Forecasting, Homework 2

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Set working directory

```
setwd("~/MSEA2022/Spring 2022/ECON 5753, Forecasting")
```

Import packages and install them if necessary

```
list.of.packages <- c("tidyverse", "caTools", "pastecs", "ggplot2")
new.packages <- list.of.packages[!(list.of.packages %in% installed.packages()[,"Package"])]
if(length(new.packages)) install.packages(new.packages)
library(tidyverse)
library(caTools)
library(pastecs)
library(ggplot2)
```

Import data

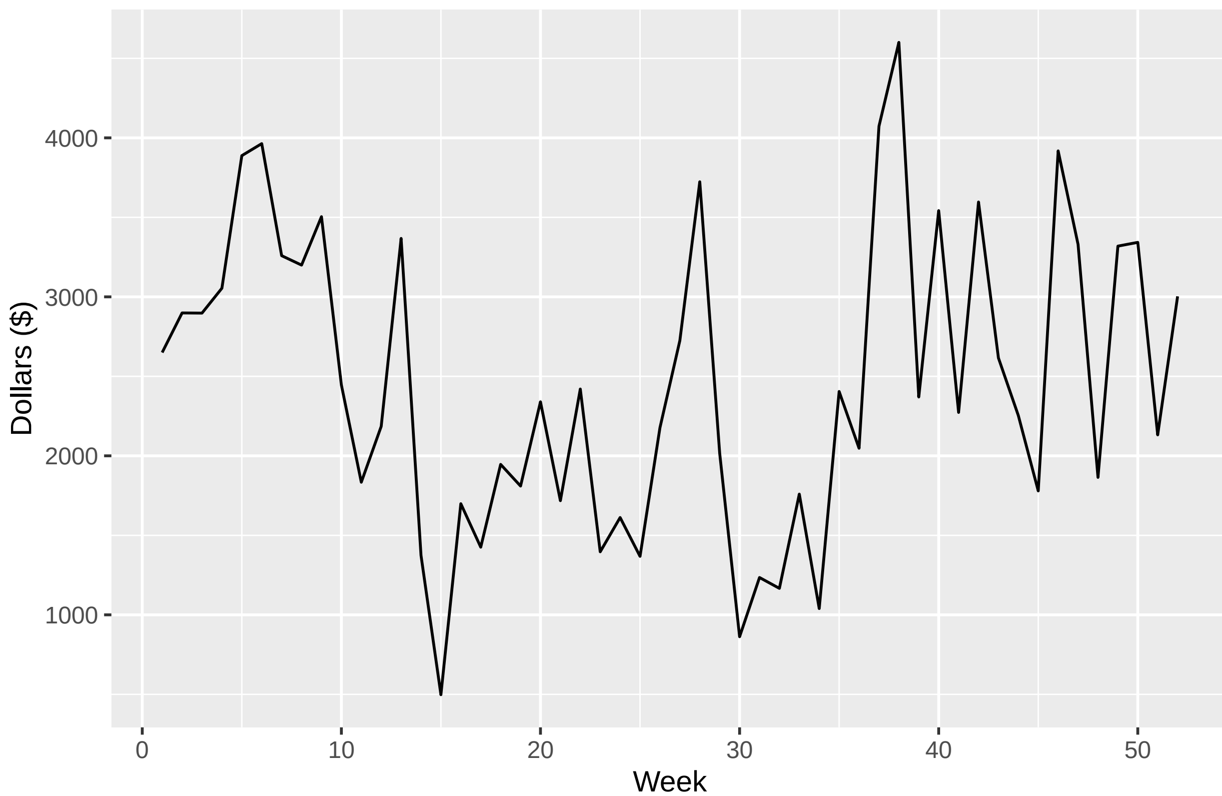
```
df = read.csv("Data/tablep21_hw2.csv")
```

1) Plot the sales data as a time series. Figure 1.

```
fig1 <- ggplot2::ggplot(df, aes(x=week, y=sales)) +
  geom_line() +
  xlab("Week") +
  ylab("Dollars ($)") +
  ggtitle("Figure 1: Sales Data as a Time Series")

fig1
```

Figure 1: Sales Data as a Time Series



2) Do you think this series is stationary or nonstationary? Explain.

I believe that the series is ________.

3) Compute the autocorrelation coefficients of the sales series for the first 10 time lags. Is the behavior of the autocorrelation consistent with your conclusion of part 2? Explain.

```
# Ask R if the data is time series or not
is.ts(df$sales)
```

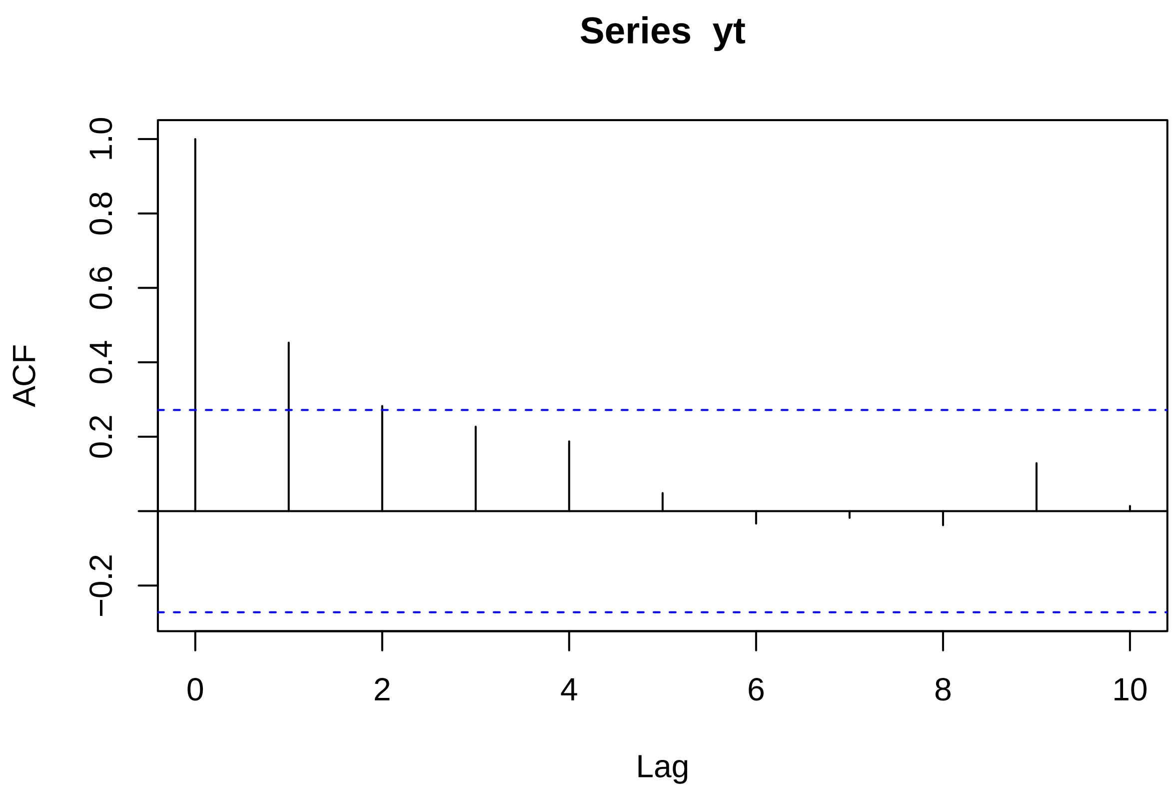
```
## [1] FALSE
```

```
# Change to time series data
yt <- ts(df$sales, start = 1, frequency = 1)

# Ask R if the new yt variable is time series or not
is.ts(yt)
```

```
## [1] TRUE
```

```r
# Autocorrelation function
rho <- acf(yt, lag.max = 10)
```




```r
rho
```

```
##
## Autocorrelations of series 'yt', by lag
##
##      0      1      2      3      4      5      6      7      8      9     10
##  1.000  0.453  0.283  0.227  0.188  0.049 -0.033 -0.018 -0.038  0.129  0.014
```

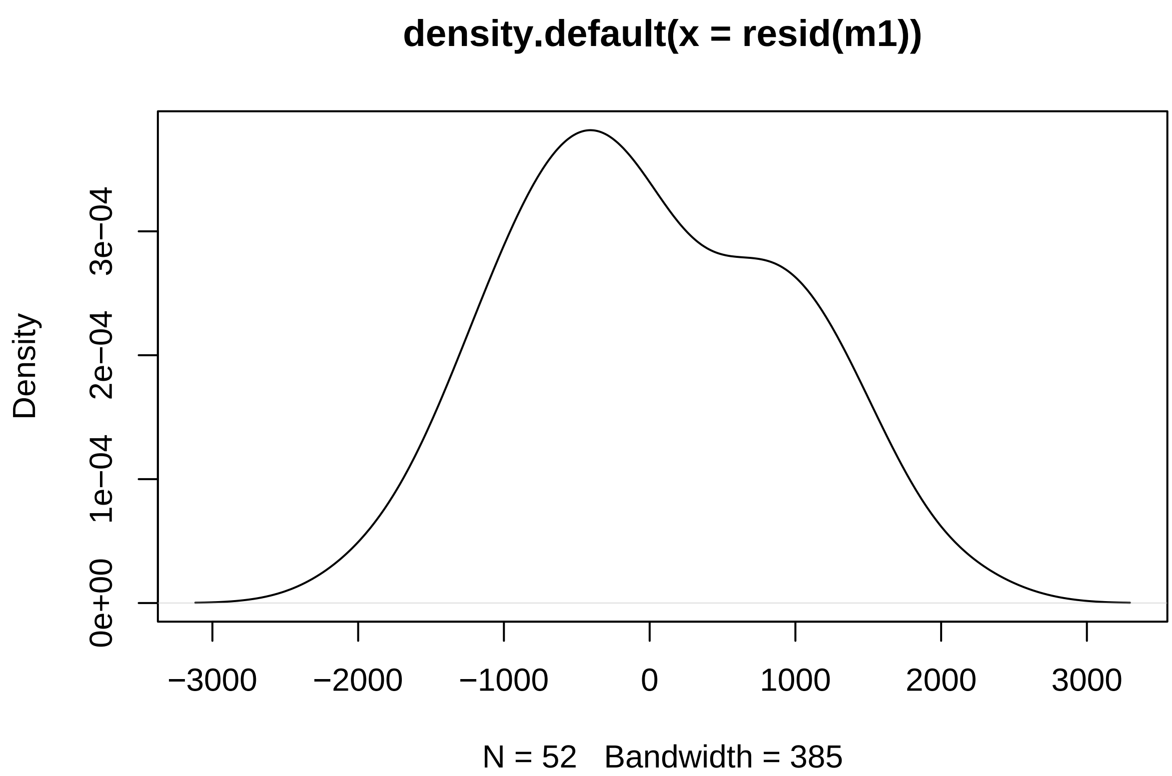
5) Fit a random model and compute residual

```r
m1 <- lm(sales ~ 1, data = df)  # Create a linear model
resid(m1) # List of residuals
```

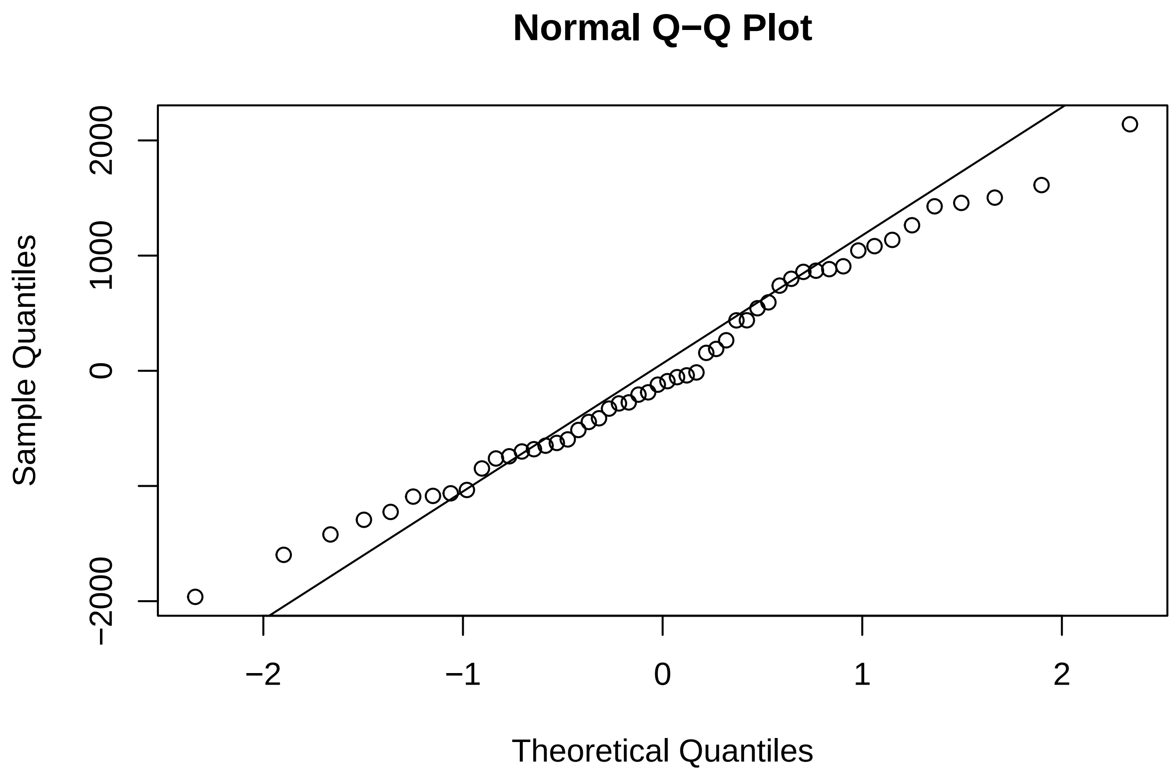
```
##           1           2           3           4           5           6
##   189.84423   438.64423   437.74423   594.24423  1428.04423  1503.54423
##           7           8           9          10          11          12
##   798.84423   739.54423  1044.24423   -14.15577  -626.15577  -274.65577
##          13          14          15          16          17          18
##   907.34423 -1085.95577 -1962.55577  -761.05577 -1034.65577  -513.85577
```

```
##          19          20          21          22          23          24
##  -650.15577  -120.15577  -742.15577   -39.75577 -1063.55577  -847.95577
##          25          26          27          28          29          30
## -1092.15577  -283.25577   264.94423  1263.64423  -444.05577 -1597.85577
##          31          32          33          34          35          36
## -1225.15577 -1293.55577  -700.55577 -1420.65577   -55.25577  -412.25577
##          37          38          39          40          41          42
##  1612.54423  2140.44423   -89.95577  1082.24423  -187.05577  1136.54423
##          43          44          45          46          47          48
##   155.74423  -206.75577  -680.65577  1457.84423   869.24423  -595.65577
##          49          50          51          52
##   858.84423   882.54423  -328.15577   543.14423
```

```
plot(density(resid(m1))) # A density plot
```

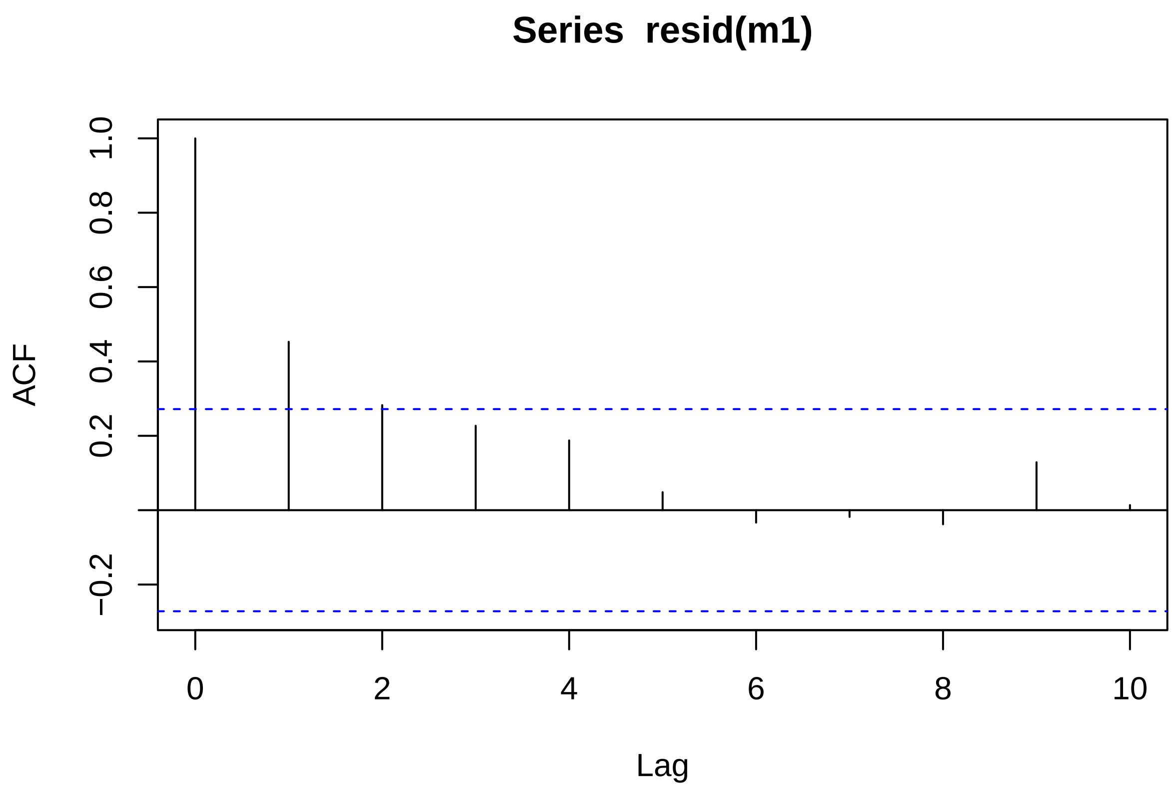



```
qqnorm(resid(m1)) # A quantile normal plot - good for checking normality
qqline(resid(m1))
```



6) Compute the autocorrelation function of epsilon_t for the first 10 time lags

```
rho2 <- acf(resid(m1), lag.max = 10)
```




```
rho2
```

```
##
## Autocorrelations of series 'resid(m1)', by lag
##
##      0      1      2      3      4      5      6      7      8      9     10
##  1.000  0.453  0.283  0.227  0.188  0.049 -0.033 -0.018 -0.038  0.129  0.014
```