Time Series - Homework 1

Matt Isaac

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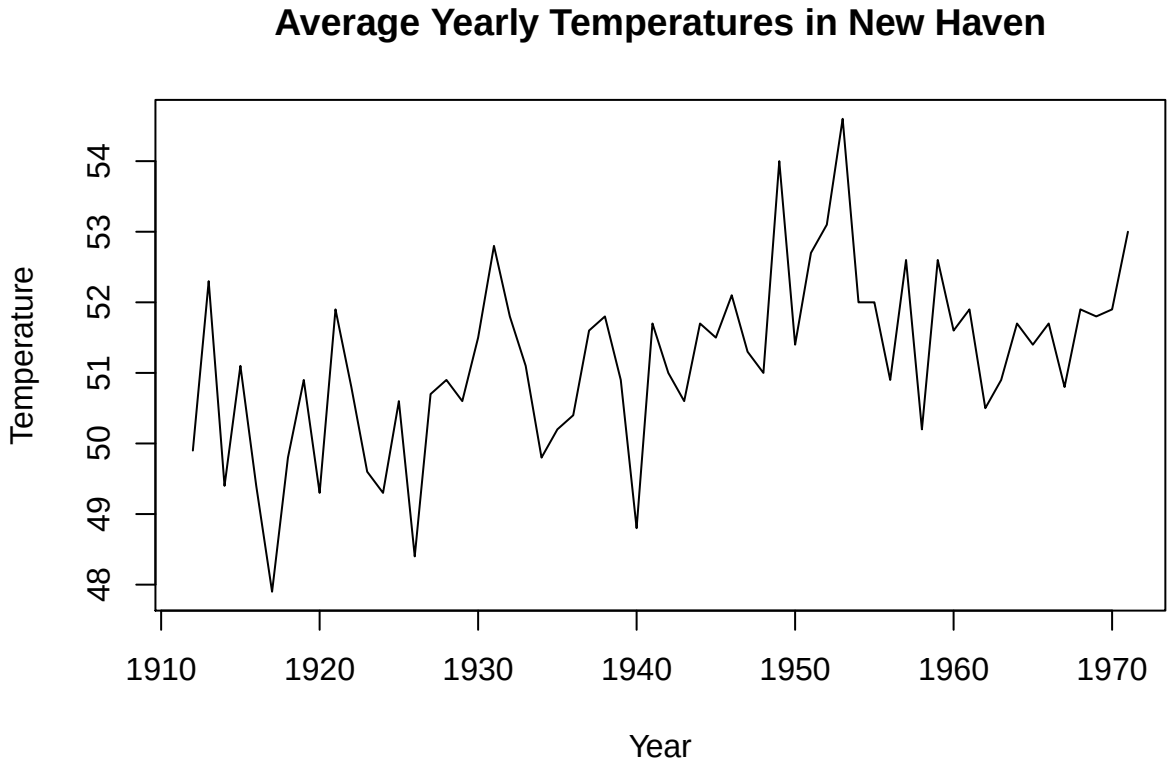
I. Data Analysis

1. The data set I chose is `nhtemp`, which contains data for the average yearly temperatures in New Haven from 1912 to 1971.

- Plot the data

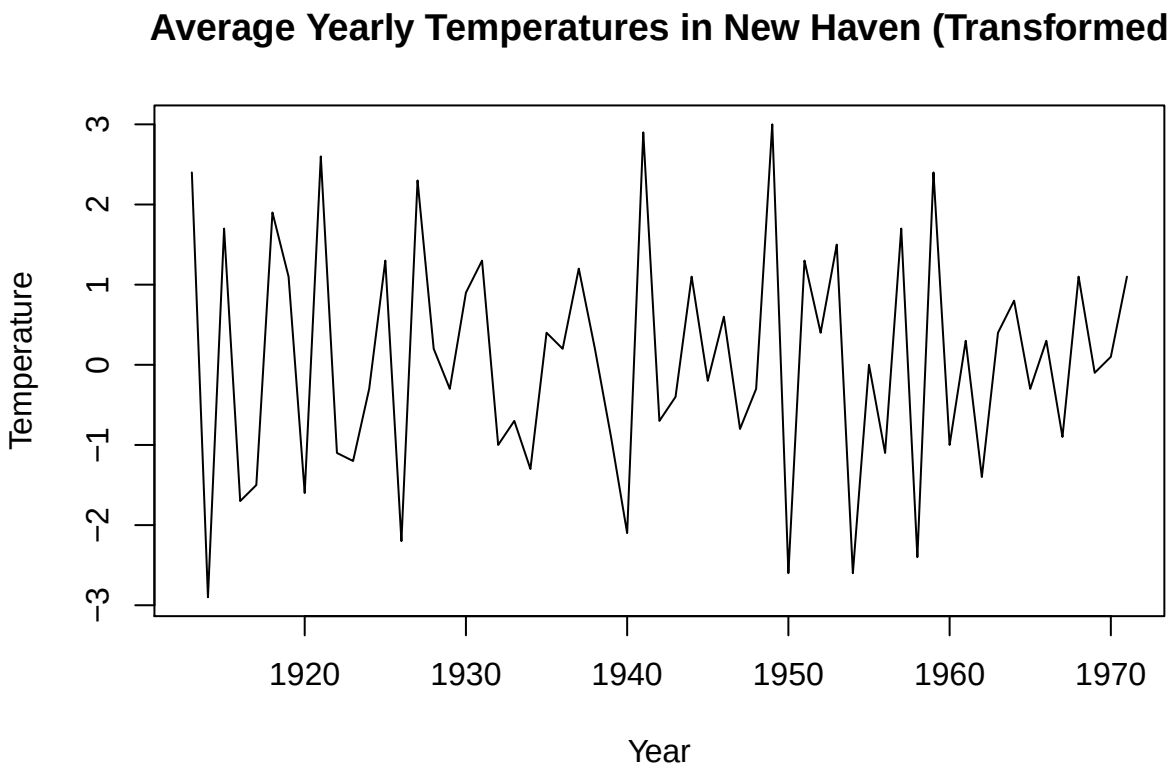
```
plot(nhtemp, xlab = "Year", ylab = "Temperature",
     main = "Average Yearly Temperatures in New Haven")
```



- Identify any trend or seasonality or both in your data.
  I see a slight upward linear trend present in these data. I don't see any evidence of seasonality/period in these data.

- Transform the data into a stationary process and plot the transformed data

```
nhtemp_st <- diff(nhtemp, differences = 1)
plot(nhtemp_st, xlab = "Year", ylab = "Temperature",
     main = "Average Yearly Temperatures in New Haven (Transformed")
```



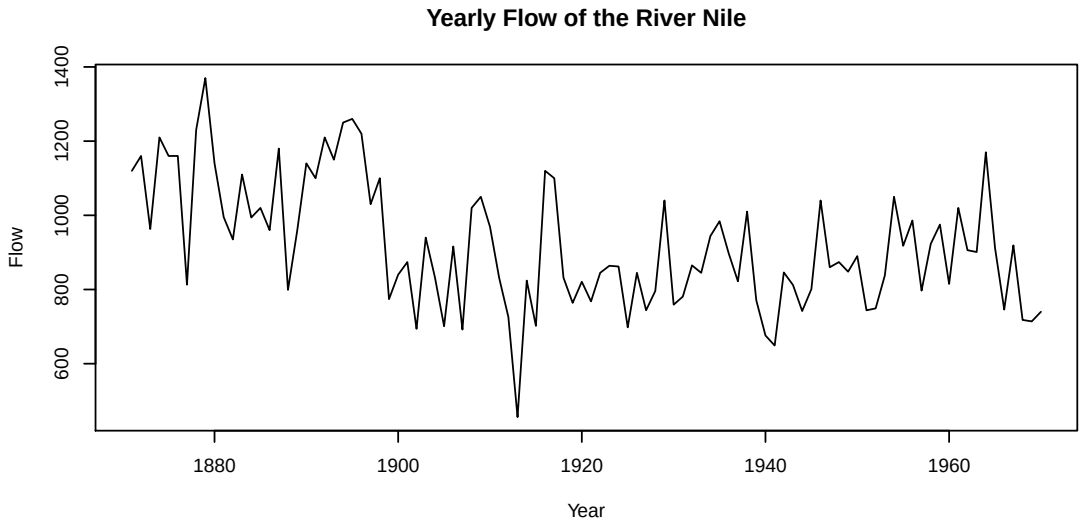
2. Consider the Nile and the JohnsonJohnson data in R Datasets package. For each one of the two:

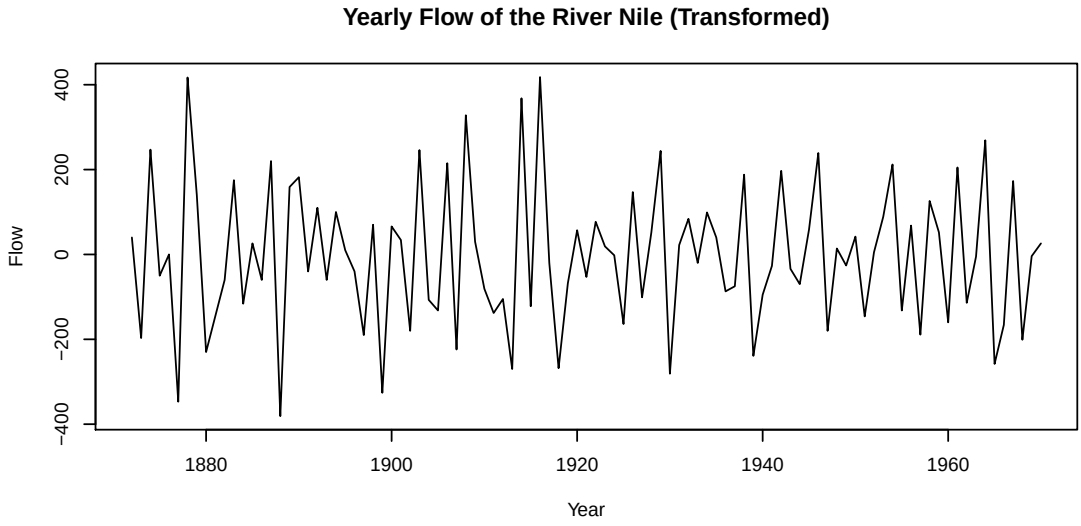
- Transform the original time series into a stationary process.
- Plot the original data, transformed data, and the sample ACF of the transformed data on one page.

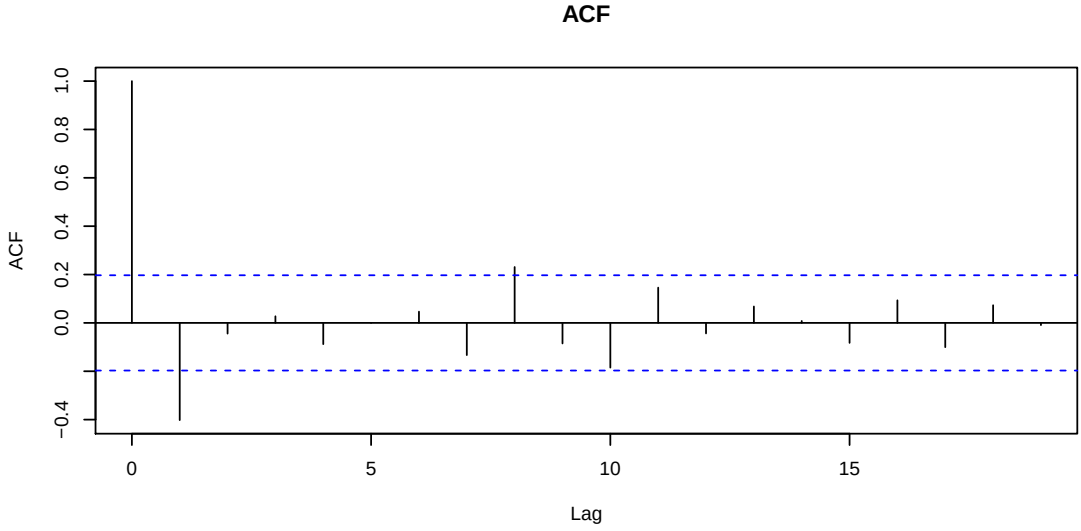
Nile data

- Transform into stationary process.
- Plots

```
Nile_st <- diff(Nile, differences = 1)
par(mfrow = c(3,1))
plot(Nile, main = "Yearly Flow of the River Nile", xlab = "Year", ylab = "Flow")
plot(Nile_st, main = "Yearly Flow of the River Nile (Transformed)", xlab = "Year", ylab = "Flow")
acf(Nile_st, main = "ACF")
```


Yearly Flow of the River Nile
Flow
600
800
1000
1200
1400
1880
1900
1920
1940
1960
Year


Yearly Flow of the River Nile (Transformed)
Flow
−400
−200
0
200
400
1880
1900
1920
1940
1960
Year

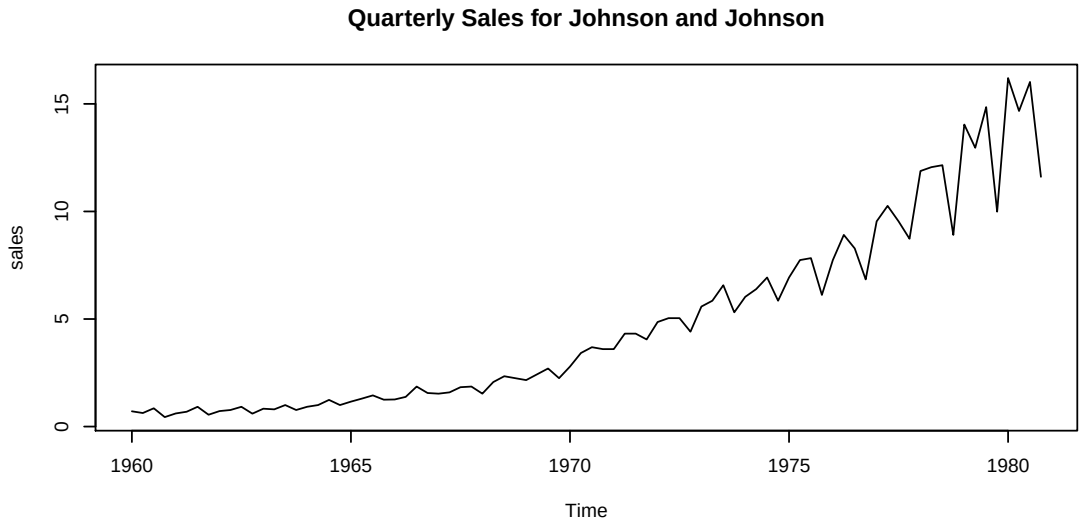

ACF
ACF
−0.4
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
Lag

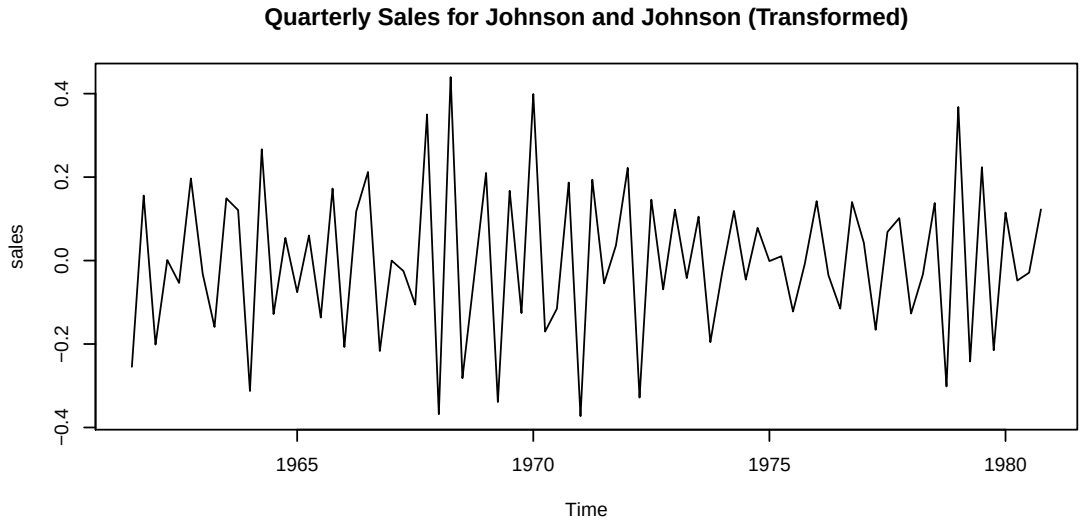
JohnsonJohnson data

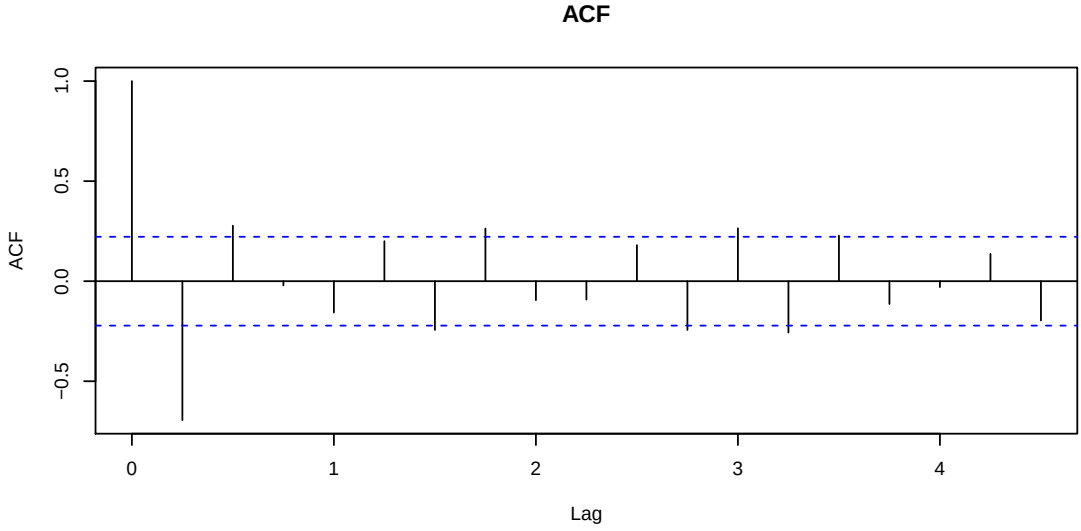
- Transform into stationary process.

- Plots

```
par(mfrow = c(3,1))
plot(JohnsonJohnson, main = "Quarterly Sales for Johnson and Johnson", ylab = "sales")
lnJJ <- log(JohnsonJohnson)
lnJJ_st1 <- diff(lnJJ, diff = 2)
lnJJ_st2 <- diff(lnJJ_st1, lag = 4)
plot(lnJJ_st2, main = "Quarterly Sales for Johnson and Johnson (Transformed)", ylab = "sales")
acf(lnJJ_st2, main = "ACF")
```


Quarterly Sales for Johnson and Johnson
sales
0
5
10
15
1960
1965
1970
1975
1980
Time


Quarterly Sales for Johnson and Johnson (Transformed)
sales
−0.4
−0.2
0.0
0.2
0.4
1965
1970
1975
1980
Time


ACF
ACF
−0.5
0.0
0.5
1.0
0
1
2
3
4
Lag