DSE511_HW6

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2024-12-09

```
# Install and load required packages
if (!require("ggplot2")) install.packages("ggplot2", quiet = TRUE)
```

```
## Loading required package: ggplot2
```

```
if (!require("forecast")) install.packages("forecast", quiet = TRUE)
```

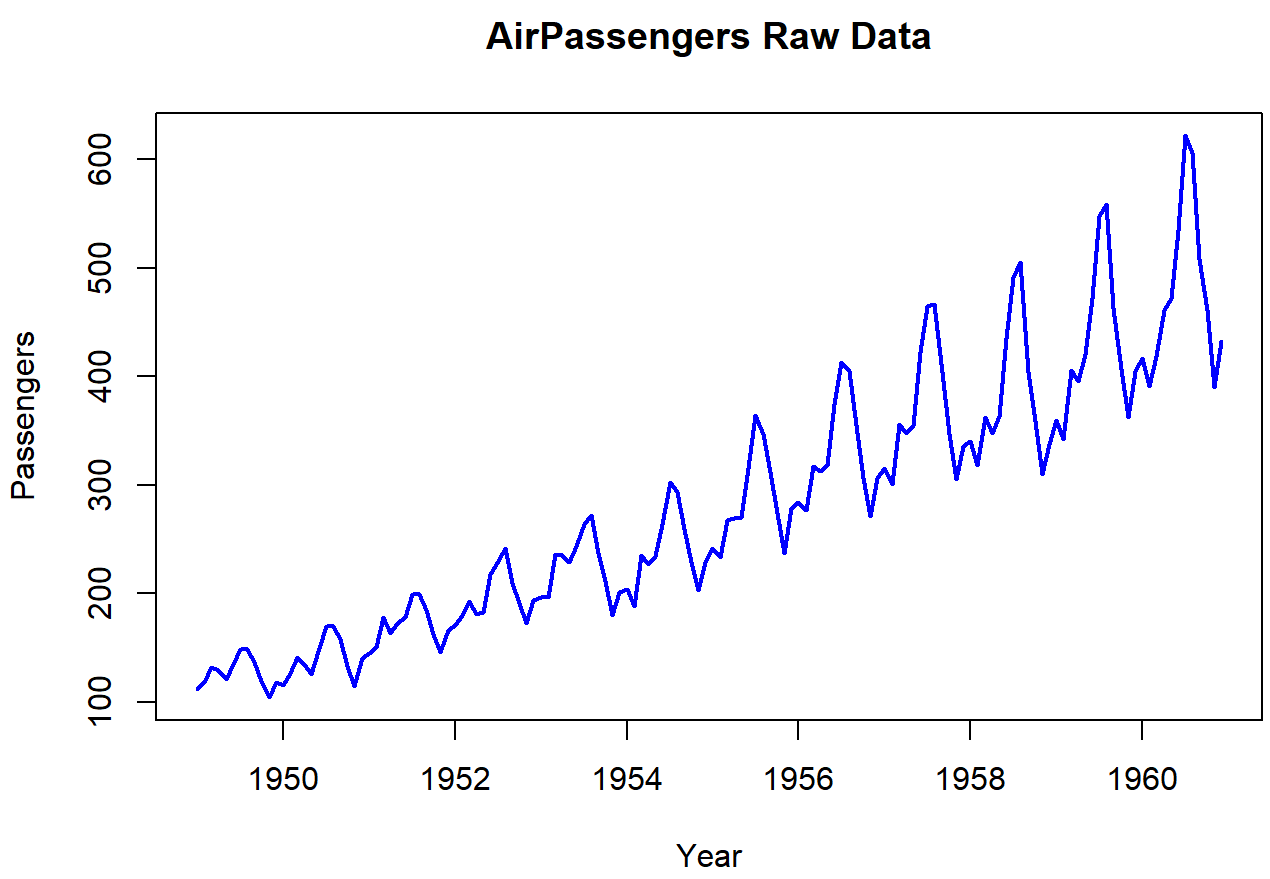
```
## Loading required package: forecast
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
if (!require("tseries")) install.packages("tseries", quiet = TRUE)
```

```
## Loading required package: tseries
```

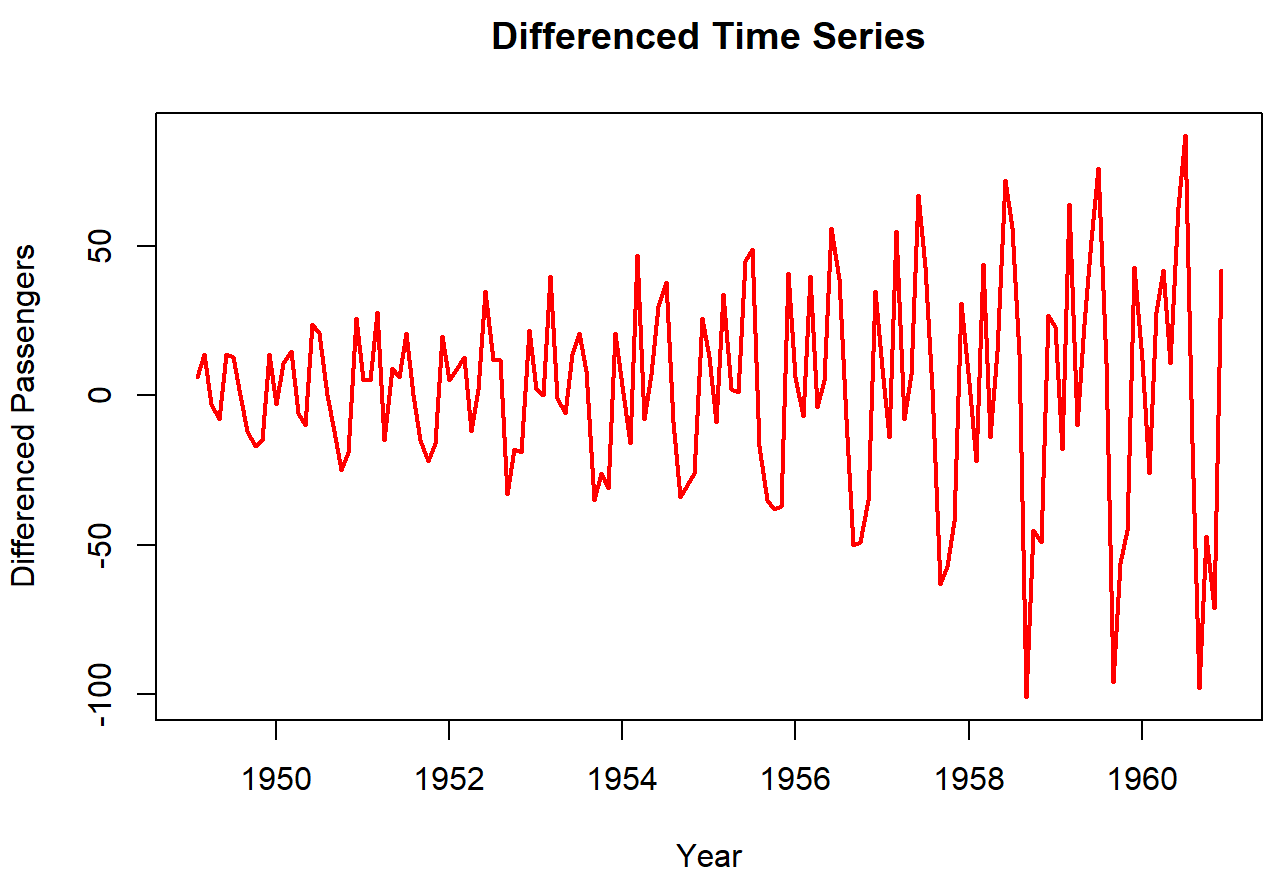
```
library(ggplot2)
library(forecast)
library(tseries)

# Load the built-in AirPassengers dataset
data("AirPassengers")
ts_data <- AirPassengers

# Plot the raw time series
plot(ts_data, ylab = "Passengers", xlab = "Year", col = "blue", lwd = 2)
title(main = "AirPassengers Raw Data")
```




```
# Perform ADF test
adf_test <- adf.test(ts_data, alternative = "stationary")
cat("ADF Test p-value (ts_data):", adf_test$p.value, "\n")
```

```
## ADF Test p-value (ts_data): 0.01
```

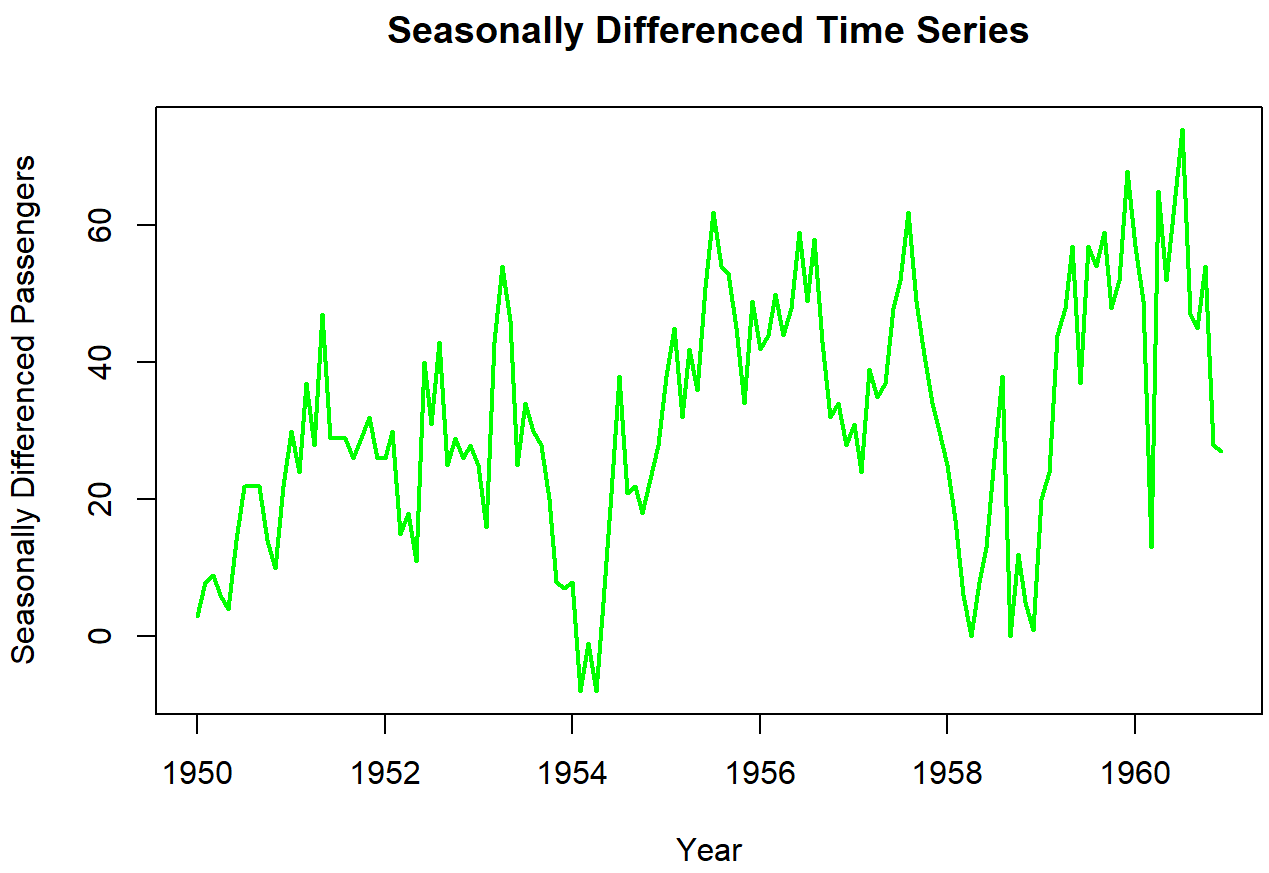
```
# Take the first difference
diff_data <- diff(ts_data)

# Plot the differenced data
plot(diff_data, ylab = "Differenced Passengers", xlab = "Year", col = "red", lwd = 2)
title(main = "Differenced Time Series")
```



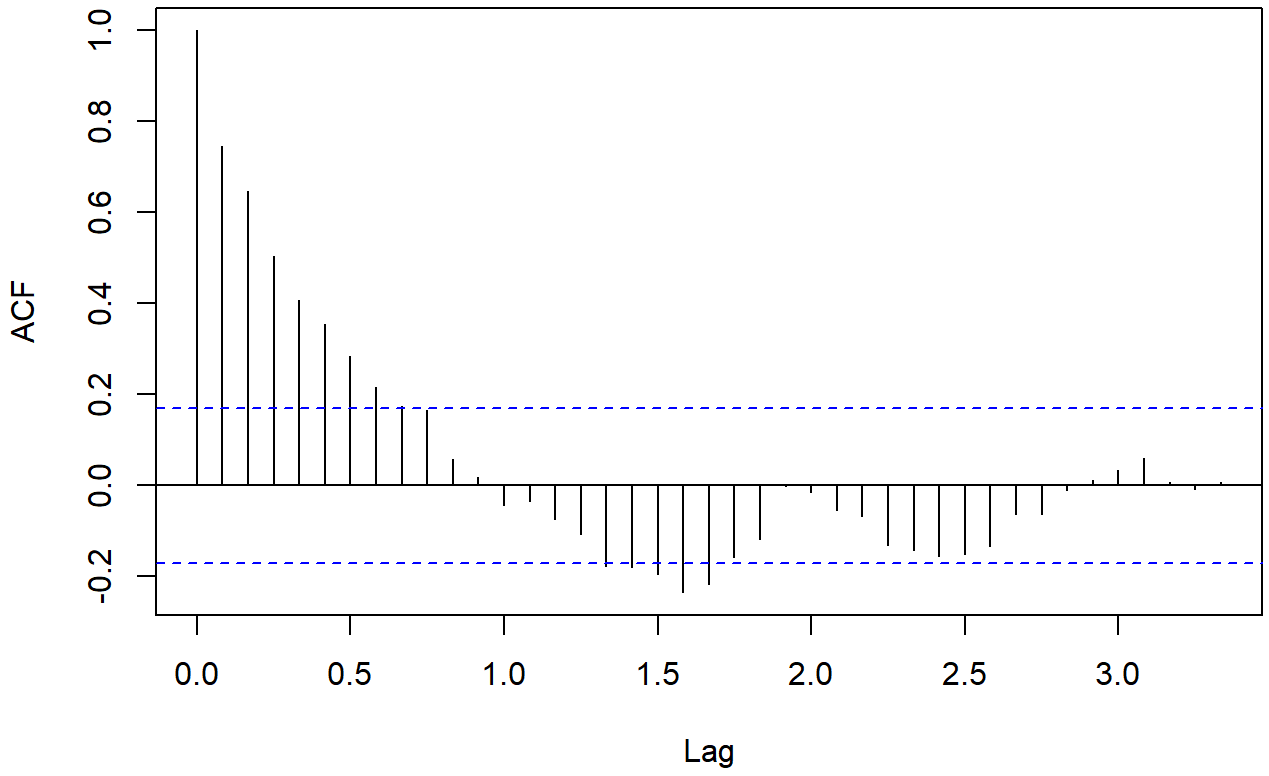

```
# Perform ADF test on differenced data
adf_test_diff <- adf.test(diff_data, alternative = "stationary")
cat("ADF Test p-value (differenced data):", adf_test_diff$p.value, "\n")
```

```
## ADF Test p-value (differenced data): 0.01
```

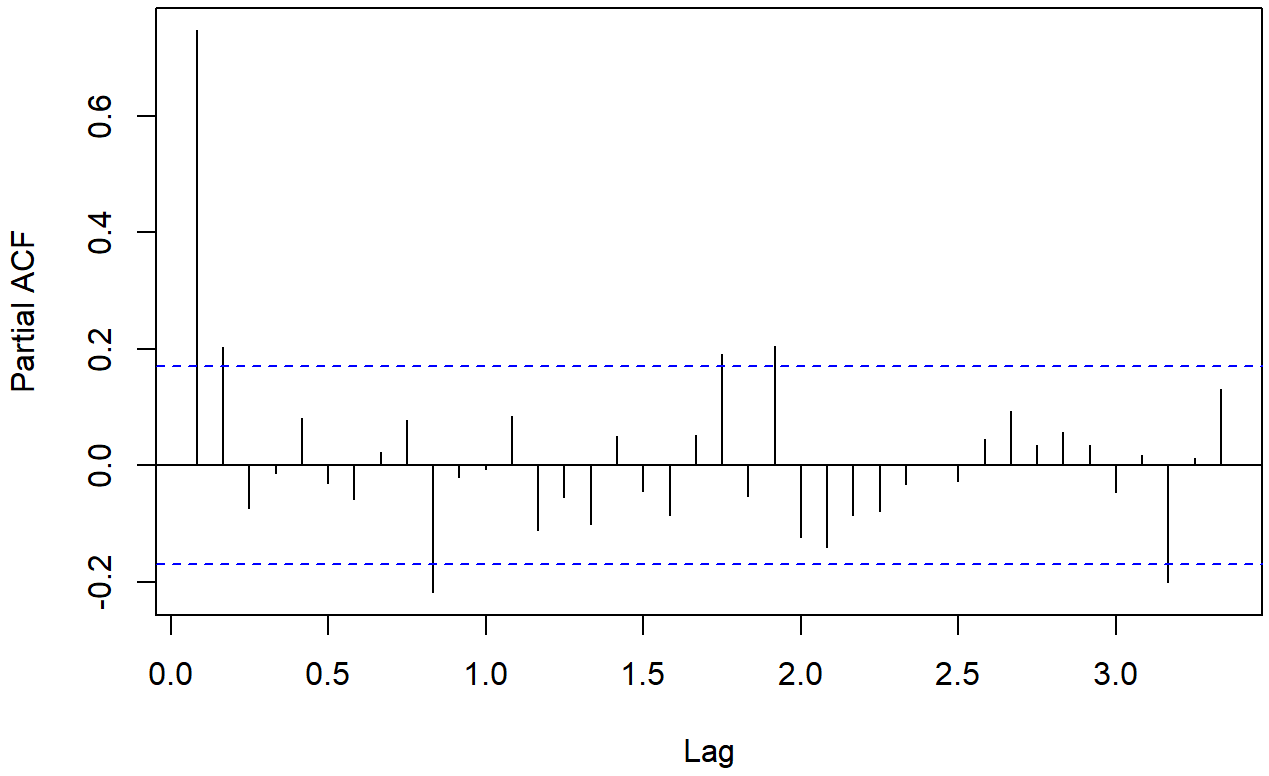
```
# Apply seasonal differencing
seasonal_diff <- diff(ts_data, lag = 12)

# Plot seasonally differenced data
plot(seasonal_diff, ylab = "Seasonally Differenced Passengers", xlab = "Year", col = "green", lw
d = 2)
title(main = "Seasonally Differenced Time Series")
```




```
# Plot ACF and PACF for seasonally differenced data
acf(seasonal_diff, lag.max = 40, main = "ACF of Seasonally Differenced Series")
```




```
pacf(seasonal_diff, lag.max = 40, main = "PACF of Seasonally Differenced Series")
```


PACF of Seasonally Differenced Series
Partial ACF
0.6
0.4
0.2
0.0
-0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Lag