

Homework4_201611531

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2021 4 20

```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --
## v ggplot2 3.3.3      v purrr 0.3.4
## v tibble 3.1.0       v dplyr 1.0.5
## v tidyr 1.1.3        v stringr 1.4.0
## v readr 1.4.0        v forcats 0.5.1

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

library(ggplot2)
library(forecast)

## Registered S3 method overwritten by 'quantmod':
##   method      from
##   as.zoo.data.frame zoo

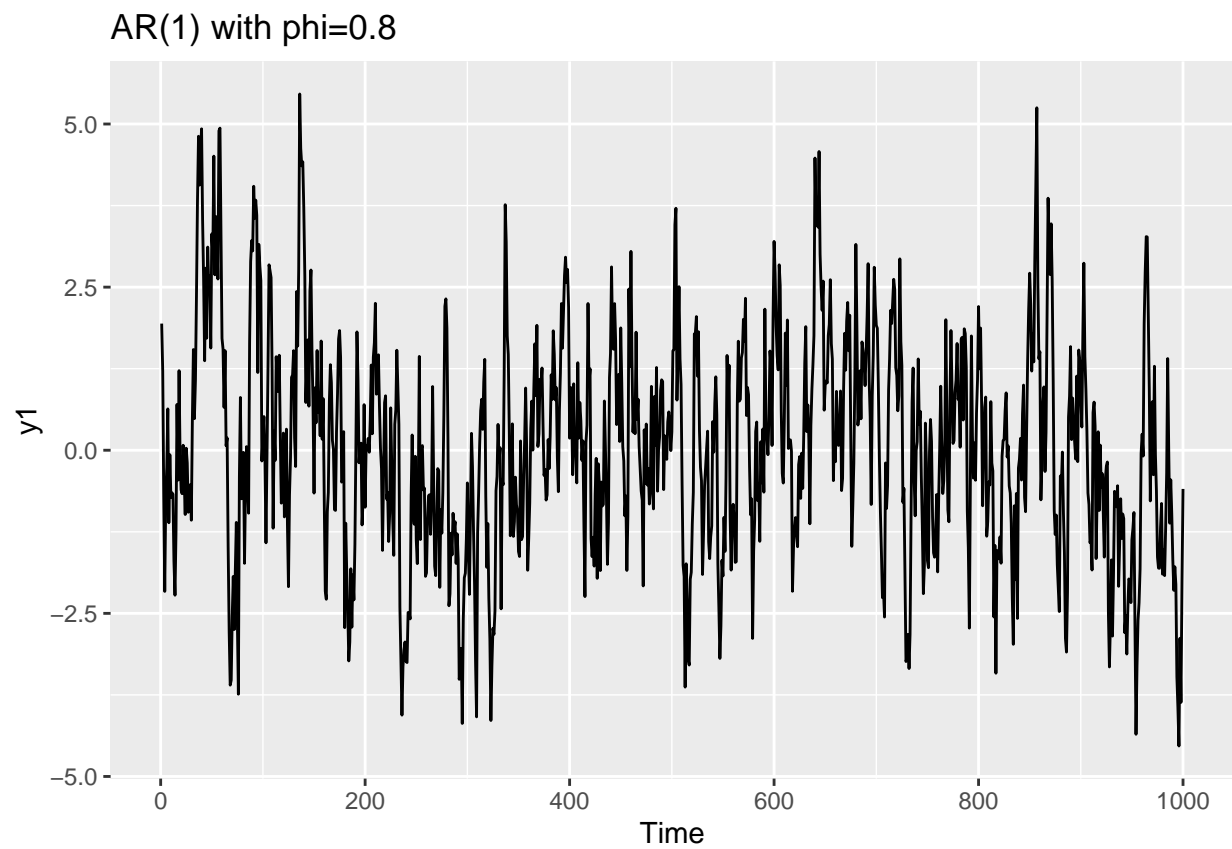
library(gridExtra)

##
## Attaching package: 'gridExtra'

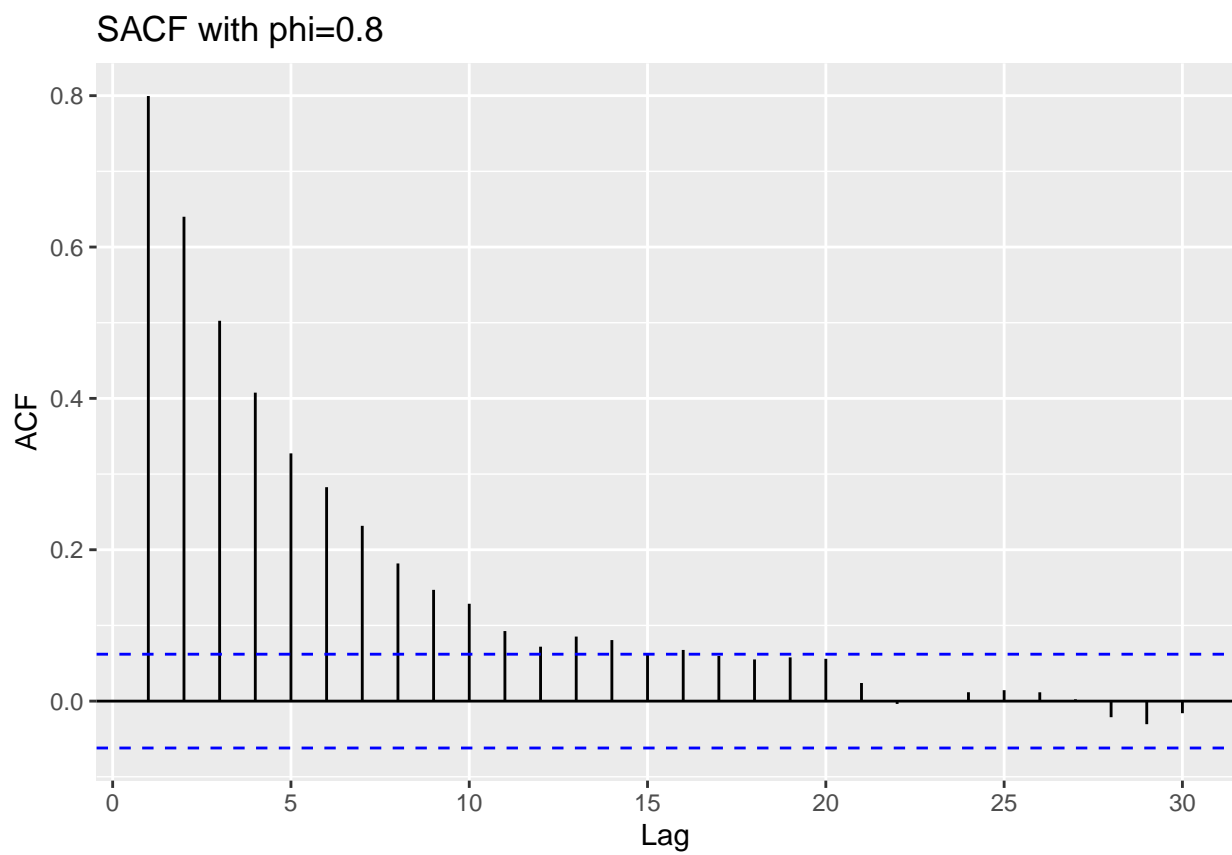
## The following object is masked from 'package:dplyr':
##
##   combine
```

1. Simulate an AR(1) process with $\phi=0.8$ ($n=1000$) and show the time series plot, SACF graph and SPACF graph.

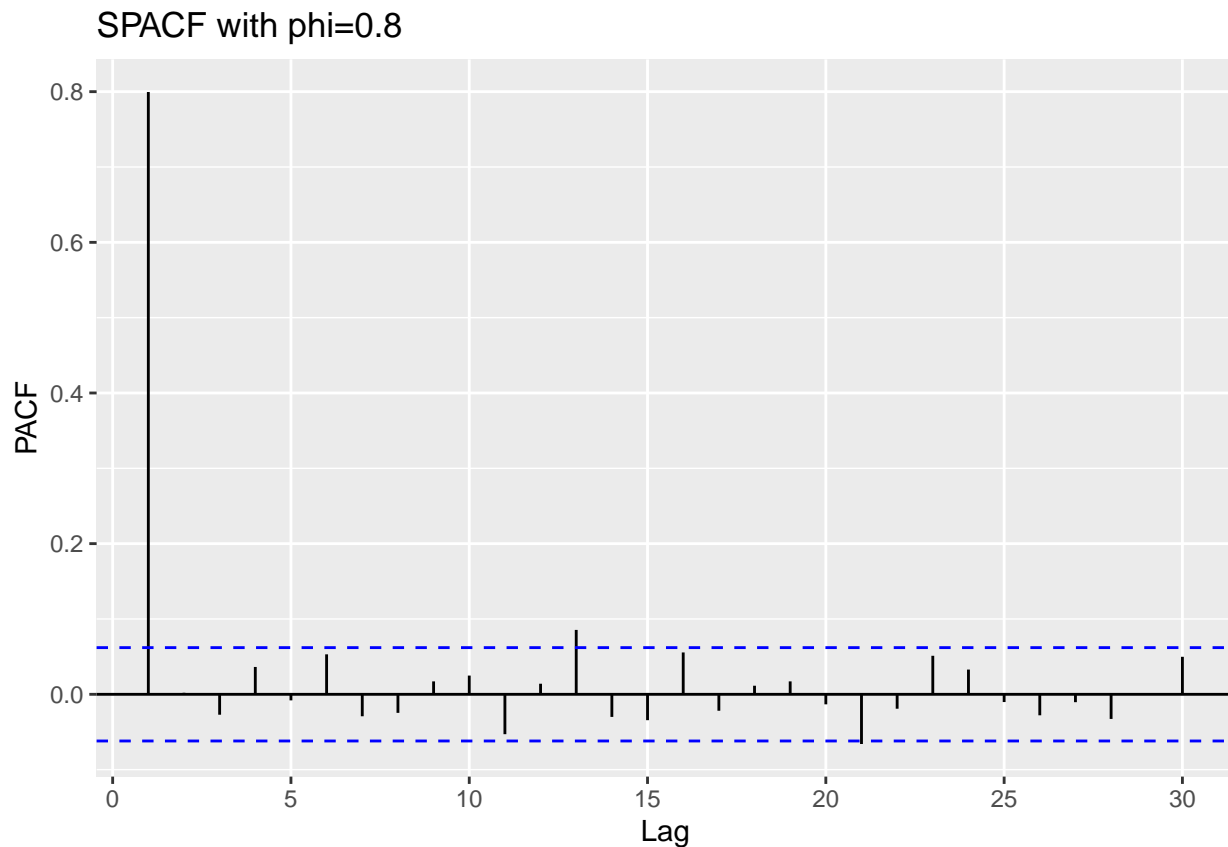
```
y1=arima.sim(n=1000, list(ar=0.8))
autoplot(y1) + ggtitle("AR(1) with  $\phi=0.8$  ")
```



```
ggAcf(y1)+ggtitle("SACF with  $\phi=0.8$ ")
```



```
ggPacf(y1)+ggtitle("SPACF with  $\phi=0.8$ ")
```



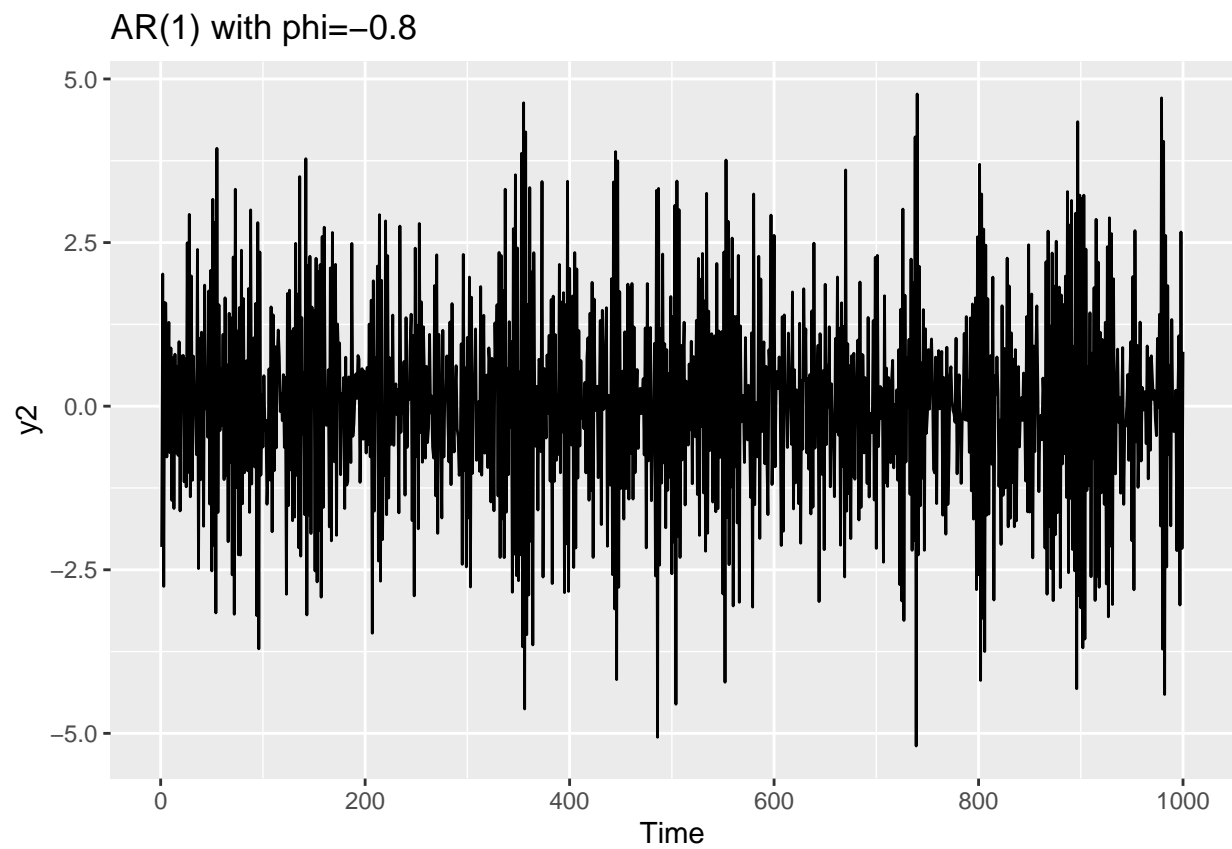
Time series plot don't get out of average. And it shows high relation with previous data value. It is stationary time series.

SACF graph shows exponential decline.

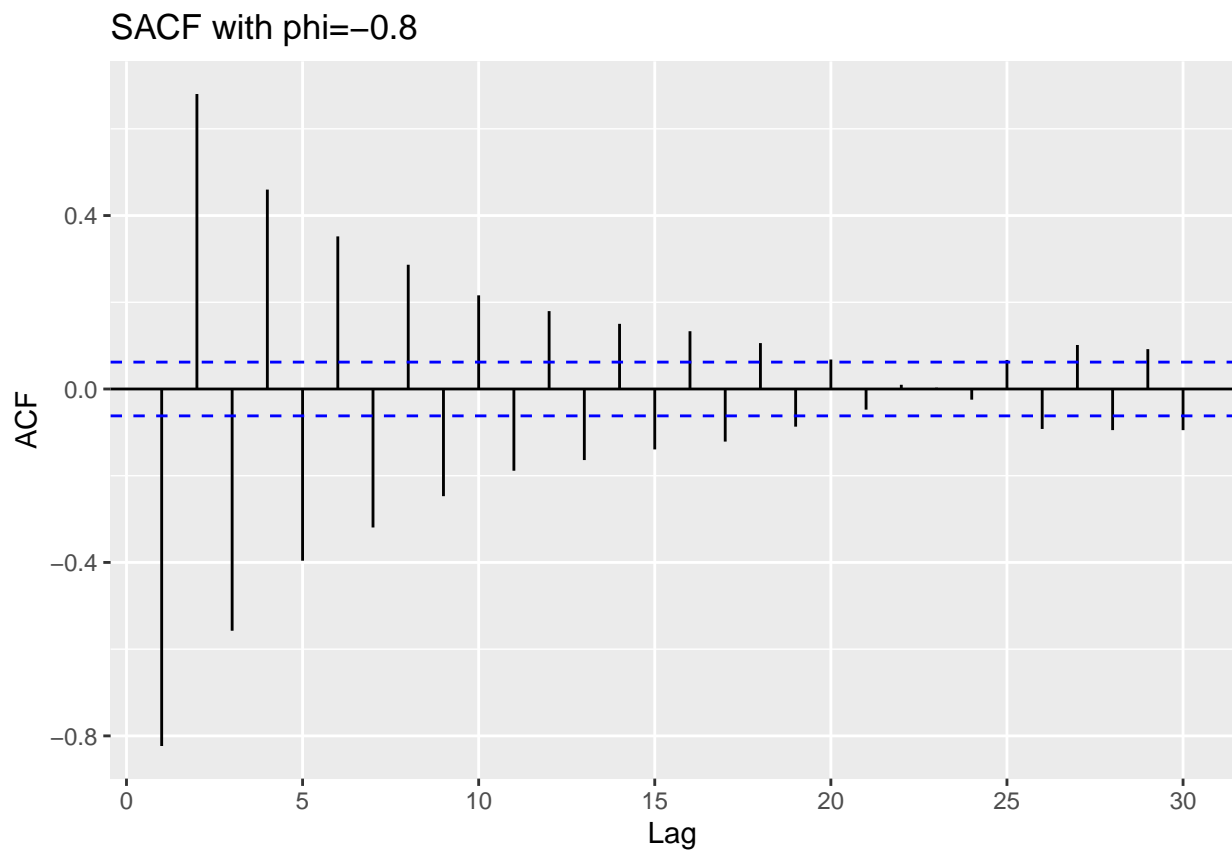
SPACF graph cuts-off after 2nd lag.

2. Repeat (1) process in case of $\phi=-0.8$.

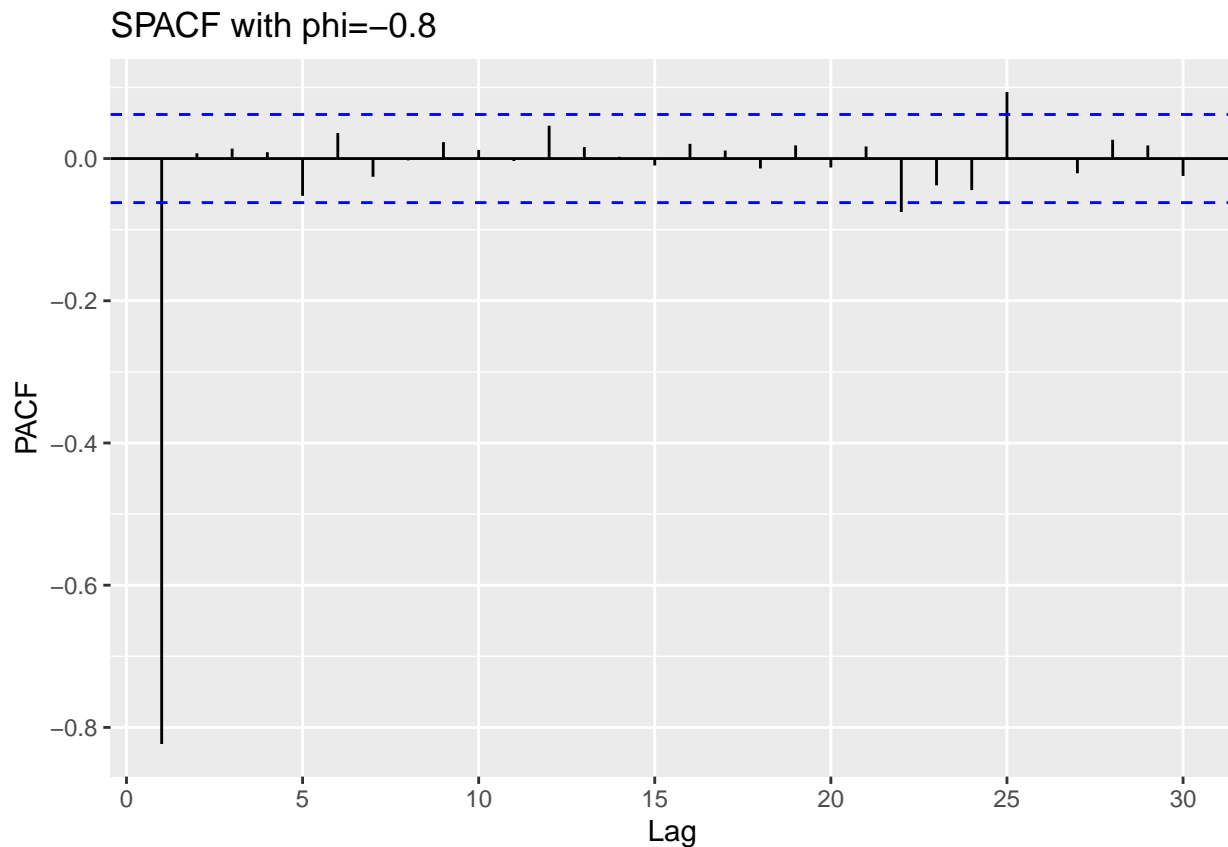
```
y2=arima.sim(n=1000, list(ar=-0.8))
autoplot(y2) + ggtitle("AR(1) with  $\phi=-0.8$  ")
```



```
ggAcf(y2)+ggtitle("SACF with  $\phi=-0.8$ ")
```



```
ggPacf(y2)+ggtitle("SPACF with  $\phi=-0.8$ ")
```



Time series plot don't get out of average. And it shows high relation with previous data value. It is stationary time series. Also, there are more to vibrate than 1 graph because ϕ is negative number.

SACF graph vibrates and decreases exponential decline.

SPACF graph vibrates and cuts-off after 2nd lag.

3. Simulate an AR(2) process with randomly chosen ϕ_1 and ϕ_2 . And Repeat (1) process.

```
set.seed(201611531)
phi1=runif(1,-1,1)
phi2=runif(1,-1,1)
phi1
```

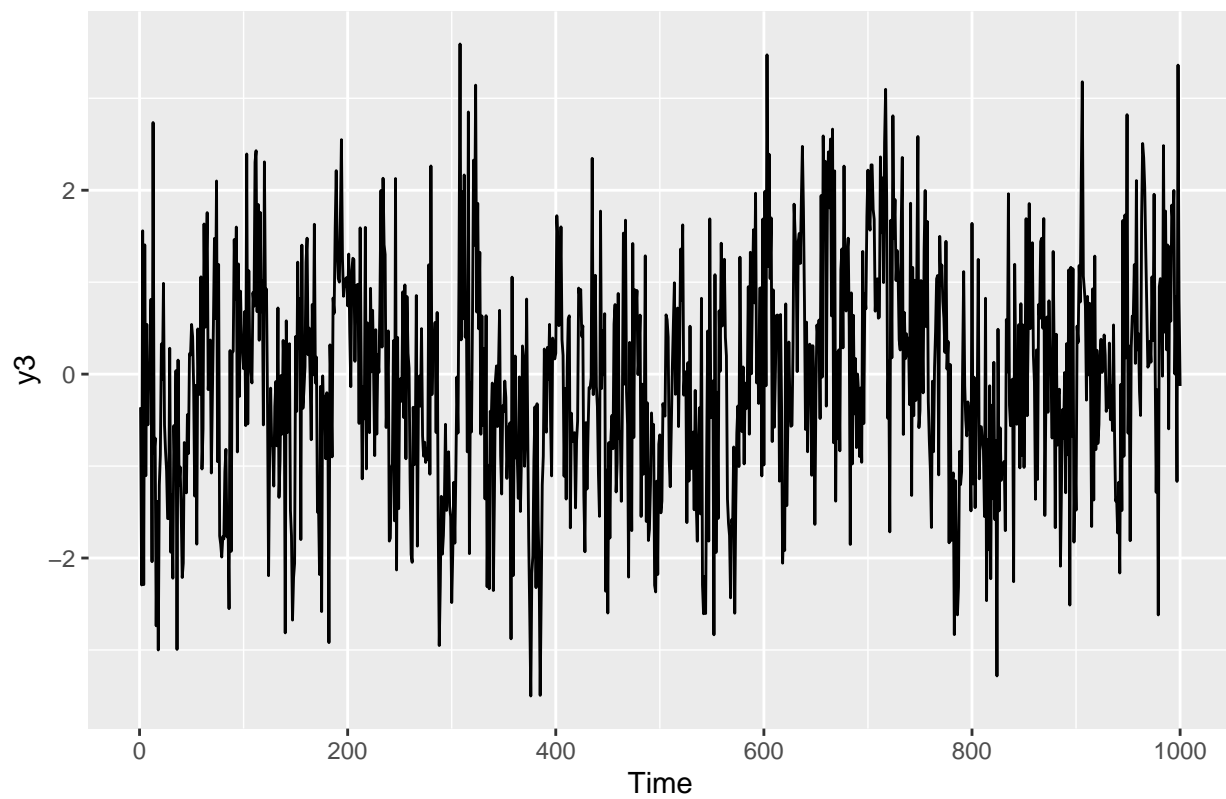
```
## [1] 0.172035
```

```
phi2
```

```
## [1] 0.5103432
```

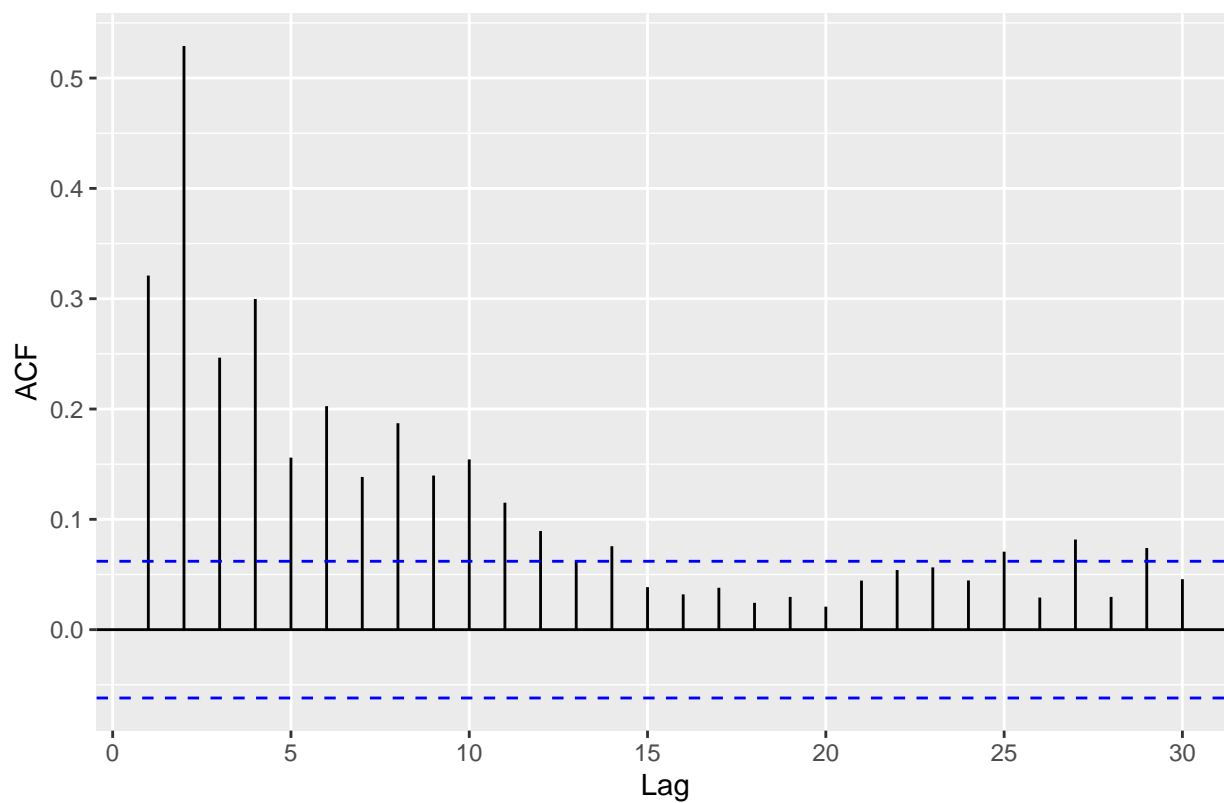
```
y3<- arima.sim(n=1000, list(ar=c(phi1, phi2)))
autoplot(y3) + ggtitle("AR(2) with phi1=0.172035, phi2=0.5103432")
```

AR(2) with $\phi_1=0.172035$, $\phi_2=0.5103432$

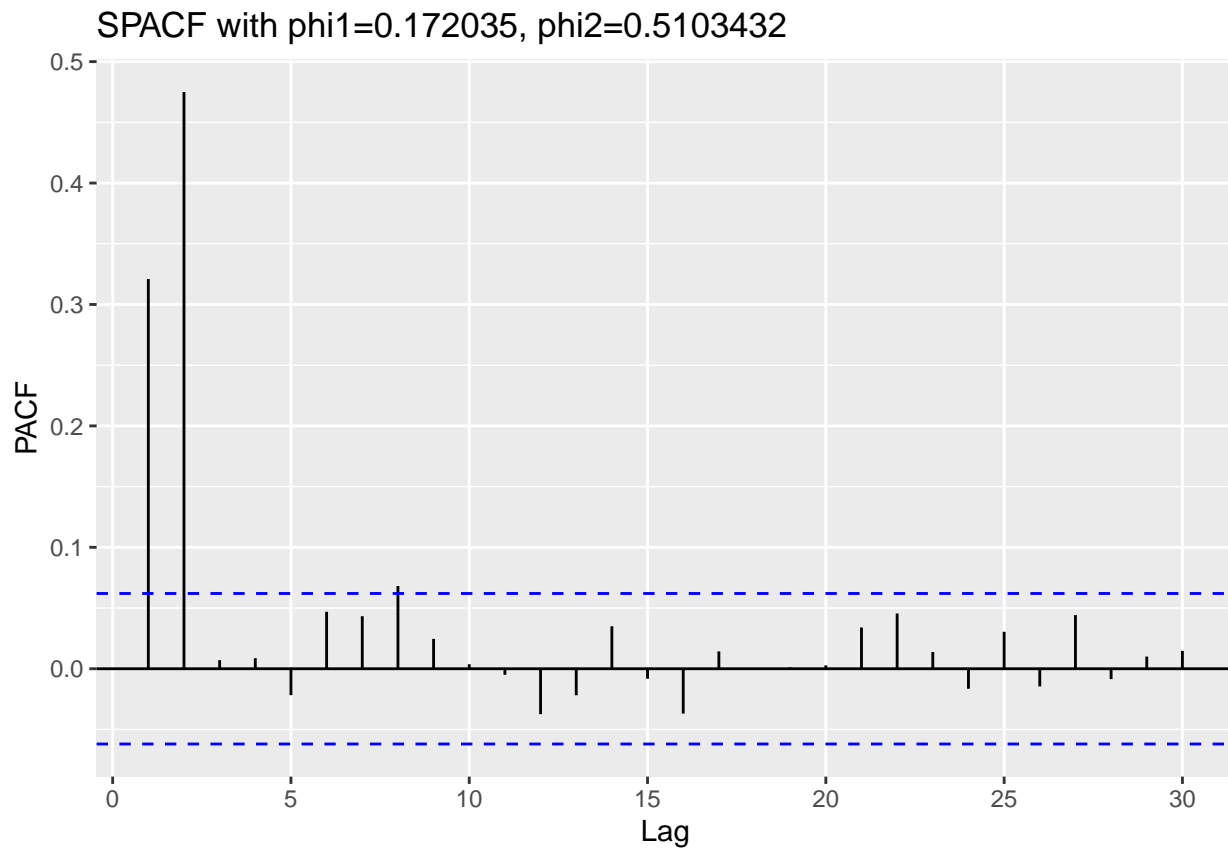


```
ggAcf(y3)+ggtitle("SACF with  $\phi_1=0.172035$ ,  $\phi_2=0.5103432$ ")
```


SACF with $\phi_1=0.172035$, $\phi_2=0.5103432$



```
ggPacf(y3)+ggtitle("SPACF with  $\phi_1=0.172035$ ,  $\phi_2=0.5103432$ ")
```



Time series plot don't get out of average. And it shows high relation with previous data value. It is stationary time series. Also, there are more to vibrate than 1 graph but it's not more to vibrate than 2 graph.

SACF graph decreases exponential decline. It has a real root.

SPACF graph cuts-off after 3rd lag because it's AR(2) model.