

STAT 443: Lab 8

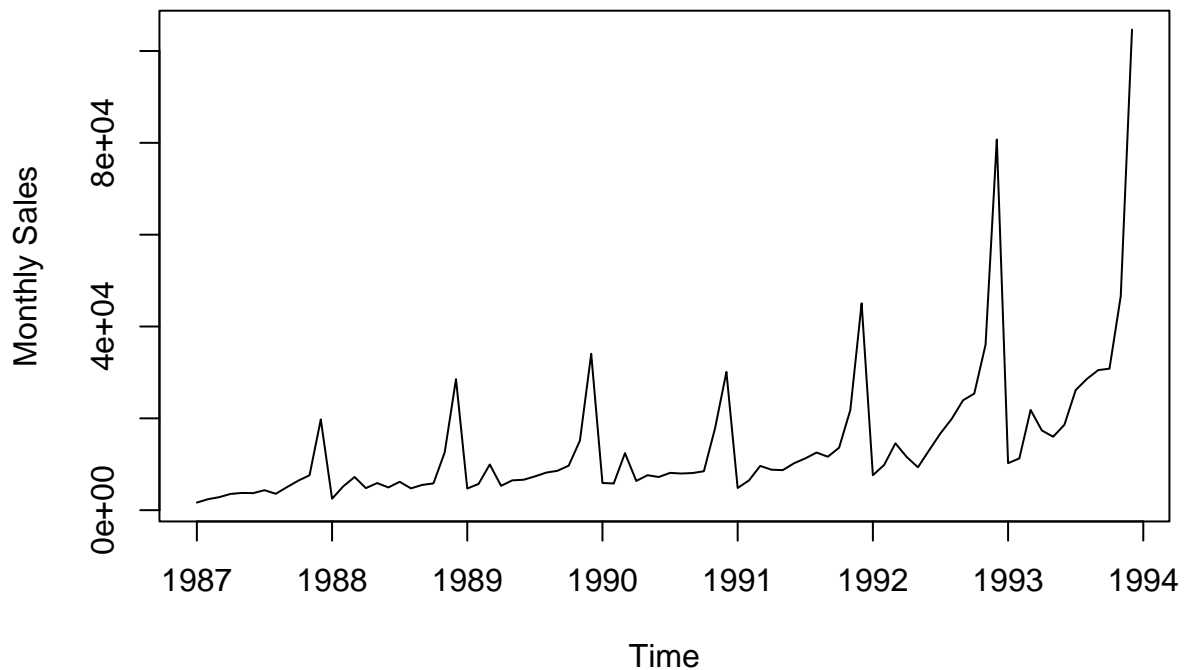
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Question 1

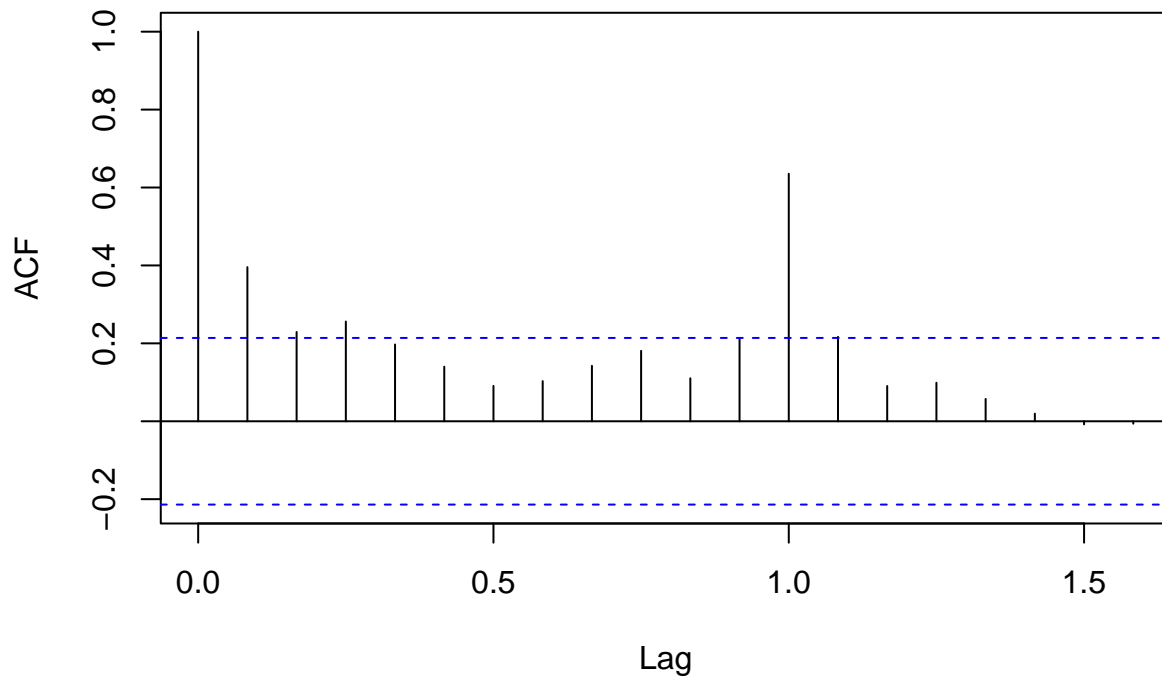
```
data <- read.csv("souvenir.txt", header = FALSE)
colnames(data) <- c("Monthly Sales")
sales_ts <- ts(data, start = c(1987,1), frequency = 12)
training_data <- window(sales_ts, start = c(1987,1), end = c(1993,1))
testing_data <- window(sales_ts, start = c(1987,2), end = c(1993,12))
plot(sales_ts,
     ylab = "Monthly Sales",
     main = "Time Series Plot for Monthly Sales Data")
```

Time Series Plot for Monthly Sales Data



```
acf(sales_ts,
    main = "Sample acf Values for Monthly Sales Data")
```

Sample acf Values for Monthly Sales Data

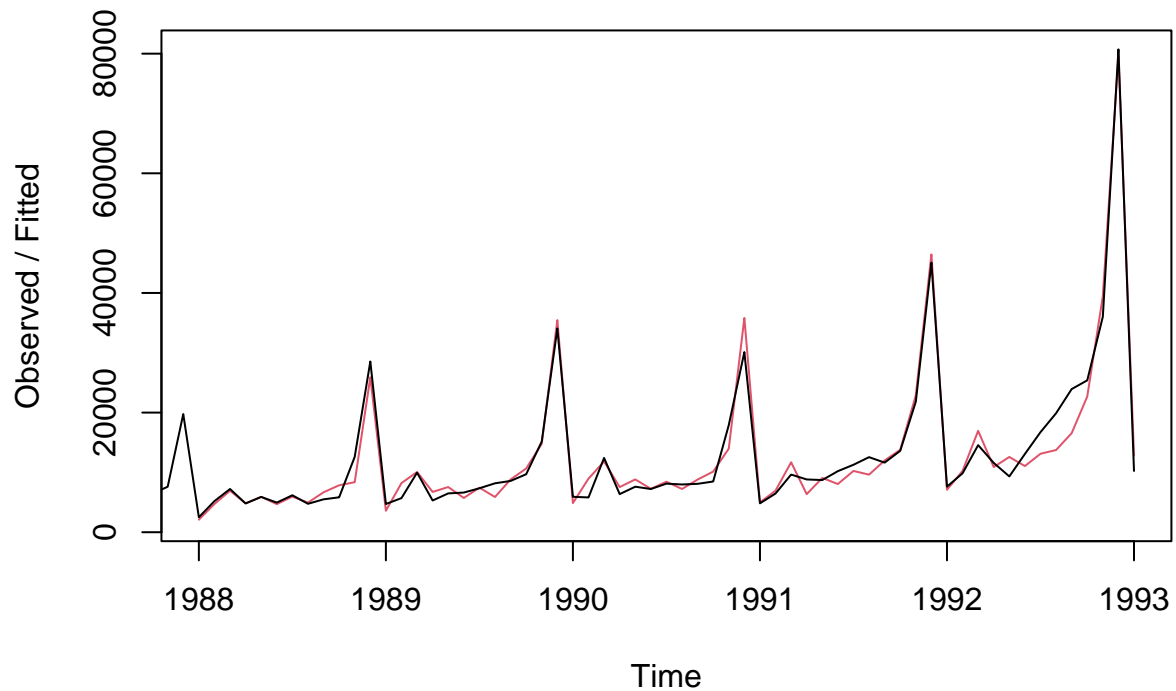


Looking at the time series plot, there is clear seasonal variation and an upward trend , and the variation seems to be increasing with time. So I would suggest a multiplicative model.

Question 2

```
HWmodel <- HoltWinters(training_data,seasonal = "multiplicative")
plot(HWmodel)
```

Holt-Winters filtering



HWmodel

```
## Holt-Winters exponential smoothing with trend and multiplicative seasonal component.
##
## Call:
## HoltWinters(x = training_data, seasonal = "multiplicative")
##
## Smoothing parameters:
##   alpha: 0.3746875
##   beta : 0.04573451
##   gamma: 0.4522636
##
## Coefficients:
##           [,1]
## a  2.579865e+04
## b  4.953699e+02
## s1  6.159633e-01
## s2  9.869614e-01
## s3  7.026077e-01
## s4  7.061663e-01
## s5  7.761045e-01
## s6  8.690603e-01
## s7  8.417587e-01
## s8  8.517196e-01
## s9  9.110375e-01
## s10 1.398782e+00
## s11 2.943041e+00
## s12 4.312388e-01
```

The estimated parameter values from the model are:

$$\alpha = 0.375, \beta = 0.046, \gamma = 0.452$$

Question 3