

```

require(pacman)

## Loading required package: pacman

## Warning: package 'pacman' was built under R version 4.1.3

#Load packages
pacman::p_load(datasets, tseries)
pacman::p_load(rio)
pacman::p_load(MASS)

#Membaca Data
library(openxlsx)

## Warning: package 'openxlsx' was built under R version 4.1.3

masterdata <- read.xlsx("C:/Users/acer/Downloads/hari.xlsx")
head(masterdata)

##      Jumlah
## 1         19
## 2         26
## 3         22
## 4         23
## 5         23
## 6         15

tail(masterdata)

##      Jumlah
## 115         3
## 116         7
## 117         8
## 118        18
## 119        23
## 120        22

summary(masterdata)

##      Jumlah
##  Min.   : 1.00
## 1st Qu.:15.75
##  Median :22.00
##   Mean  :19.52
## 3rd Qu.:25.00
##   Max.  :31.00

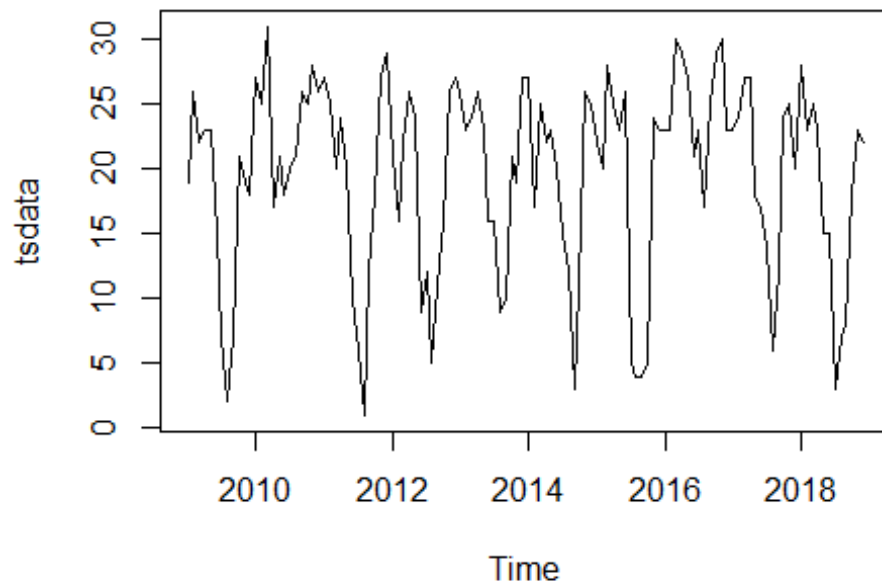
#Plot time series
tsdata <- ts(masterdata$Jumlah, frequency = 12, start = c(2009, 1))
tsdata

##      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 2009  19  26  22  23  23  15   7   2   7  21  19  18

```

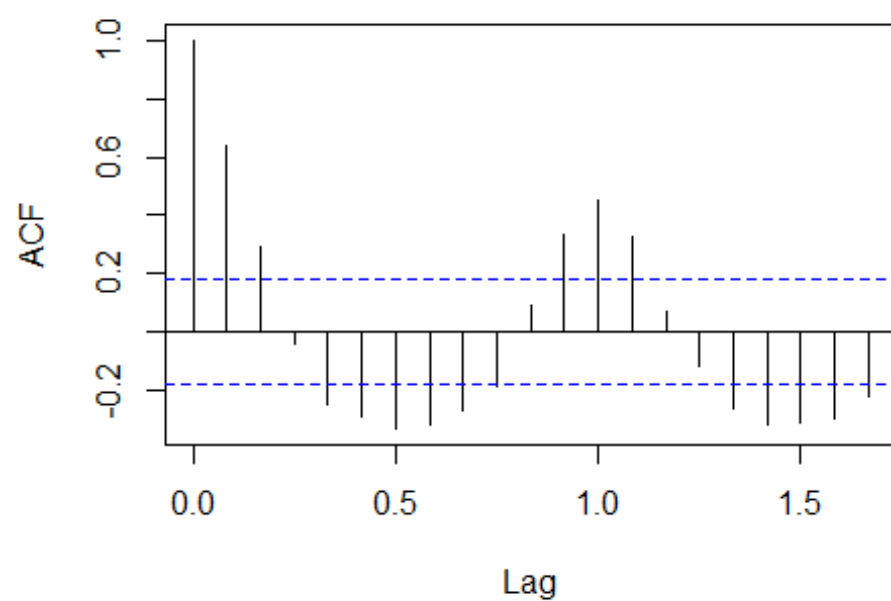
```
## 2010 27 25 31 17 21 18 20 21 26 25 28 26
## 2011 27 25 20 24 20 10 6 1 12 18 27 29
## 2012 21 16 22 26 24 9 12 5 11 16 26 27
## 2013 26 23 24 26 23 16 16 9 10 21 19 27
## 2014 27 17 25 22 23 20 15 12 3 11 26 25
## 2015 22 20 28 25 23 26 5 4 4 5 24 23
## 2016 23 23 30 29 27 21 23 17 25 29 30 23
## 2017 23 24 27 27 18 17 14 6 12 24 25 20
## 2018 28 23 25 23 15 15 3 7 8 18 23 22
```

```
plot.ts(tsddata)
```



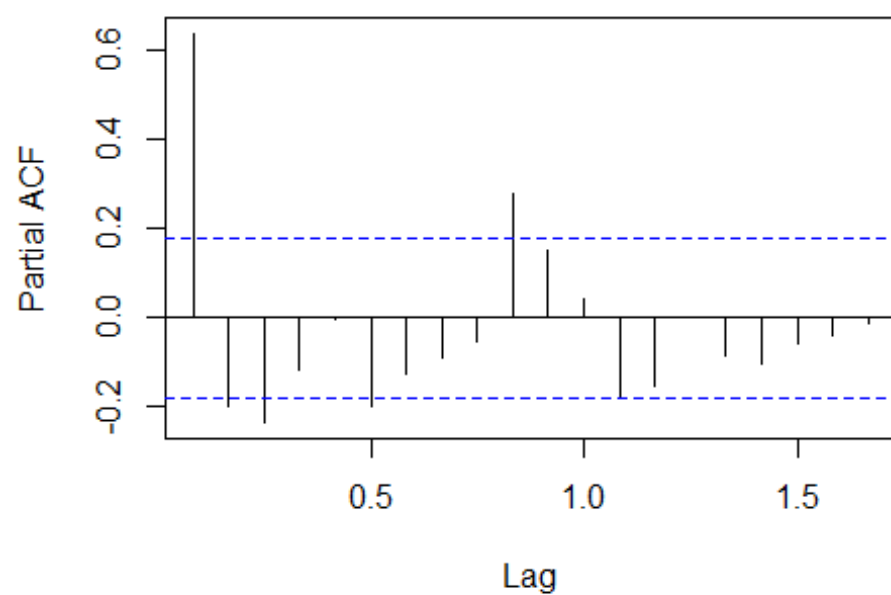
```
acf(tsddata)
```

Series tsdata



```
pacf(tsdata)
```

Series tsdata



```
#Cek kestasioneritasan Data
```

```
library(tseries)
```

```
adf.test(tsdata,k=12)
```

```
##
```

```
## Augmented Dickey-Fuller Test
```

```
##
```

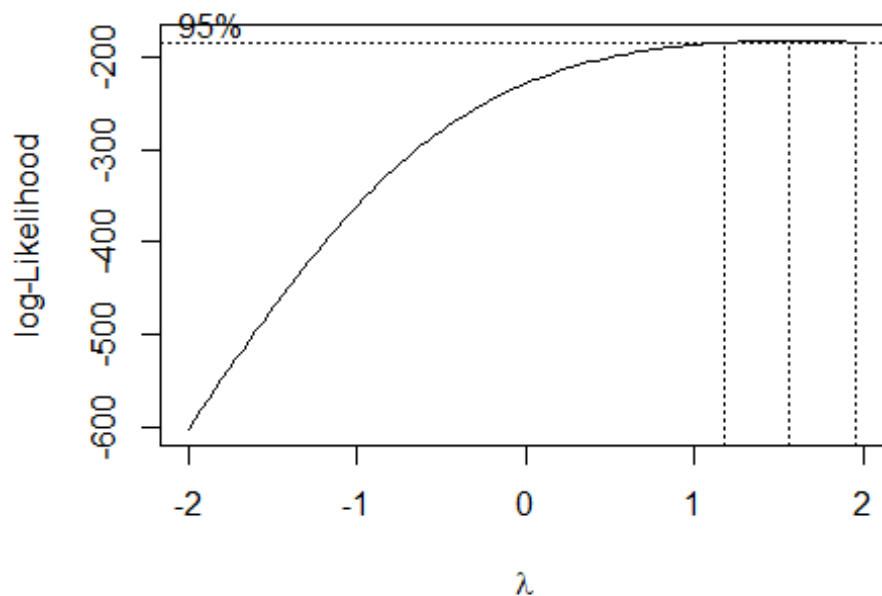
```
## data: tsdata
```

```
## Dickey-Fuller = -2.5519, Lag order = 12, p-value = 0.3473
```

```
## alternative hypothesis: stationary
```

```
#transformasi box-cox
```

```
boxcox(lm(tsdata~1))
```



```
#diff 1
```

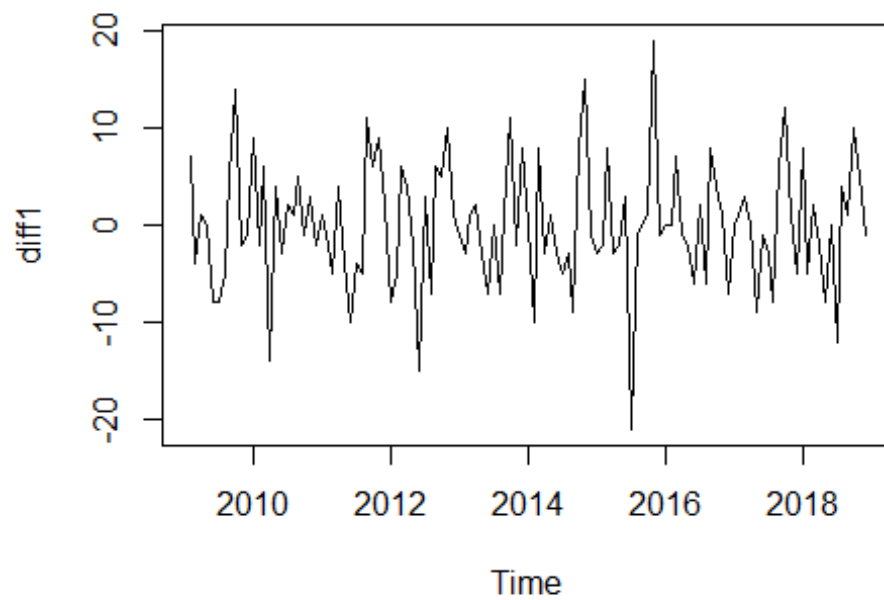
```
diff1 <- diff(tsdata, 1)
```

```
diff1
```

```
##      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 2009      7  -4  1  0  -8  -8  -5  5  14  -2  -1
## 2010     9  -2  6 -14  4  -3  2  1  5  -1  3  -2
## 2011     1  -2  -5  4  -4 -10  -4  -5  11  6  9  2
## 2012    -8  -5  6  4  -2 -15  3  -7  6  5  10  1
## 2013    -1  -3  1  2  -3  -7  0  -7  1  11  -2  8
## 2014     0 -10  8  -3  1  -3  -5  -3  -9  8  15  -1
## 2015    -3  -2  8  -3  -2  3 -21  -1  0  1  19  -1
## 2016     0  0  7  -1  -2  -6  2  -6  8  4  1  -7
```

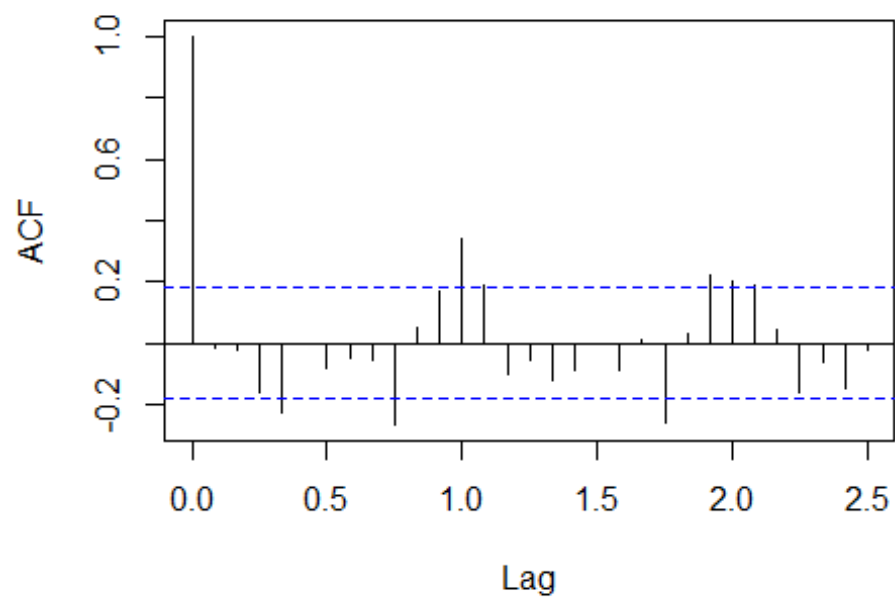
```
## 2017  0  1  3  0 -9 -1 -3 -8  6 12  1 -5
## 2018  8 -5  2 -2 -8  0 -12  4  1 10  5 -1

plot.ts(diff1)
```



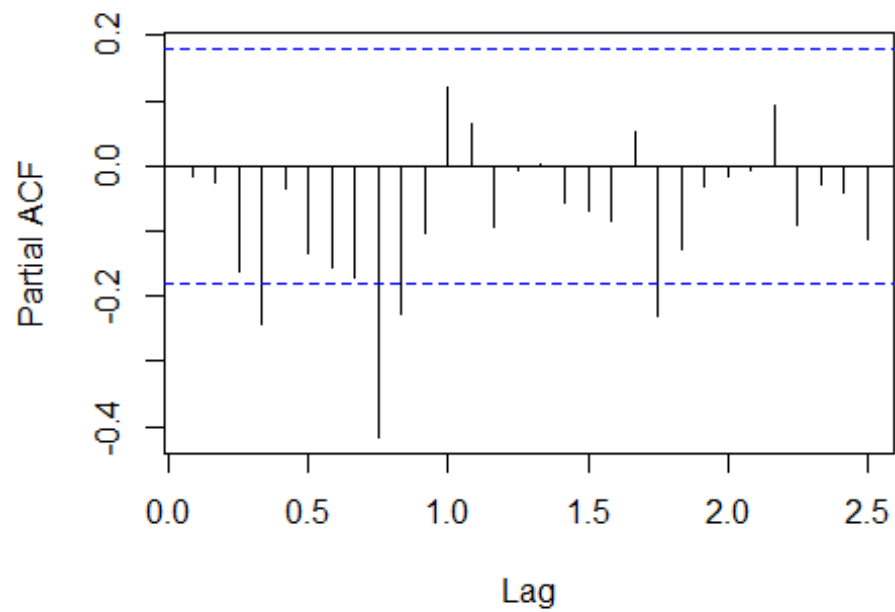
```
acf(diff1, lag.max = 30)
```

Series diff1



```
pacf(diff1, lag.max=30)
```

Series diff1



```
adf.test(diff1, k=12)
```

```
##
## Augmented Dickey-Fuller Test
##
## data: diff1
## Dickey-Fuller = -3.961, Lag order = 12, p-value = 0.01354
## alternative hypothesis: stationary

library(TSA)

## Warning: package 'TSA' was built under R version 4.1.3

##
## Attaching package: 'TSA'

## The following objects are masked from 'package:stats':
##
##     acf, arima

## The following object is masked from 'package:utils':
##
##     tar

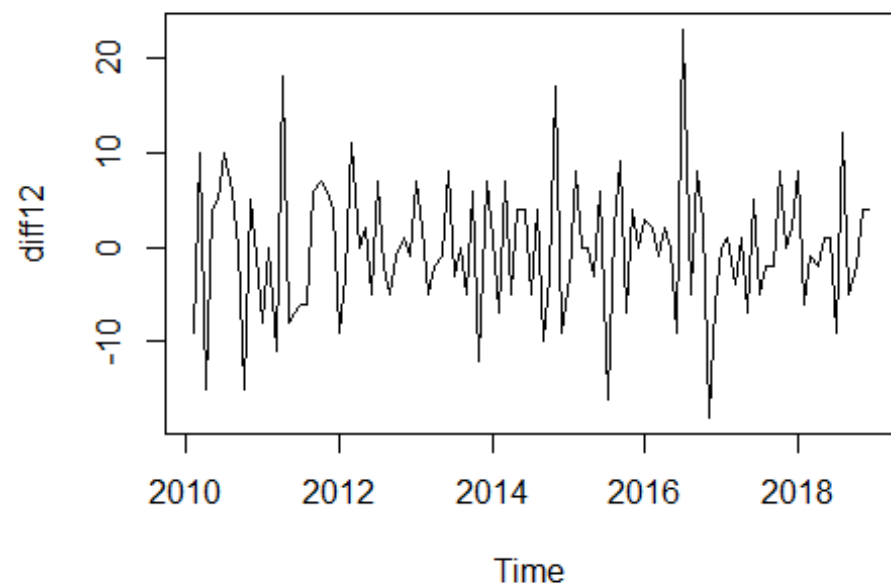
eacf(diff1)

## AR/MA
##   0 1 2 3 4 5 6 7 8 9 10 11 12 13
## 0 o o o x o o o o x o o x o o
## 1 x o o x o o o o x o o x x o
## 2 o o o x o o o o x o o o o o
## 3 x x o x o o o o o o o o o o
## 4 o x x x o o o o o o o x o o
## 5 x x o o x o o o x o o x o o
## 6 x o o o x o o o o o o x o o
## 7 x o o o x o o o o o o x o o

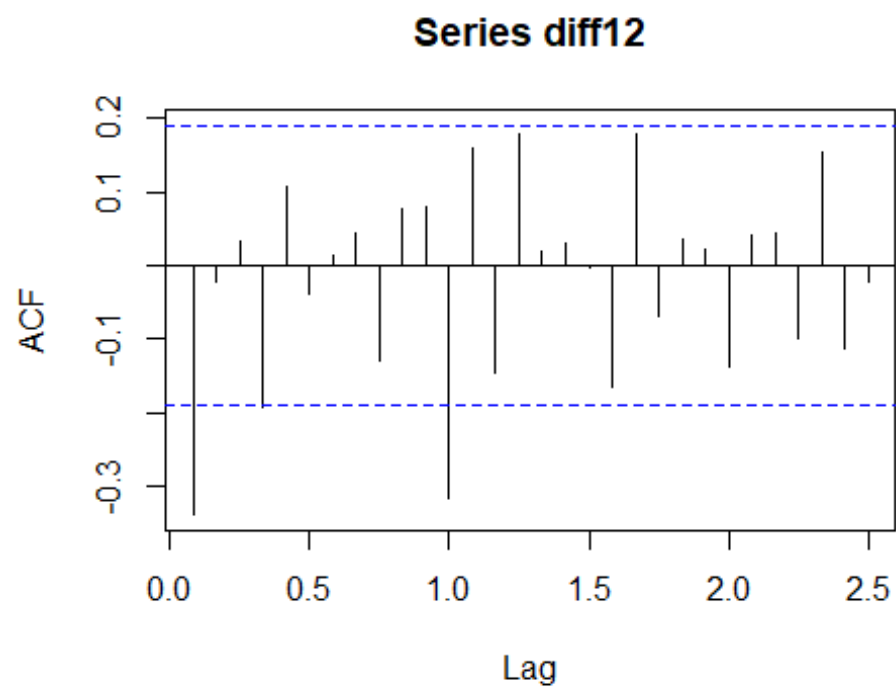
#diff 12
diff12 <- diff(diff1, 12)
diff12

##      Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
## 2010      -9 10 -15  4  5 10  6  0 -15  5 -1
## 2011  -8  0 -11 18  -8 -7 -6 -6  6  7  6  4
## 2012  -9 -3 11  0  2 -5  7 -2 -5 -1  1 -1
## 2013   7  2 -5 -2 -1  8 -3  0 -5  6 -12  7
## 2014   1 -7  7 -5  4  4 -5  4 -10 -3 17 -9
## 2015  -3  8  0  0 -3  6 -16  2  9 -7  4  0
## 2016   3  2 -1  2  0 -9 23 -5  8  3 -18 -6
## 2017   0  1 -4  1 -7  5 -5 -2 -2  8  0  2
## 2018   8 -6 -1 -2  1  1 -9 12 -5 -2  4  4

plot.ts(diff12)
```

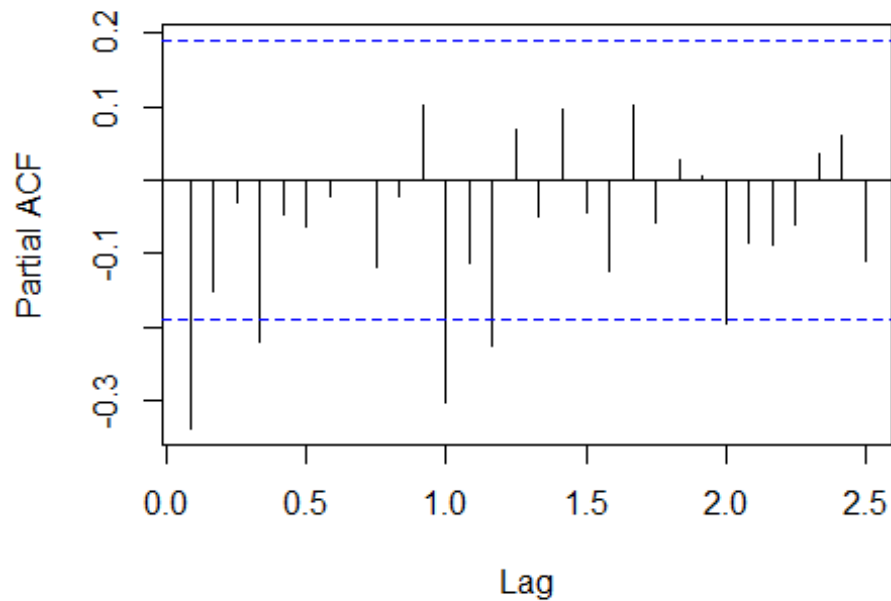


```
acf(diff12, lag.max = 30)
```



```
pacf(diff12, lag.max=30)
```


Series diff12



```
adf.test(diff12,k=12)

## Warning in adf.test(diff12, k = 12): p-value smaller than printed p-value
##
## Augmented Dickey-Fuller Test
##
## data: diff12
## Dickey-Fuller = -4.3415, Lag order = 12, p-value = 0.01
## alternative hypothesis: stationary

library(TSA)
eacf(diff12)

## AR/MA
##   0 1 2 3 4 5 6 7 8 9 10 11 12 13
## 0 x o o o o o o o o o o x o o
## 1 x x o o o o o o o o o x o o
## 2 x o o x o o o o o o o x o o
## 3 o x x x o o o o o o o x o o
## 4 o x o o o o o o o o o x o o
## 5 x x o o x o o o o o o x o o
## 6 o o o o o o o o o o o x o o
## 7 x o x o o o o o o o o x o o

##Estimasi Model
Arimasima.p<- arima(tsdata, order = c(1, 1, 1), seasonal =
```

```

list(order=c(0,1,1),period=12),include.mean = TRUE)
Arimasima.p

##
## Call:
## arima(x = tsdata, order = c(1, 1, 1), seasonal = list(order = c(0, 1, 1),
##      period = 12),
##      include.mean = TRUE)
##
## Coefficients:
##          ar1          ma1          sma1
##          0.4666   -0.9999   -0.9995
## s.e.   0.0869    0.0576    0.2625
##
## sigma^2 estimated as 20.28:  log likelihood = -329.6,  aic = 665.2

library(lmtest)

## Warning: package 'lmtest' was built under R version 4.1.3

## Loading required package: zoo

## Warning: package 'zoo' was built under R version 4.1.3

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##      as.Date, as.Date.numeric

#Diagnostik Checking
#1. Uji Signifikansi Parameter
coeftest(Arimasima.p)

##
## z test of coefficients:
##
##      Estimate Std. Error  z value  Pr(>|z|)
## ar1    0.466640    0.086948   5.3669  8.01e-08 ***
## ma1   -0.999929    0.057646 -17.3460 < 2.2e-16 ***
## sma1 -0.999543    0.262464  -3.8083 0.0001399 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

t.test(Arimasima.p$residuals, mu = 0, alternative = "two.sided")

##
## One Sample t-test
##
## data:  Arimasima.p$residuals
## t = -0.92488, df = 119, p-value = 0.3569

```

```
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## -1.1284304 0.4098978
## sample estimates:
## mean of x
## -0.3592663
```

#2. Pengujian apakah residual white noise

```
Box.test(Arimasima.p$residuals, type="Ljung")
```

```
##
## Box-Ljung test
##
## data: Arimasima.p$residuals
## X-squared = 0.1818, df = 1, p-value = 0.6698
```

#3. Pengujian residual apakah berdistribusi normal

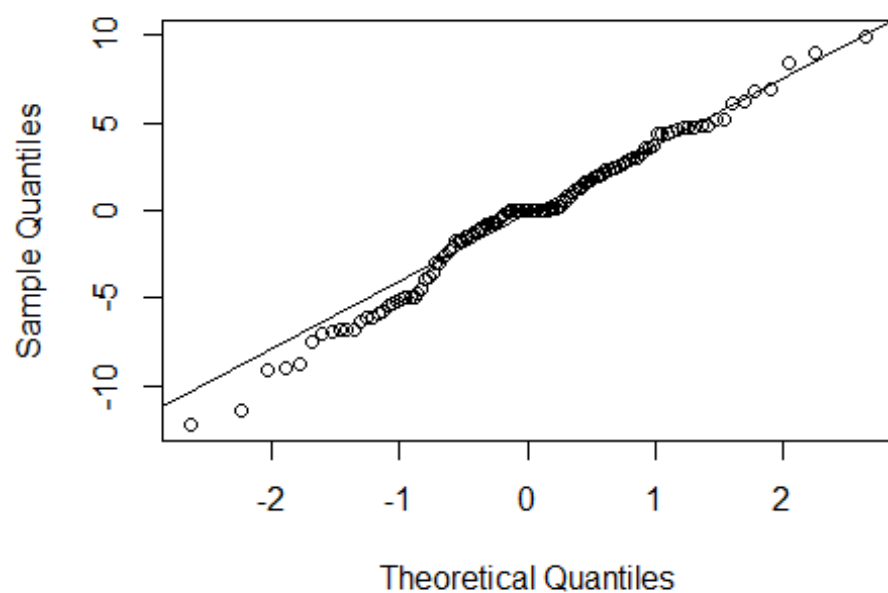
#Dengan Kolmogorov Smirnov

```
ks.test(Arimasima.p$residuals,"pnorm",mean=0, sd=sd(Arimasima.p$residuals))
```

```
##
## One-sample Kolmogorov-Smirnov test
##
## data: Arimasima.p$residuals
## D = 0.090856, p-value = 0.2751
## alternative hypothesis: two-sided
```

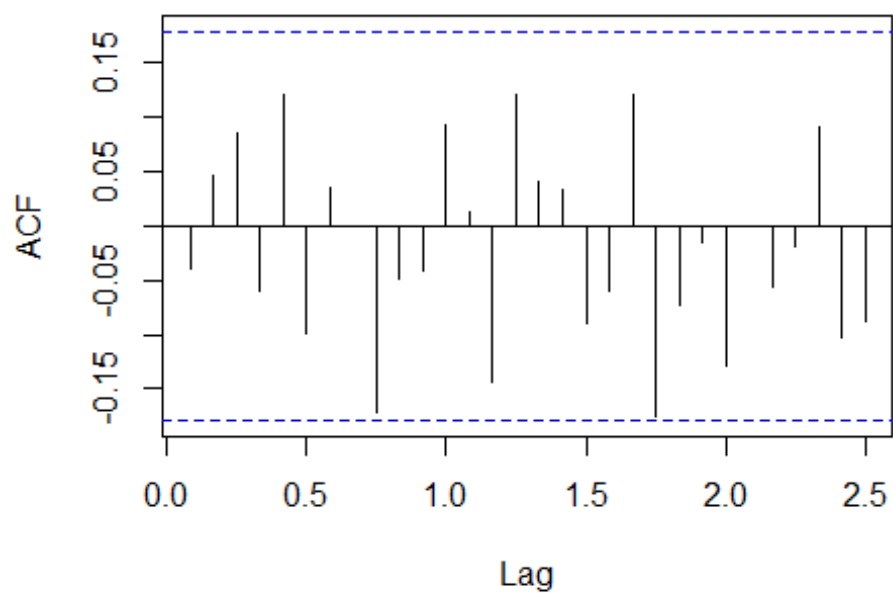
```
qqnorm(Arimasima.p$residuals)
qqline(Arimasima.p$residuals)
```

Normal Q-Q Plot



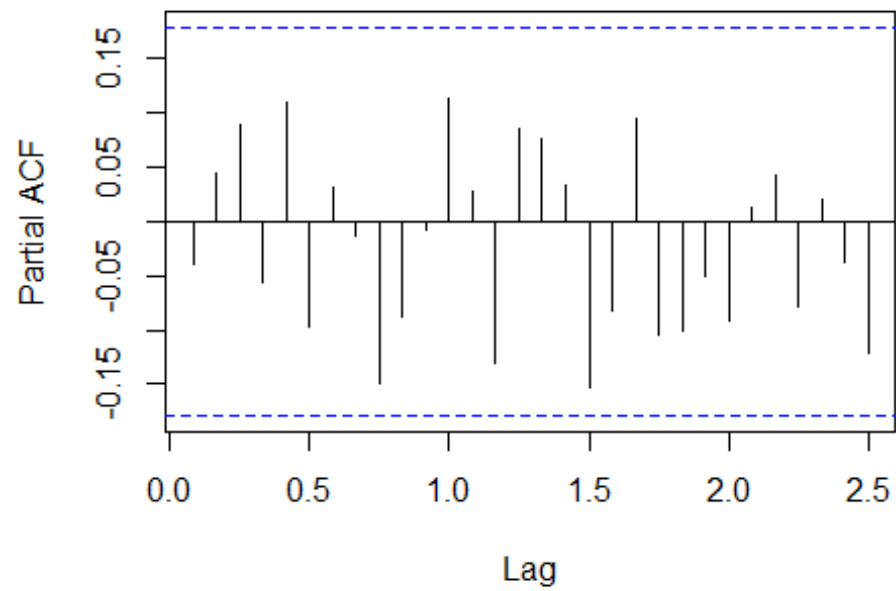
```
acf(Arimasima.p$residuals, lag.max = 30)
```

Series Arimasima.p\$residuals



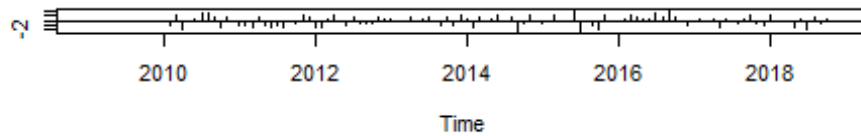
```
pacf(Arimasima.p$residuals, lag.max=30)
```

Series Arimasima.p\$residuals

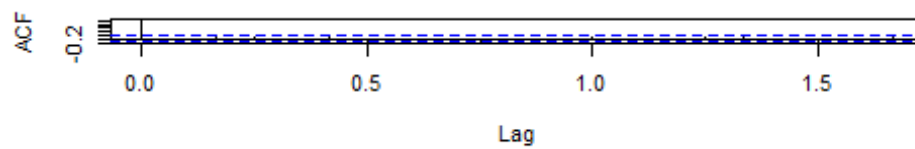


```
tsdiag(Arimasima.p)
```

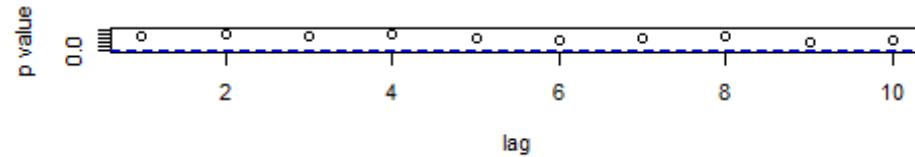
Standardized Residuals



ACF of Residuals



p values for Ljung-Box statistic



```
#Forecasting
```

```
library(forecast)
```

```
## Warning: package 'forecast' was built under R version 4.1.3
```

```
## Registered S3 methods overwritten by 'forecast':
```

```
##   method      from
```

```
##   fitted.Arima TSA
```

```
##   plot.Arima   TSA
```

```
library(sarima)
```

```
## Warning: package 'sarima' was built under R version 4.1.3
```

```
## Loading required package: stats4
```

```
##
```

```
## Attaching package: 'sarima'
```

```
## The following object is masked from 'package:TSA':
```

```
##
```

```
##   periodogram
```

```
## The following object is masked from 'package:stats':
```

```
##
```

```
##   spectrum
```

```
forecasting <- forecast(tsddata, model = Arimasima.p, h = 5)
```

```
forecasting
```

```
##           Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## Jan 2019      23.60981 17.46383 29.75580 14.21034 33.00929
## Feb 2019      22.07945 15.24035 28.91854 11.61995 32.53894
## Mar 2019      25.54516 18.53567 32.55466 14.82506 36.26526
## Apr 2019      24.46894 17.40964 31.52825 13.67267 35.26522
## May 2019      22.02624 14.94993 29.10254 11.20396 32.84851
```

```
autoplot(forecasting)
```

Forecasts from ARIMA(1,1,1)(0,1,1)[12]

