Stats 326 - Assignment 5

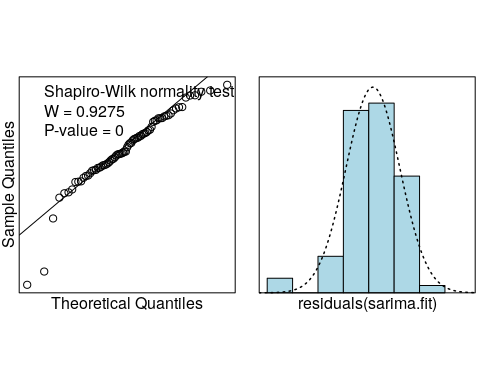
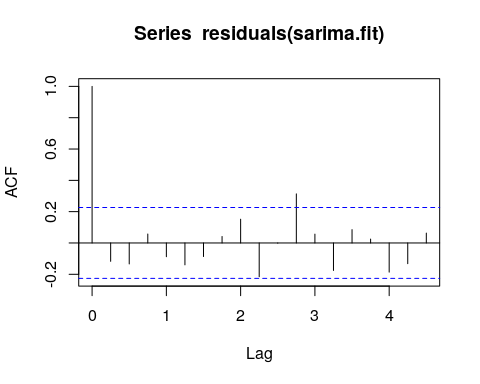
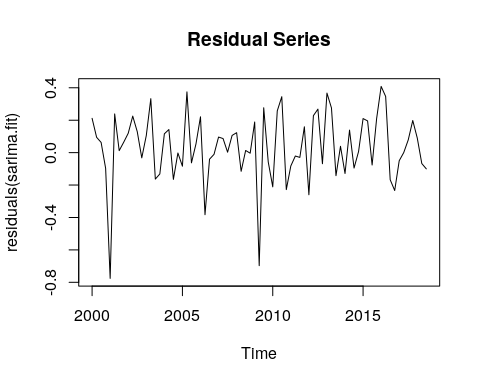
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## Question 1

#best fitting SARIMA  
sarima.fit = arima(red.CO2.ts,order=c(0,1,1),  
seasonal=list(order=c(0,1,1),period=4))  
sarima.fit

##   
## Call:  
## arima(x = red.CO2.ts, order = c(0, 1, 1), seasonal = list(order = c(0, 1, 1),   
## period = 4))  
##   
## Coefficients:  
## ma1 sma1  
## 0.5764 -0.8992  
## s.e. 0.1129 0.1326  
##   
## sigma^2 estimated as 0.03919: log likelihood = 10.48, aic = -14.96

 The Residual Series show reasonably random scatter about 0, although there are two large negative residuals (2001 Quarter 1 and 2009 Quarter 2). The autocorrelation function plot of the Residual Series shows a significant lag at lag 11. This is an unsual lag to be significant in quarterly data. Furthermore, the residuals seems reasonably normally distributed. Therefore, all model assumptions are satifised. Normality is okay with CLT though?

sarima.pred = predict(sarima.fit,n.ahead=4)  
sarima.pred

## $pred  
## Qtr1 Qtr2 Qtr3 Qtr4  
## 2018 405.8136  
## 2019 405.7907 406.3947 407.6694   
##   
## $se  
## Qtr1 Qtr2 Qtr3 Qtr4  
## 2018 0.1983784  
## 2019 0.3702966 0.4845881 0.5766555

pred.CO2.ts

## Qtr1 Qtr2 Qtr3 Qtr4  
## 2018 405.83  
## 2019 405.73 406.71 408.25

RMSEP.sarima = sqrt(1/4\*sum((pred.CO2.ts-sarima.pred$pred)^2))  
RMSEP.sarima

## [1] 0.3318586

The model had an RMSEP of 0.33 ppm. The best predicting model from previous assginments was the seasonal-trend-lowess seasonally adjusted model as it had the lowest RMSEP (0.2 ppm). Therefore, the SARIMA model is not better predicting the the STL model has SARIMA has a higher RMSEP.

## Question 2

#best fitting SARIMA  
sarima.fit.full = arima(full.CO2.ts,order=c(0,1,1),  
seasonal=list(order=c(0,1,1),period=4))  
sarima.fit.full

##   
## Call:  
## arima(x = full.CO2.ts, order = c(0, 1, 1), seasonal = list(order = c(0, 1, 1),   
## period = 4))  
##   
## Coefficients:  
## ma1 sma1  
## 0.5614 -0.8524  
## s.e. 0.1150 0.1008  
##   
## sigma^2 estimated as 0.04027: log likelihood = 10.98, aic = -15.97

sarima.pred.full = predict(sarima.fit.full,n.ahead=4)  
sarima.pred.full

## $pred  
## Qtr1 Qtr2 Qtr3 Qtr4  
## 2019 408.5781  
## 2020 408.5639 409.2513 410.5714   
##   
## $se  
## Qtr1 Qtr2 Qtr3 Qtr4  
## 2019 0.2007288  
## 2020 0.3721713 0.4865370 0.5787271

Model in backshift notation:

## Question 3 - Executive Summary