

# 19\_AR-2\_processes.R

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```
# Course: Time series analysis
# Exercise: 17th / AR(2) processes
# Author: Felix Reichel
```

```
require(plotrix)
```

```
## Loading required package: plotrix
```

```
phil <- c(0.3, 0.5, 0.6, -0.9, 0.4)
phi2 <- c(-0.1, -0.8, 0.4, 0.5, 0.8)

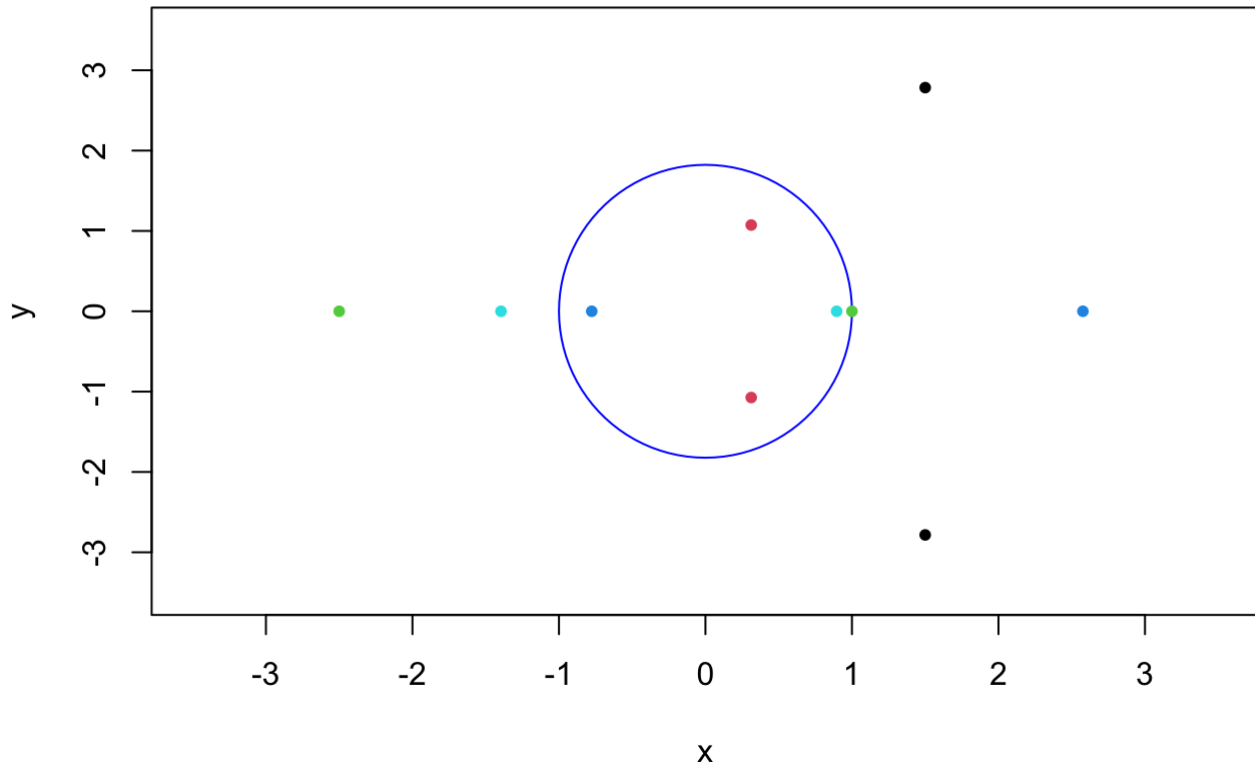
zx_results <- list()
zy_results <- list()

for (i in 1:5) {
  discr <- phil[i] ^ 2 + 4 * phi2[i]
  if (discr >= 0) {

    zx_results[[i]] <- c(-phil[i]+sqrt(discr), -phil[i]-sqrt(discr))/(2*phi2[i])
    zy_results[[i]] <- rep(0,2)
  } else {
    zx_results[[i]] <- rep(-phil[i]/(2*phi2[i]),2)
    zy_results[[i]] <- c(1,-1)*(sqrt(-discr)/(2*phi2[i]))
  }
}

plot(c(-3.5, 3.5), c(-3.5,3.5), type = "n",xlab="x",ylab="y")
draw.circle(x=0, y=0, radius=1,border="blue")

for (i in 1:5) {
  points(zx_results[[i]],zy_results[[i]],pch=20,col=i)
}
```



```

sim_ar2 = function(phil, phi2, Tt, sigma2 = 1) {
  set.seed(2345)
  eps <- rnorm(Tt) * sqrt(sigma2)
  y <- rep(0, Tt)
  y[1] <- eps[1]
  y[2] <- phil * y[1] + eps[1]

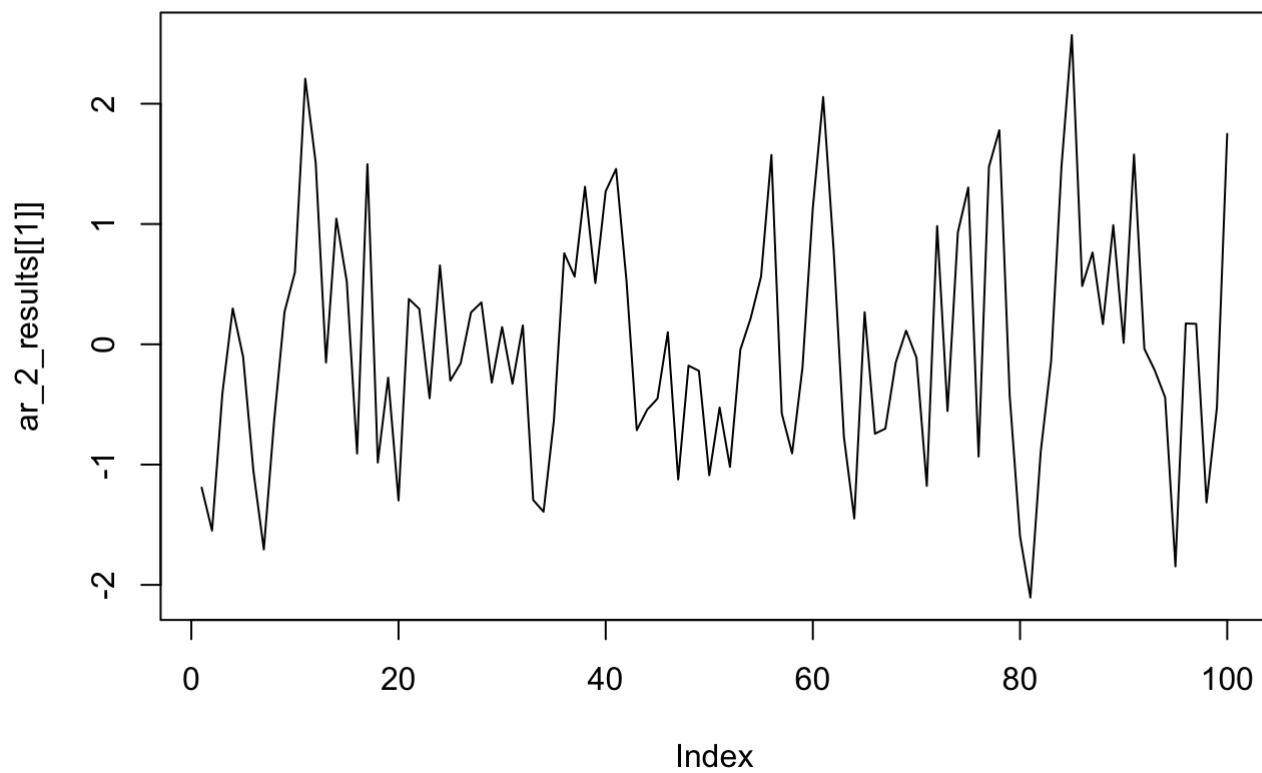
  for (t in 3:Tt){
    y[t]= phil * y[t-1] + phi2 * y[t-2] + eps[t]
  }
  return(y)
}

Tau <- 100
ar_2_results <- list()

for (i in 1:5) {
  ar_2_results[[i]] <- sim_ar2(phil[i], phi2[i], Tau)
}

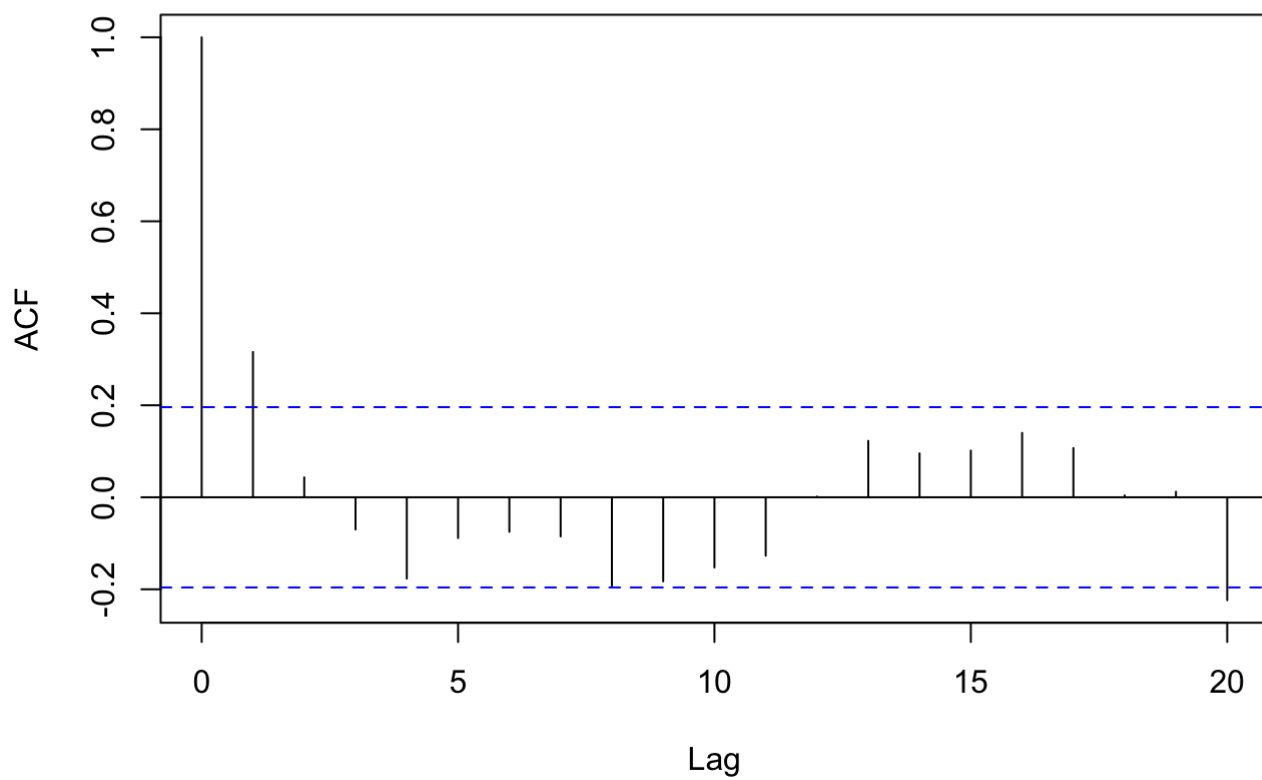
plot(ar_2_results[[1]], type = "l")

```

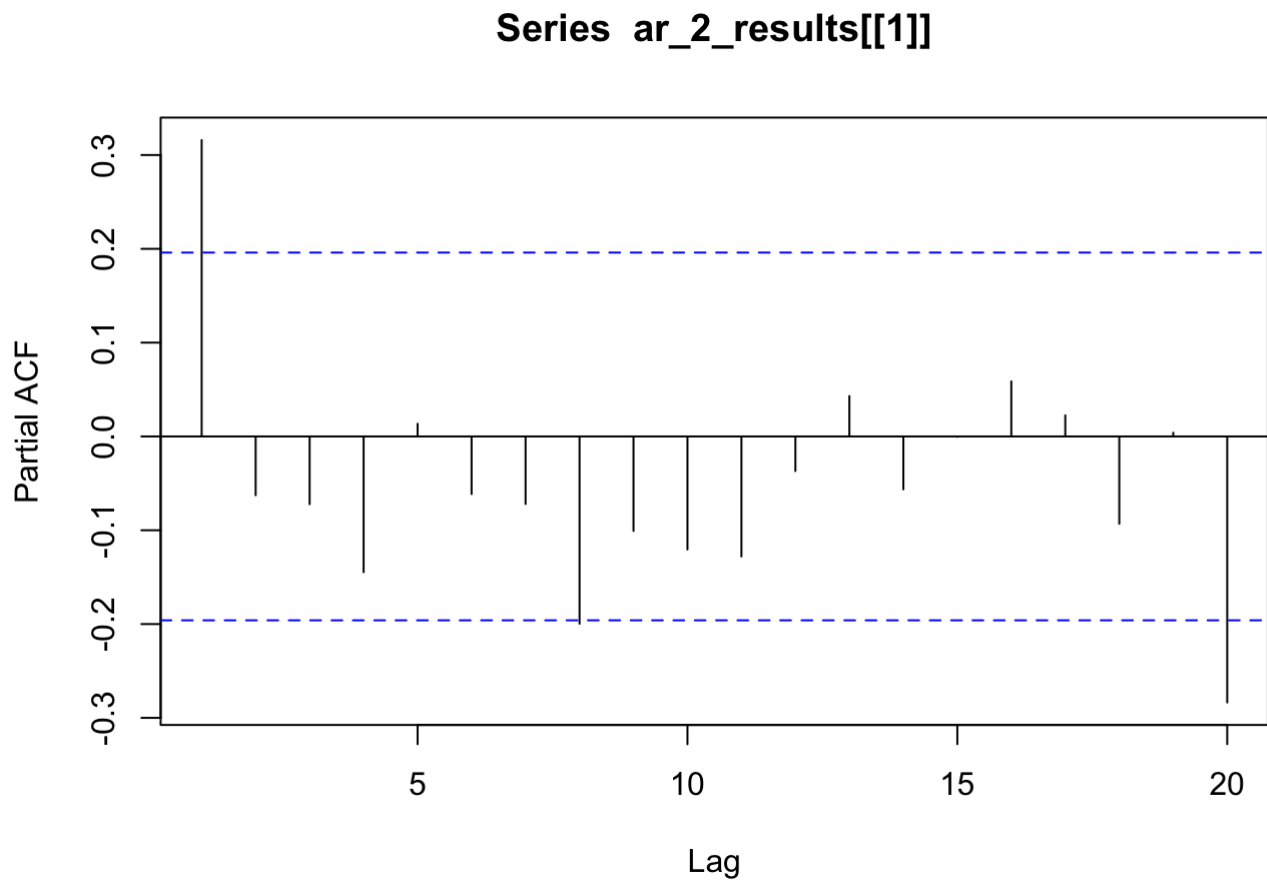


```
acf(ar_2_results[[1]])
```

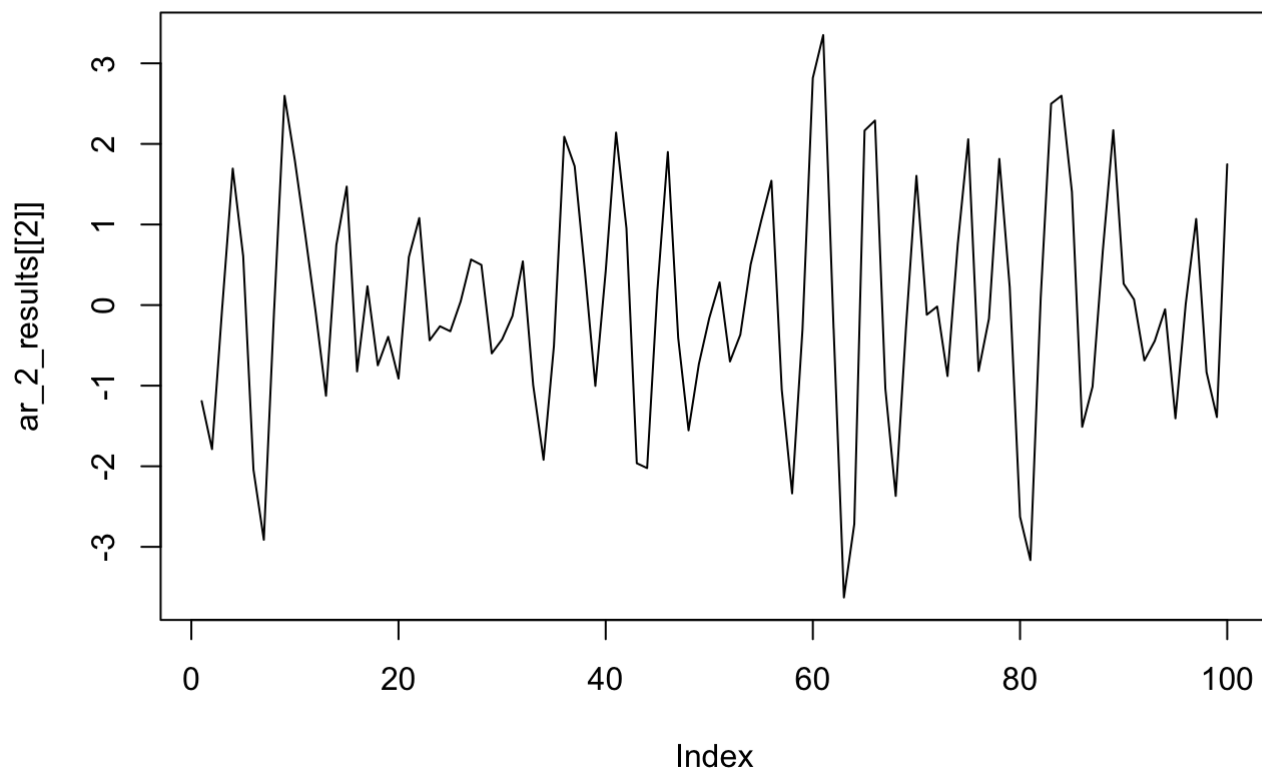
**Series `ar_2_results[[1]]`**



```
pacf(ar_2_results[[1]])
```

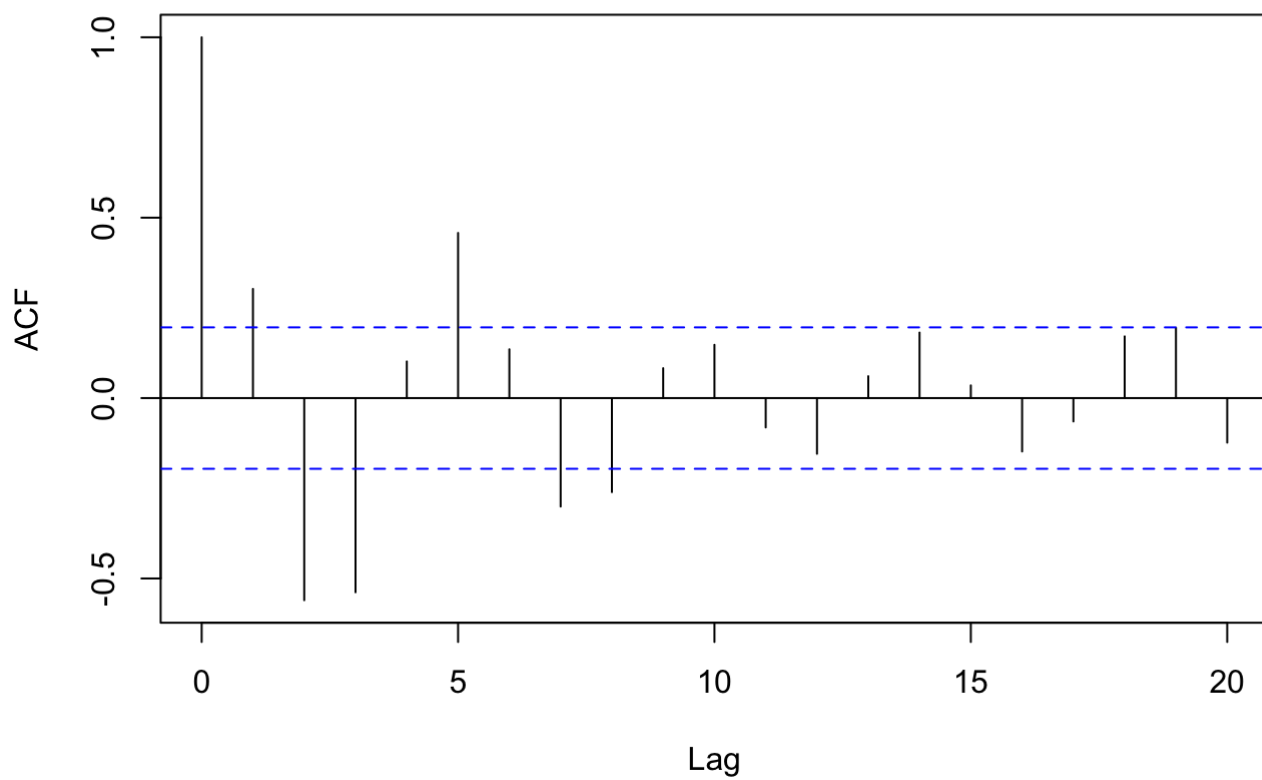


```
plot(ar_2_results[[2]], type = "l")
```

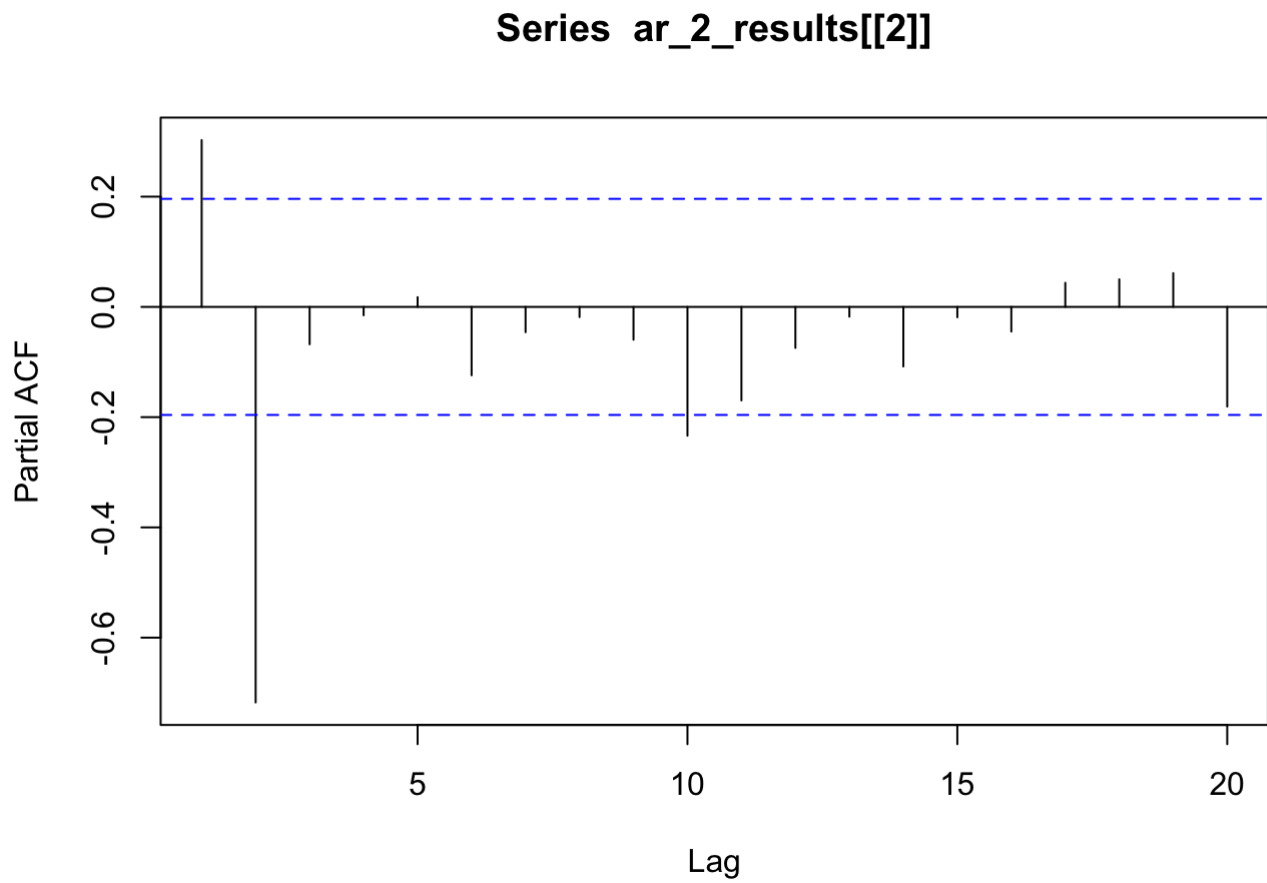


```
acf(ar_2_results[[2]])
```

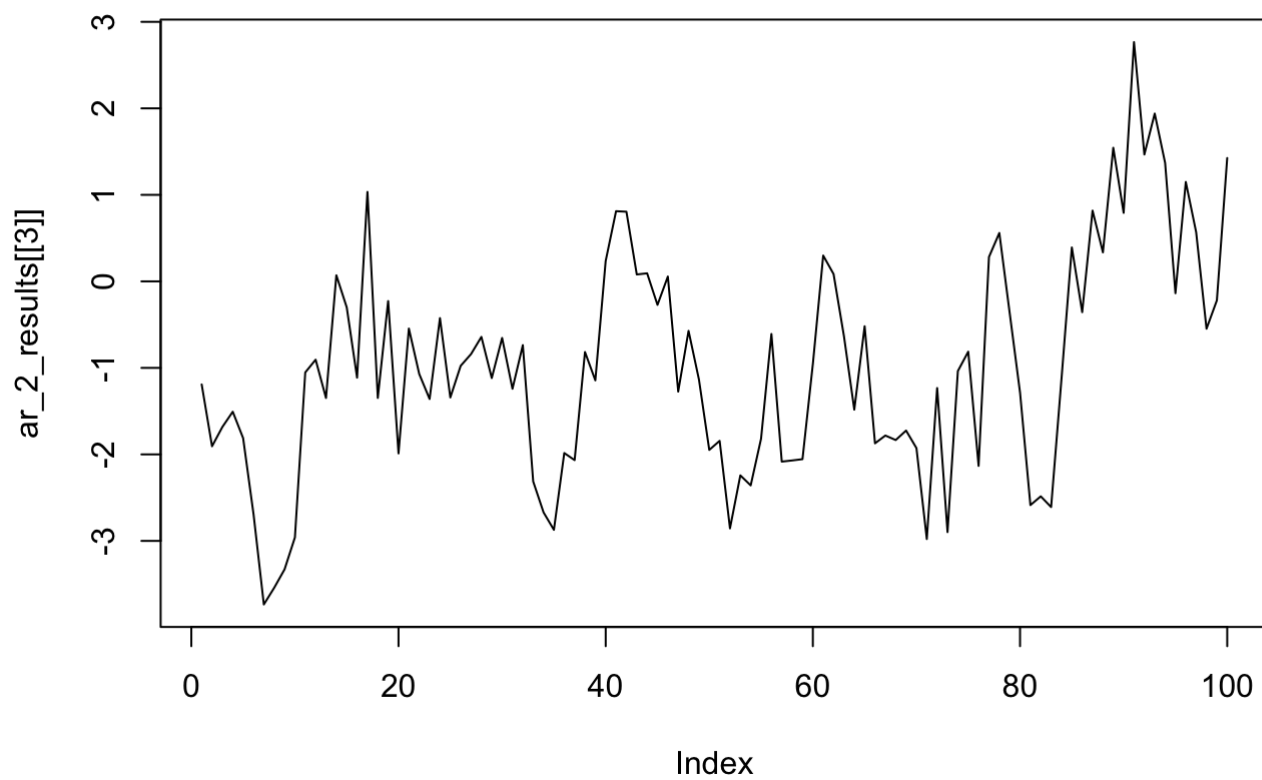
**Series ar\_2\_results[[2]]**



```
pacf(ar_2_results[[2]])
```

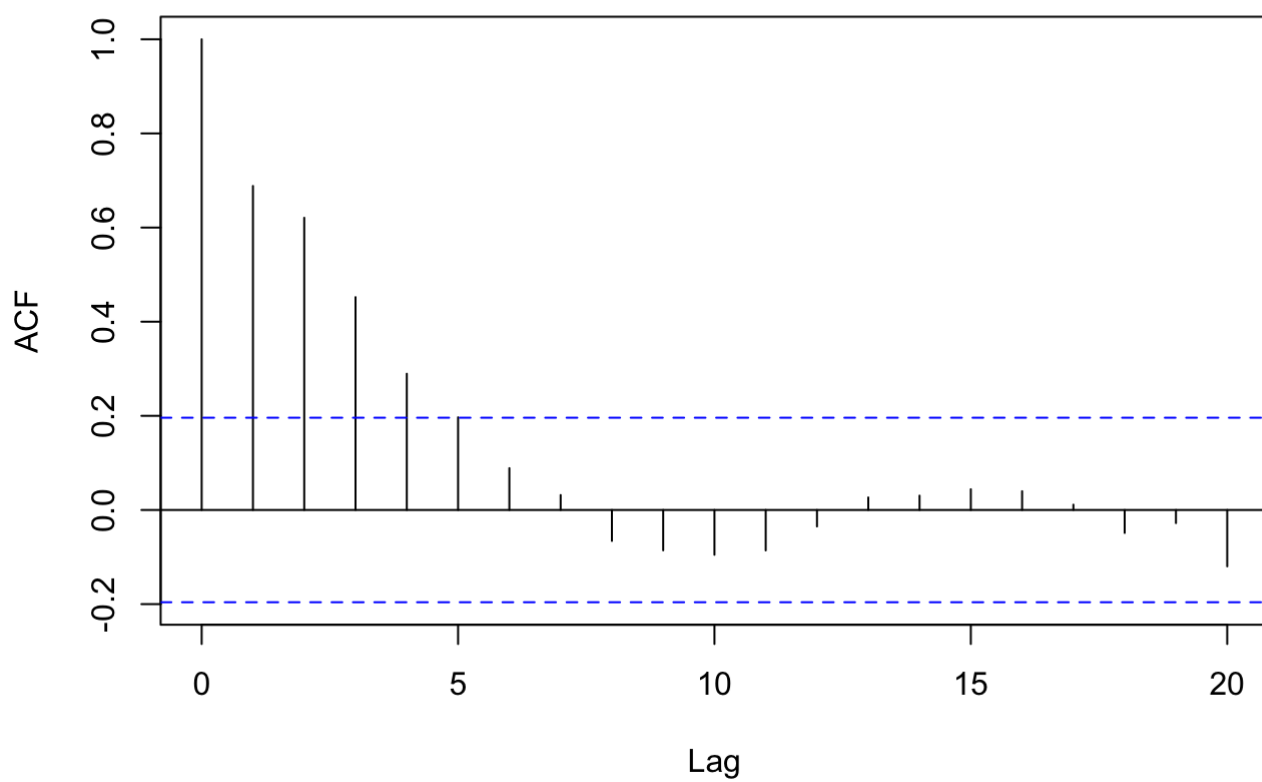


```
# phi1+phi2 = 1  
plot(ar_2_results[[3]], type = "l")
```



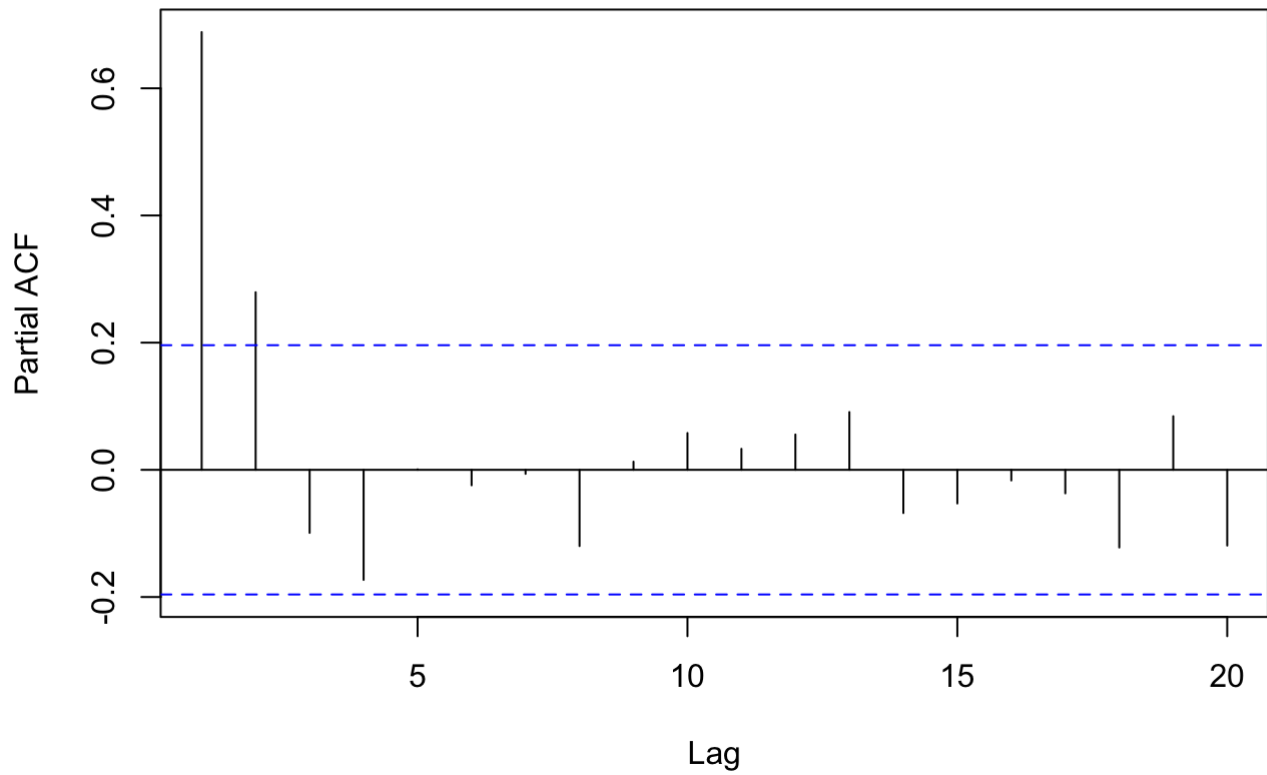
```
acf(ar_2_results[[3]])
```

**Series ar\_2\_results[[3]]**



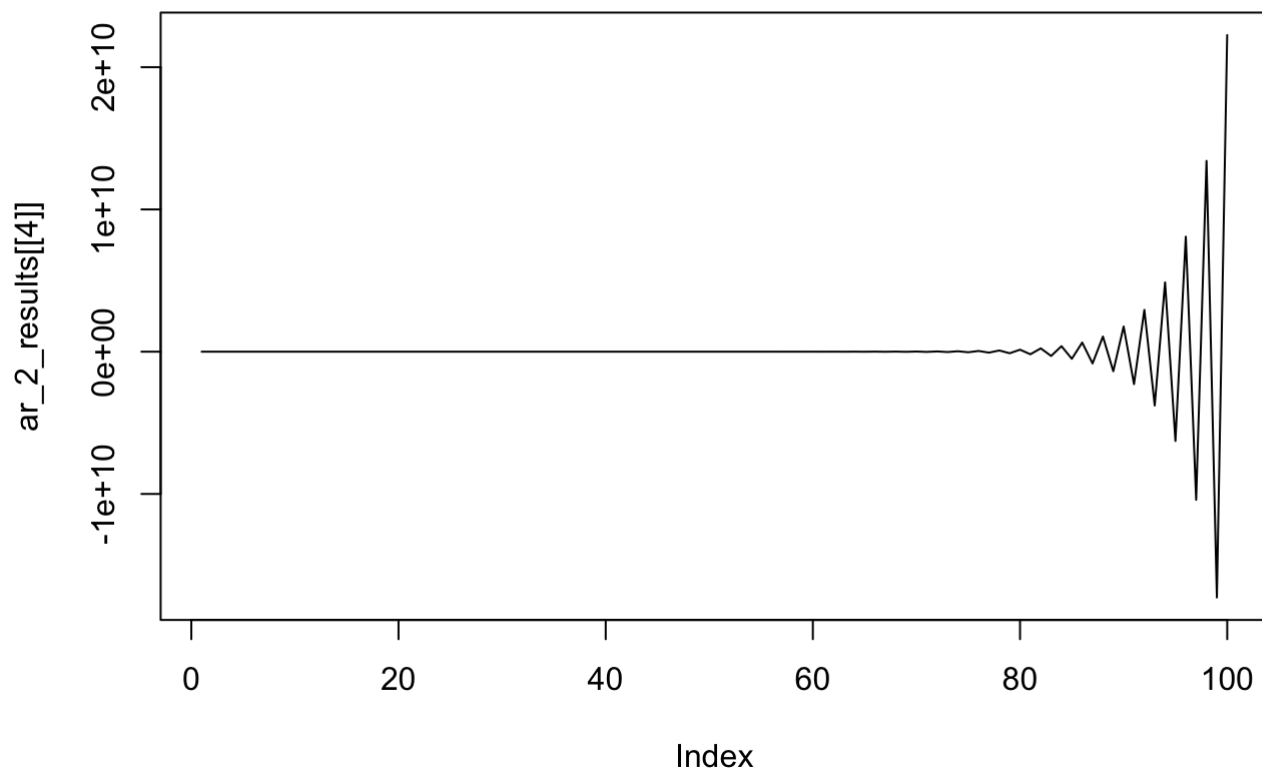
```
pacf(ar_2_results[[3]])
```

**Series ar\_2\_results[[3]]**

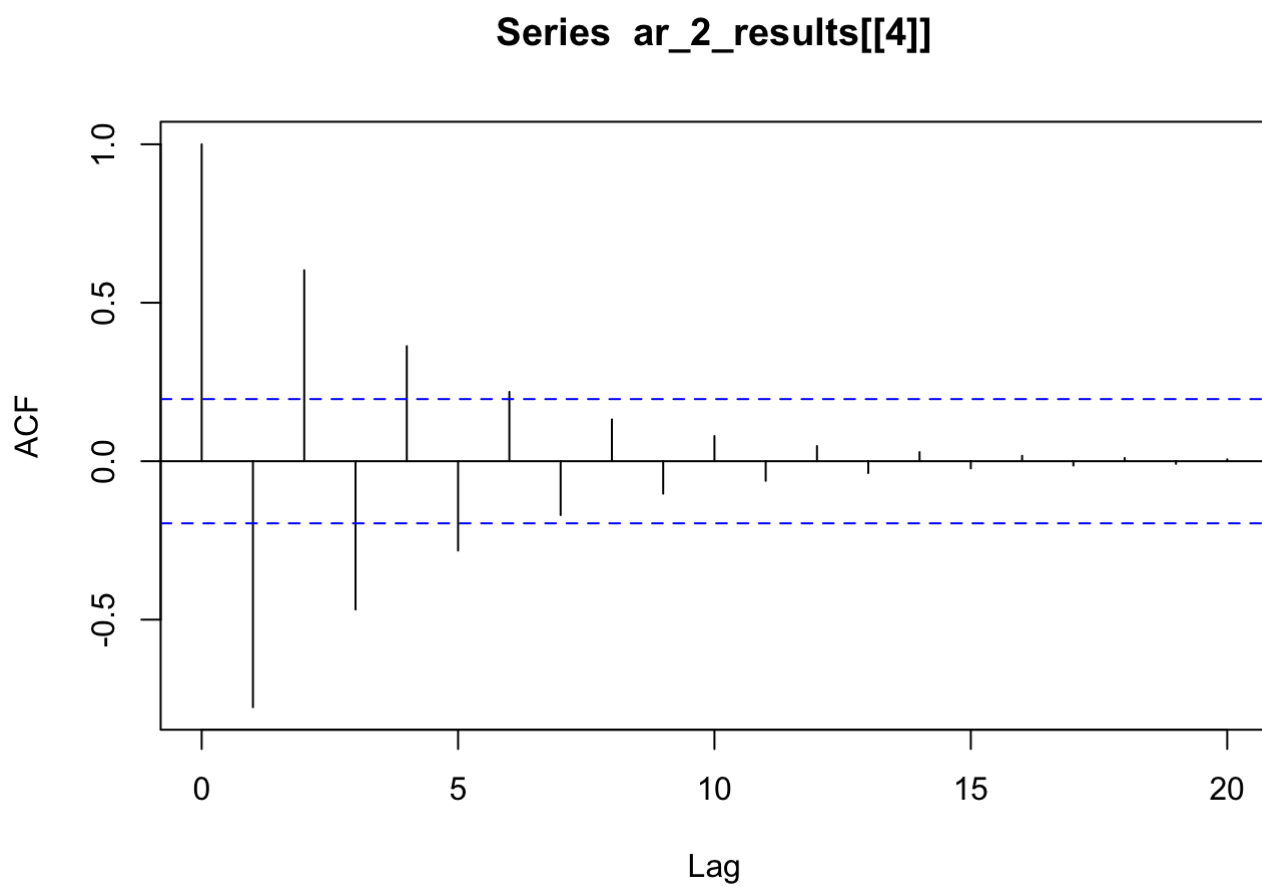


```
plot(ar_2_results[[4]], type = "l")
```

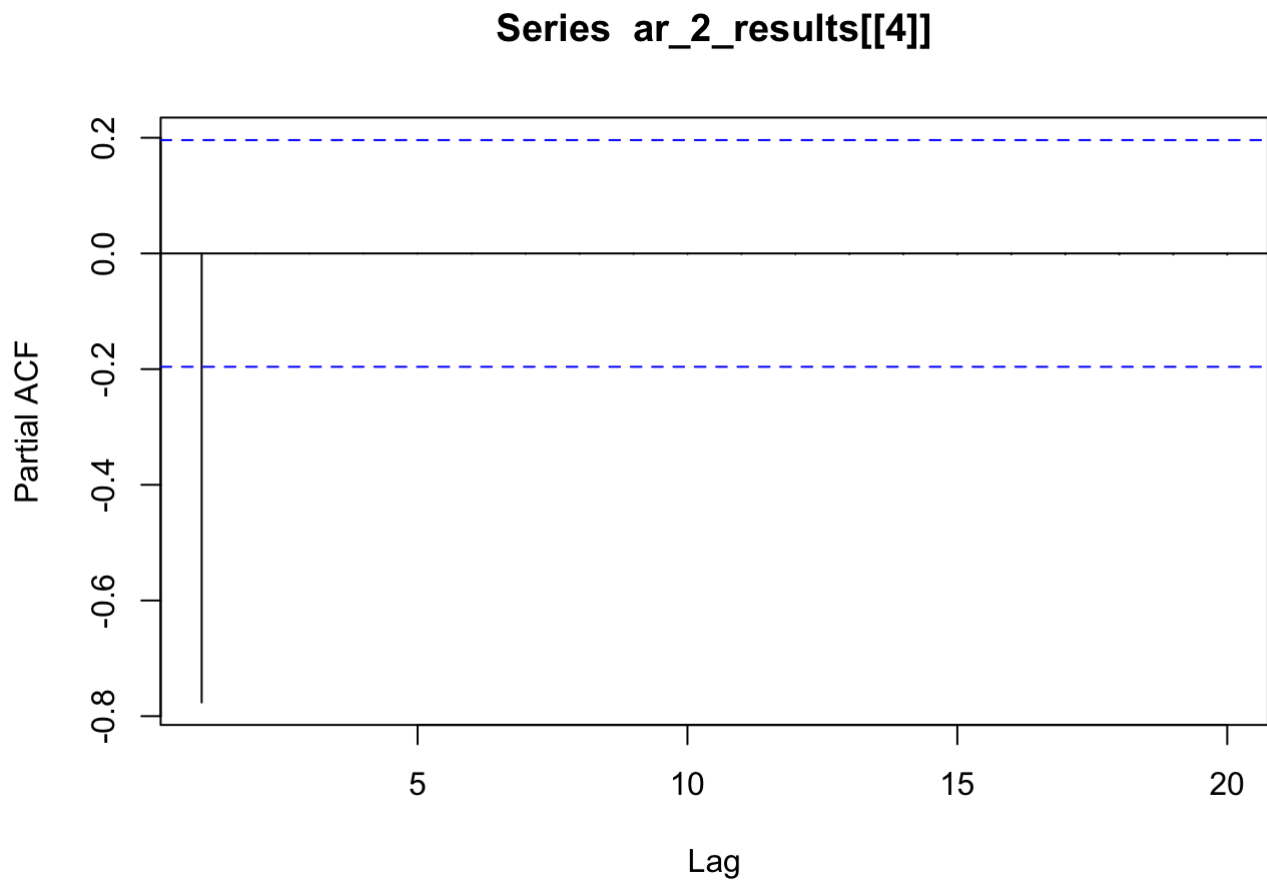




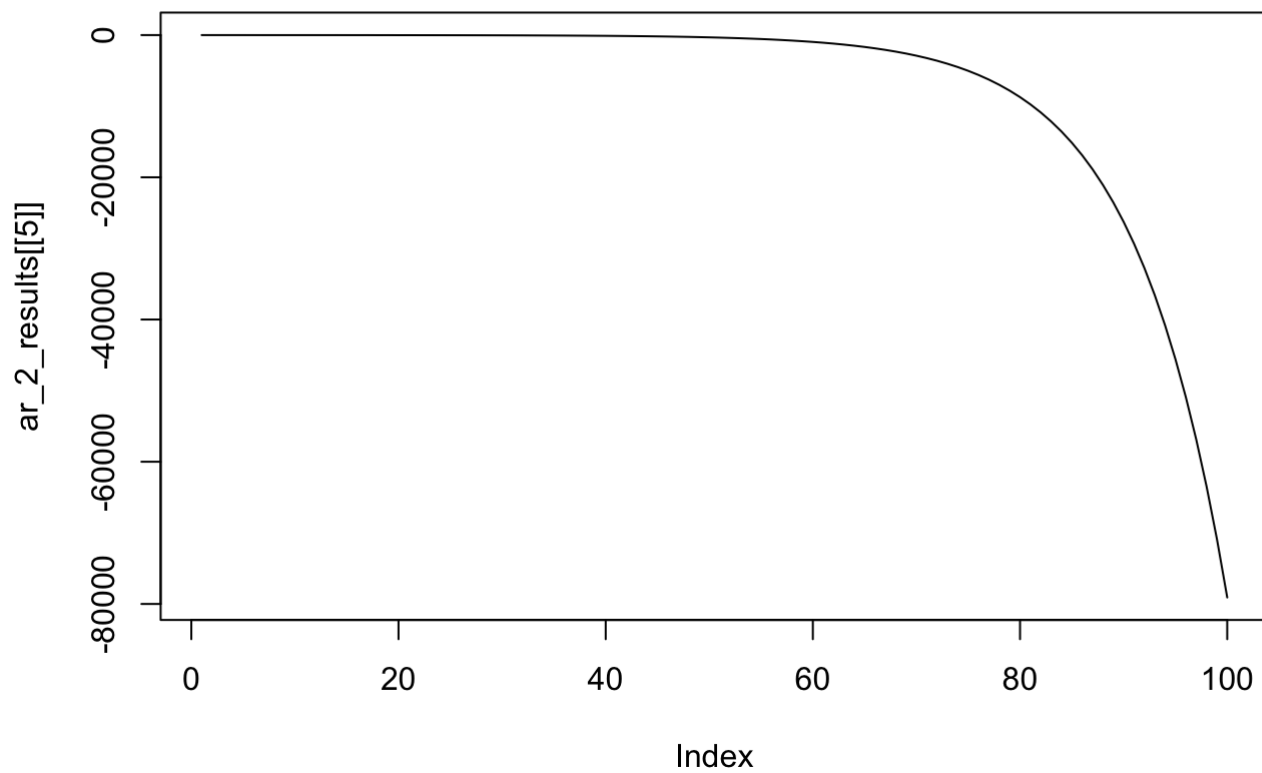
```
acf(ar_2_results[[4]])
```



```
pacf(ar_2_results[[4]])
```

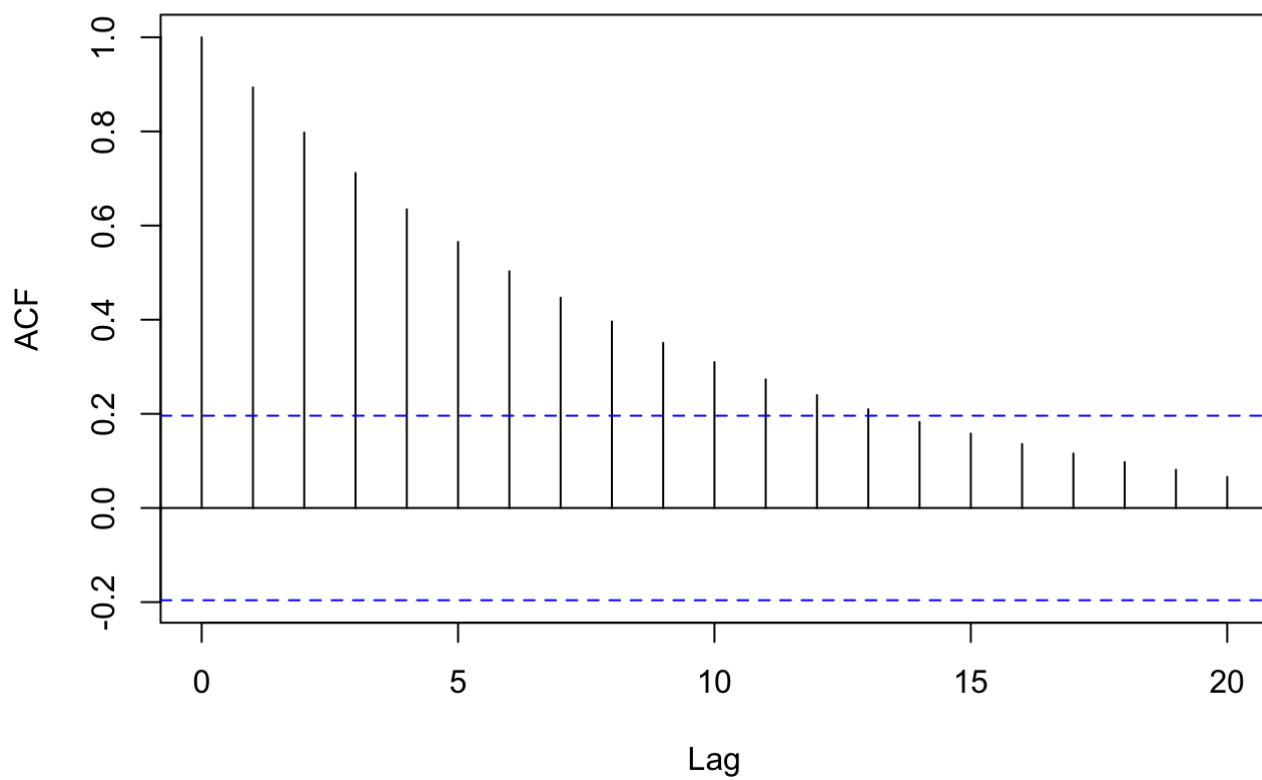


```
plot(ar_2_results[[5]], type = "l")
```



```
acf(ar_2_results[[5]])
```

**Series ar\_2\_results[[5]]**



```
pacf(ar_2_results[[5]])
```

**Series ar\_2\_results[[5]]**

