STAT 443: Lab 9

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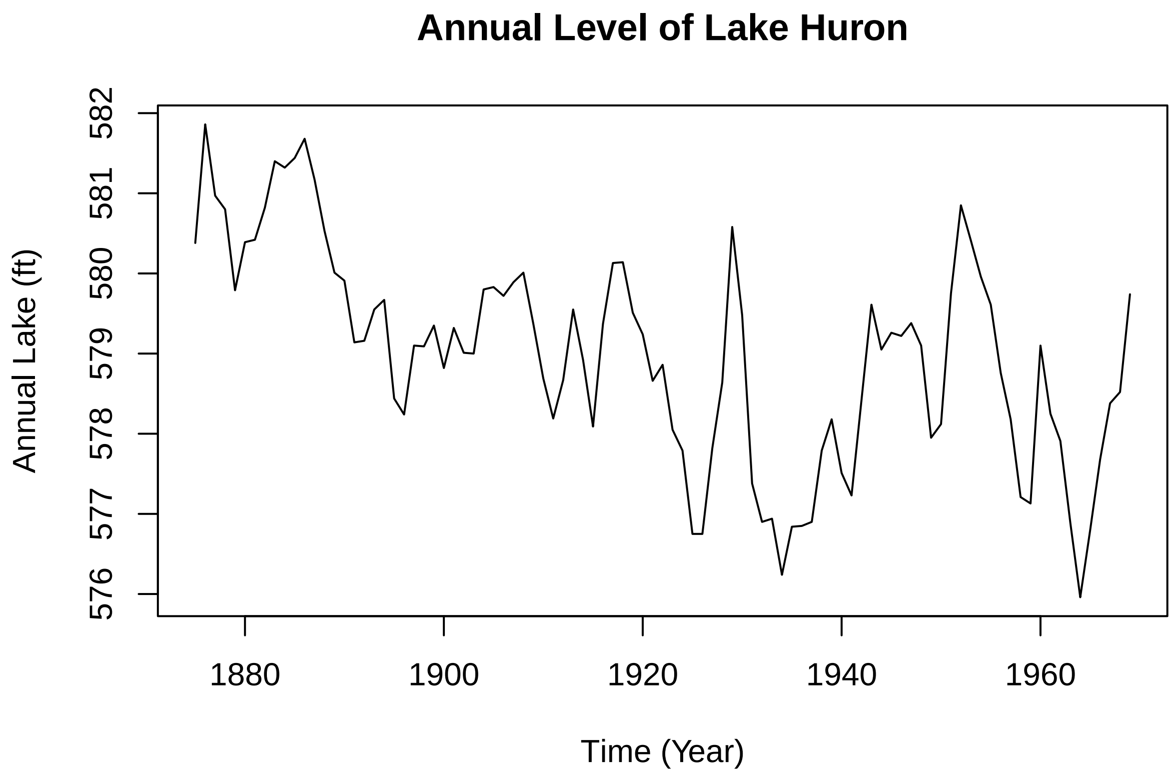
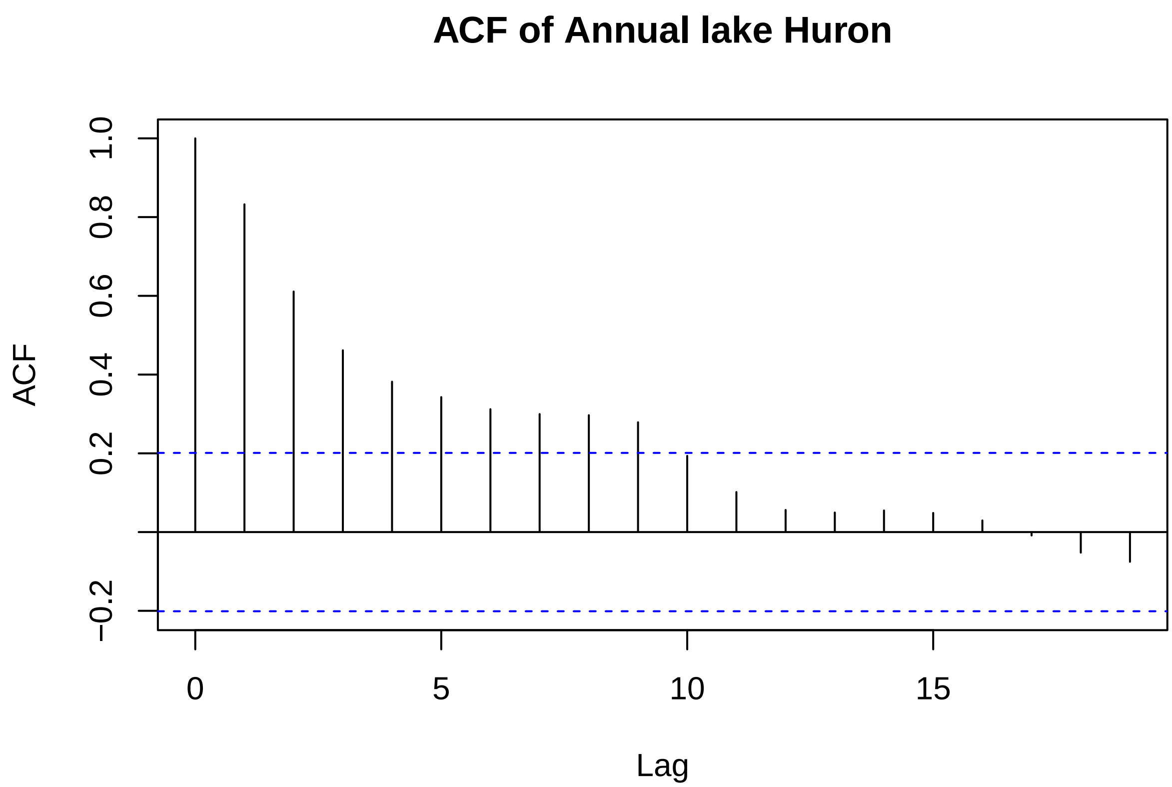
Question 1

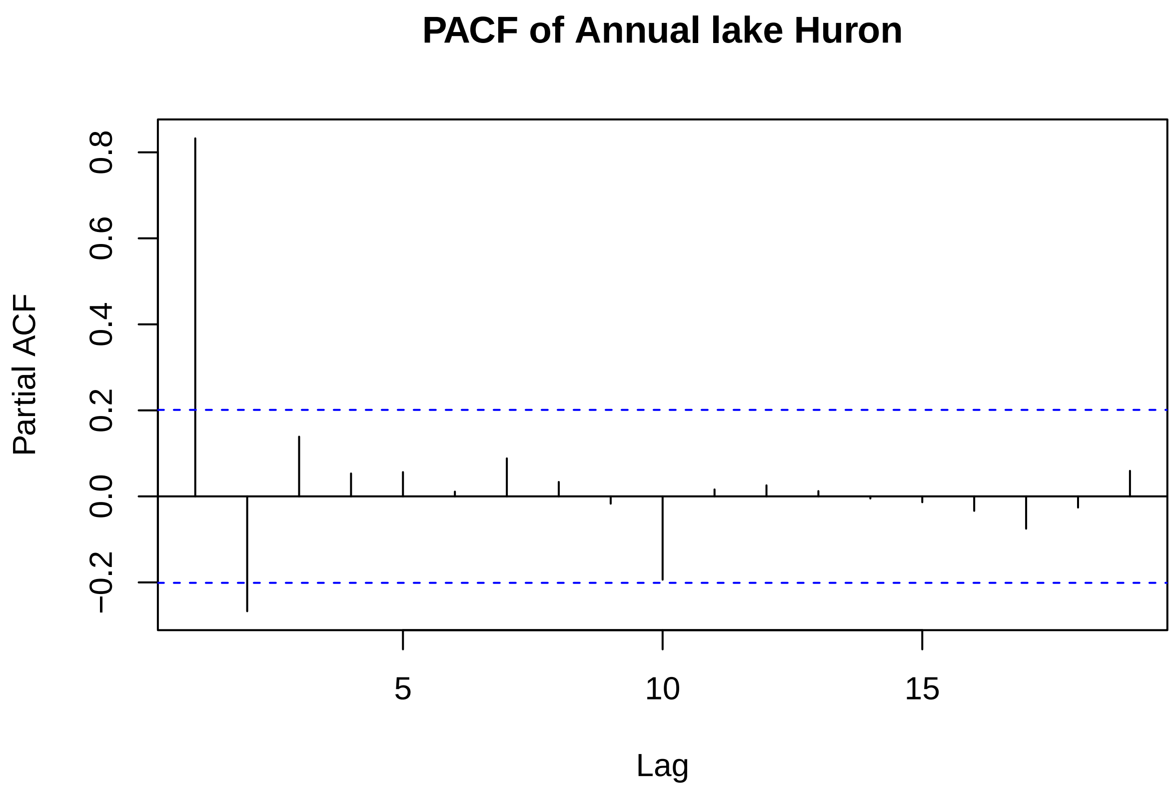
```r
# this is where your R code goes
data(LakeHuron)

data.ts.train <- window(LakeHuron,
                     start = c(1875),
                     end = c(1969))

data.ts.test <- window(LakeHuron,
                    start = c(1970),
                    end = c(1972))

plot(data.ts.train,
     main = "Annual Level of Lake Huron",
     xlab = "Time (Year)", ylab = "Annual Lake (ft)")
```




```
acf(data.ts.train, main = "ACF of Annual lake Huron")
```




```
pacf(data.ts.train, main = "PACF of Annual lake Huron")
```



Since we see an exponential decay in our ACF plot and a cut off at lag = 2 for our PACF plot, I believe an appropriate ARMA model would be an AR(2) process.

Question 2

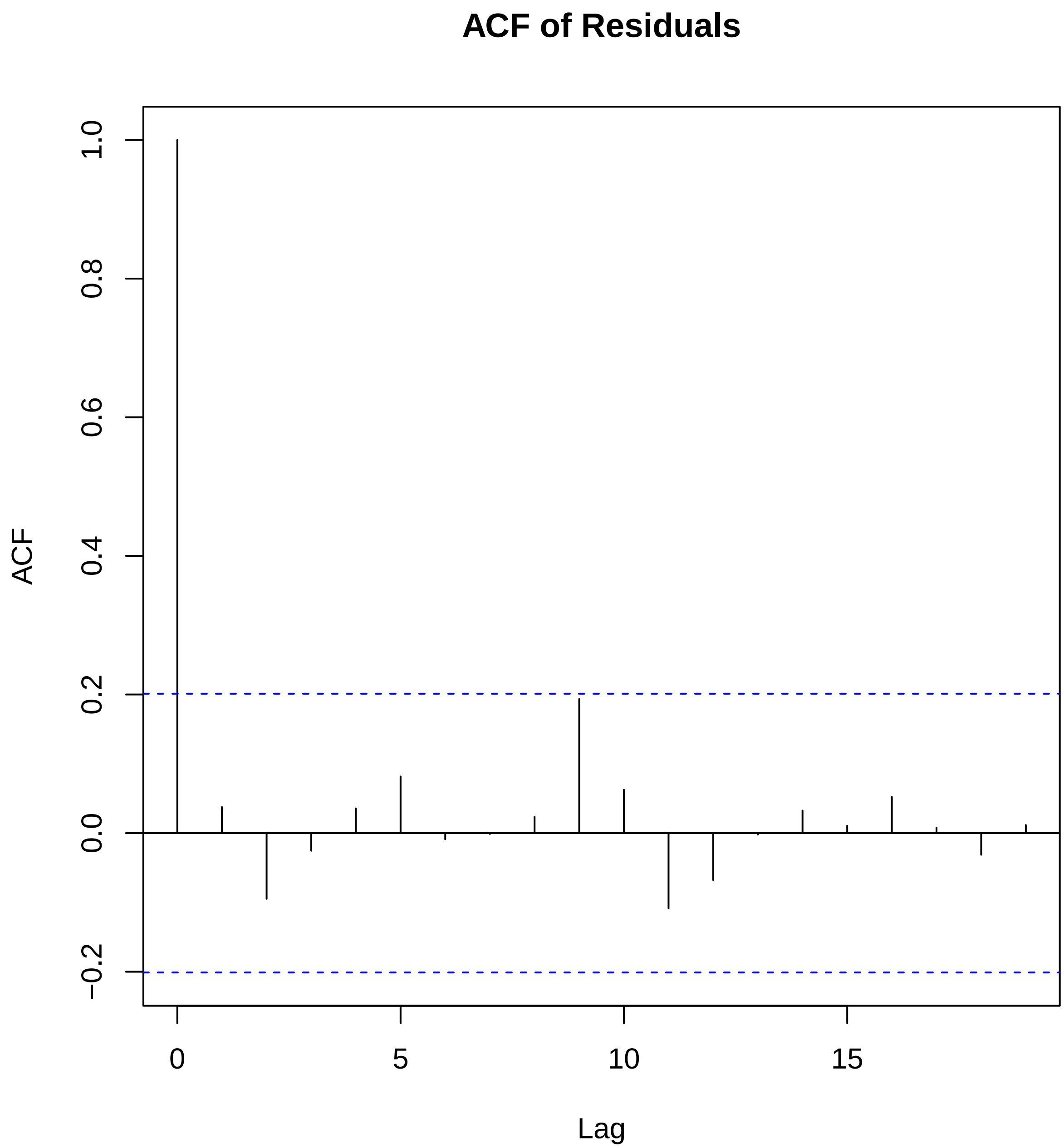
```r
# this is where your R code goes
model <- arima(data.ts.train, order = c(2, 0, 0))
model
```

```
##
## Call:
## arima(x = data.ts.train, order = c(2, 0, 0))
##
## Coefficients:
##          ar1      ar2  intercept
##       1.0617  -0.2707   579.0319
## s.e.  0.1006   0.1030     0.3339
##
## sigma^2 estimated as 0.484:  log likelihood = -101.01,  aic = 210.01
```

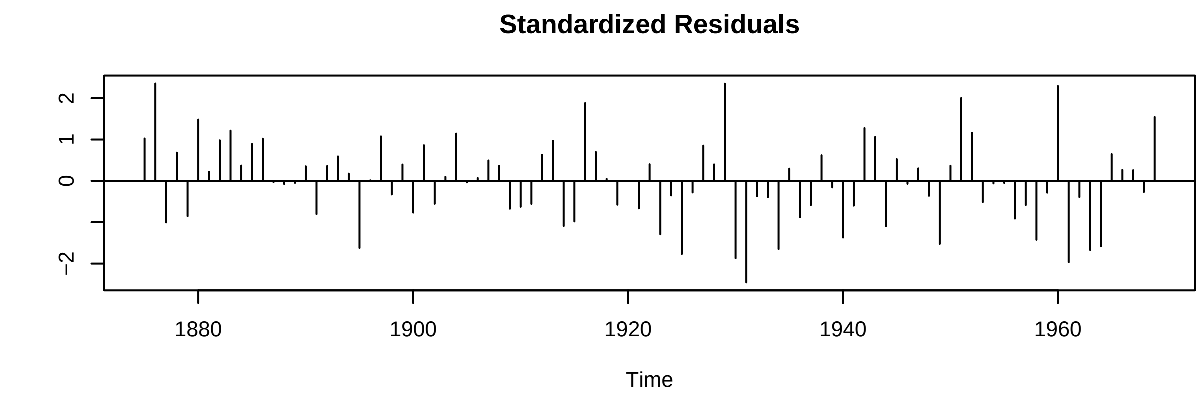
The Model is $X_t - 579.0319 = 1.0617 * (X_{t-1} - 579.0319) - 0.27 * (X_{t-2} - 579.0319) + Z_t$

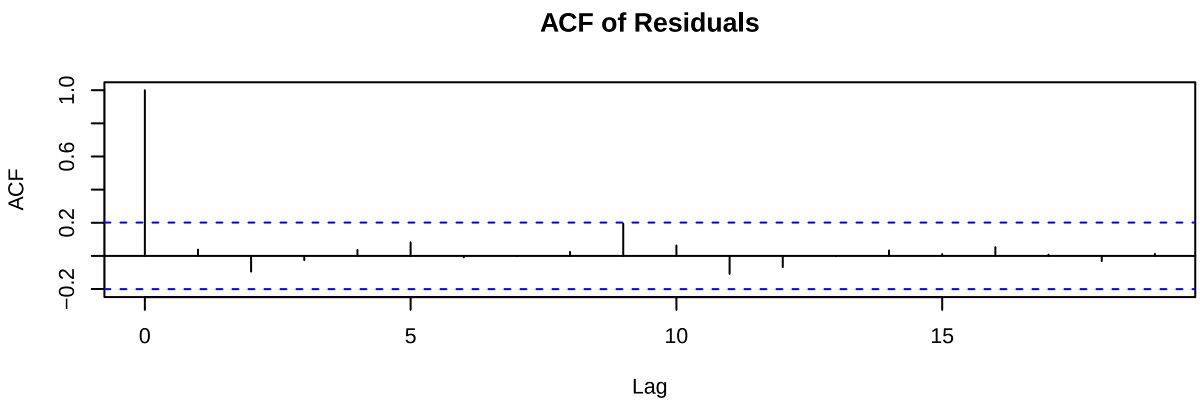
Question 3

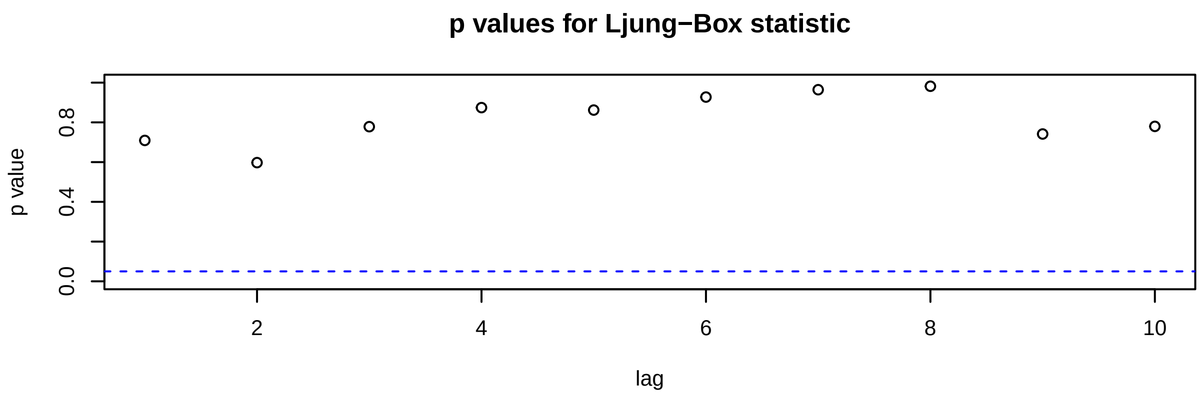
```
# this is where your R code goes
acf(model$residuals, main = "ACF of Residuals")
```



```r
tsdiag(model)
```







There are no patterns to our ACF residual plot and standardized residuals, and the p-values for our Ljung-Box Statistics do not show any significant p-value.

Question 4

```r
# this is where your R code goes
prediction <- predict(model, n.ahead = 3)
```

```r
data.frame(
  Year = 1970:1972,
  Forecast = prediction$pred,
  Lower_CI = prediction$pred - 1.96 * prediction$se,
  Upper_CI = prediction$pred + 1.96 * prediction$se
)
```

```
##   Year Forecast Lower_CI Upper_CI
## 1 1970 579.9223 578.5587 581.2859
## 2 1971 579.7856 577.7967 581.7744
## 3 1972 579.5911 577.2846 581.8976
```

Question 5

```r
# this is where your R code goes
data.frame(
  Year = 1970:1972,
  Forecast = prediction$pred,
  Lower_CI = prediction$pred - 1.96 * prediction$se,
  Upper_CI = prediction$pred + 1.96 * prediction$se,
  True_Value = data.ts.test
)
```

```
##   Year Forecast Lower_CI Upper_CI True_Value
## 1 1970 579.9223 578.5587 581.2859     579.31
## 2 1971 579.7856 577.7967 581.7744     579.89
## 3 1972 579.5911 577.2846 581.8976     579.96
```

The true values for Year 1970-72 are within our prediction intervals and relatively close to our forecast values.