BF HW 4

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```
library(fpp)
```

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

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

```
## Loading required package: fma
```

```
## Loading required package: expsmooth
```

```
## Loading required package: lmtest
```

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

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

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

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

```
library(fpp2)
```

```
## ── Attaching packages ─────────────────────────────────────── fpp2 2.4 ──
```

```
## ✓ ggplot2 3.3.6
```

```
##
```

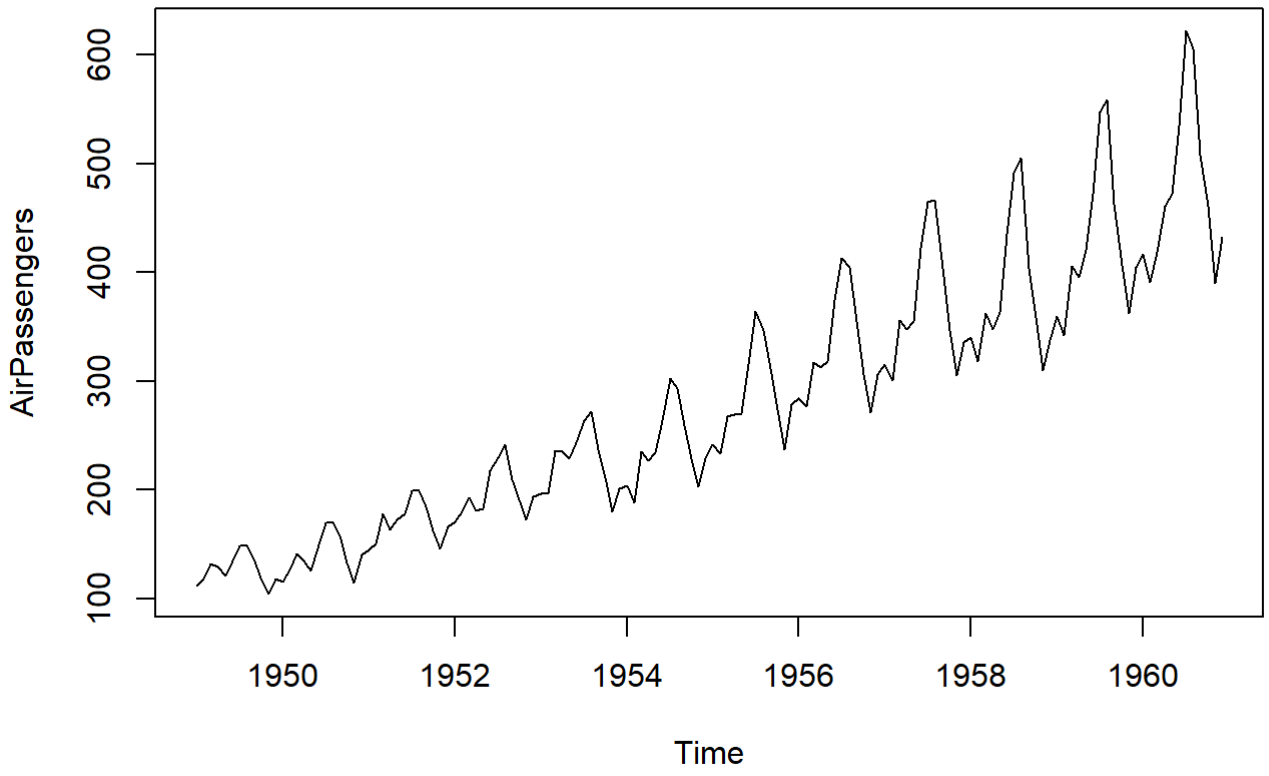
```
##
## Attaching package: 'fpp2'
```

```
## The following objects are masked from 'package:fpp':
##
##     ausair, ausbeer, austa, austourists, debitcards, departures,
##     elecequip, euretail, guinearice, oil, sunspotarea, usmelec
```

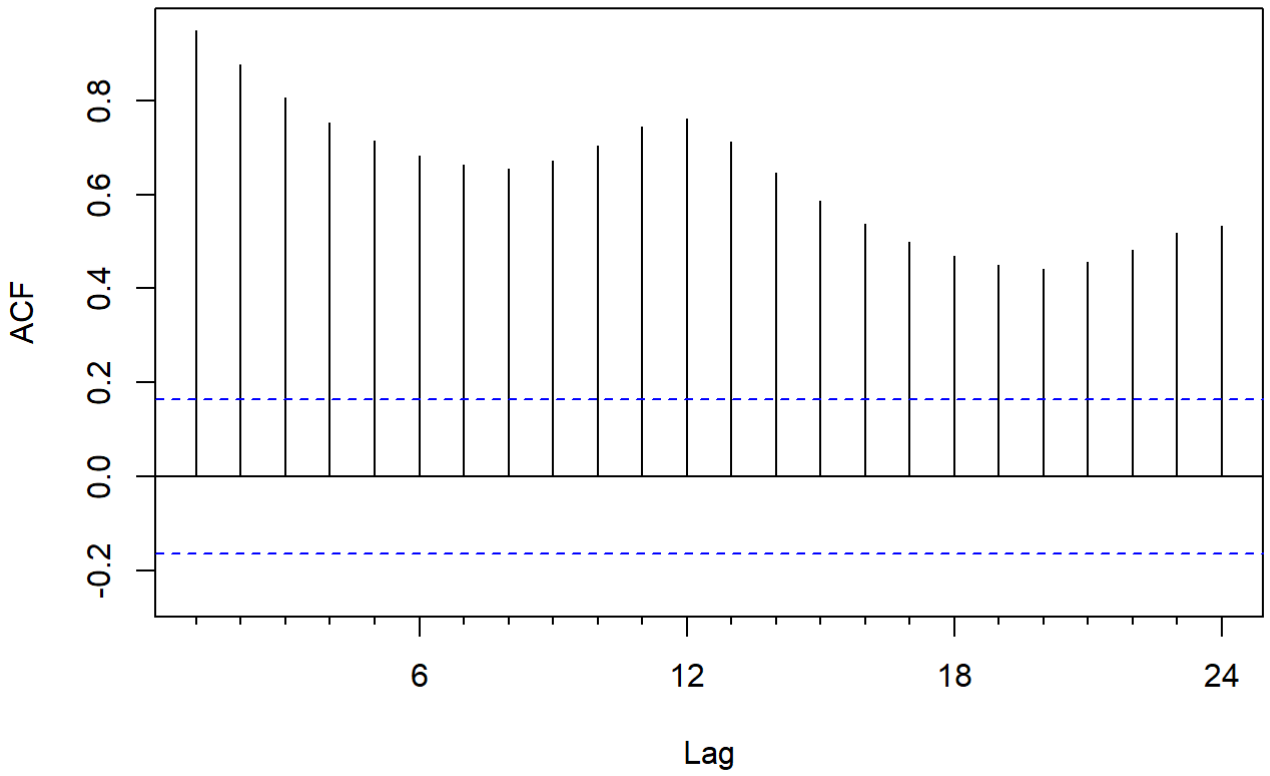
```
library(TTR)

attributes(AirPassengers)
```

```
## $tsp
## [1] 1949.000 1960.917   12.000
##
## $class
## [1] "ts"
```

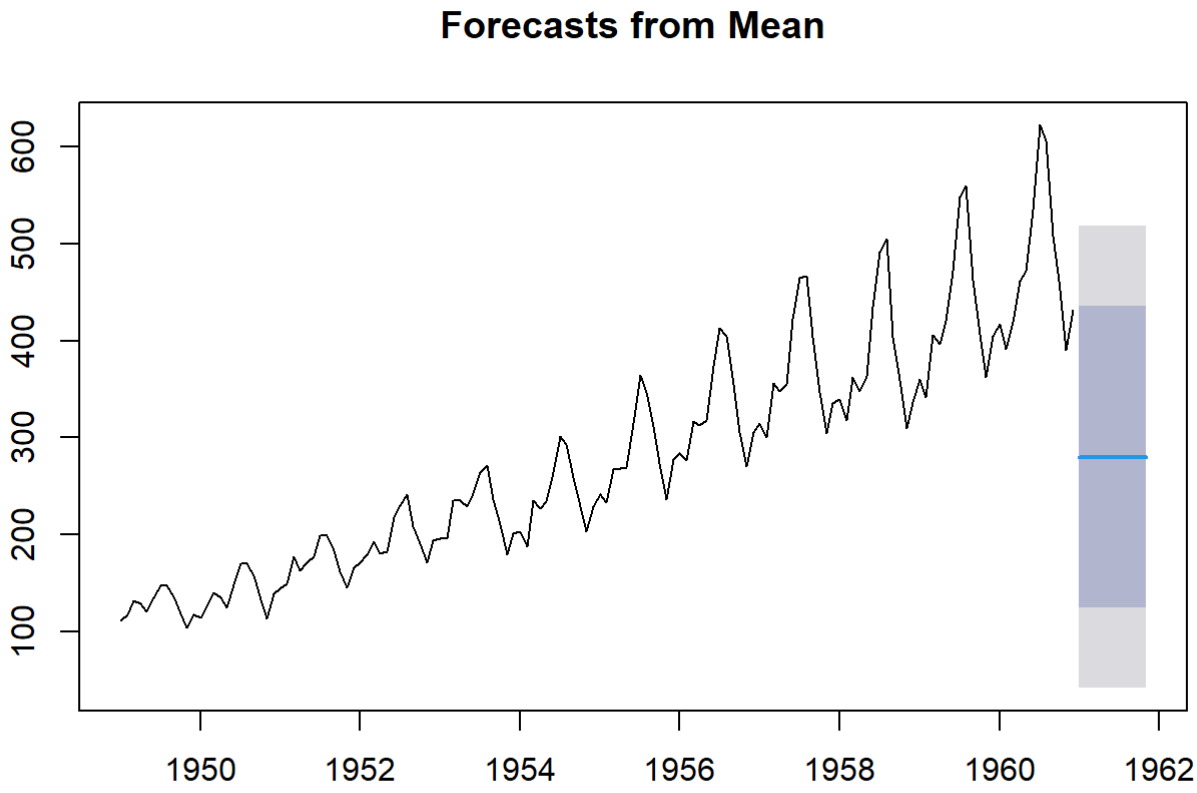
```
plot(AirPassengers)
```



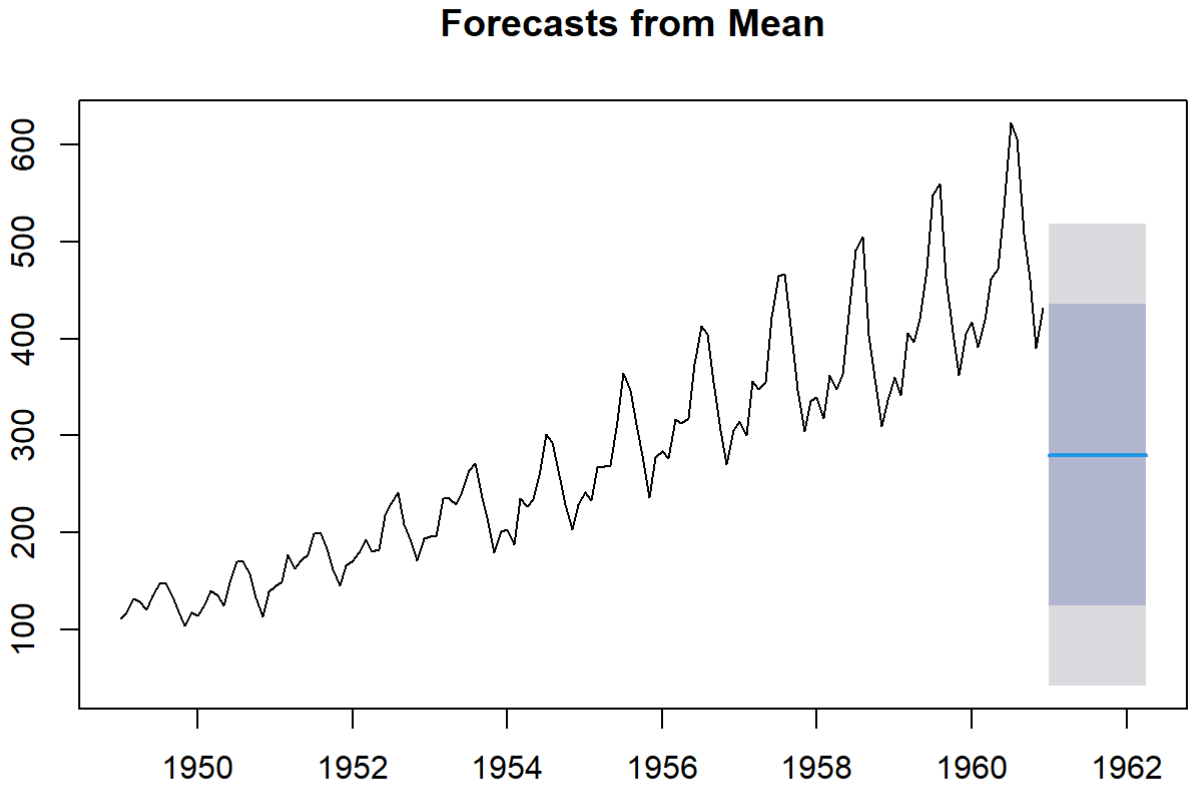

```
Acf(AirPassengers)
```



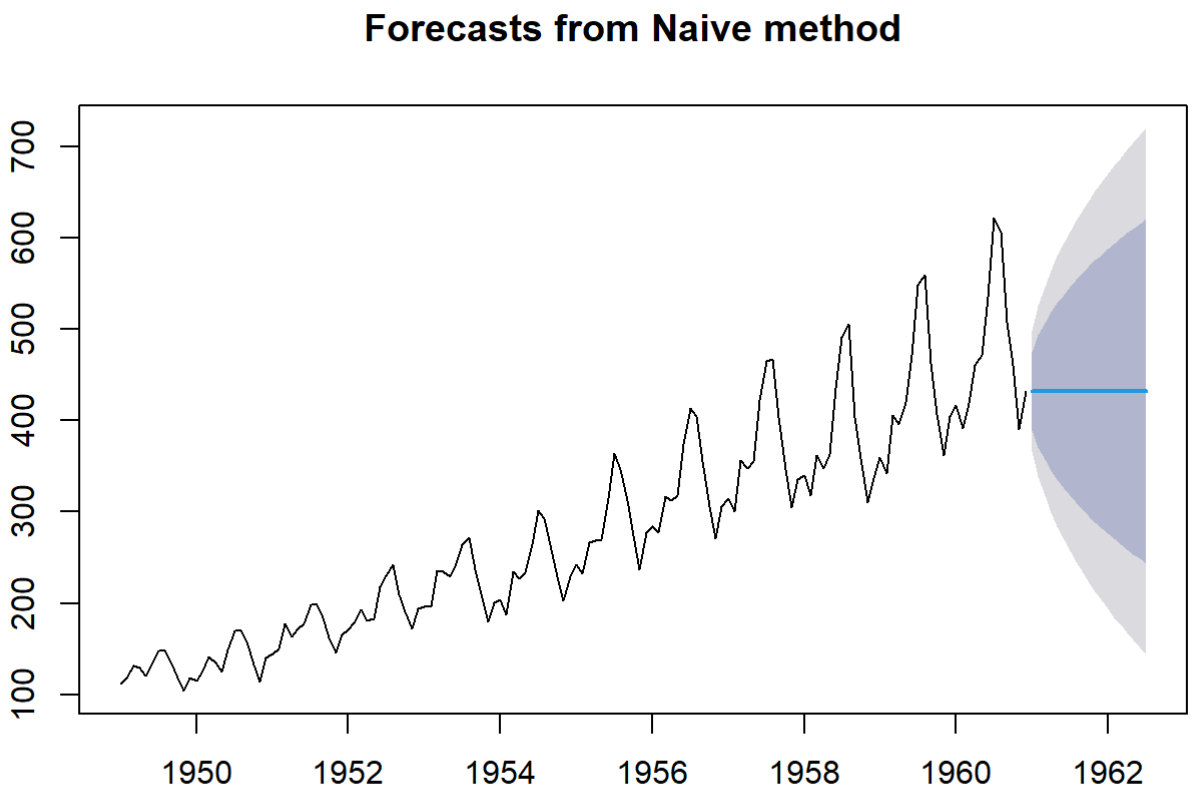

```
#Mean

mean_forecast <- meanf(AirPassengers,11)
plot(mean_forecast)
```



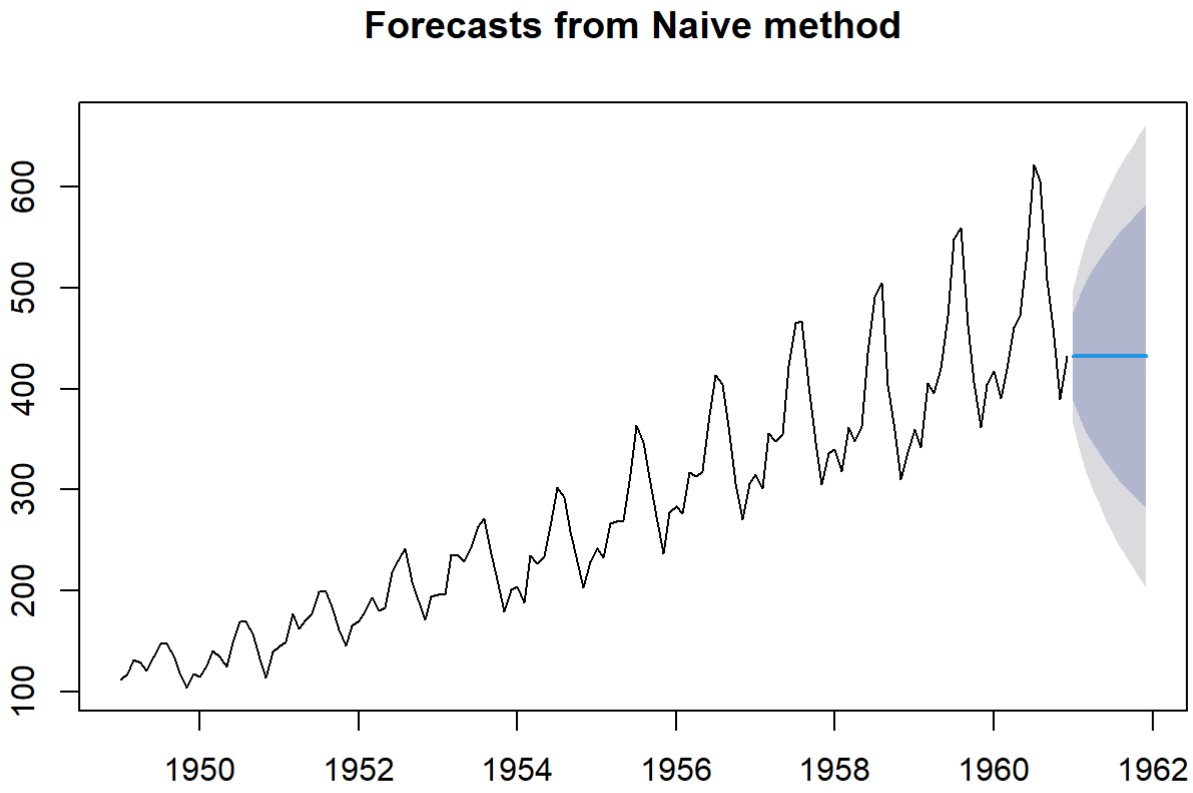

```
mean_forecast <- meanf(AirPassengers,16)
plot(mean_forecast)
```



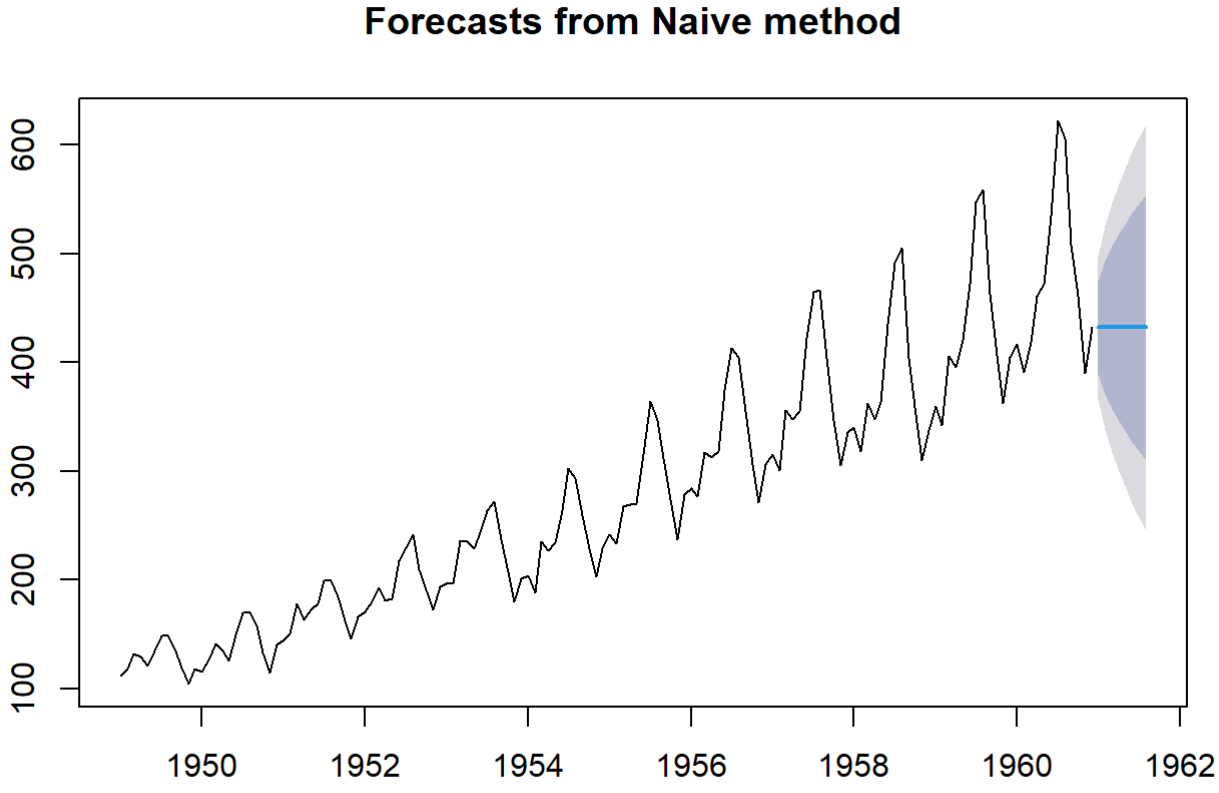
```
# Naive
naive_forecast <- naive(AirPassengers,19)
plot(naive_forecast)
```



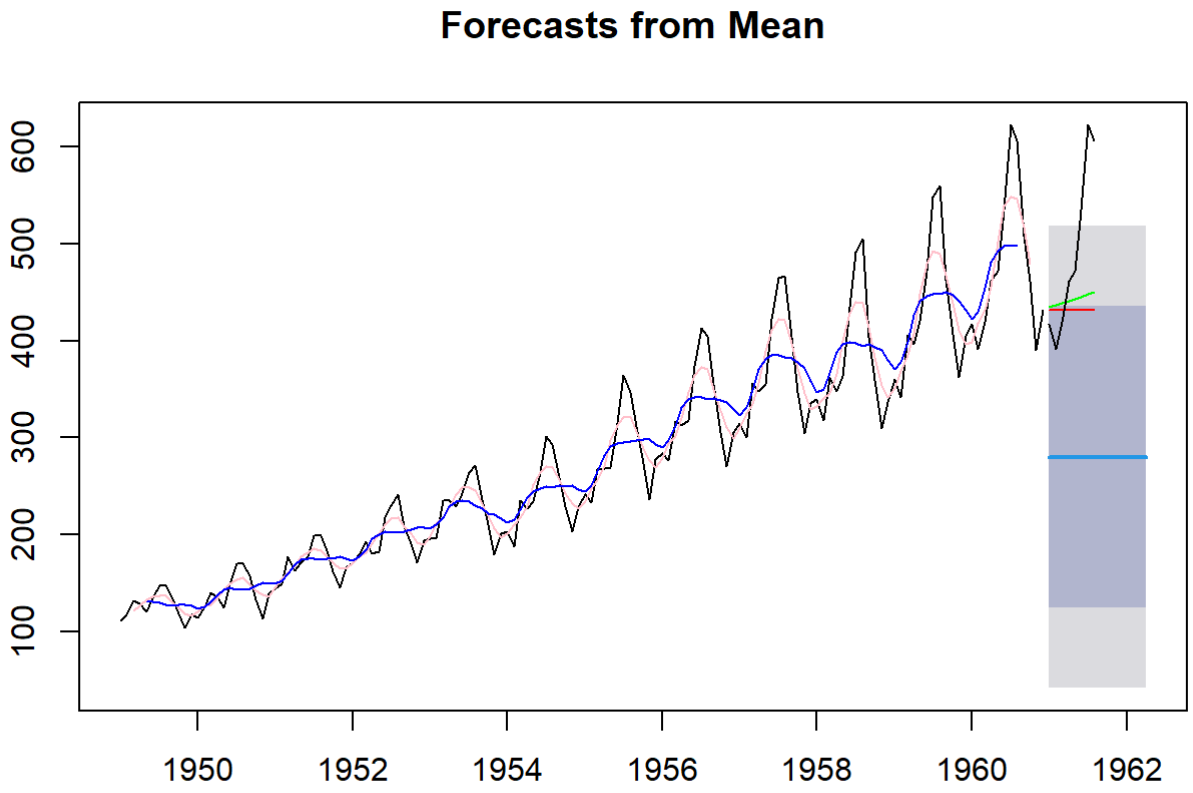

```
naive_forecast <- naive(AirPassengers,12)
plot(naive_forecast)
```




```
naive_forecast <- naive(AirPassengers,8)
plot(naive_forecast)
```



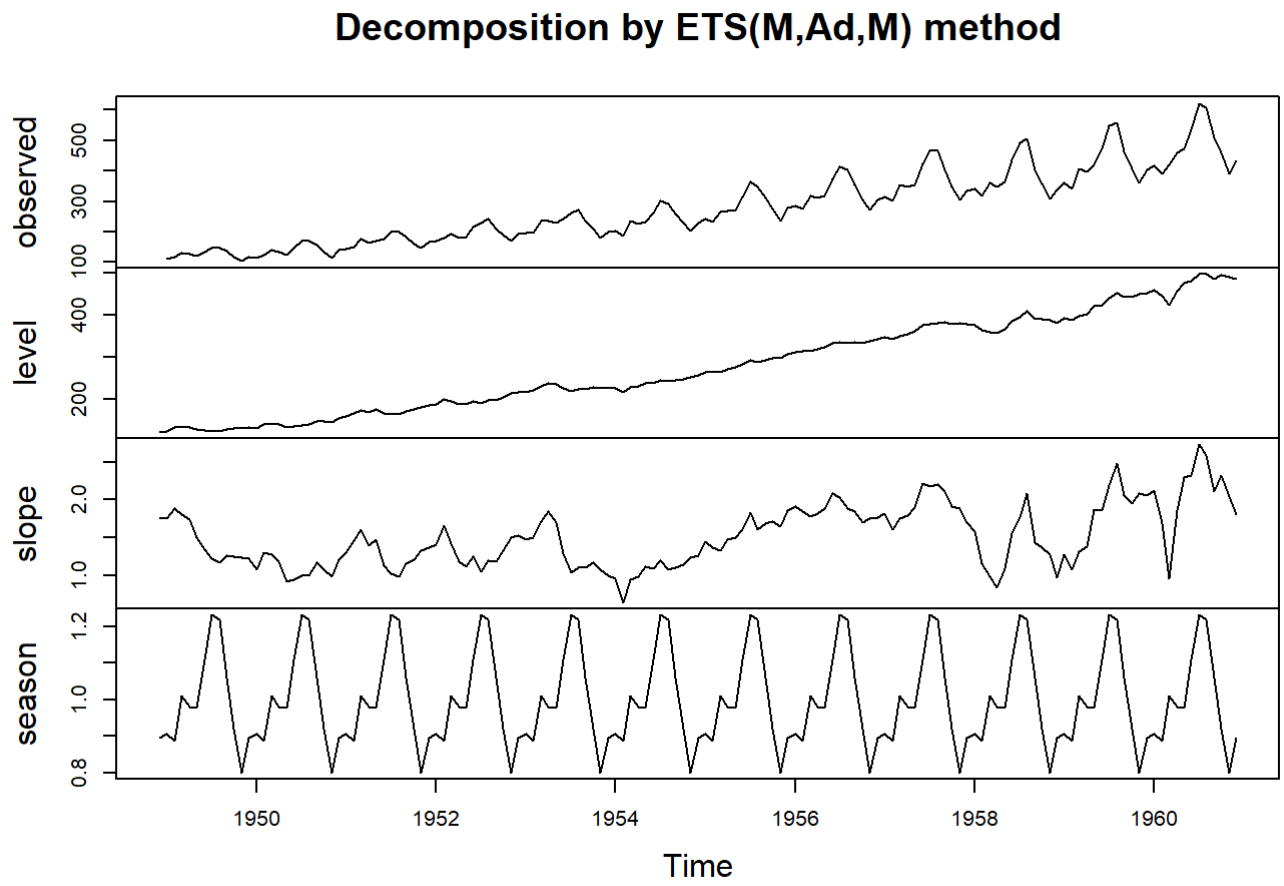
```
# Random Walk
rwf_forecast <- rwf(AirPassengers,8)
rwf_forecast <- rwf(AirPassengers,8, drift=TRUE)
# Seasonal Naive
snaive_forecast <- snaive(AirPassengers,8)

# Moving Averages

MA5_forecast <- ma(AirPassengers,order=5)
MA9_forecast <- ma(AirPassengers,order=9)

#Plots
plot(mean_forecast)
lines(naive_forecast$mean,col="red")
lines(rwf_forecast$mean,col="green")
lines(snaive_forecast$mean,col="black")
lines(MA5_forecast,col="Pink")
lines(MA9_forecast,col="Blue")
```




```
# Attributes
attributes(naive_forecast)
```

```
## $names
##  [1] "method"    "model"     "lambda"    "x"         "fitted"    "residuals"
##  [7] "series"    "mean"      "level"     "lower"     "upper"
##
## $class
## [1] "forecast"
```

```
# Decomposition
ets_forecast <- ets(AirPassengers)
plot(ets_forecast)
```



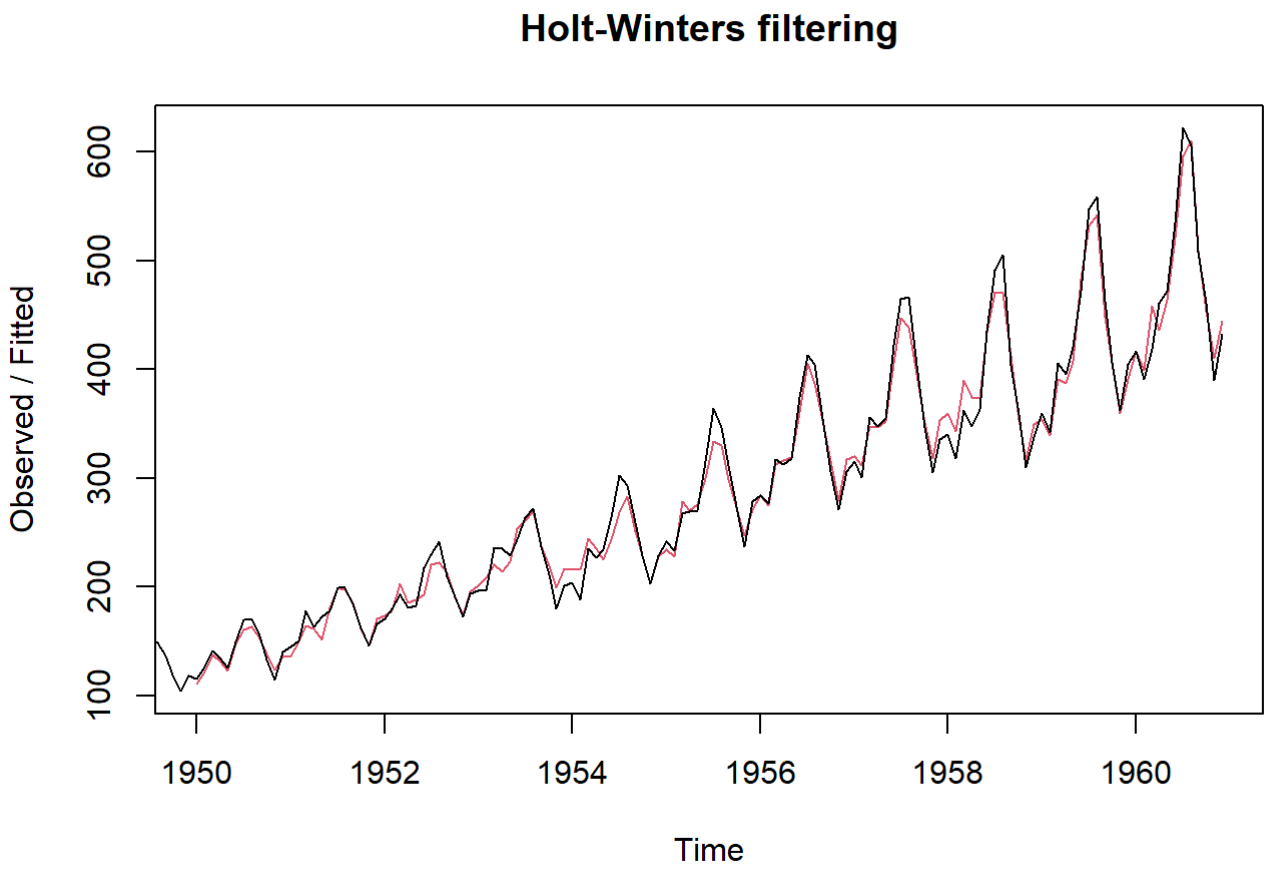

```
attributes(ets_forecast)
```

```
## $names
##  [1] "loglik"     "aic"        "bic"        "aicc"       "mse"
##  [6] "amse"       "fit"        "residuals"  "fitted"     "states"
## [11] "par"        "m"          "method"     "series"     "components"
## [16] "call"       "initstate"  "sigma2"     "x"
##
## $class
## [1] "ets"
```

```
ets_forecast$mse
```

```
## [1] 115.5035
```

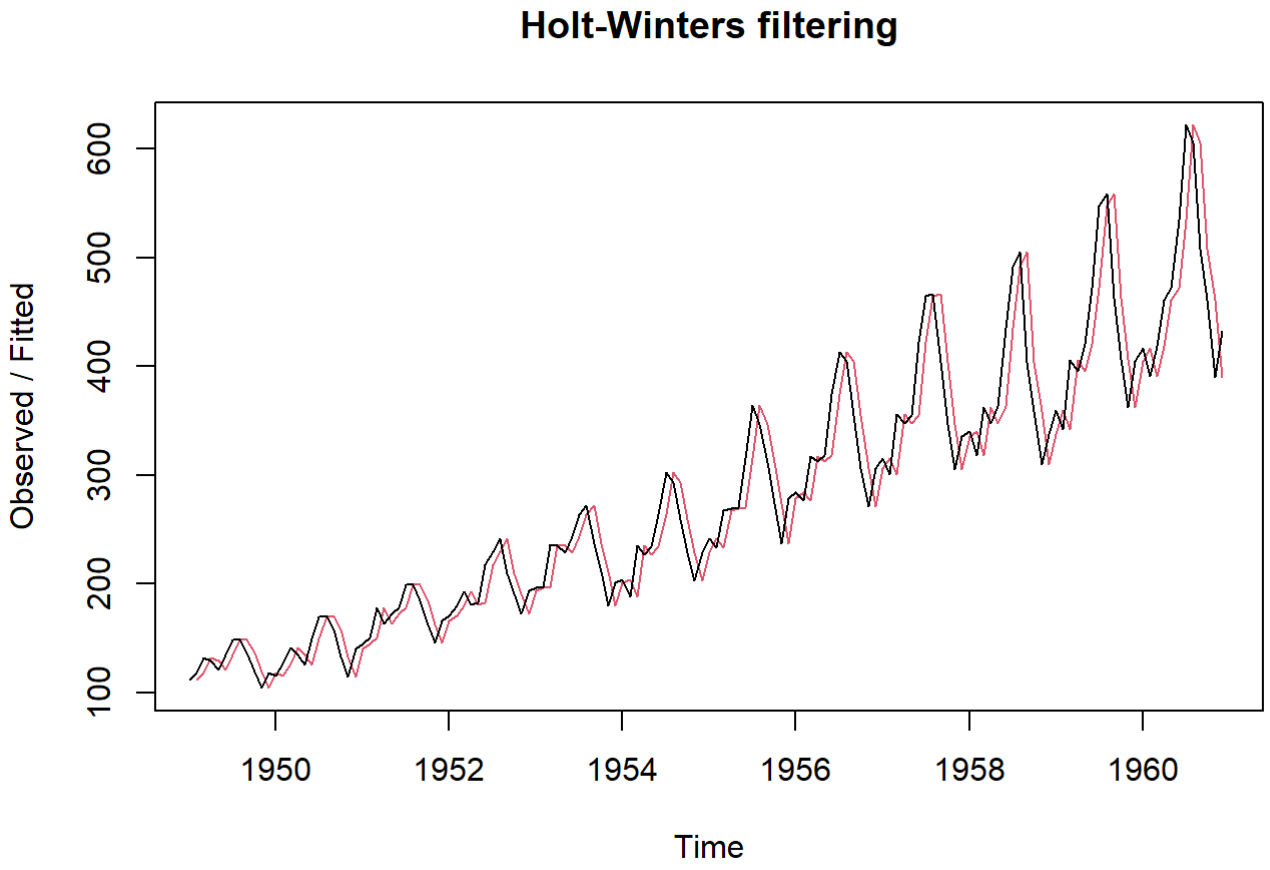
```
# HoltWinters
HW_forecast <- HoltWinters(AirPassengers)
plot(HW_forecast)
```




```
SSE_Simple <- HoltWinters(AirPassengers,beta=FALSE,gamma=FALSE)
attributes(SSE_Simple)
```

```
## $names
## [1] "fitted"       "x"            "alpha"        "beta"         "gamma"
## [6] "coefficients" "seasonal"     "SSE"          "call"
##
## $class
## [1] "HoltWinters"
```

```
plot(SSE_Simple)
```



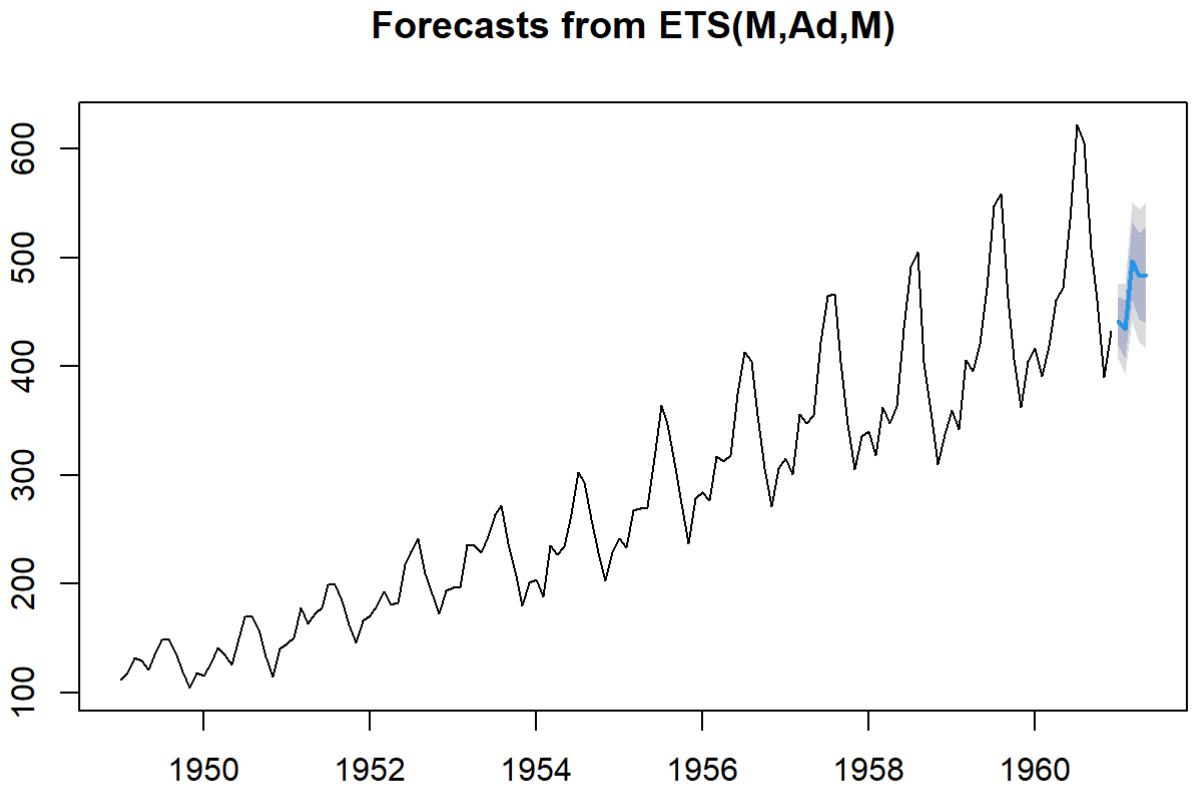

```
SSE_Simple$SSE
```

```
## [1] 162510.6
```

```
head(SSE_Simple$fitted)
```

```
##              xhat    level
## Feb 1949 112.0000 112.0000
## Mar 1949 117.9996 117.9996
## Apr 1949 131.9991 131.9991
## May 1949 129.0002 129.0002
## Jun 1949 121.0005 121.0005
## Jul 1949 134.9991 134.9991
```

```
#Forecast
forecast_ets_1 <- forecast.ets(ets_forecast, h=5)
plot(forecast_ets_1)
forecast_ets_2 <- forecast(ets_forecast, h=5)
plot(forecast_ets_2)
```


Forecasts from ETS(M,Ad,M)
100
200
300
400
500
600
1950
1952
1954
1956
1958
1960

```
```