```
library(forecast)

## Warning: package 'forecast' was built under R version 4.2.3

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

library(tseries)

## Warning: package 'tseries' was built under R version 4.2.3

dataUAS = read.csv(file = "D:/Semester VIII/Analisis Runtun Waktu/uts
2/dataUAS.csv", header = TRUE, sep = ";")
attach(dataUAS)
xT = (dataUAS$Xt)
# Melakukan tes ADF pada data
adf.test(Xt)

## Warning in adf.test(Xt): p-value smaller than printed p-value

##
##  Augmented Dickey-Fuller Test
##
## data:  Xt
## Dickey-Fuller = -7.3186, Lag order = 5, p-value = 0.01
## alternative hypothesis: stationary

# Menampilkan plot data
par(mfrow=c(1,1))
plot.ts(Xt, lag.max = 200)

## Warning in plot.window(xlim, ylim, log, ...): "lag.max" is not a graphical
## parameter

## Warning in title(main = main, xlab = xlab, ylab = ylab, ...): "lag.max" is
not
## a graphical parameter

## Warning in axis(1, ...): "lag.max" is not a graphical parameter

## Warning in axis(2, ...): "lag.max" is not a graphical parameter

## Warning in box(...): "lag.max" is not a graphical parameter
```
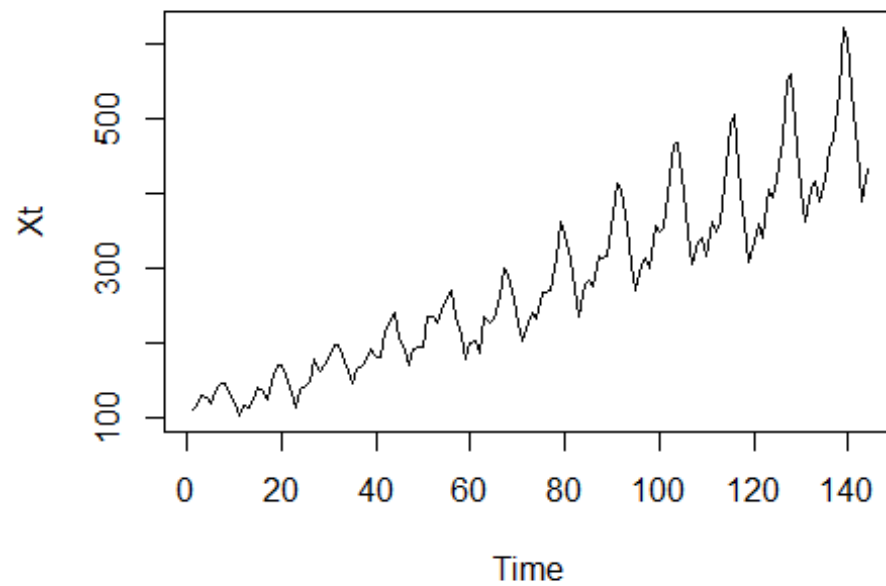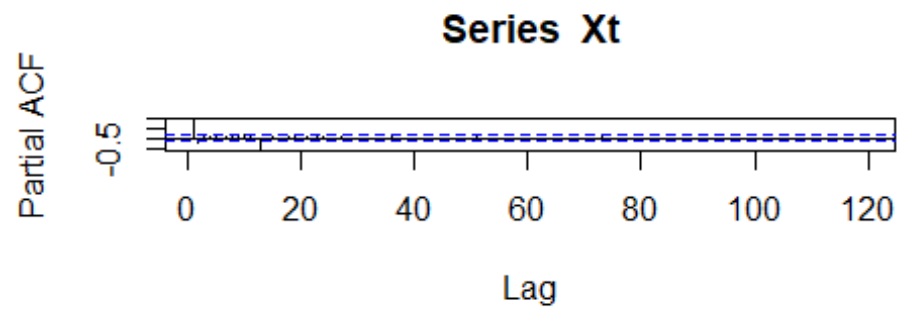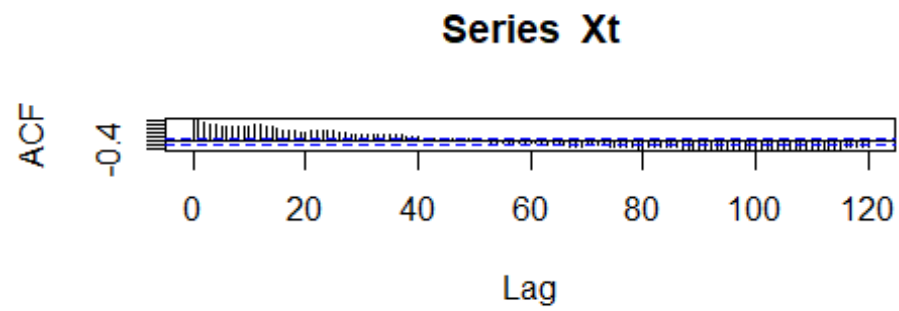
```r
# Menampilkan plot ACF dan PACF
par(mfrow=c(2,1))
acf(Xt, lag.max = 120)
pacf(Xt, lag.max = 120)
```

Series Xt

Series Xt


```r
# Melakukan diferensiasi pada data untuk membuatnya stasioner
differenced_dataUAS <- diff(Xt)

# Menampilkan plot data yang sudah didiferensiasi
par(mfrow=c(1,1))
plot.ts(differenced_dataUAS)
```
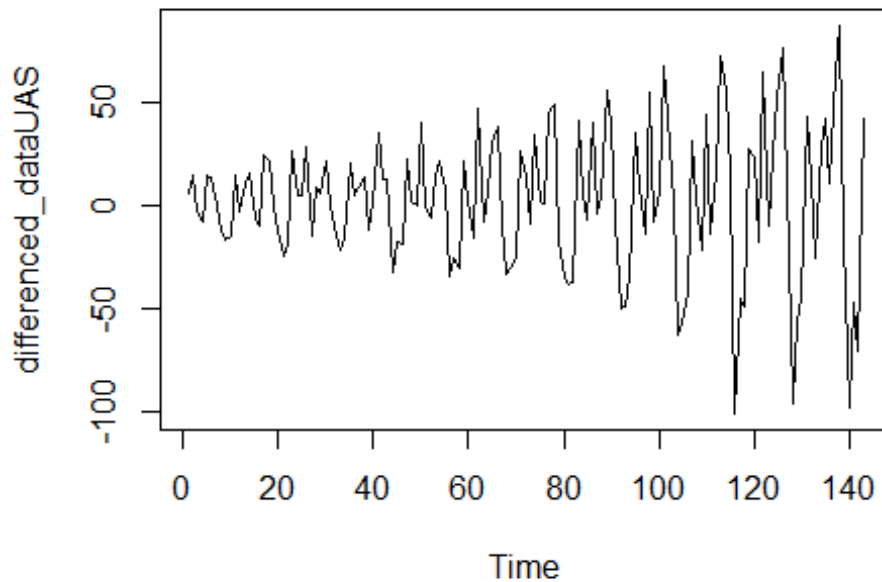
```r
# Melakukan tes ADF pada data yang sudah didiferensiasi
adf.test(differenced_dataUAS)

## Warning in adf.test(differenced_dataUAS): p-value smaller than printed p-
value

##
##  Augmented Dickey-Fuller Test
##
## data:  differenced_dataUAS
## Dickey-Fuller = -7.0177, Lag order = 5, p-value = 0.01
## alternative hypothesis: stationary

# Menampilkan plot ACF dan PACF dari data yang sudah didiferensiasi
par(mfrow=c(2,1))
Acf(differenced_dataUAS, lag.max = 200)
Pacf(differenced_dataUAS, lag.max = 200)
```
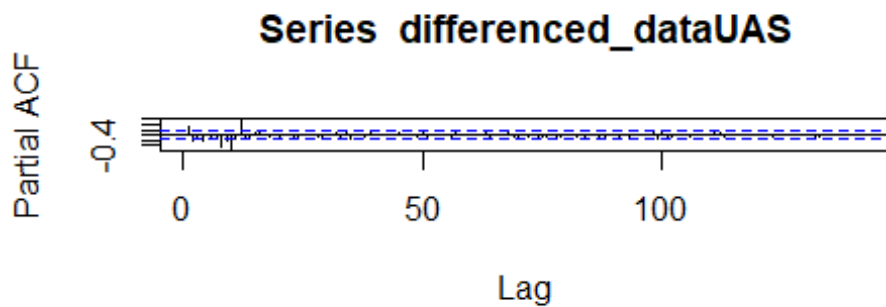
Series differenced_dataUAS

Series differenced_dataUAS
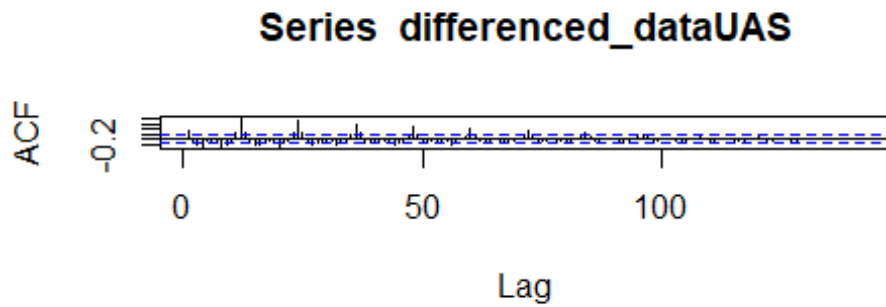

```r
# Melakukan diferensiasi musiman pada data yang sudah didiferensiasi
musimUAS = diff(differenced_dataUAS, lag=4)
adf.test(musimUAS)

## Warning in adf.test(musimUAS): p-value smaller than printed p-value

##
##  Augmented Dickey-Fuller Test
##
## data:  musimUAS
## Dickey-Fuller = -5.6189, Lag order = 5, p-value = 0.01
## alternative hypothesis: stationary

par(mfrow=c(1,1))
plot.ts(musimUAS)
```
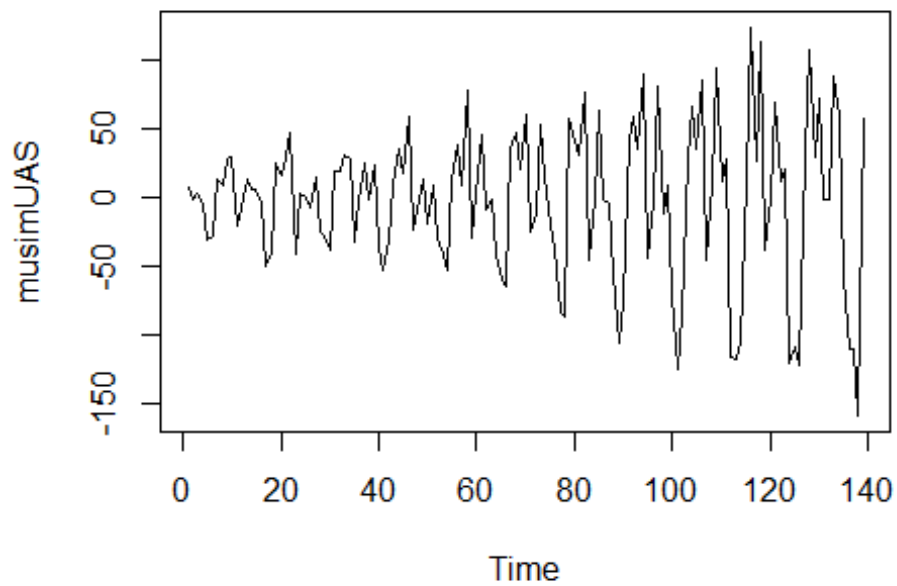
```r
# Menampilkan plot ACF dan PACF dari data yang sudah didiferensiasi musiman
par(mfrow=c(2,1))
acf(musimUAS, lag.max = 200)
pacf(musimUAS, lag.max = 200)
```

Series musimUAS
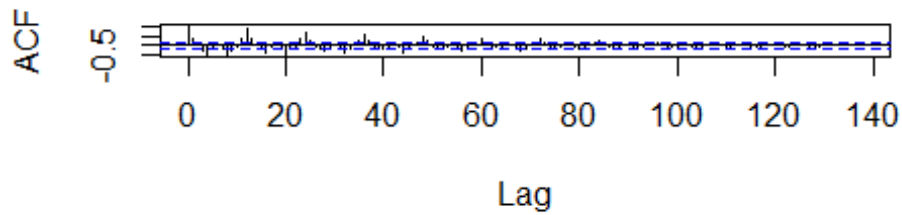
Series musimUAS
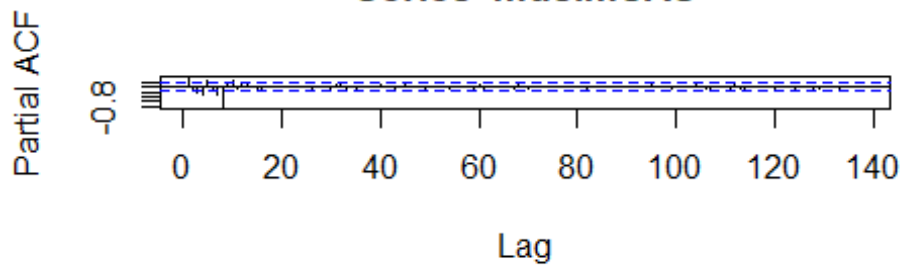

```r
## estimasi
#estimasi1
estimasi1=arima(Xt,order=c(0,1,0),seasonal=list(order=c(0,1,0),period = 4))
estimasi1

##
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(0, 1, 0),
period = 4))
##
##
## sigma^2 estimated as 2885:  log likelihood = -750.97,  aic = 1503.94

residual1=resid(estimasi1)
shapiro.test(residual1)

##
##   Shapiro-Wilk normality test
##
## data:  residual1
## W = 0.97485, p-value = 0.009384

Box.test(residual1,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
```

```
## data:  residual1
## X-squared = 58.076, df = 6, p-value = 1.106e-10
```

#estimasi2
```
estimasi2=arima(Xt,order=c(1,1,0),seasonal=list(order=c(0,1,0),period = 4))
estimasi2
```

```
##
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(0, 1, 0),
## period = 4))
##
## Coefficients:
##          ar1
##       0.3517
## s.e.  0.0793
##
## sigma^2 estimated as 2527:  log likelihood = -741.8,  aic = 1487.61
```

```
residual2=resid(estimasi2)
shapiro.test(residual2)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  residual2
## W = 0.9914, p-value = 0.5307
```

```
Box.test(residual2,lag=6,type="Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  residual2
## X-squared = 36.477, df = 6, p-value = 2.226e-06
```

#estimasi3
```
estimasi3=arima(Xt,order=c(1,1,1),seasonal=list(order=c(0,1,0),period = 4))
estimasi3
```

```
##
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(0, 1, 0),
## period = 4))
##
## Coefficients:
##           ar1     ma1
##        -0.4163  1.0000
## s.e.    0.0814  0.0254
##
## sigma^2 estimated as 2086:  log likelihood = -730.44,  aic = 1466.88
```

```
residual3=resid(estimasi3)
shapiro.test(residual3)

##
##  Shapiro-Wilk normality test
##
## data:  residual3
## W = 0.98332, p-value = 0.07763

Box.test(residual3,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual3
## X-squared = 32.795, df = 6, p-value = 1.148e-05

#estimasi4
estimasi4=arima(Xt,order=c(1,1,0),seasonal=list(order=c(1,1,0),period = 4))
estimasi4

##
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(1, 1, 0),
period = 4))
##
## Coefficients:
##          ar1      sar1
##       0.3503   -0.4976
## s.e.  0.0793    0.0769
##
## sigma^2 estimated as 1936:  log likelihood = -723.87,  aic = 1453.75

residual4=resid(estimasi4)
shapiro.test(residual4)

##
##  Shapiro-Wilk normality test
##
## data:  residual4
## W = 0.99017, p-value = 0.4113

Box.test(residual4,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual4
## X-squared = 35.919, df = 6, p-value = 2.858e-06
```

```
#estimasi5
estimasi5=arima(Xt,order=c(1,1,0),seasonal=list(order=c(0,1,1),period = 4))
estimasi5

##
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(0, 1, 1),
period = 4))
##
## Coefficients:
##           ar1      sma1
##        0.3321   -1.0000
## s.e.   0.0803    0.0648
##
## sigma^2 estimated as 943.1:   log likelihood = -680.45,   aic = 1366.9

residual5=resid(estimasi5)
shapiro.test(residual5)

##
##   Shapiro-Wilk normality test
##
## data:  residual5
## W = 0.98302, p-value = 0.07194

Box.test(residual5,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  residual5
## X-squared = 28.772, df = 6, p-value = 6.72e-05

#estimasi6
estimasi6=arima(Xt,order=c(1,1,1),seasonal=list(order=c(1,1,0),period = 4))
estimasi6

##
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(1, 1, 0),
period = 4))
##
## Coefficients:
##           ar1      ma1      sar1
##        0.1498   0.2360   -0.4962
## s.e.   0.2545   0.2572    0.0771
##
## sigma^2 estimated as 1917:   log likelihood = -723.21,   aic = 1454.42

residual6=resid(estimasi6)
shapiro.test(residual6)
```

```
## 
##  Shapiro-Wilk normality test
## 
## data:  residual6
## W = 0.98835, p-value = 0.271
```

```
Box.test(residual6,lag=6,type="Ljung-Box")
```

```
## 
##  Box-Ljung test
## 
## data:  residual6
## X-squared = 32.555, df = 6, p-value = 1.277e-05
```

```
#estimasi7
estimasi7=arima(Xt,order=c(1,1,0),seasonal=list(order=c(1,1,1),period = 4))
estimasi7
```

```
## 
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(1, 1, 1),
## period = 4))
## 
## Coefficients:
##           ar1      sar1      sma1
##        0.3013   -0.4351   -0.9404
## s.e.   0.0816    0.0815    0.0467
## 
## sigma^2 estimated as 802.3:  log likelihood = -668.12,  aic = 1344.25
```

```
residual7=resid(estimasi7)
shapiro.test(residual7)
```

```
## 
##  Shapiro-Wilk normality test
## 
## data:  residual7
## W = 0.98839, p-value = 0.2741
```

```
Box.test(residual7,lag=6,type="Ljung-Box")
```

```
## 
##  Box-Ljung test
## 
## data:  residual7
## X-squared = 22.108, df = 6, p-value = 0.001158
```

```
#estimasi8
estimasi8=arima(Xt,order=c(1,1,1),seasonal=list(order=c(0,1,1),period = 4))
estimasi8
```

```
##
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(0, 1, 1),
period = 4))
##
## Coefficients:
##            ar1      ma1      sma1
##        -0.5023   0.8789   -1.0000
## s.e.    0.1151   0.0770    0.0608
##
## sigma^2 estimated as 900.9:  log likelihood = -678.32,  aic = 1364.65

residual8=resid(estimasi8)
shapiro.test(residual8)

##
##   Shapiro-Wilk normality test
##
## data:  residual8
## W = 0.98778, p-value = 0.2366

Box.test(residual8,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  residual8
## X-squared = 28.472, df = 6, p-value = 7.654e-05

#estimasi9
estimasi9=arima(Xt,order=c(1,1,1),seasonal=list(order=c(1,1,1),period = 4))
estimasi9

##
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(1, 1, 1),
period = 4))
##
## Coefficients:
##             ar1      ma1      sar1      sma1
##         0.0776   0.2537   -0.4321   -0.9503
## s.e.    0.2570   0.2506    0.0819    0.0538
##
## sigma^2 estimated as 790.7:  log likelihood = -667.46,  aic = 1344.93

residual9=resid(estimasi9)
shapiro.test(residual9)

##
##   Shapiro-Wilk normality test
##
```

```
## data:  residual9
## W = 0.98867, p-value = 0.2923

Box.test(residual9,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual9
## X-squared = 19.762, df = 6, p-value = 0.003053

#estimasi10
estimasi10=arima(Xt,order=c(0,1,1),seasonal=list(order=c(0,1,0),period = 4))
estimasi10

##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(0, 1, 0),
## period = 4))
##
## Coefficients:
##          ma1
##       0.4066
## s.e.  0.0940
##
## sigma^2 estimated as 2494:  log likelihood = -740.92,  aic = 1485.85

residual10=resid(estimasi10)
shapiro.test(residual10)

##
##  Shapiro-Wilk normality test
##
## data:  residual10
## W = 0.98941, p-value = 0.3469

Box.test(residual10,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual10
## X-squared = 32.756, df = 6, p-value = 1.168e-05

#estimasi11
estimasi11=arima(Xt,order=c(0,1,1),seasonal=list(order=c(1,1,0),period = 4))
estimasi11

##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(1, 1, 0),
## period = 4))
```

```
##
## Coefficients:
##           ma1      sar1
##        0.3847   -0.4950
## s.e.  0.0877    0.0773
##
## sigma^2 estimated as 1920:  log likelihood = -723.3,   aic = 1452.61

residual11=resid(estimasi11)
shapiro.test(residual11)

##
##   Shapiro-Wilk normality test
##
## data:  residual11
## W = 0.98721, p-value = 0.2061

Box.test(residual11,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  residual11
## X-squared = 32.746, df = 6, p-value = 1.173e-05

#estimasi12
estimasi12=arima(Xt,order=c(0,1,1),seasonal=list(order=c(0,1,1),period = 4))
estimasi12

##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(0, 1, 1),
## period = 4))
##
## Coefficients:
##           ma1      sma1
##        0.3680   -1.0000
## s.e.  0.0856    0.0547
##
## sigma^2 estimated as 932.4:  log likelihood = -679.7,   aic = 1365.41

residual12=resid(estimasi12)
shapiro.test(residual12)

##
##   Shapiro-Wilk normality test
##
## data:  residual12
## W = 0.98587, p-value = 0.1478

Box.test(residual12,lag=6,type="Ljung-Box")
```

```
##
##   Box-Ljung test
##
## data:  residual12
## X-squared = 26.446, df = 6, p-value = 0.0001839
```

```
#estimasi13
estimasi13=arima(Xt,order=c(0,1,1),seasonal=list(order=c(1,1,1),period = 4))
estimasi13
```

```
##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(1, 1, 1),
## period = 4))
##
## Coefficients:
##           ma1      sar1      sma1
##        0.3250   -0.4319   -0.9538
## s.e.   0.0818    0.0820    0.0553
##
## sigma^2 estimated as 789.6:   log likelihood = -667.5,   aic = 1343.01
```

```
residual13=resid(estimasi13)
shapiro.test(residual13)
```

```
##
##   Shapiro-Wilk normality test
##
## data:  residual13
## W = 0.98853, p-value = 0.2827
```

```
Box.test(residual13,lag=6,type="Ljung-Box")
```

```
##
##   Box-Ljung test
##
## data:  residual13
## X-squared = 20.088, df = 6, p-value = 0.002671
```

```
#estimasi14
estimasi14=arima(Xt,order=c(0,1,0),seasonal=list(order=c(1,1,0),period = 4))
estimasi14
```

```
##
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(1, 1, 0),
## period = 4))
##
## Coefficients:
##           sar1
##        -0.5024
## s.e.    0.0775
```

```
## 
## sigma^2 estimated as 2209:  log likelihood = -733,  aic = 1469.99

residual14=resid(estimasi14)
shapiro.test(residual14)

## 
##  Shapiro-Wilk normality test
## 
## data:  residual14
## W = 0.9822, p-value = 0.05851

Box.test(residual14,lag=6,type="Ljung-Box")

## 
##  Box-Ljung test
## 
## data:  residual14
## X-squared = 61.458, df = 6, p-value = 2.275e-11

#estimasi15
estimasi15=arima(Xt,order=c(0,1,0),seasonal=list(order=c(1,1,1),period = 4))
estimasi15

## 
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(1, 1, 1),
## period = 4))
## 
## Coefficients:
##           sar1     sma1
##        -0.4560  -0.9548
## s.e.    0.0805   0.0543
## 
## sigma^2 estimated as 873.8:  log likelihood = -674.63,  aic = 1355.26

residual15=resid(estimasi15)
shapiro.test(residual15)

## 
##  Shapiro-Wilk normality test
## 
## data:  residual15
## W = 0.98848, p-value = 0.2795

Box.test(residual15,lag=6,type="Ljung-Box")

## 
##  Box-Ljung test
## 
## data:  residual15
## X-squared = 45.062, df = 6, p-value = 4.549e-08
```

```
#estimasi16
estimasi16=arima(Xt,order=c(0,1,0),seasonal=list(order=c(0,1,1),period = 4))
estimasi16

##
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(0, 1, 1),
period = 4))
##
## Coefficients:
##           sma1
##        -1.0000
## s.e.    0.0537
##
## sigma^2 estimated as 1060:   log likelihood = -688.53,   aic = 1381.06

residual16=resid(estimasi16)
shapiro.test(residual16)

##
##   Shapiro-Wilk normality test
##
## data:  residual16
## W = 0.98178, p-value = 0.05251

Box.test(residual16,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  residual16
## X-squared = 53.816, df = 6, p-value = 8.036e-10

#estimasi17
estimasi17=arima(Xt,order=c(0,1,0),seasonal=list(order=c(0,1,2),period = 4))
estimasi17

##
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(0, 1, 2),
period = 4))
##
## Coefficients:
##           sma1      sma2
##        -0.1371   -0.8629
## s.e.    0.0652    0.0619
##
## sigma^2 estimated as 1271:   log likelihood = -701.45,   aic = 1408.91

residual17=resid(estimasi17)
shapiro.test(residual17)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  residual17
## W = 0.99113, p-value = 0.5031
```

```r
Box.test(residual17,lag=6,type="Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  residual17
## X-squared = 51.496, df = 6, p-value = 2.355e-09
```

```r
#estimasi18
estimasi18=arima(Xt,order=c(1,1,0),seasonal=list(order=c(0,1,2),period = 4))
estimasi18
```

```
##
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(0, 1, 2),
## period = 4))
##
## Coefficients:
##           ar1      sma1     sma2
##        0.2274  -1.6797   0.7920
## s.e.   0.0846   0.0619   0.0585
##
## sigma^2 estimated as 557.9:  log likelihood = -644.95,  aic = 1297.9
```

```r
residual18=resid(estimasi18)
shapiro.test(residual18)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  residual18
## W = 0.99221, p-value = 0.6185
```

```r
Box.test(residual18,lag=6,type="Ljung-Box")
```

```
##
##  Box-Ljung test
##
## data:  residual18
## X-squared = 12.424, df = 6, p-value = 0.05315
```

```r
#estimasi19
estimasi19=arima(Xt,order=c(0,1,1),seasonal=list(order=c(0,1,2),period = 4))
estimasi19
```

```
##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(0, 1, 2),
## period = 4))
##
## Coefficients:
##           ma1     sma1     sma2
##        0.2242  -1.6852   0.7928
## s.e.   0.0790   0.0616   0.0587
##
## sigma^2 estimated as 556.5:  log likelihood = -644.88,  aic = 1297.77

residual19=resid(estimasi19)
shapiro.test(residual19)

##
##   Shapiro-Wilk normality test
##
## data:  residual19
## W = 0.99284, p-value = 0.6882

Box.test(residual19,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  residual19
## X-squared = 12.605, df = 6, p-value = 0.04975

#estimasi20
estimasi20=arima(Xt,order=c(0,1,0),seasonal=list(order=c(1,1,2),period = 4))
estimasi20

##
## Call:
## arima(x = Xt, order = c(0, 1, 0), seasonal = list(order = c(1, 1, 2),
## period = 4))
##
## Coefficients:
##           sar1     sma1     sma2
##        -0.6033  -0.0406  -0.9594
## s.e.    0.0887   0.0797   0.0784
##
## sigma^2 estimated as 910.6:  log likelihood = -679.61,  aic = 1367.23

residual20=resid(estimasi20)
shapiro.test(residual20)

##
##   Shapiro-Wilk normality test
##
```

```
## data:  residual20
## W = 0.97242, p-value = 0.005256

Box.test(residual20,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual20
## X-squared = 52.72, df = 6, p-value = 1.336e-09
```

#estimasi21
```
estimasi21=arima(Xt,order=c(1,1,1),seasonal=list(order=c(0,1,2),period = 4))
estimasi21

##
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(0, 1, 2),
period = 4))
##
## Coefficients:
##           ar1     ma1     sma1    sma2
##        0.1098  0.1285  -1.6815  0.7909
## s.e.   0.2324  0.2233   0.0622  0.0588
##
## sigma^2 estimated as 556.3:  log likelihood = -644.78,  aic = 1299.56

residual21=resid(estimasi21)
shapiro.test(residual21)

##
##  Shapiro-Wilk normality test
##
## data:  residual21
## W = 0.99294, p-value = 0.7001

Box.test(residual21,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual21
## X-squared = 12.006, df = 6, p-value = 0.06183
```

#estimasi22
```
estimasi22=arima(Xt,order=c(1,1,0),seasonal=list(order=c(1,1,2),period = 4))
estimasi22

##
## Call:
## arima(x = Xt, order = c(1, 1, 0), seasonal = list(order = c(1, 1, 2),
period = 4))
```

```
##
## Coefficients:
##           ar1     sar1     sma1     sma2
##        0.3276  -0.6269  -0.0244  -0.9756
## s.e.  0.0808   0.0893   0.1131   0.1124
##
## sigma^2 estimated as 807.2:  log likelihood = -671.86,  aic = 1353.71

residual22=resid(estimasi22)
shapiro.test(residual22)

##
##  Shapiro-Wilk normality test
##
## data:  residual22
## W = 0.98689, p-value = 0.1905

Box.test(residual22,lag=6,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  residual22
## X-squared = 30.605, df = 6, p-value = 3.015e-05

#estimasi23
estimasi23=arima(Xt,order=c(0,1,1),seasonal=list(order=c(1,1,2),period = 4))
estimasi23

##
## Call:
## arima(x = Xt, order = c(0, 1, 1), seasonal = list(order = c(1, 1, 2),
## period = 4))
##
## Coefficients:
##           ma1     sar1     sma1     sma2
##        0.3645  -0.6275  -0.0283  -0.9717
## s.e.  0.0885   0.0897   0.1009   0.1002
##
## sigma^2 estimated as 801.4:  log likelihood = -671.21,  aic = 1352.42

residual23=resid(estimasi23)
shapiro.test(residual23)

##
##  Shapiro-Wilk normality test
##
## data:  residual23
## W = 0.98511, p-value = 0.1222

Box.test(residual23,lag=6,type="Ljung-Box")
```

```
## 
##  Box-Ljung test
## 
## data:  residual23
## X-squared = 28.399, df = 6, p-value = 7.904e-05
```

```
#estimasi24
estimasi24=arima(Xt,order=c(1,1,1),seasonal=list(order=c(1,1,2),period = 4))
estimasi24
```

```
## 
## Call:
## arima(x = Xt, order = c(1, 1, 1), seasonal = list(order = c(1, 1, 2),
## period = 4))
## 
## Coefficients:
##           ar1      ma1      sar1      sma1      sma2
##        0.0926   0.2722   -0.6297   -0.0259   -0.9741
## s.e.   0.3227   0.3274    0.0898    0.1074    0.1068
## 
## sigma^2 estimated as 800.1:   log likelihood = -671.19,   aic = 1354.37
```

```
residual24=resid(estimasi24)
shapiro.test(residual24)
```

```
## 
##  Shapiro-Wilk normality test
## 
## data:  residual24
## W = 0.98566, p-value = 0.1402
```

```
Box.test(residual24,lag=6,type="Ljung-Box")
```

```
## 
##  Box-Ljung test
## 
## data:  residual24
## X-squared = 28.256, df = 6, p-value = 8.408e-05
```

```
# SAIMA (1,1,1,0,1,2)
library(astsa)
```

```
## Warning: package 'astsa' was built under R version 4.3.0
```
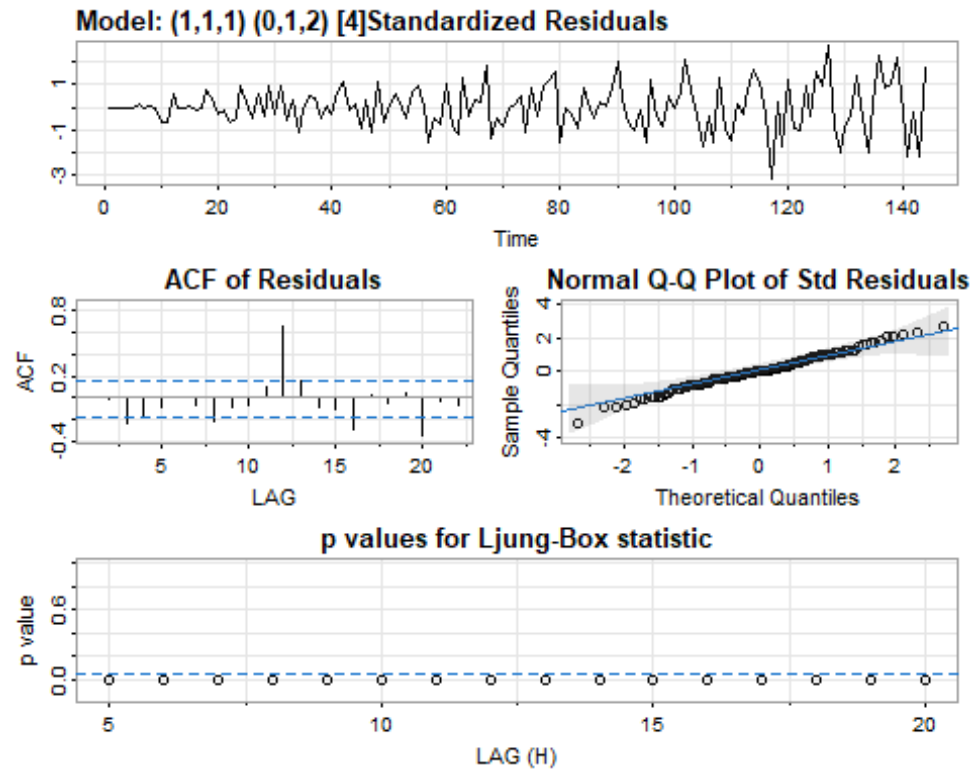
```
## 
## Attaching package: 'astsa'
```

```
## The following object is masked from 'package:forecast':
## 
##     gas
```

```
Xt5<-sarima(Xt,1,1,1,0,1,2,4)
```

```
## initial  value 3.987248
## iter    2 value 3.619139
## iter    3 value 3.609560
## iter    4 value 3.573574
## iter    5 value 3.569111
## iter    6 value 3.566032
## iter    7 value 3.564273
## iter    8 value 3.561425
## iter    9 value 3.560810
## iter   10 value 3.543078
## iter   11 value 3.539794
## iter   12 value 3.460655
## iter   13 value 3.447574
## iter   14 value 3.311735
## iter   15 value 3.269198
## iter   16 value 3.201161
## iter   17 value 3.200046
## iter   18 value 3.199488
## iter   19 value 3.199310
## iter   20 value 3.199023
## iter   21 value 3.198579
## iter   22 value 3.198556
## iter   23 value 3.198478
## iter   24 value 3.198418
## iter   25 value 3.198396
## iter   26 value 3.198353
## iter   27 value 3.198275
## iter   28 value 3.198266
## iter   29 value 3.198266
## iter   29 value 3.198266
## iter   29 value 3.198266
## final  value 3.198266
## converged
## initial  value 3.222760
## iter    2 value 3.222300
## iter    3 value 3.221881
## iter    4 value 3.221383
## iter    5 value 3.220489
## iter    6 value 3.219957
## iter    7 value 3.219816
## iter    8 value 3.219785
## iter    9 value 3.219783
## iter    9 value 3.219783
## iter    9 value 3.219783
## final  value 3.219783
## converged
```

Model: (1,1,1) (0,1,2) [4]Standardized Residuals

ACF of Residuals

Normal Q-Q Plot of Std Residuals

p values for Ljung-Box statistic
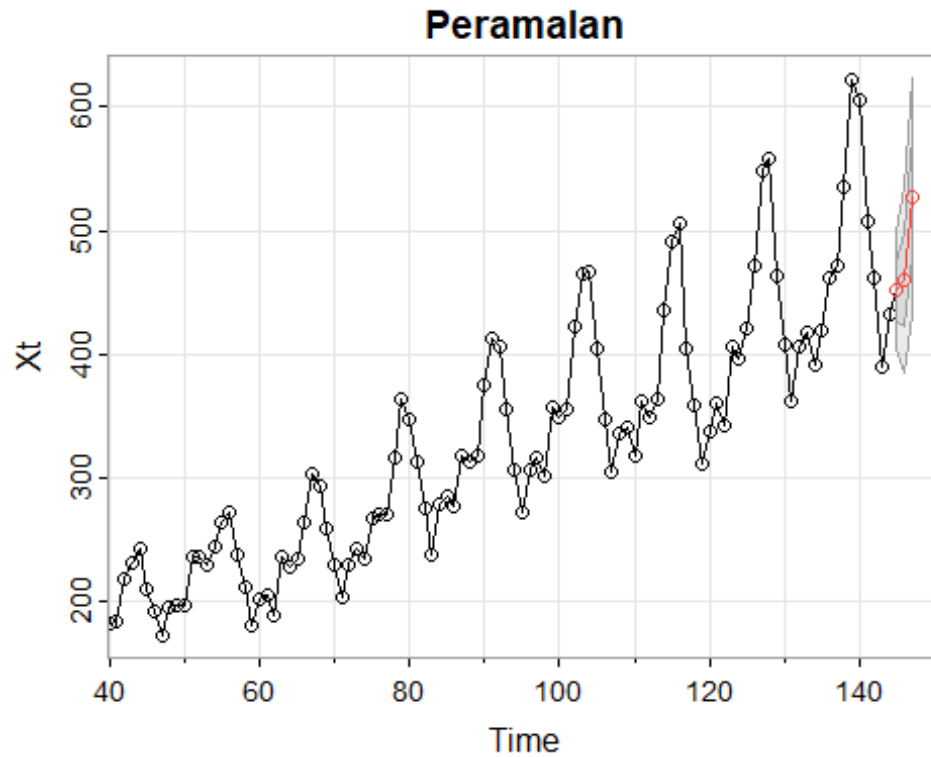


```
Xt5$ttable

##        Estimate     SE  t.value p.value
## ar1     0.1098 0.2324   0.4725  0.6374
## ma1     0.1285 0.2233   0.5755  0.5659
## sma1   -1.6815 0.0622 -27.0304  0.0000
## sma2    0.7909 0.0588  13.4550  0.0000

## Peramalan
library(astsa)
par(mfrow = c(1, 1))
sarima.for(Xt, n.ahead = 3, 1, 1, 0, 0, 1, 2, 4, main = "Peramalan")
```

Peramalan


```
## $pred
## Time Series:
## Start = 145
## End = 147
## Frequency = 1
## [1] 451.1692 460.0787 527.4001
##
## $se
## Time Series:
## Start = 145
## End = 147
## Frequency = 1
## [1] 23.62114 37.39658 48.07671
```

Perbandingan

```r
library(forecast)
fit <- Arima(Xt, order = c(1, 1, 0), seasonal = list(order = c(0, 1, 2),
period = 4))
plot.ts(Xt, col = "red", main = "Perbandingan")
lines(fitted(fit), col = "blue")
```

Perbandingan