```
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("_____.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
```
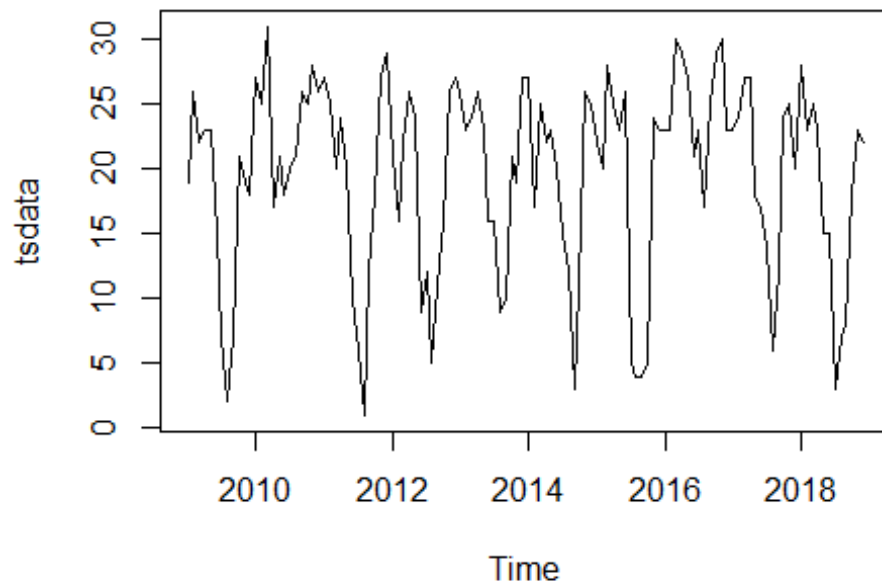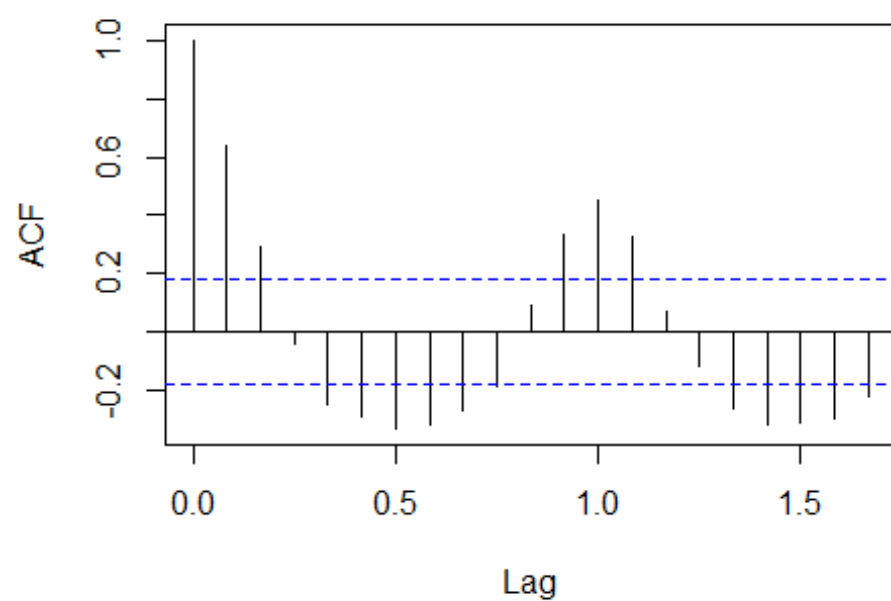
```
## 2010   27   25   31   17   21   18   20   21   26   25   28   26
## 2011   27   25   20   24   20   10    6    1   12   18   27   29
## 2012   21   16   22   26   24    9   12    5   11   16   26   27
## 2013   26   23   24   26   23   16   16    9   10   21   19   27
## 2014   27   17   25   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
```
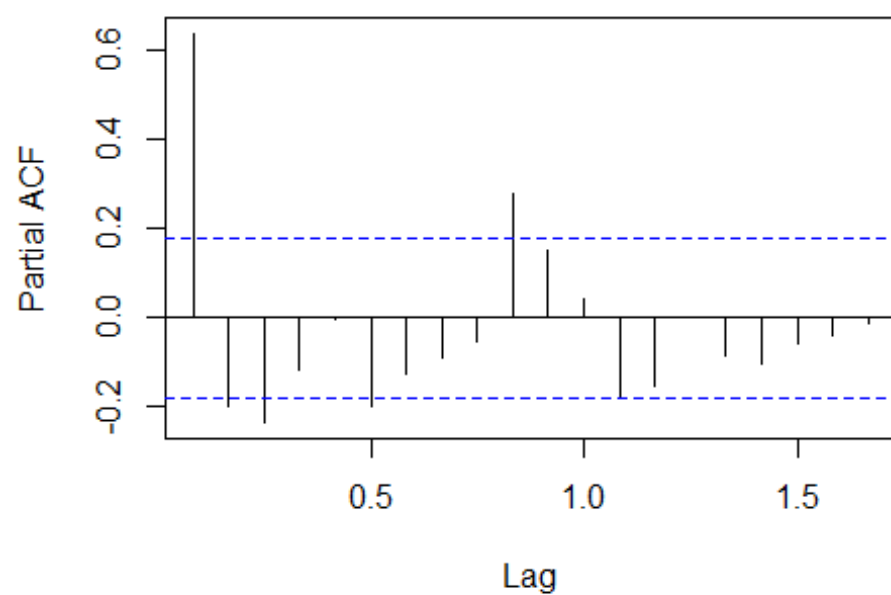
plot.ts(tsdata)

acf(tsdata)

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))
```
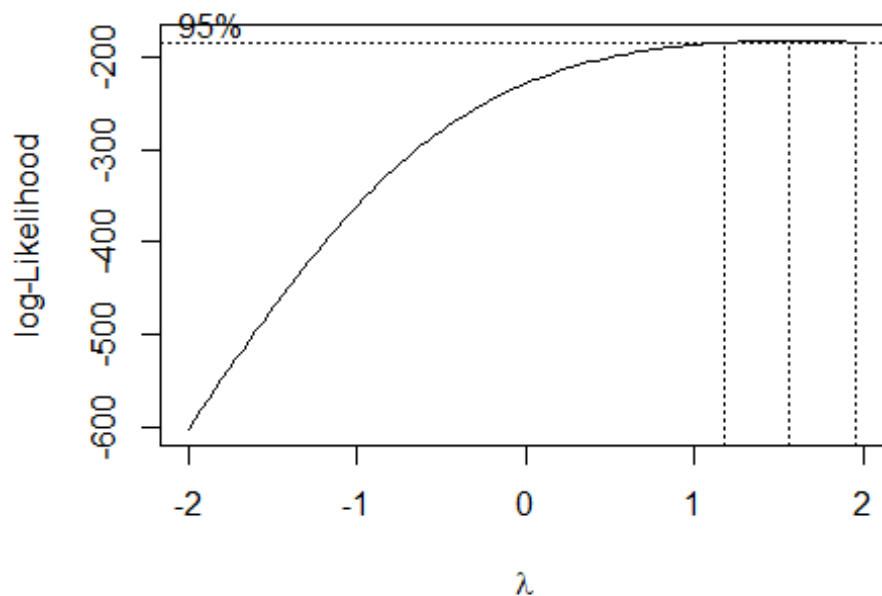


```
#diff 1
diff1 <- diff(tsdata, 1)
diff1

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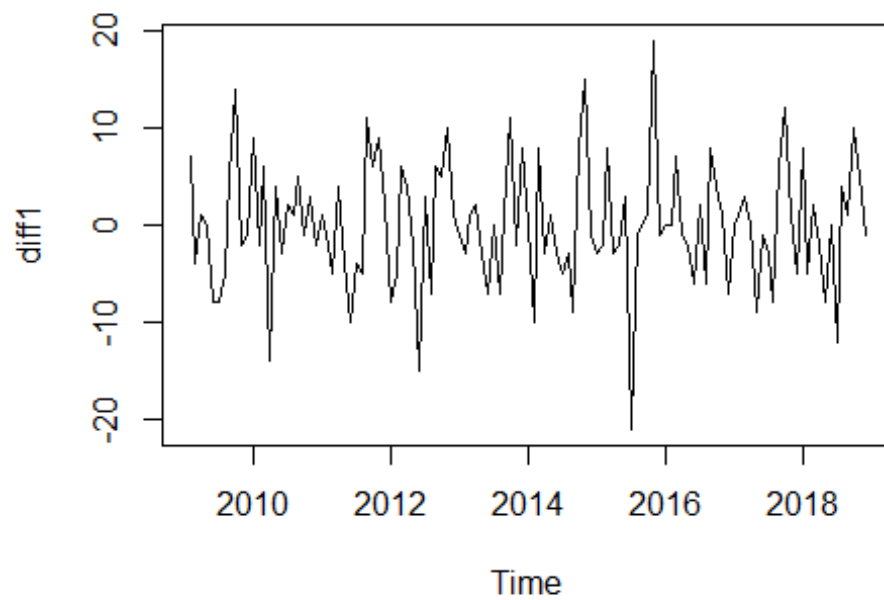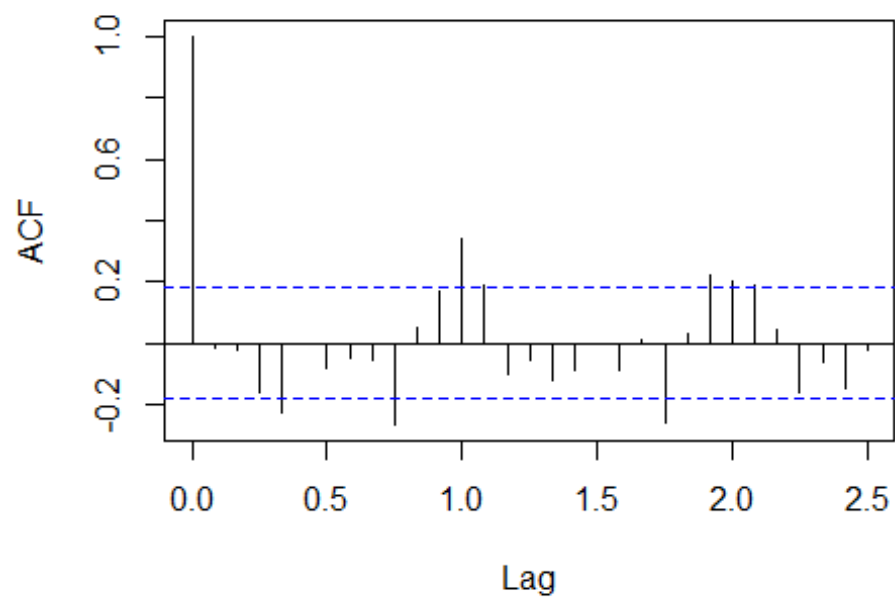
```
## 2017    0    1    3    0   -9   -1   -3   -8    6   12    1   -5
## 2018    8   -5    2   -2   -8    0  -12    4    1   10    5   -1

plot.ts(diff1)
```
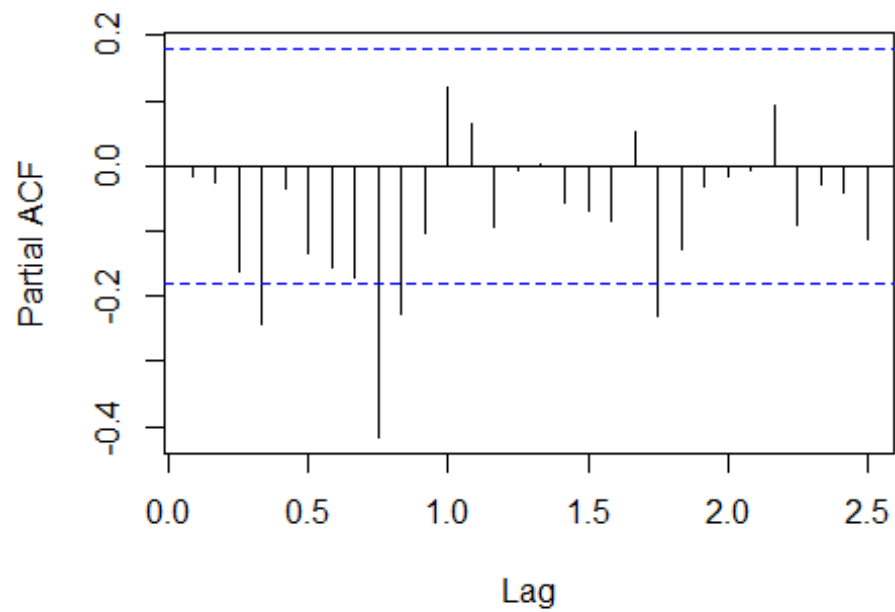


```
acf(diff1,lag.max = 30)
```

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 o x o o o o x o o  x  o  o
## 1 x o o x o o o o o x o o  x  x  o
## 2 o o o x o 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  o
## 4 o x x x o o o o o o o o  x  o  o
## 5 x x o o x o o o o x o o  x  o  o
## 6 x o o o x o o o o o o o  x  o  o
## 7 x o o o x o o o o o o o  x  o  o
```
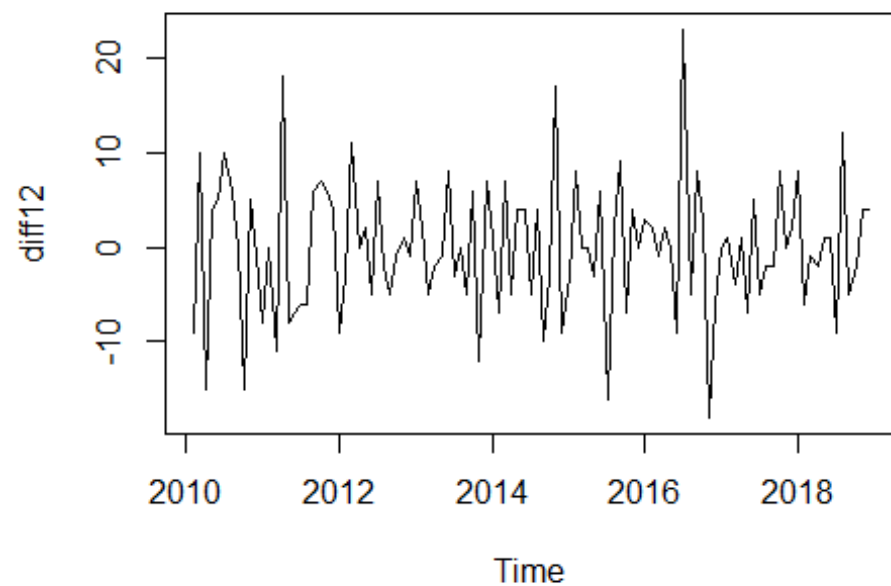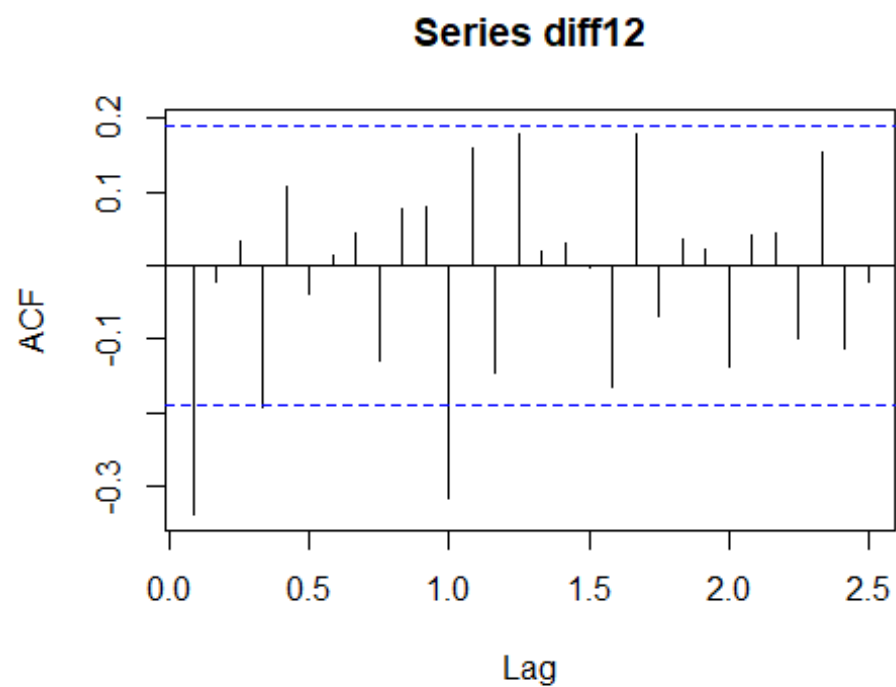
#diff 12
```
diff12 <- diff(diff1, 12)
diff12
```

```
##        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
```
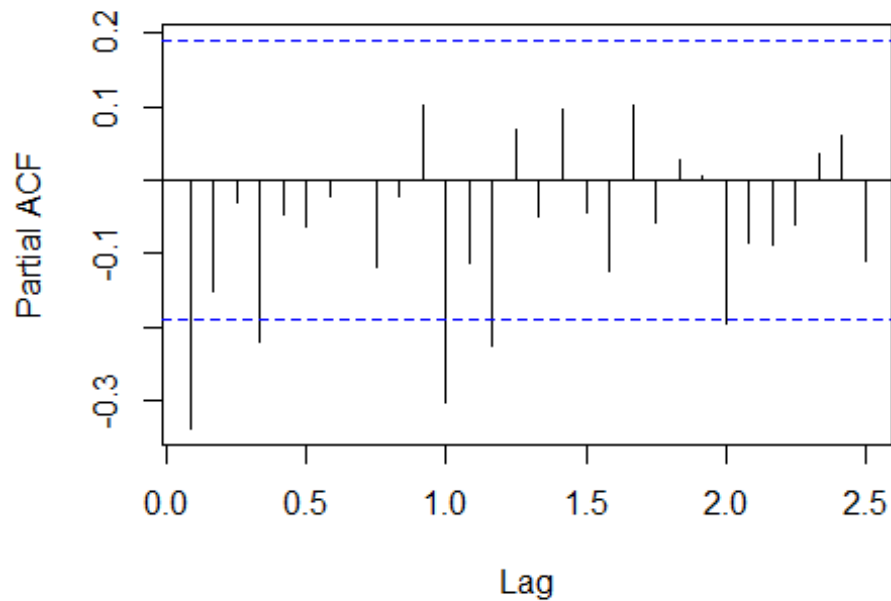
```
plot.ts(diff12)
```

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

Series diff12


```
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  o  x  o  o
## 1 x x o o o o o o o o o  o  x  o  o
## 2 x o o x o o o o o o o  o  x  o  o
## 3 o x x x o o o o o o o  o  x  o  o
## 4 o x o o o o o o o o o  o  x  o  o
## 5 x x o o x o o o o o o  o  x  o  o
## 6 o 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  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$residuals
## D = 0.090856, p-value = 0.2751
## alternative hypothesis: two-sided
```
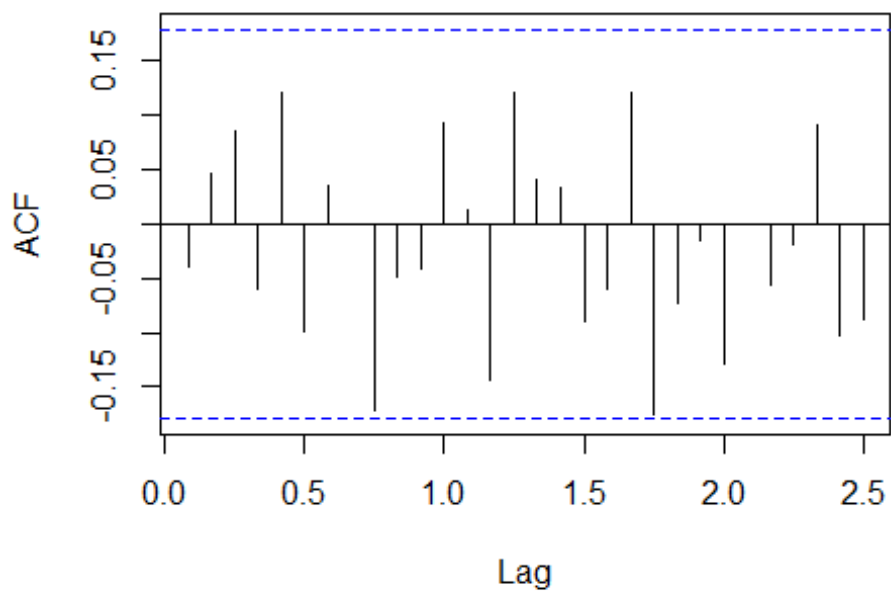
```
qqnorm(Arimasima.p$residuals)
qqline(Arimasima.p$residuals)
```
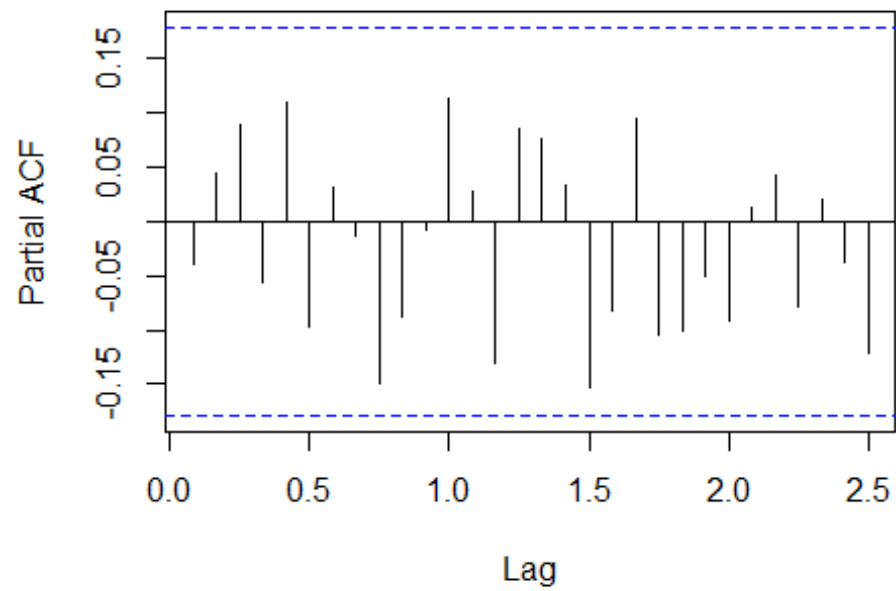
Normal Q-Q Plot


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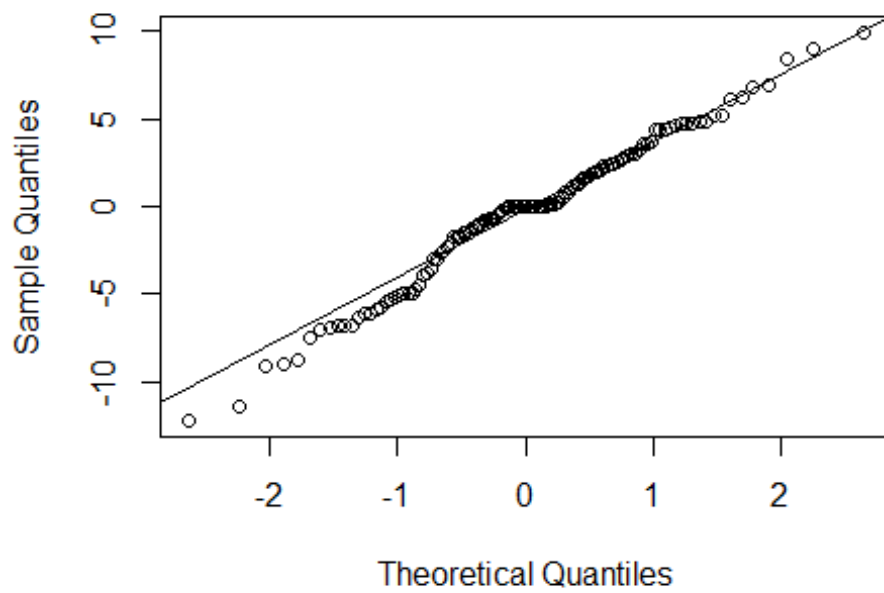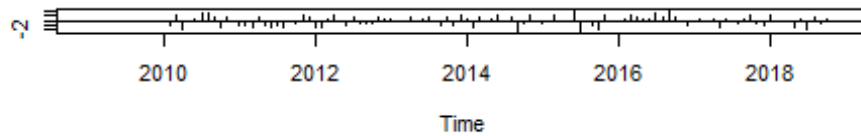
Series Arimasima.p$residuals


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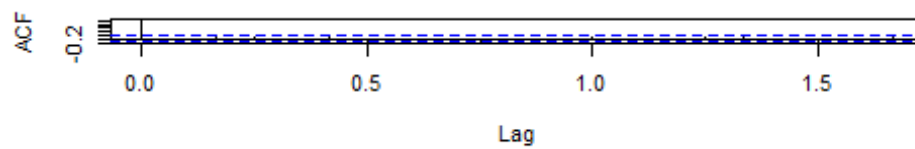
Series Arimasima.p$residuals
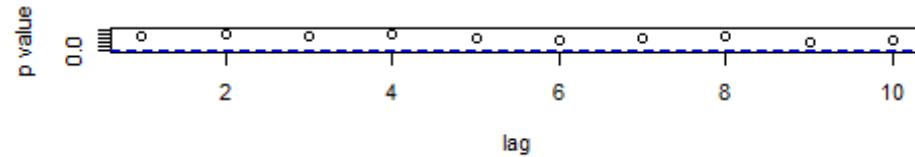


```
tsdiag(Arimasima.p)
```

Standardized Residuals

ACF of Residuals

p values for Ljung-Box statistic

```r
#Foracasting
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
```

```r
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
```

```r
forecasting <- forecast(tsdata, 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
```

```r
autoplot(forecasting)
```

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