Homework 7

Problem 25 b

LD recursions ar(1)

```
AR1.acvf <- as.vector(ARMAacf(ar=c(6/13),ma=0,lag=4))
AR1.pacvf <- as.vector(ARMAacf(ar=c(6/13),ma=0,lag=4,pacf = TRUE))

print('LD')
```

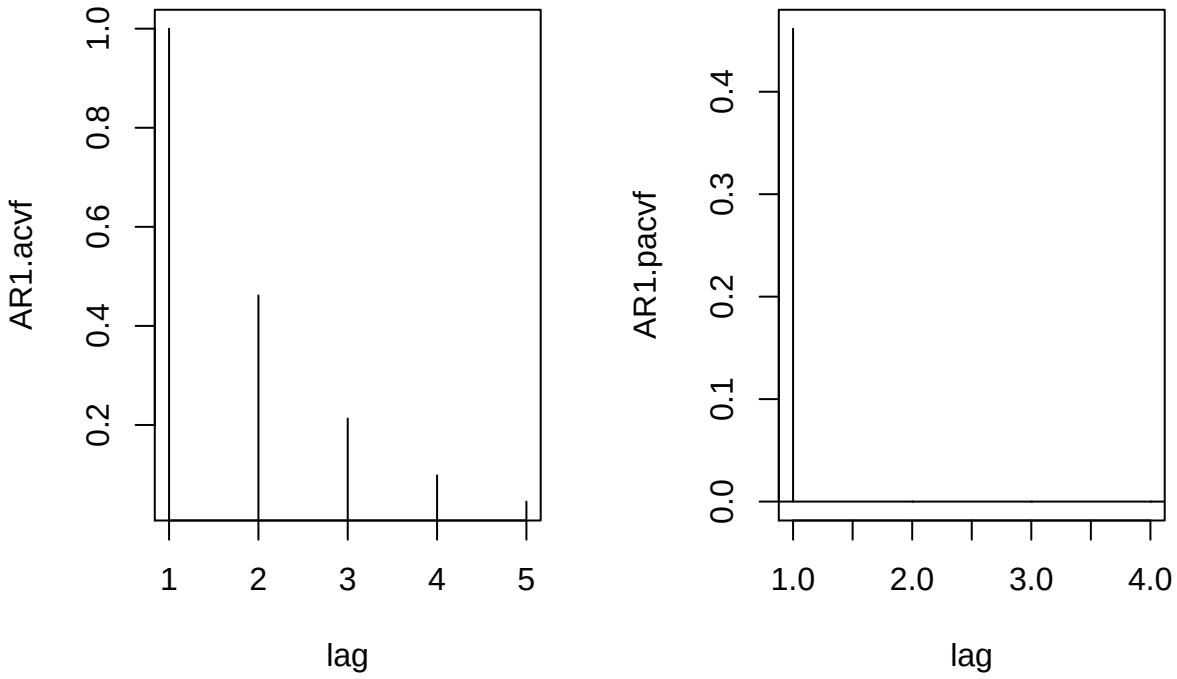
```
## [1] "LD"
```

```
print((results <- LD.recursions(AR1.acvf)))
```

```
## $coeffs
## [1] 4.615385e-01 7.053673e-17 0.000000e+00 0.000000e+00
##
## $innov.var
## [1] 0.7869822
##
## $pev
## [1] 1.0000000 0.7869822 0.7869822 0.7869822 0.7869822
##
## $pacf
## [1] 4.615385e-01 7.053673e-17 0.000000e+00 0.000000e+00
##
## $blpc
## $blpc[[1]]
## [1] 0.4615385
##
## $blpc[[2]]
## [1] 4.615385e-01 7.053673e-17
##
## $blpc[[3]]
## [1] 4.615385e-01 7.053673e-17 0.000000e+00
##
## $blpc[[4]]
## [1] 4.615385e-01 7.053673e-17 0.000000e+00 0.000000e+00
```

```
par(mfrow=c(1,2))
plot(AR1.acvf,type = "h",xlab="lag")
abline(h=0)

plot(AR1.pacvf,type = "h",xlab="lag")
abline(h=0)
```



innovations ar(1)

```
print('innovations')
```

```
## [1] "innovations"
```

```
(results <- innovations.algorithm(AR1.acvf))
```

```
## $vs
## [1] 1.0000000 0.7869822 0.7869822 0.7869822 0.7869822
##
## $thetas
## $thetas[[1]]
## [1] 0.4615385
##
## $thetas[[2]]
## [1] 0.4615385 0.2130178
##
## $thetas[[3]]
## [1] 0.46153846 0.21301775 0.09831589
##
## $thetas[[4]]
## [1] 0.46153846 0.21301775 0.09831589 0.04537656
```

LD recursions MA(1)

```
ma1.acvf <- as.vector(ARMAacf(ma=c(2/3),lag=4))
ma1.pacvf <- as.vector(ARMAacf(ma=c(2/3),lag=4,pacf = TRUE))
(results <- LD.recursions(ma1.acvf))
```

```
## $coeffs
## [1]  0.6519604 -0.4125808  0.2419647 -0.1116760
##
## $innov.var
## [1] 0.6990952
##
## $pev
## [1] 1.0000000 0.7869822 0.7293233 0.7079241 0.6990952
##
## $pacf
## [1]  0.4615385 -0.2706767  0.1712926 -0.1116760
##
## $blpc
## $blpc[[1]]
## [1] 0.4615385
##
## $blpc[[2]]
## [1]  0.5864662 -0.2706767
##
## $blpc[[3]]
## [1]  0.6328311 -0.3711340  0.1712926
##
## $blpc[[4]]
## [1]  0.6519604 -0.4125808  0.2419647 -0.1116760
```

```
### > results$vs  # v_0, v_1, v_2, v_3
### [1] 1.777778 1.333333 1.000000 1.000000
### > results$thetas[[1]]  # theta_{1,1}
### [1] 0.5
### > results$thetas[[2]]  # theta_{2,1}, theta_{2,2}
### [1]  0.750 -0.125
### > results$thetas[[3]]  # theta_{3,1}, theta_{3,2}, theta_{3,3}
### [1]  0.75000  0.06250 -0.34375
```

innovations ma(1)

```
ma1.acvf <- as.vector(ARMAacf(ma=c(2/3),lag=4))
ma1.pacvf <- as.vector(ARMAacf(ma=c(2/3),lag=4,pacf = TRUE))
(results <- innovations.algorithm(ma1.acvf))
```

```
## $vs
## [1] 1.0000000 0.7869822 0.7293233 0.7079241 0.6990952
##
## $thetas
## $thetas[[1]]
## [1] 0.4615385
##
## $thetas[[2]]
## [1] 0.5864662 0.0000000
##
## $thetas[[3]]
## [1] 0.6328311 0.0000000 0.0000000
```

```
##
## $thetas[[4]]
## [1] 0.6519604 0.0000000 0.0000000 0.0000000
```

```
### > results$vs  # v_0, v_1, v_2, v_3
### [1] 1.777778 1.333333 1.000000 1.000000
### > results$thetas[[1]]  # theta_{1,1}
### [1] 0.5
### > results$thetas[[2]]  # theta_{2,1}, theta_{2,2}
### [1]  0.750 -0.125
### > results$thetas[[3]]  # theta_{3,1}, theta_{3,2}, theta_{3,3}
### [1]  0.75000  0.06250 -0.34375
```

Sample mean

```
#colMeans(acf.tss.mat.1000)
```

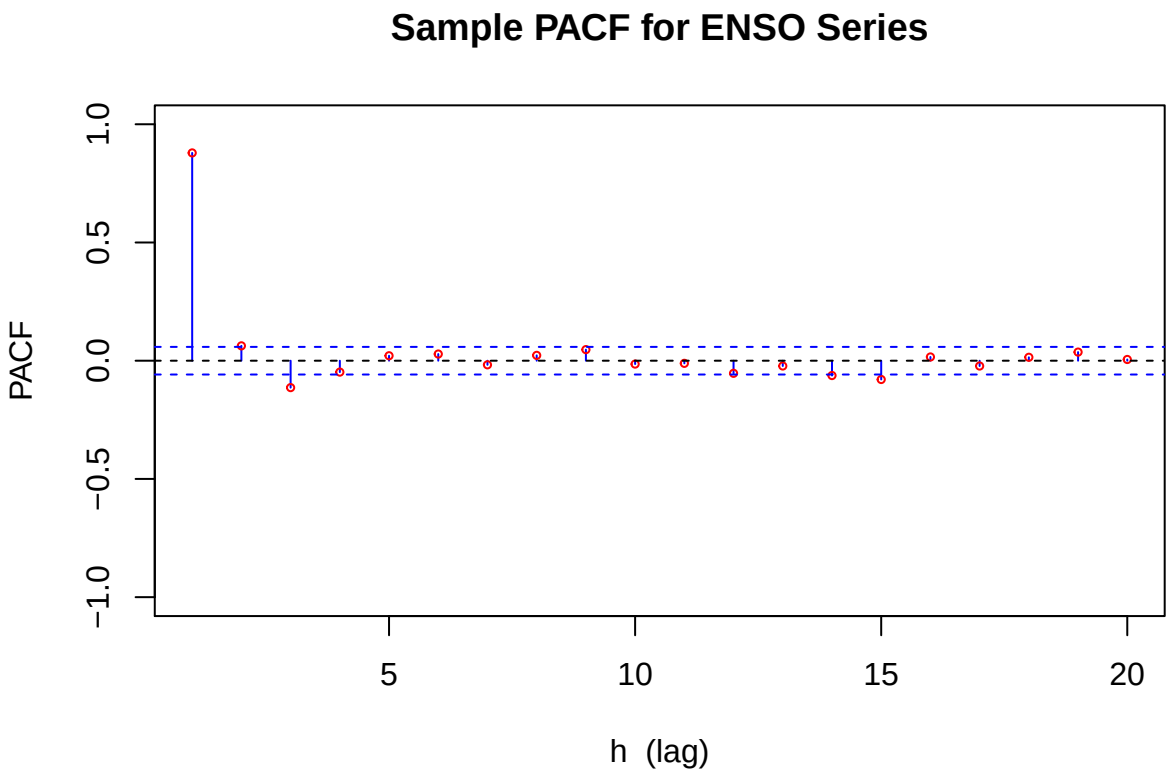
Correlation Matrix

```
#knitr::kable(df_corr)
```

Covariance Matrix

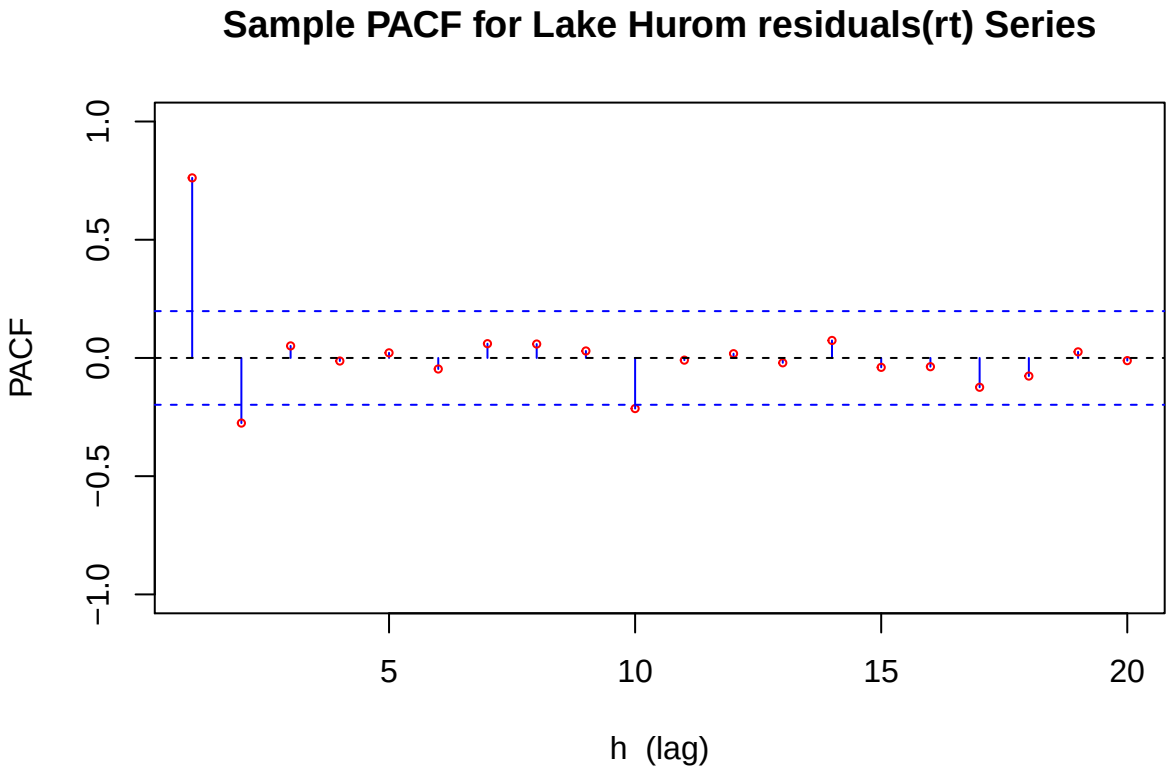
```
#knitr::kable(df_cov)
```

Plotting PACF for ENSO



We have PACF at lag 1,3 is out of 95% bounds, so it is not white noise.

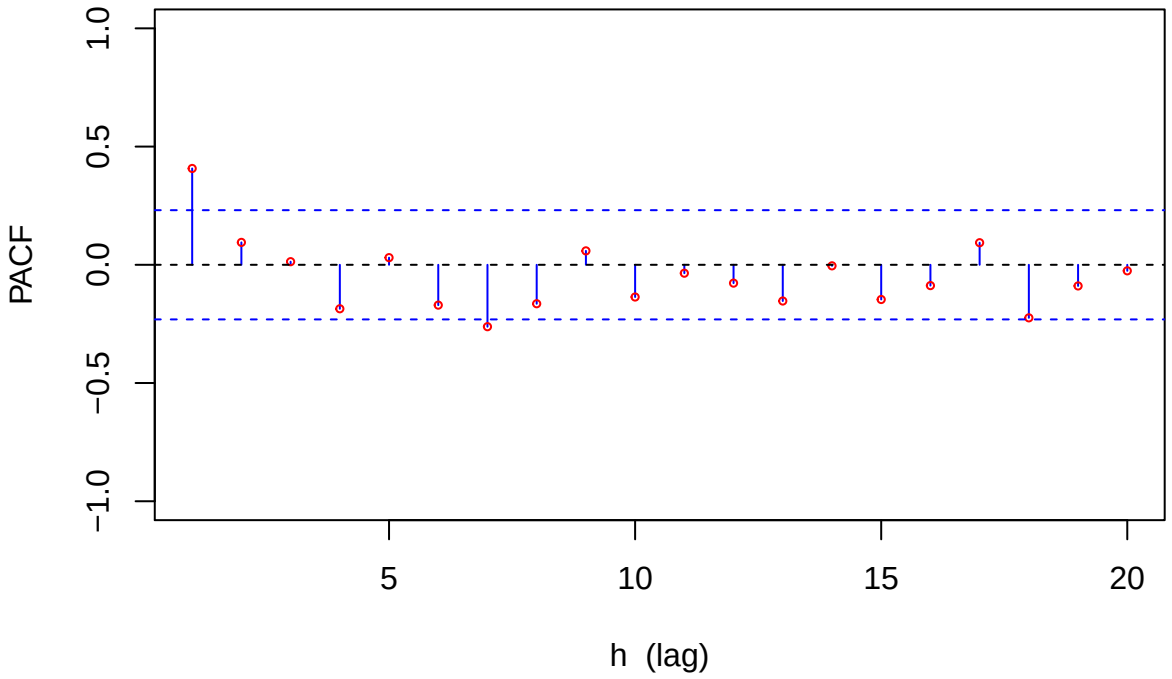
Plotting PACF for residuals {rt} from Lake Huron level time series



Lake Huron looks to be AR(2) model and, for h > p (which is 2), we see that phi h,h is 0. This is not a semblance of white noise as PACF is IID(0,1/98) for orders greater than 2 .

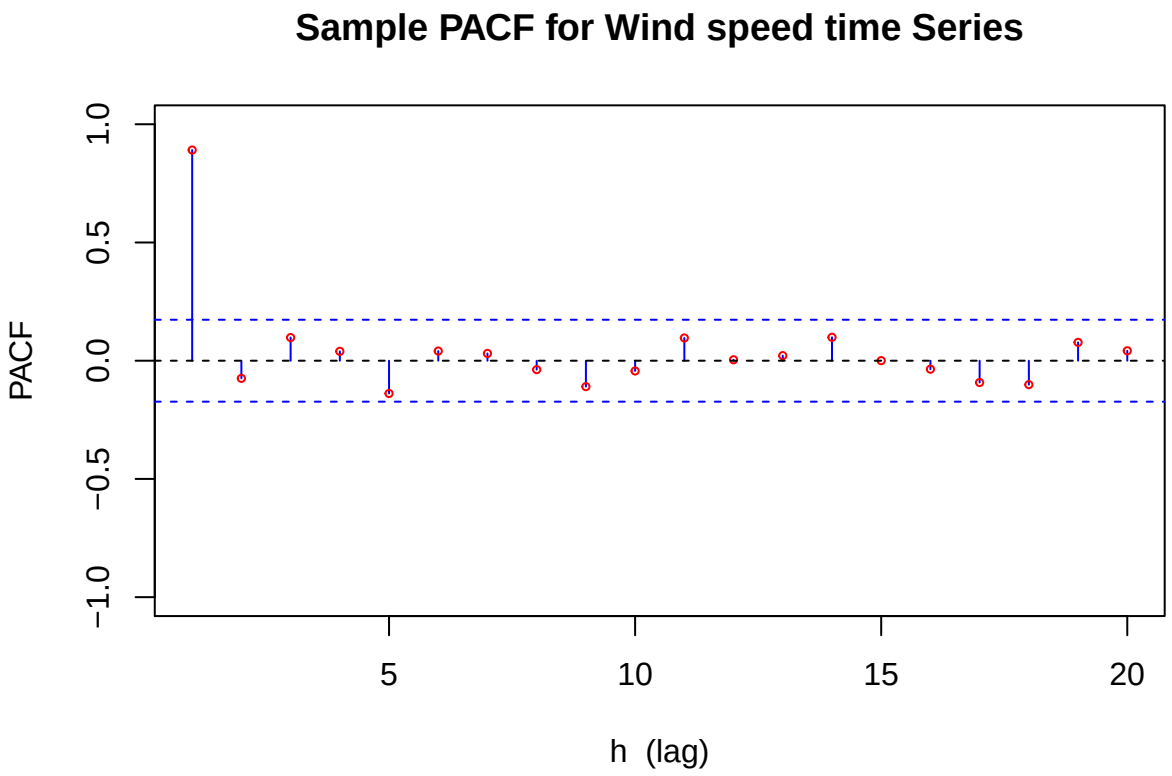
Sample PACF residuals {rt} from accidental deaths time series

```
## [1] 72
```



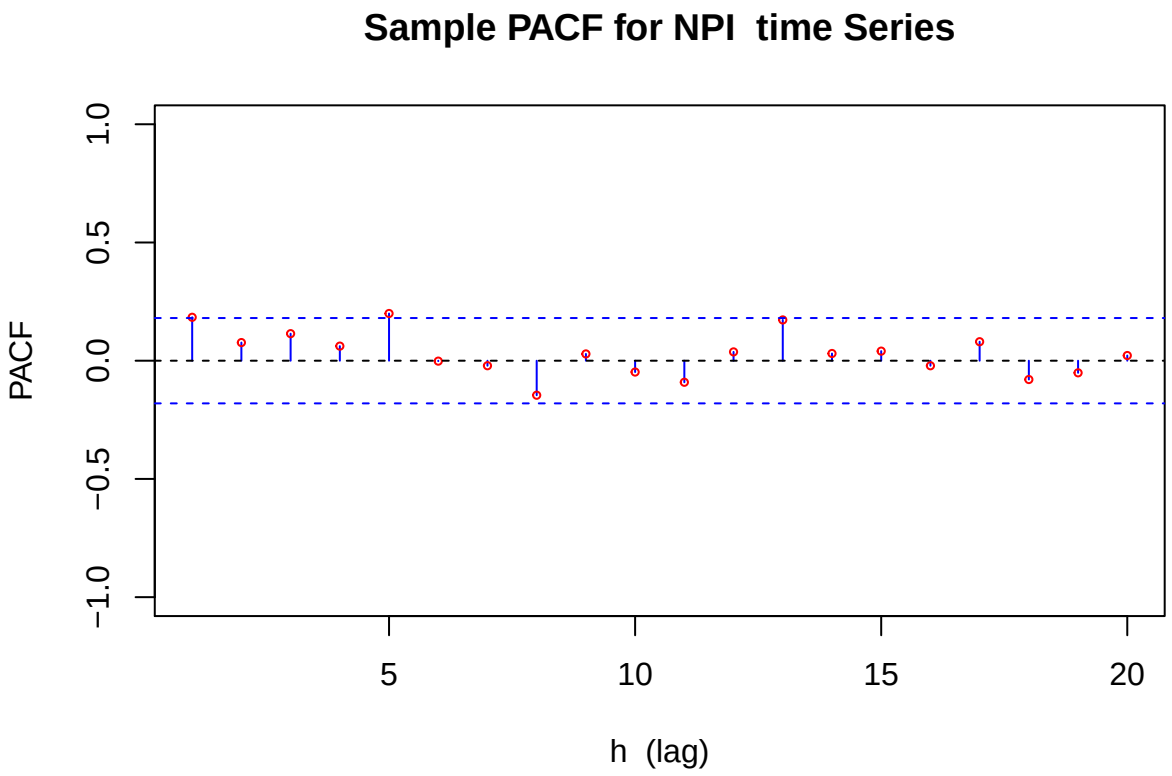
AD time series looks to be AR(1) model and, for h > p (which is 1), we see that phi h,h is 0. This is not a semblance of white noise as PACF is IID(0,1/72) for orders greater than 1.

Sample PACF for wind speed time series



Windspeed time series looks to be AR(1) model and, for h > p (which is 1), we see that phi h,h is 0. This is not a semblance of white noise as PACF is IID(0,1/128) for orders greater than 1.

Sample PACF for NPI time series



MPI time series looks to be white noise, we see that phi 1,1 through phi h,h are approximately 0. This is infact a semblance of white noise as PACF is IID(0,1/118) (h << n).