Assignment 5

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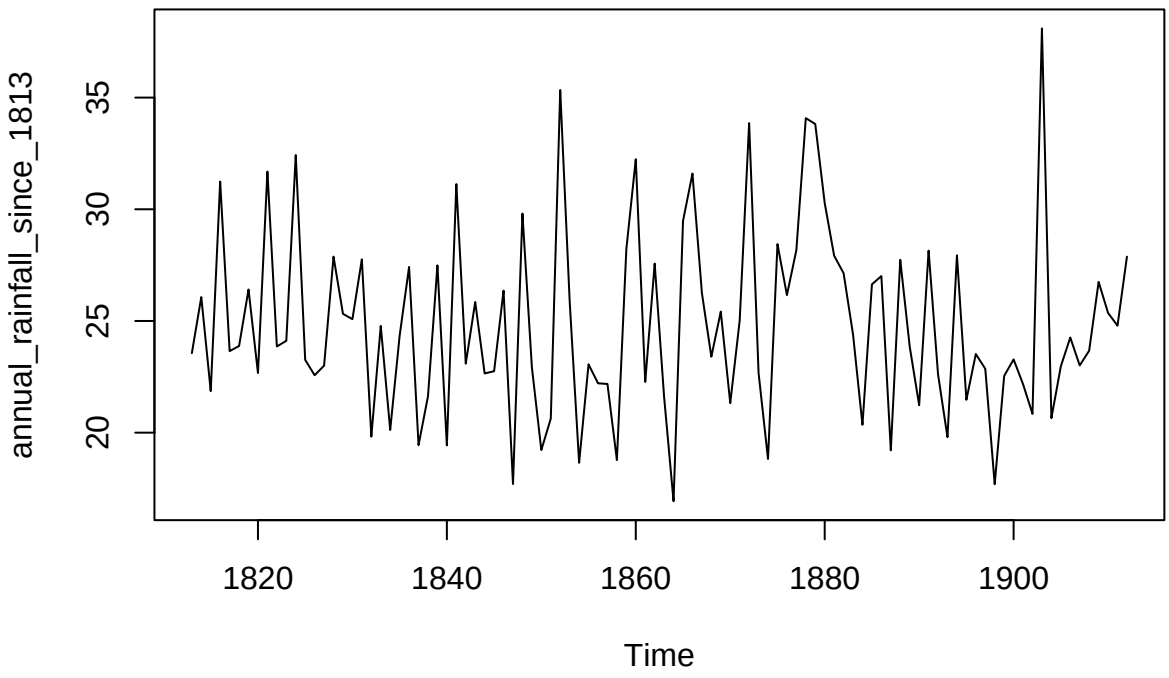
1. Run the codes in the slides to reproduce the results.

Rainfall data: Constant level (no trend) and no seasonality

```
rainfall <- read.csv("https://bryantstats.github.io/math475/slides/rainfall_london.csv")

# install.packages("forecast")
library(forecast)
```

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

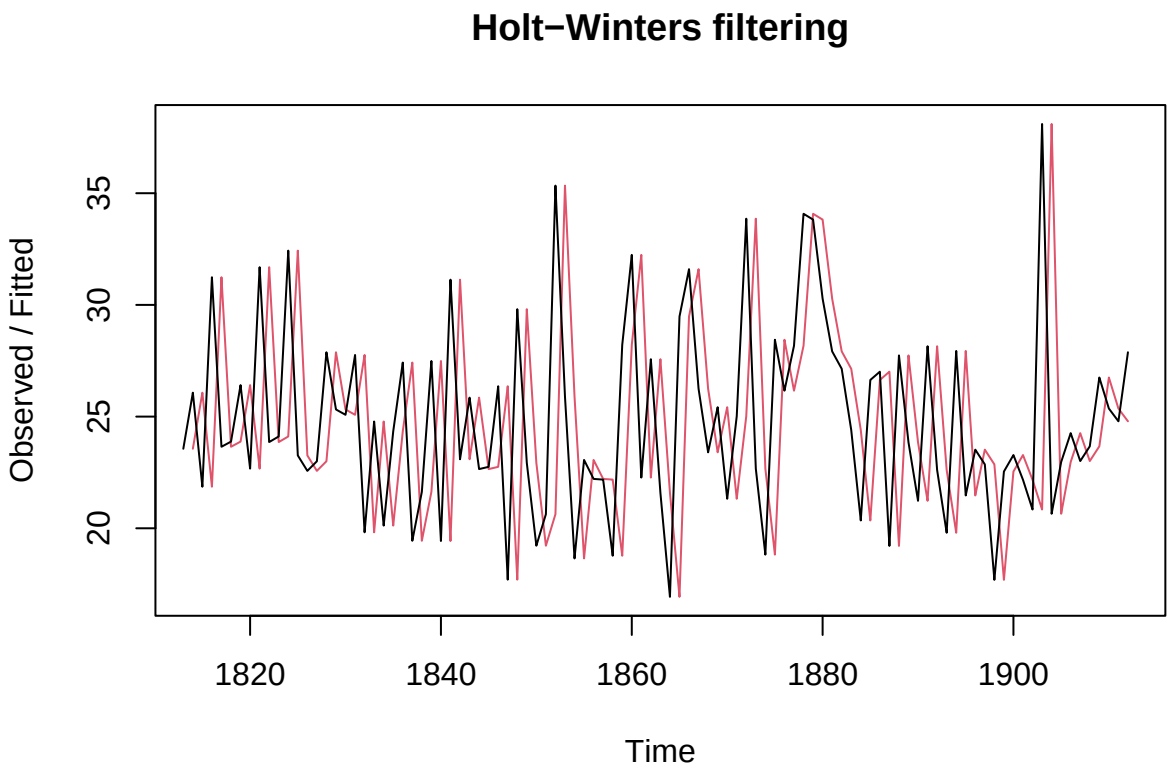
```
#forecasting with single exponential smoothing
ts1 <- ts(rainfall,start=c(1813))
plot(ts1)
```




```
#making forecast
ts1_forecast <- HoltWinters(ts1, alpha=TRUE,
                            beta=FALSE,
                            gamma=FALSE)
ts1_forecast
```

```
## Holt-Winters exponential smoothing without trend and without seasonal component.
##
## Call:
## HoltWinters(x = ts1, alpha = TRUE, beta = FALSE, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: TRUE
##  beta : FALSE
##  gamma: FALSE
##
## Coefficients:
##    [,1]
## a 27.88
```

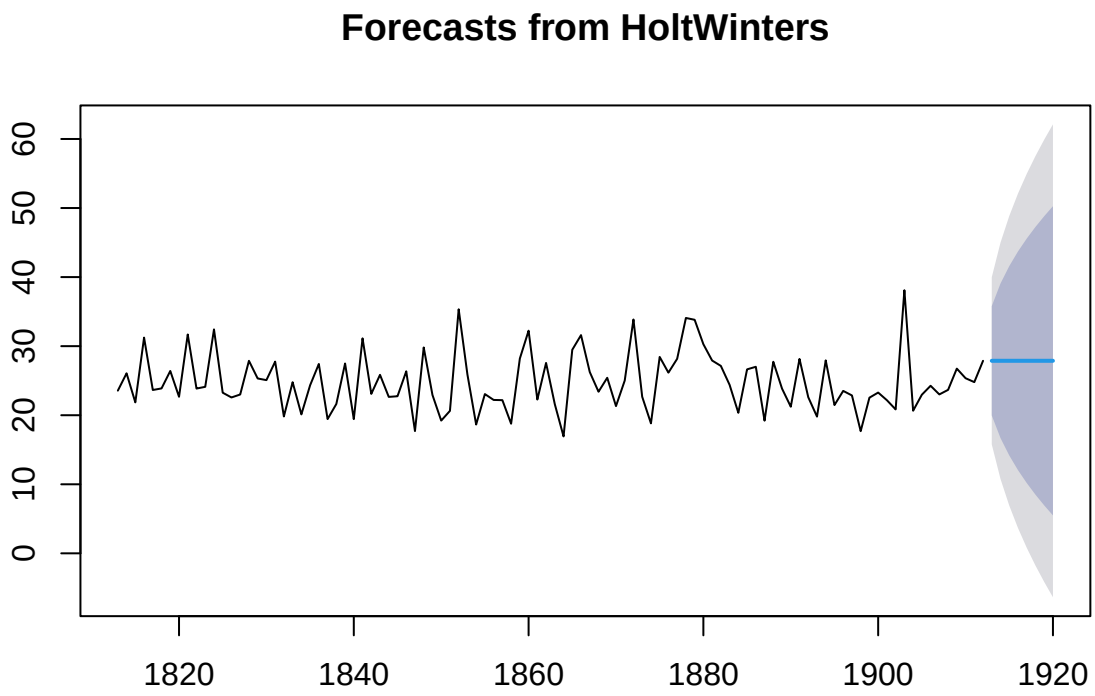
```r
plot(ts1_forecast)
```




```r
#forecasting
ts1_forecast2 <- forecast(ts1_forecast, h=8)
ts1_forecast2
```

```
##      Point Forecast     Lo 80    Hi 80      Lo 95    Hi 95
## 1913          27.88 19.965161 35.79484 15.7752977 39.98470
## 1914          27.88 16.686727 39.07327 10.7613658 44.99863
## 1915          27.88 14.171096 41.58890  6.9140405 48.84596
## 1916          27.88 12.050321 43.70968  3.6705953 52.08940
## 1917          27.88 10.181881 45.57812  0.8130627 54.94694
## 1918          27.88  8.492682 47.26732 -1.7703442 57.53034
## 1919          27.88  6.939303 48.82070 -4.1460321 59.90603
## 1920          27.88  5.493453 50.26655 -6.3572684 62.11727
```

```r
plot(ts1_forecast2)
```



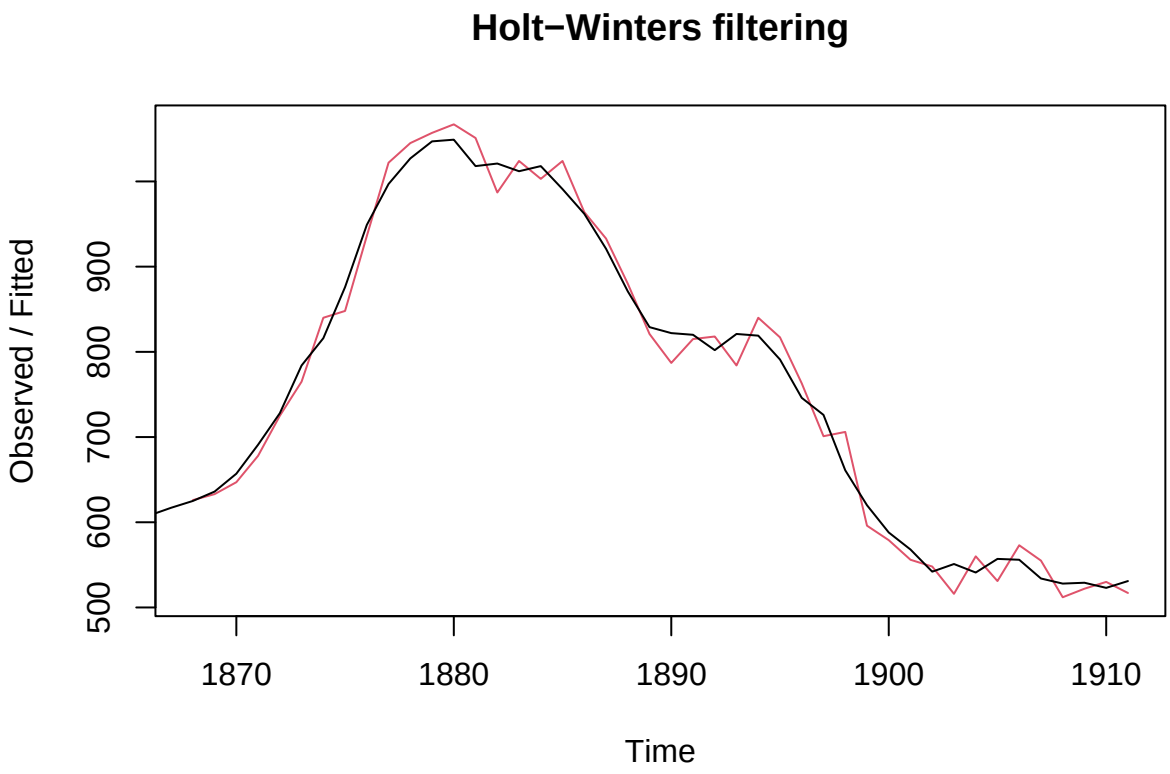
Skirts data: Increasing or decreasing trend and no seasonality

```
skirts <- read.csv("https://bryantstats.github.io/math475/slides/skirts.csv")

#forecasting with single exponential smoothing
ts2 <- ts(skirts,start=c(1866))
plot(ts2)
```

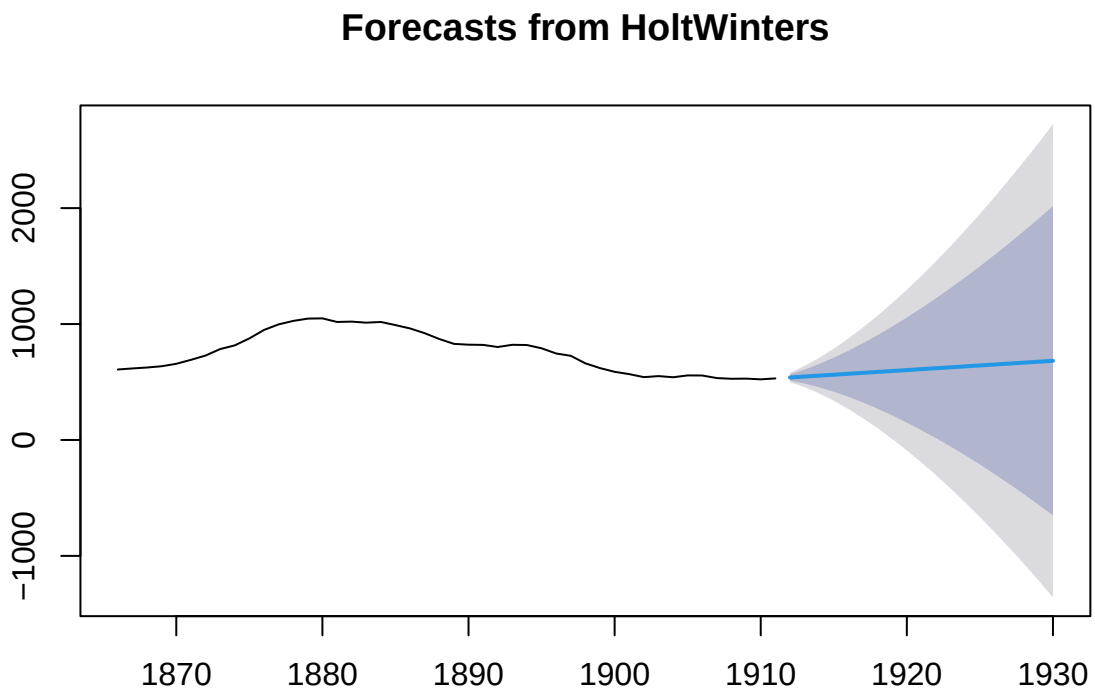

```
#making forecast
ts2_forecast <- HoltWinters(ts2, alpha=TRUE,
                            beta=TRUE,
                            gamma=FALSE)
ts2_forecast
```

```
## Holt-Winters exponential smoothing with trend and without seasonal component.
##
## Call:
## HoltWinters(x = ts2, alpha = TRUE, beta = TRUE, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: TRUE
##  beta : TRUE
##  gamma: FALSE
##
## Coefficients:
##   [,1]
## a  531
## b    8
```

```
plot(ts2_forecast)
```

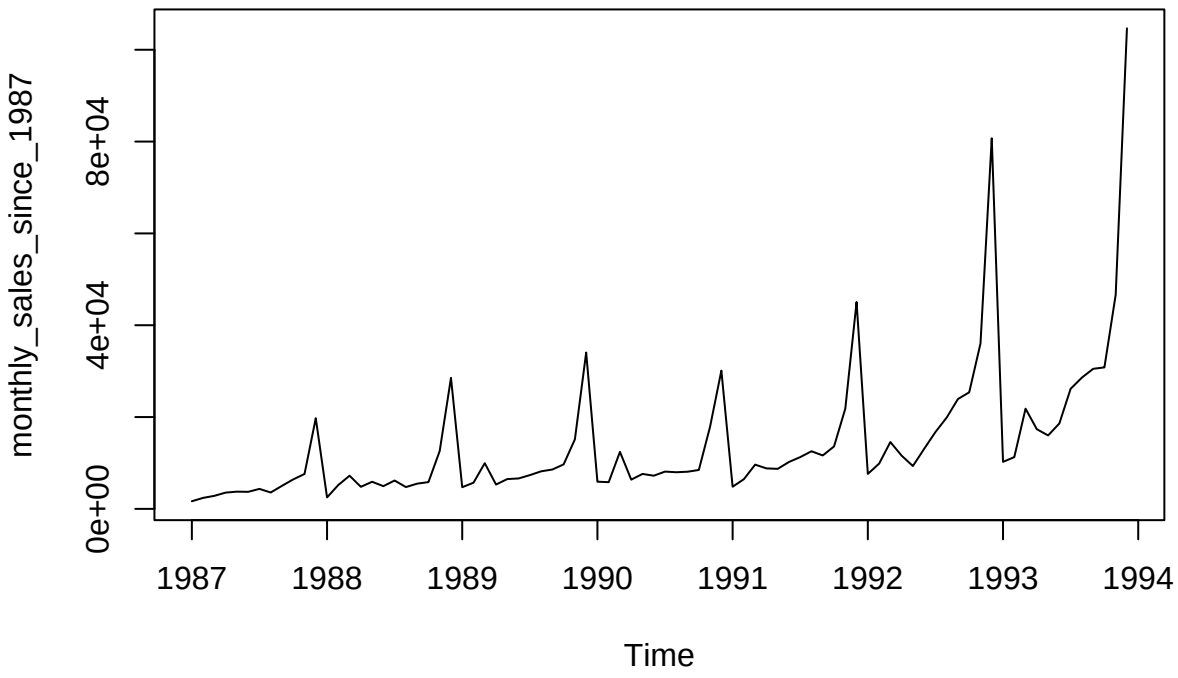



```
#forecasting
ts2_forecast2 <- forecast(ts2_forecast, h=19)
plot(ts2_forecast2)
```

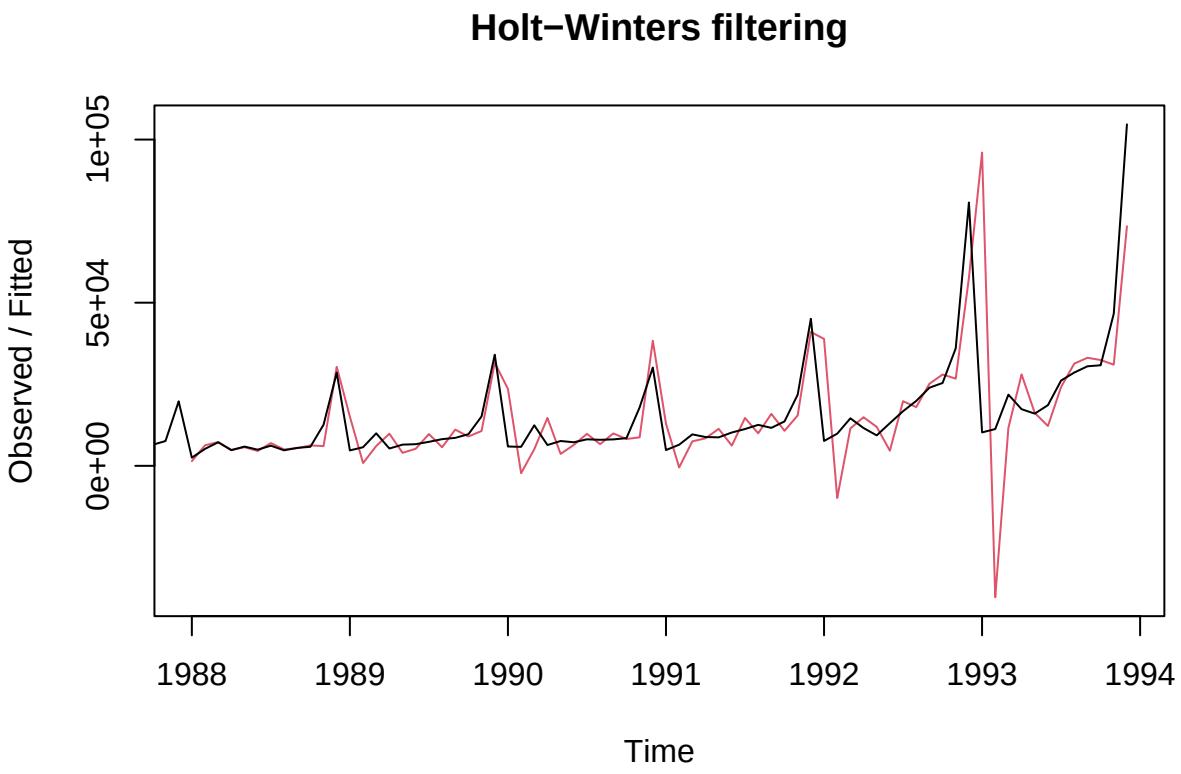


Souvenir data: Increasing or decreasing trend and seasonality

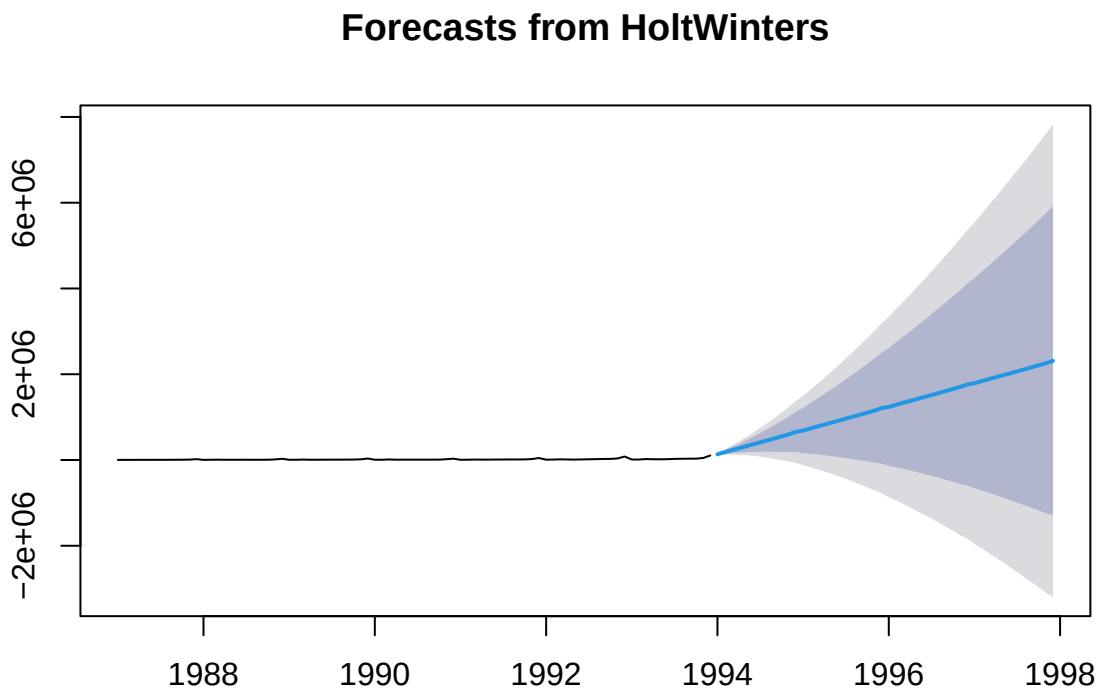
```
souvenir <- read.csv("https://bryantstats.github.io/math475/slides/souvenir.csv")

#forecasting with single exponential smoothing
ts3 <- ts(souvenir, frequency=12, start=c(1987,1))
plot(ts3)
```



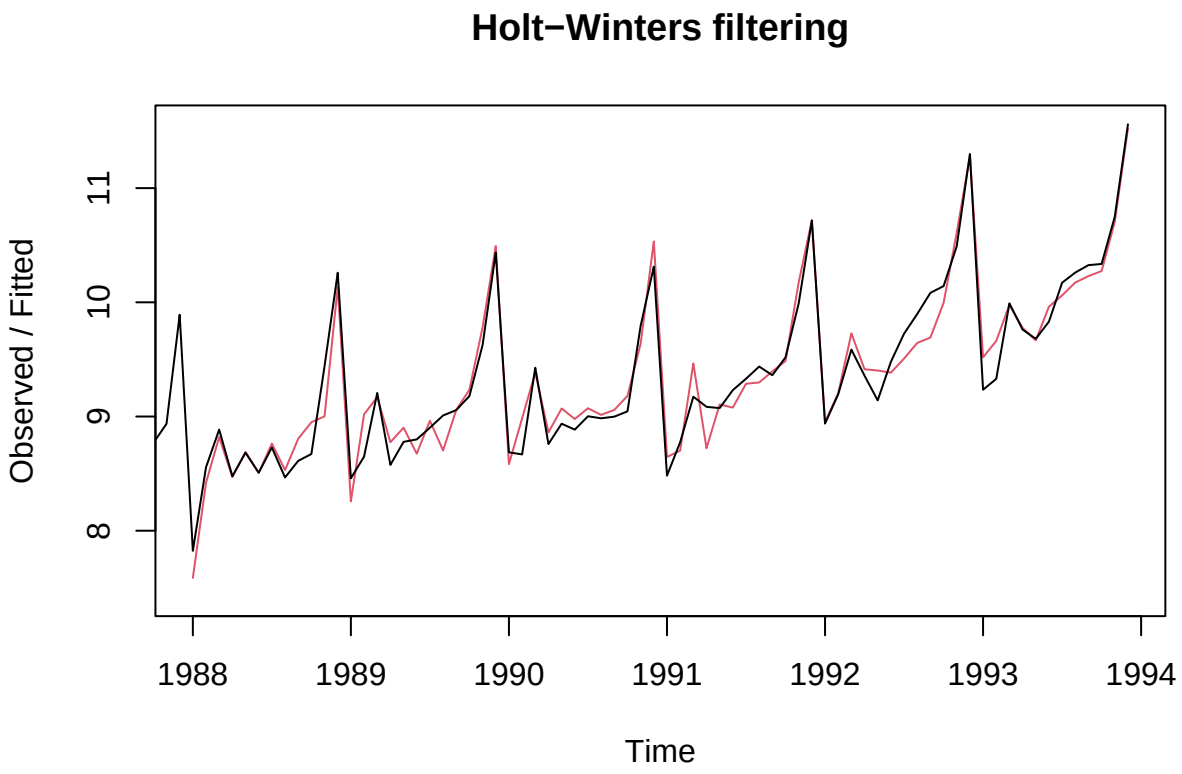

```
#making forecast
ts3_forecasts <- HoltWinters(ts3, alpha=TRUE,
                             beta=TRUE,
                             gamma=TRUE)
plot(ts3_forecasts)
```



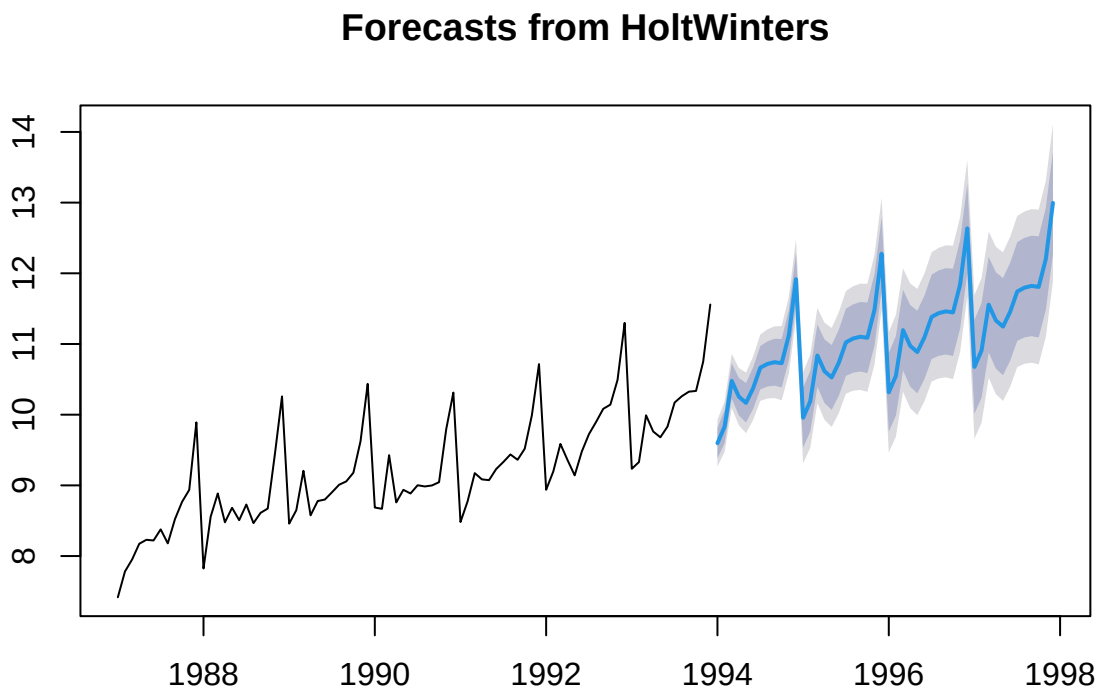

```
#forecasting
ts3_forecasts2 <- forecast(ts3_forecasts, h=48)
plot(ts3_forecasts2)
```




```r
#log(ts3) example
ts3 <- ts(souvenir, frequency=12, start=c(1987,1))
logts3 <- log(ts3)

ts3_forecasts <- HoltWinters(logts3)
plot(ts3_forecasts)
```



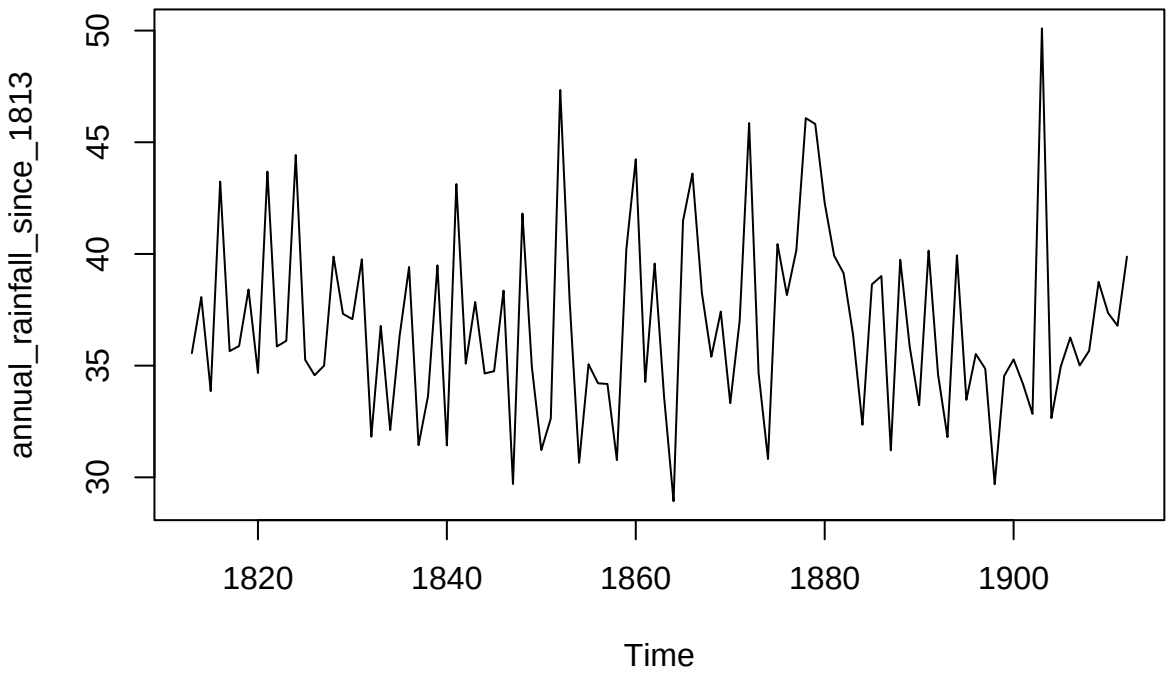

```
ts3_forecasts2 <- forecast(ts3_forecasts, h=48)
plot(ts3_forecasts2)
```



2. Find three examples of the below time series and make forecast using Exponential Smoothing

- Time series with no trend and no seasonality:

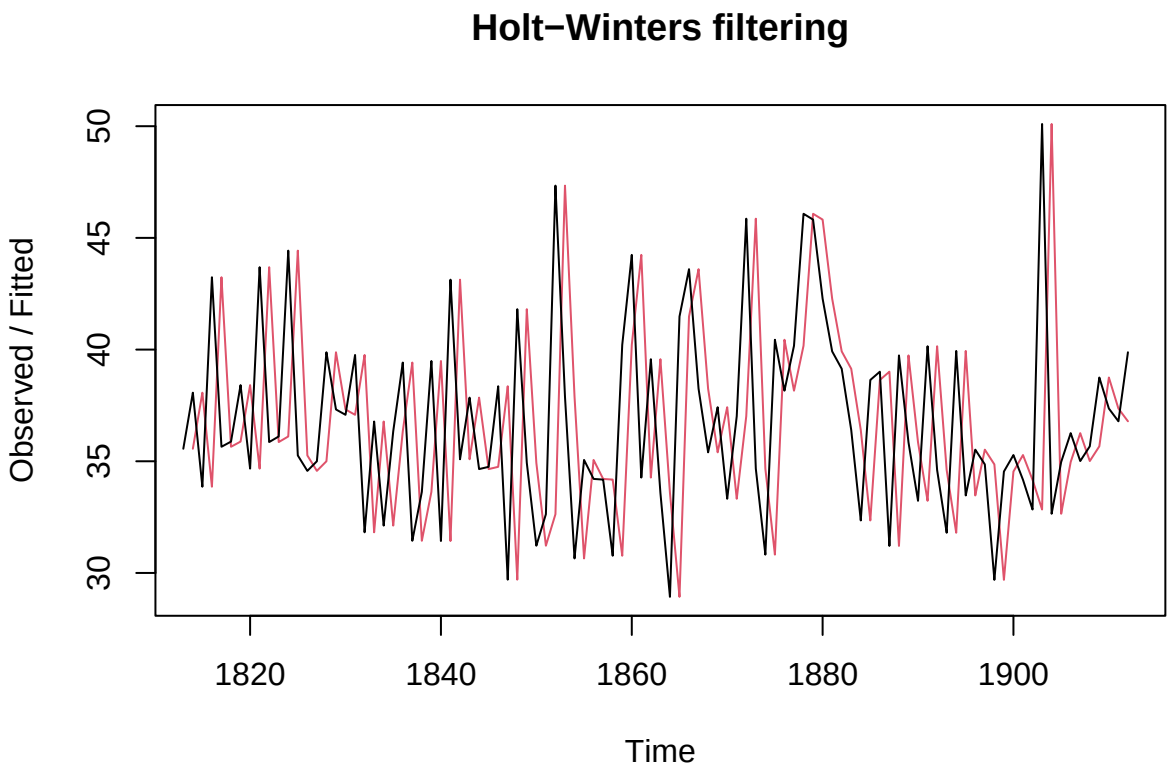
```
library(readxl)
rainfall_brazil <- read_excel("~/Applied Analystics SAS Prog/Assignments/Assignment 5/rainfall_london.x
    sheet = "new_rainfall")

# install.packages("forecast")
library(forecast)

#forecasting with single exponential smoothing
ts1 <- ts(rainfall_brazil,start=c(1813))
plot(ts1)
```




```
#making forecast
ts1_forecast <- HoltWinters(ts1, alpha=TRUE,
                            beta=FALSE,
                            gamma=FALSE)
ts1_forecast
```

```
## Holt-Winters exponential smoothing without trend and without seasonal component.
##
## Call:
## HoltWinters(x = ts1, alpha = TRUE, beta = FALSE, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: TRUE
##  beta : FALSE
##  gamma: FALSE
##
## Coefficients:
##    [,1]
## a 39.88
```

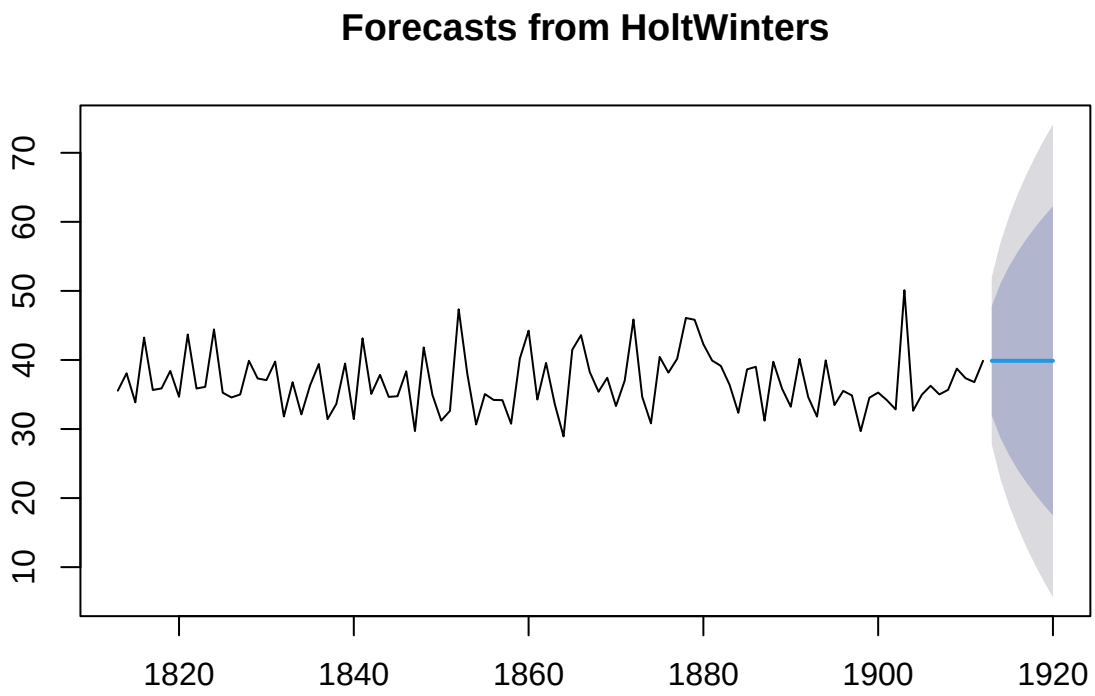
```r
plot(ts1_forecast)
```




```r
#forecasting
ts1_forecast2 <- forecast(ts1_forecast, h=8)
ts1_forecast2
```

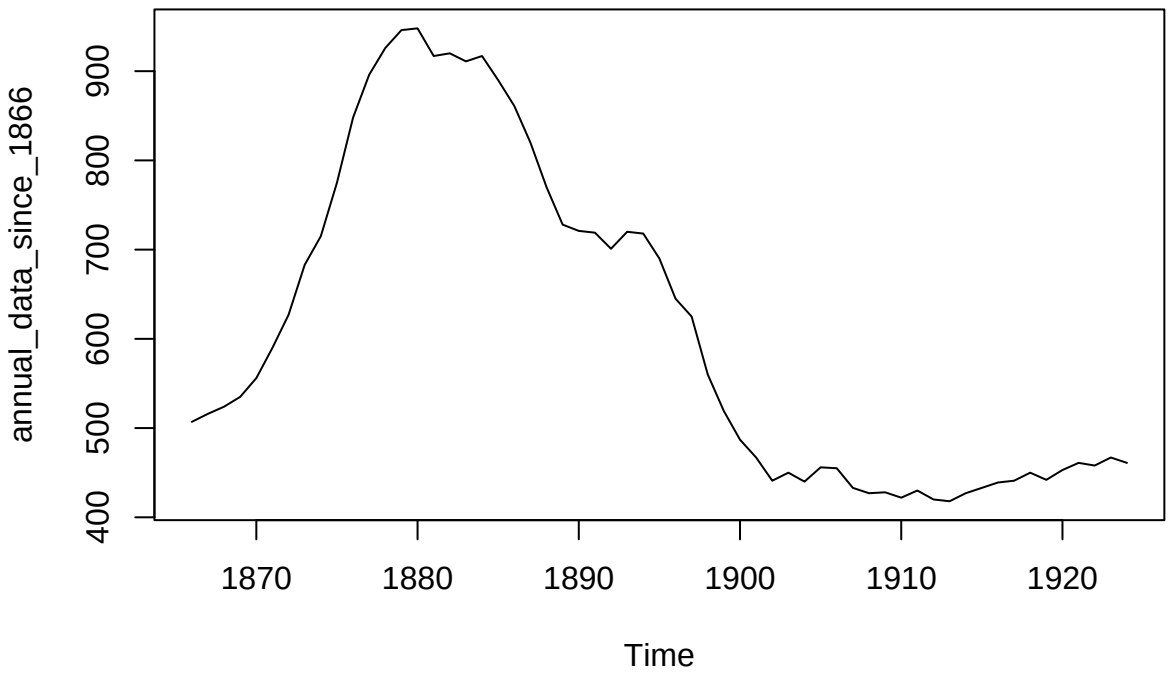
```
##      Point Forecast    Lo 80    Hi 80     Lo 95    Hi 95
## 1913          39.88 31.96516 47.79484 27.775298 51.98470
## 1914          39.88 28.68673 51.07327 22.761366 56.99863
## 1915          39.88 26.17110 53.58890 18.914041 60.84596
## 1916          39.88 24.05032 55.70968 15.670595 64.08940
## 1917          39.88 22.18188 57.57812 12.813063 66.94694
## 1918          39.88 20.49268 59.26732 10.229656 69.53034
## 1919          39.88 18.93930 60.82070  7.853968 71.90603
## 1920          39.88 17.49345 62.26655  5.642732 74.11727
```

```r
plot(ts1_forecast2)
```



- Time series with trend and no seasonality:

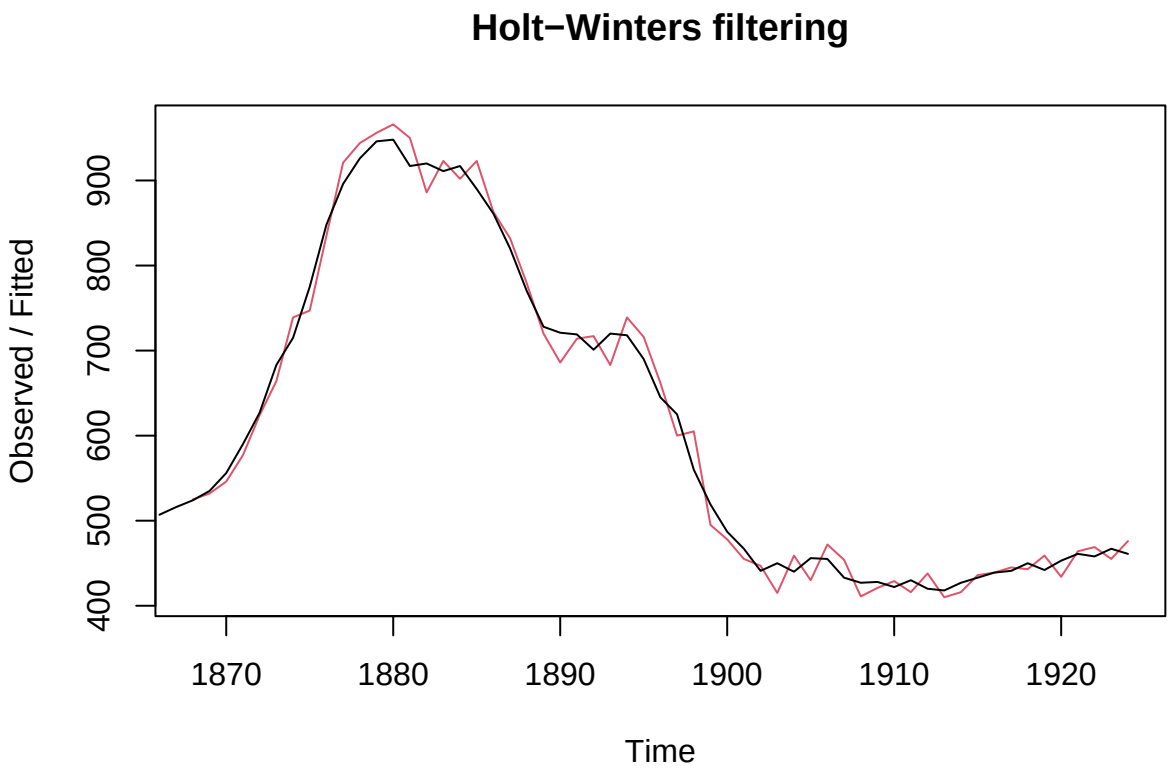
```
shorts <- read_excel("~/Applied Analystics SAS Prog/Assignments/Assignment 5/skirts.xlsx",
    sheet = "new_shorts")

#forecasting with single exponential smoothing
ts2 <- ts(shorts,start=c(1866))
plot(ts2)
```



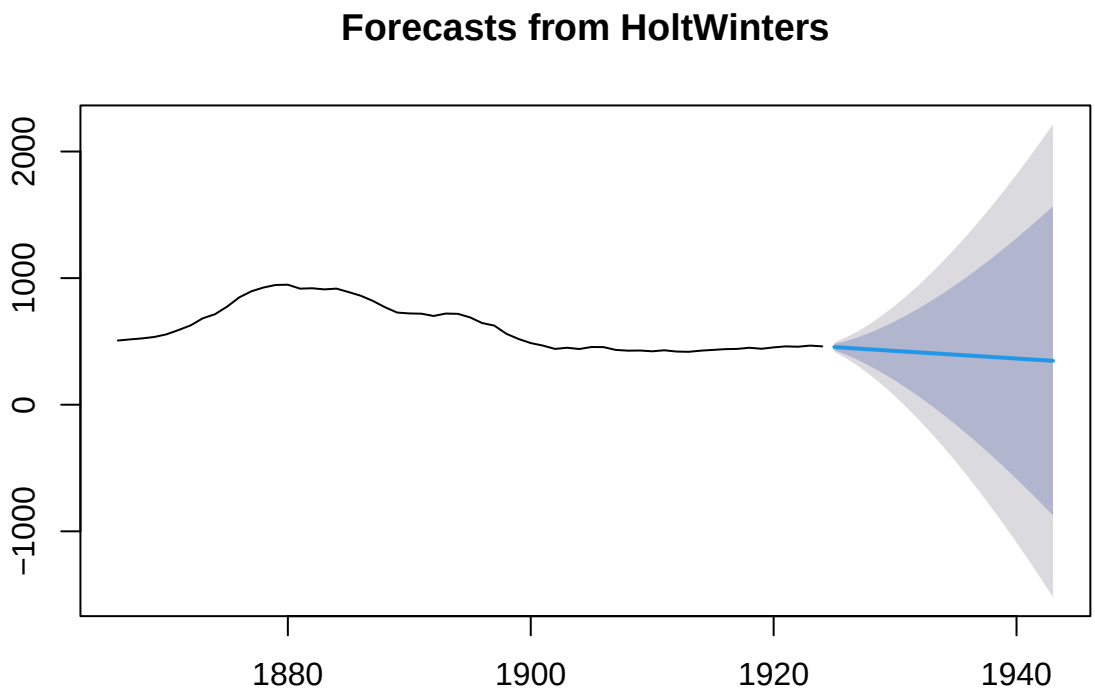

```
#making forecast
ts2_forecast <- HoltWinters(ts2, alpha=TRUE,
                            beta=TRUE,
                            gamma=FALSE)
ts2_forecast
```

```
## Holt-Winters exponential smoothing with trend and without seasonal component.
##
## Call:
## HoltWinters(x = ts2, alpha = TRUE, beta = TRUE, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: TRUE
##  beta : TRUE
##  gamma: FALSE
##
## Coefficients:
##   [,1]
## a  461
## b   -6
```

```
plot(ts2_forecast)
```

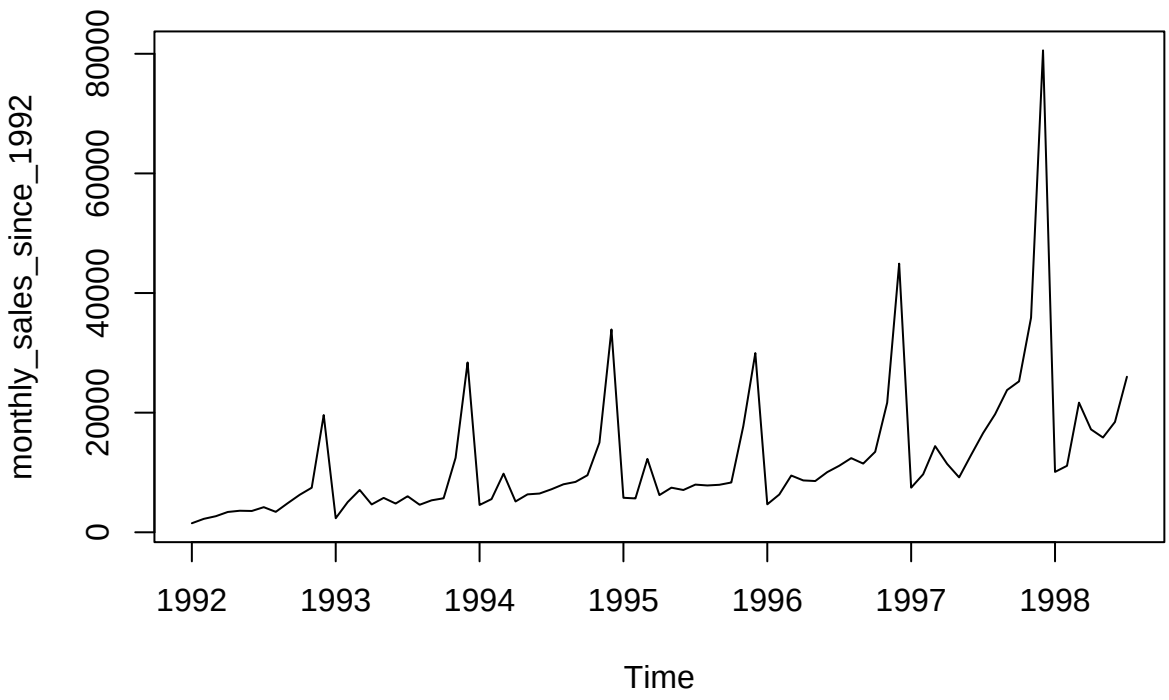



```
#forecasting
ts2_forecast2 <- forecast(ts2_forecast, h=19)
plot(ts2_forecast2)
```

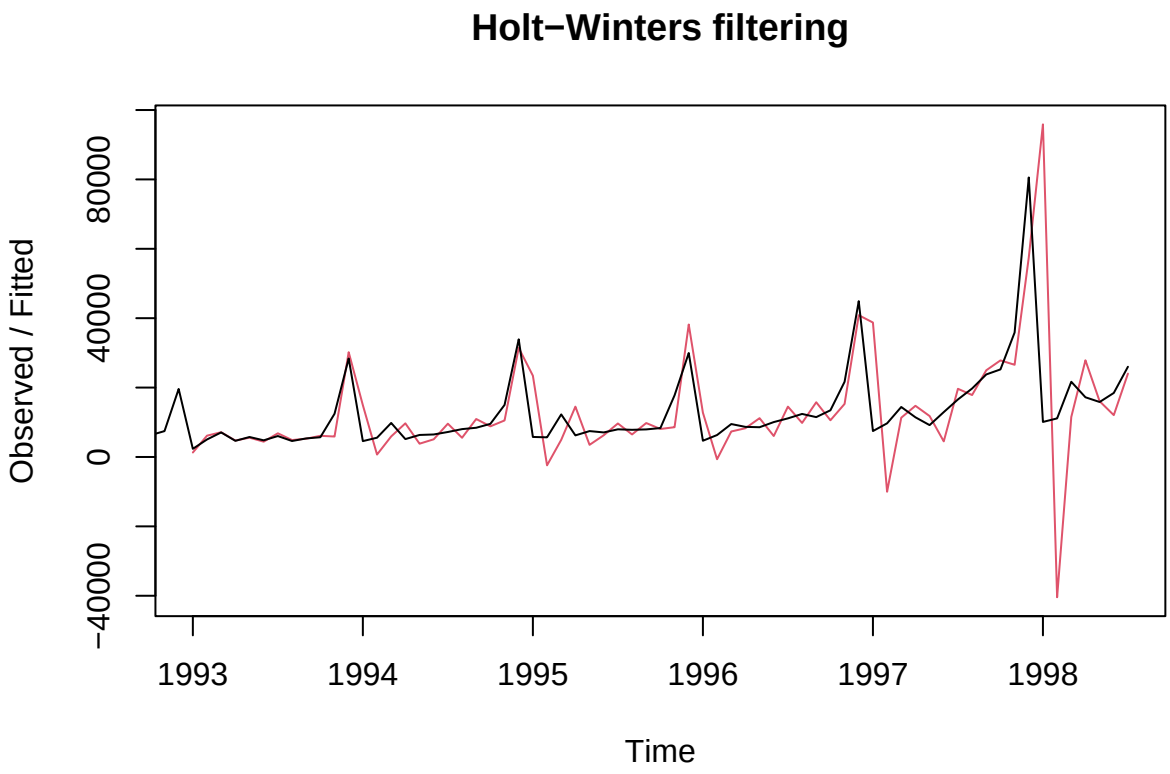


- Time series with trend and seasonality:

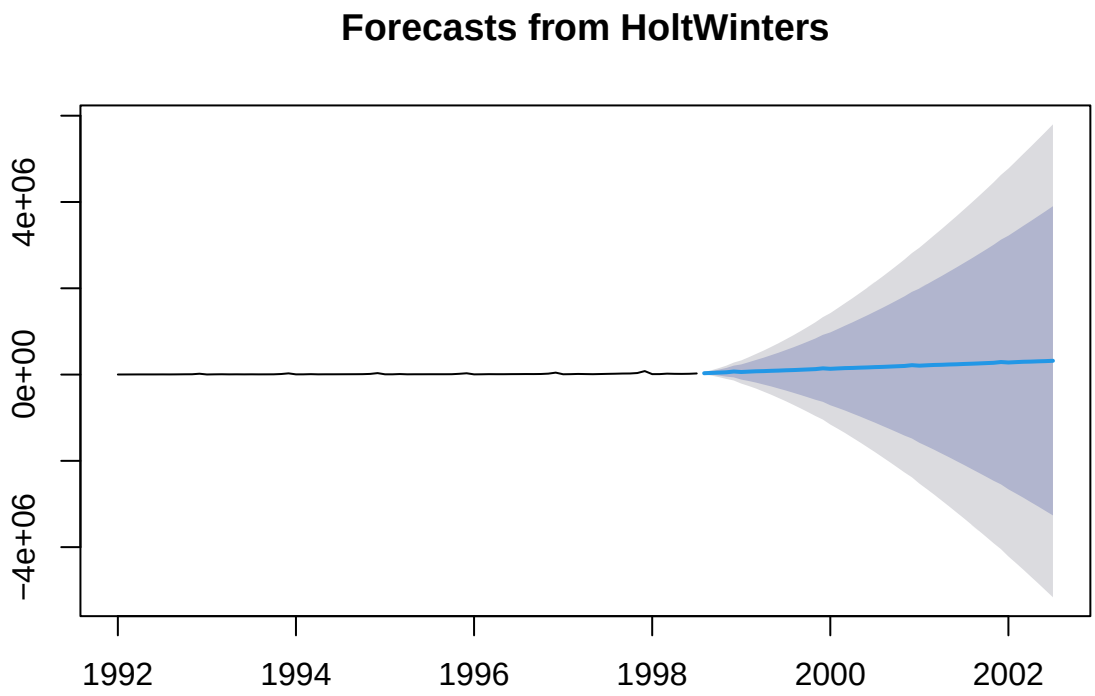
```
tickets <- read_excel("~/Applied Analystics SAS Prog/Assignments/Assignment 5/souvenir.xlsx",
    sheet = "tickets")

#forecasting with single exponential smoothing
ts3 <- ts(tickets, frequency=12, start=c(1992,1))
plot(ts3)
```



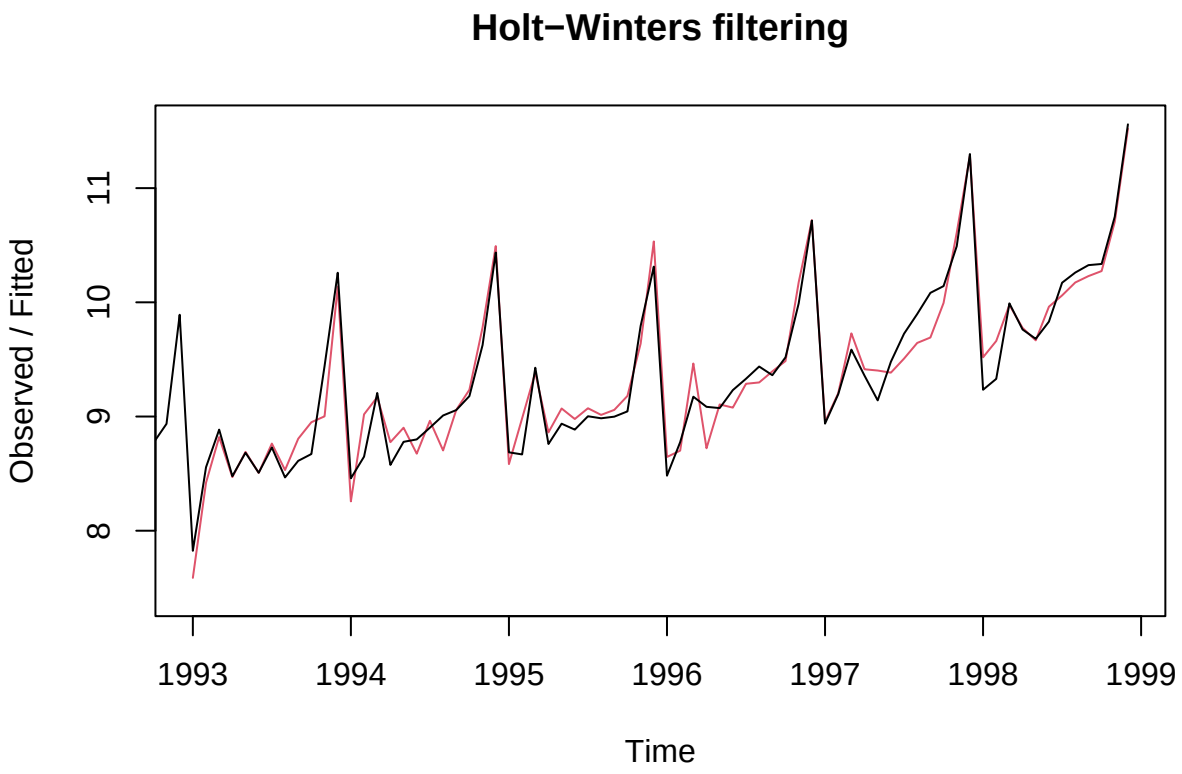

```
#making forecast
ts3_forecasts <- HoltWinters(ts3, alpha=TRUE,
                             beta=TRUE,
                             gamma=TRUE)
plot(ts3_forecasts)
```



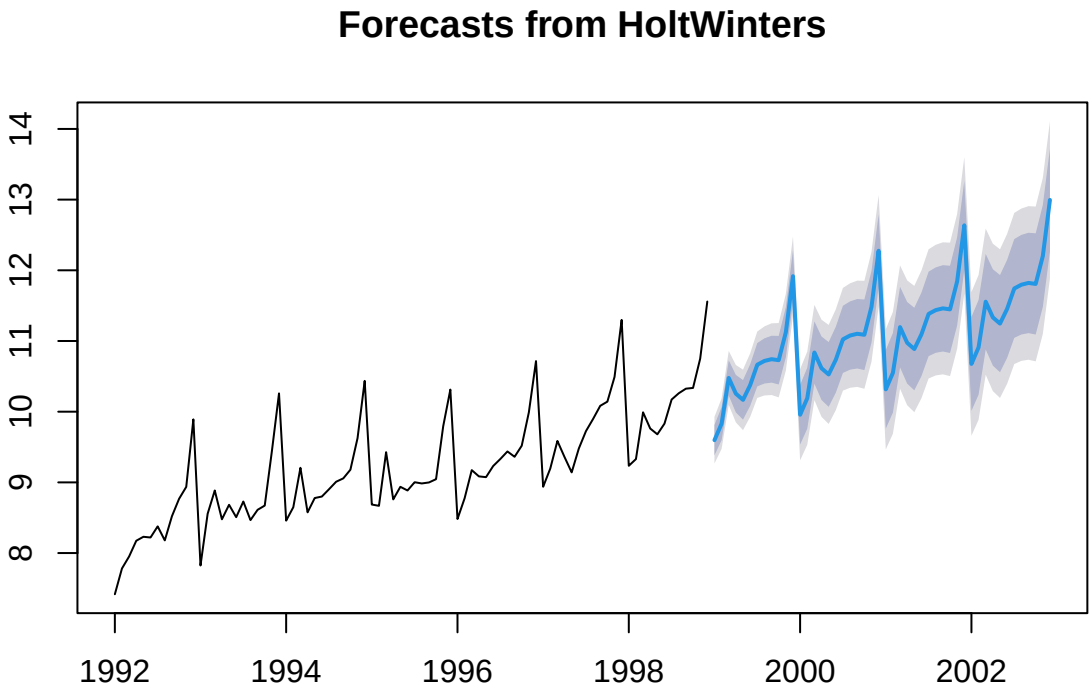

```
#forecasting
ts3_forecasts2 <- forecast(ts3_forecasts, h=48)
plot(ts3_forecasts2)
```




```r
#log(ts3) example
ts3 <- ts(souvenir, frequency=12, start=c(1992,1))
logts3 <- log(ts3)

ts3_forecasts <- HoltWinters(logts3)
plot(ts3_forecasts)
```




```
ts3_forecasts2 <- forecast(ts3_forecasts, h=48)
plot(ts3_forecasts2)
```


Forecasts from HoltWinters
8
9
10
11
12
13
14
1992
1994
1996
1998
2000
2002