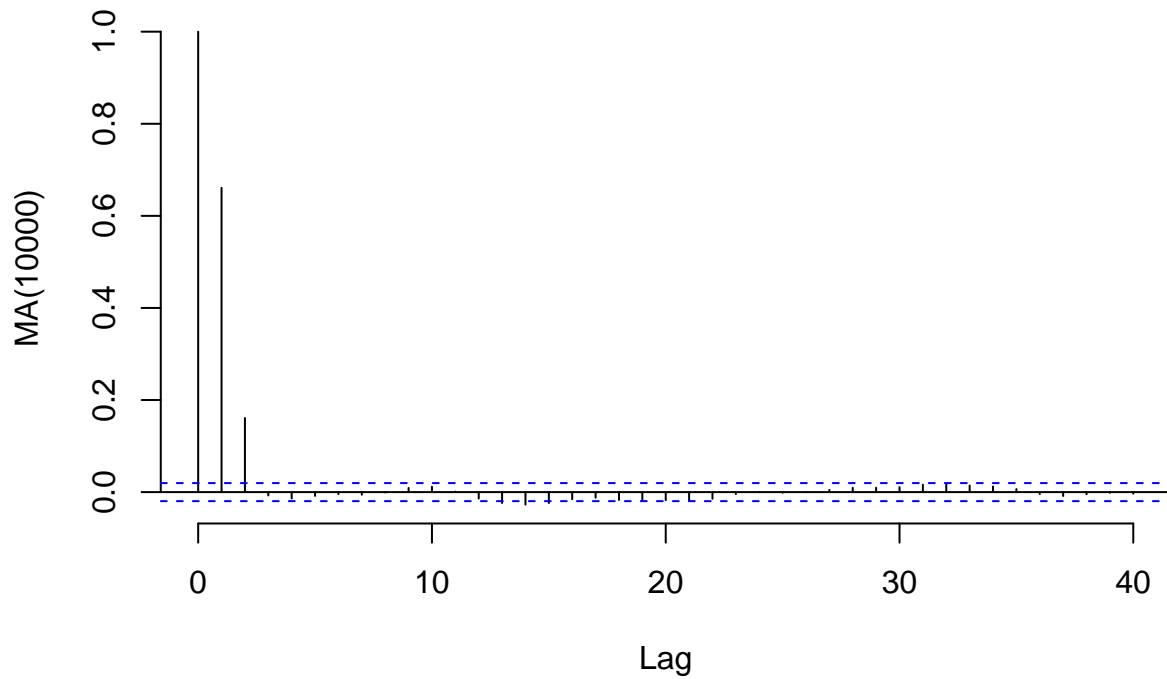
```
acf( ma100
     ,ylab = 'MA(100)'
     ,frame.plot=FALSE
     ,type = "correlation")
```

Series ma100



```
acf( ma10000
     ,ylab = 'MA(10000)'
     ,frame.plot=FALSE
     ,type = "correlation")
```

Series ma10000



As n increase from 10 to 10000, the significance band (ie confidence interval) shrinks. Lag 1 and Lag 2 also exceeds the significance bands at some point.