Modelo de Series de Tiempo

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LLamado de las librerias requeridas

```
library(readxl)
library(xts)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
library(lubridate)
```

```
##
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
library(forecast)
```

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

Esto es una prueba =) Se puede cambiar el nombre de la variable “file” abajo

Lectura de los Datos Historicos

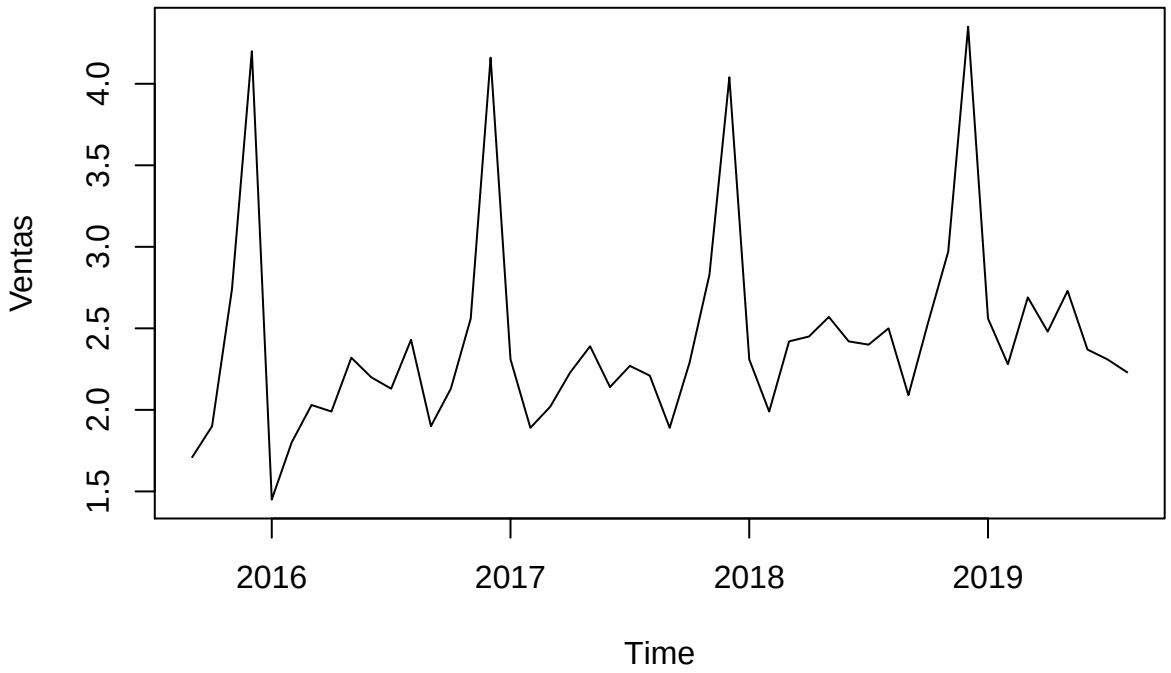
```
file = "Carlson_Data.xlsx"

df = read_excel(file)
```

Construcción de la Serie de tiempos y Gráfica

```
Sales.ts = ts(df[2],start = c(2015,9),frequency = 12)

plot(Sales.ts)
```

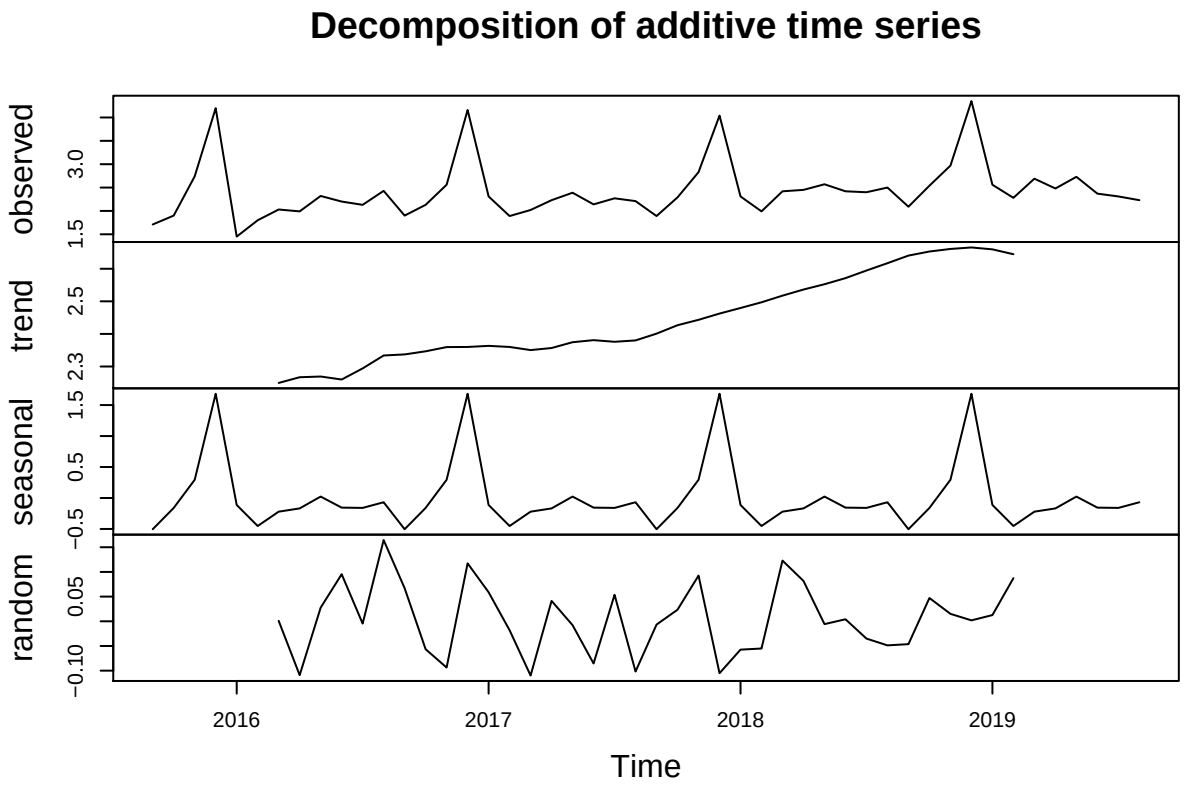



```
Sales.ts
```

```
##       Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
## 2015                                             1.71 1.90 2.74 4.20
## 2016 1.45 1.80 2.03 1.99 2.32 2.20 2.13 2.43 1.90 2.13 2.56 4.16
## 2017 2.31 1.89 2.02 2.23 2.39 2.14 2.27 2.21 1.89 2.29 2.83 4.04
## 2018 2.31 1.99 2.42 2.45 2.57 2.42 2.40 2.50 2.09 2.54 2.97 4.35
## 2019 2.56 2.28 2.69 2.48 2.73 2.37 2.31 2.23
```

Descomposición de la serie de tiempo

```
plot(decompose(Sales.ts))
```

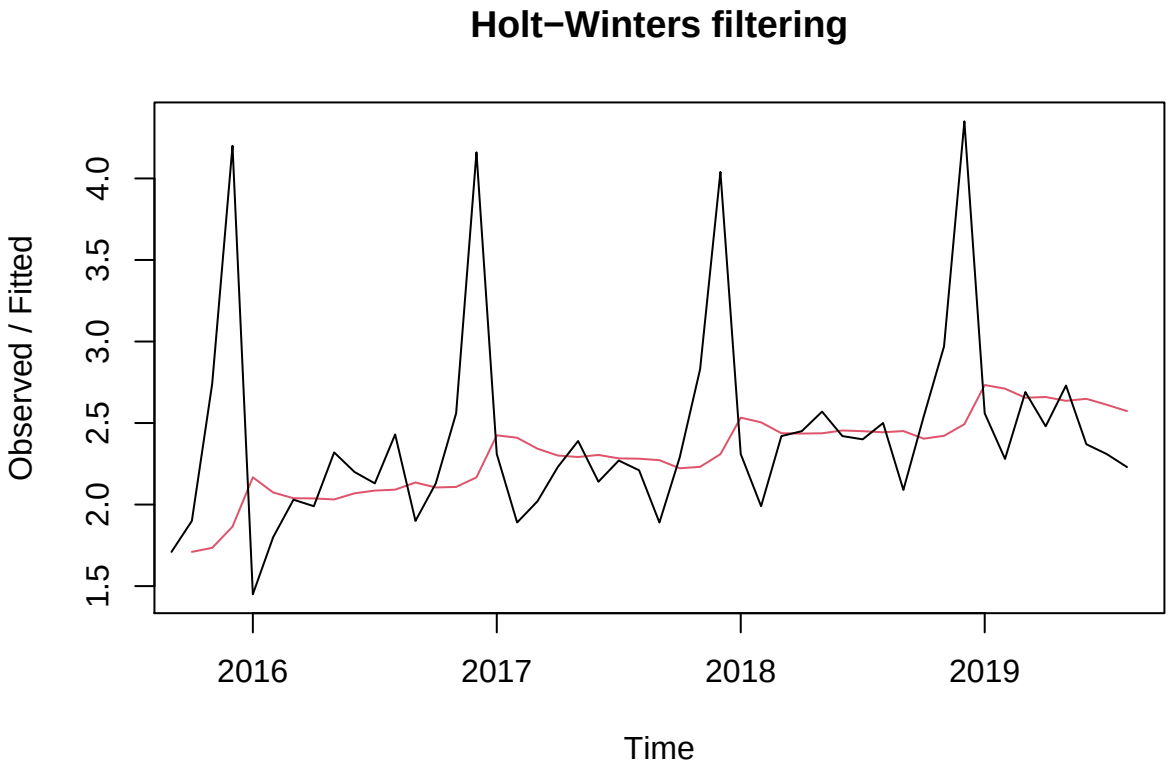


Definición del Modelo - Suavización Exponencial

```
model1.ts = HoltWinters(Sales.ts,beta = FALSE, gamma = FALSE)
```

Resultados del Modelo

```
plot(model1.ts)
```




```
model1.ts
```

```
## Holt-Winters exponential smoothing without trend and without seasonal component.
##
## Call:
## HoltWinters(x = Sales.ts, beta = FALSE, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: 0.1294996
##  beta : FALSE
##  gamma: FALSE
##
## Coefficients:
##       [,1]
## a 2.528761
```

```
model1.ts$SSE
```

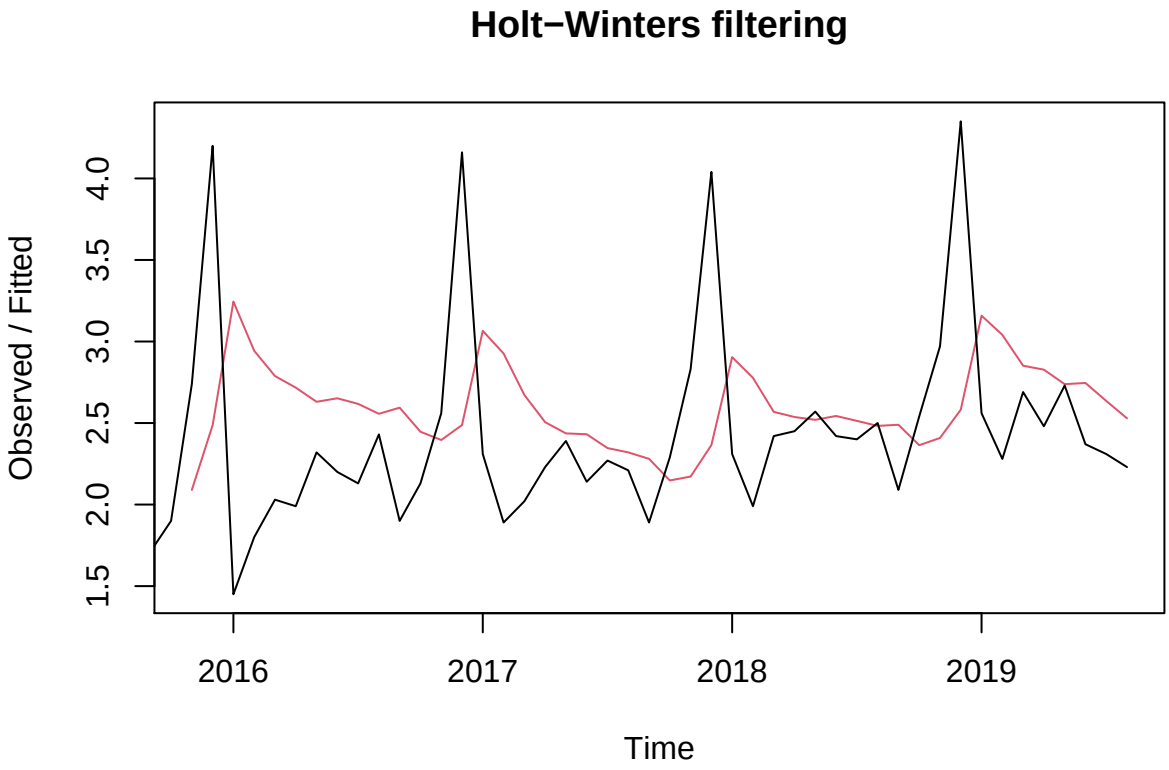
```
## [1] 20.26536
```

Definición del Modelo - Suavización exponencial y tendencia

```
model2.ts = HoltWinters(Sales.ts,gamma = FALSE )
```

Resultados del Modelo

```
plot(model2.ts)
```




```
model2.ts
```

```
## Holt-Winters exponential smoothing with trend and without seasonal component.
##
## Call:
## HoltWinters(x = Sales.ts, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: 0.284688
##  beta : 0.1189368
##  gamma: FALSE
##
## Coefficients:
##          [,1]
## a  2.44381714
## b -0.02418091
```

```
model2.ts$SSE
```

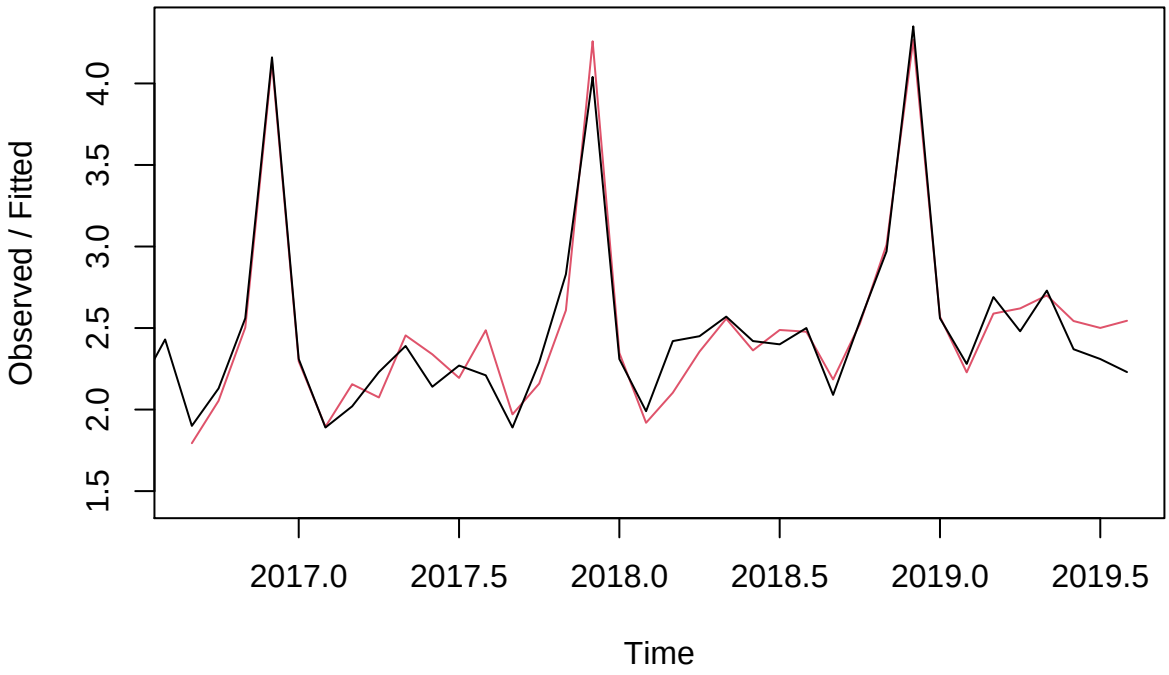
```
## [1] 24.69735
```

Definición del Modelo - Suavización exponencial - tendencia y Estacionalidad

```
model3.ts = HoltWinters(Sales.ts)
```

Resultados del Modelo

```
plot(model3.ts)
```




```
model3.ts
```

```
## Holt-Winters exponential smoothing with trend and additive seasonal component.
##
## Call:
## HoltWinters(x = Sales.ts)
##
## Smoothing parameters:
##  alpha: 0.2626038
##  beta : 0
##  gamma: 1
##
## Coefficients:
##            [,1]
## a    2.57380215
## b    0.01180216
## s1  -0.50871282
## s2  -0.07434676
## s3   0.35464964
## s4   1.70125076
## s5  -0.09813109
## s6  -0.40355511
## s7  -0.03199667
## s8  -0.21693364
## s9   0.01343937
## s10 -0.31292308
## s11 -0.33464464
## s12 -0.34380215
```

```
model3.ts$SSE
```

```
## [1] 0.6543817
```

Pronóstico

```
forecast = forecast(model3.ts,h=4)
```

Resultados del Pronóstico

```
forecast
```

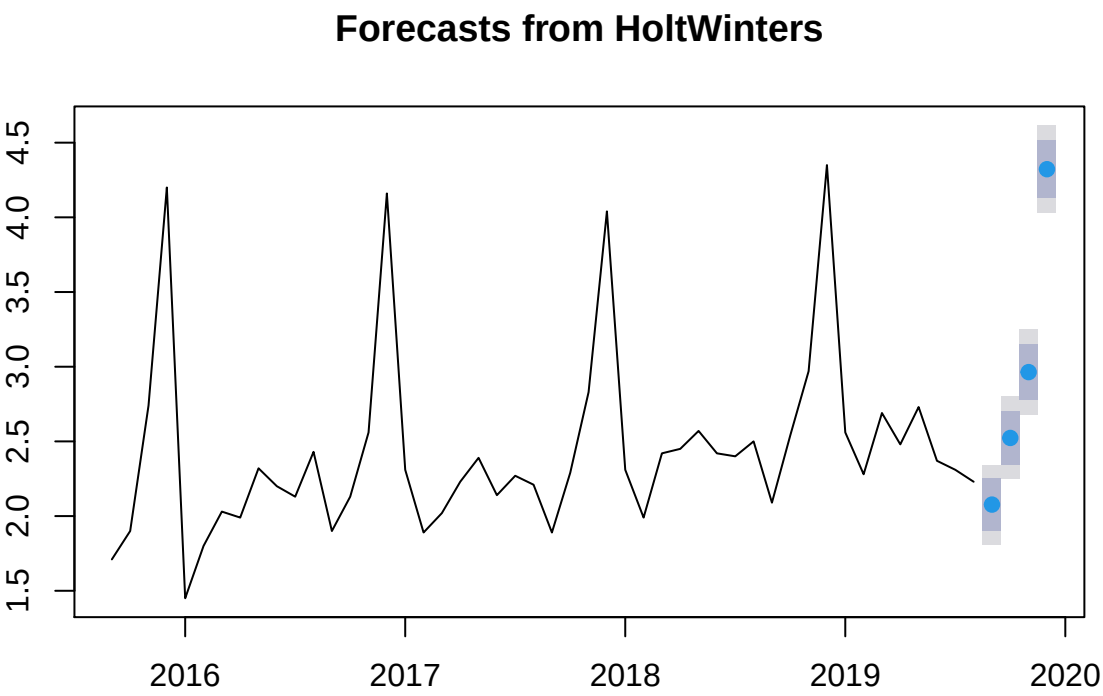
```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## Sep 2019       2.076891 1.902106 2.251677 1.809580 2.344203
## Oct 2019       2.523060 2.342348 2.703772 2.246684 2.799435
## Nov 2019       2.963858 2.777408 3.150308 2.678707 3.249009
## Dec 2019       4.322262 4.130245 4.514278 4.028597 4.615926
```

```
sum(forecast$mean)
```

```
## [1] 11.88607
```

Representación Gráfica del Pronóstico

```
plot(forecast)
```



Análisis:

En base a los resultados obtenidos ……..