BF HW 5

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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
```

```
##
```

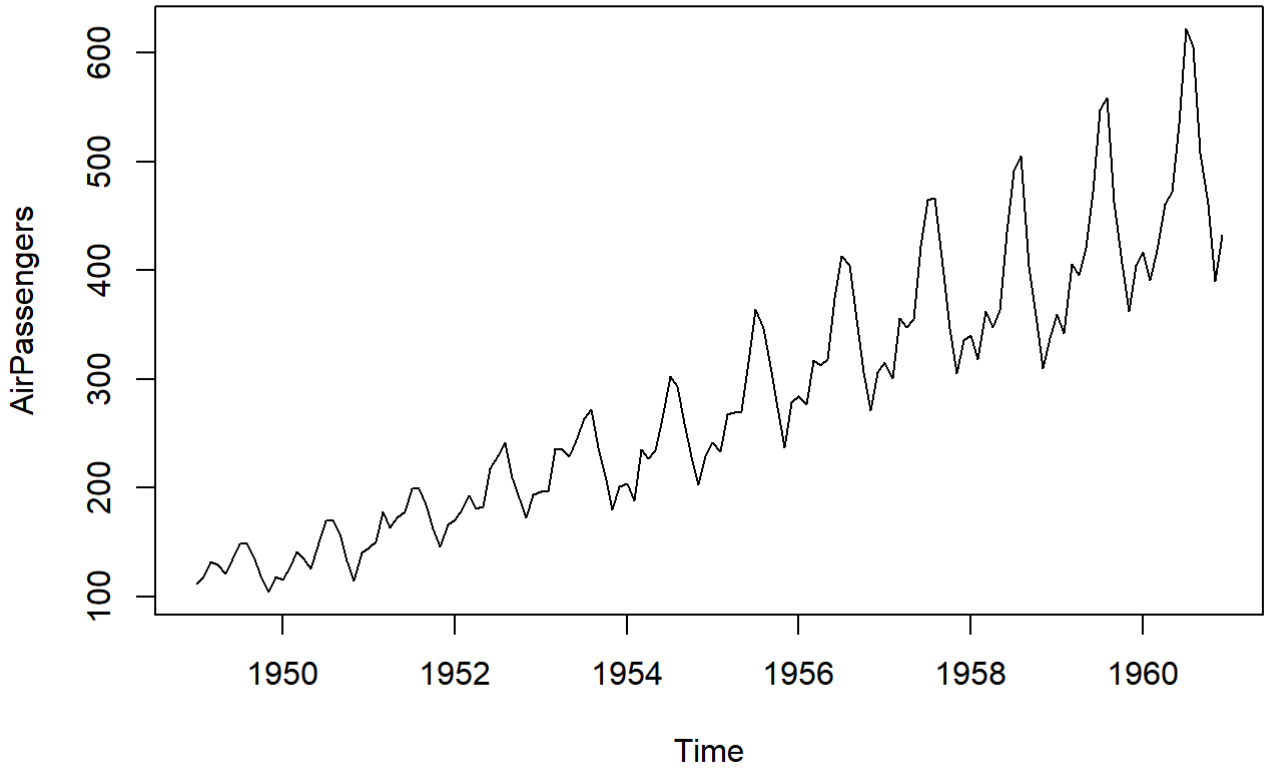
```
##
## Attaching package: 'fpp2'
```

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

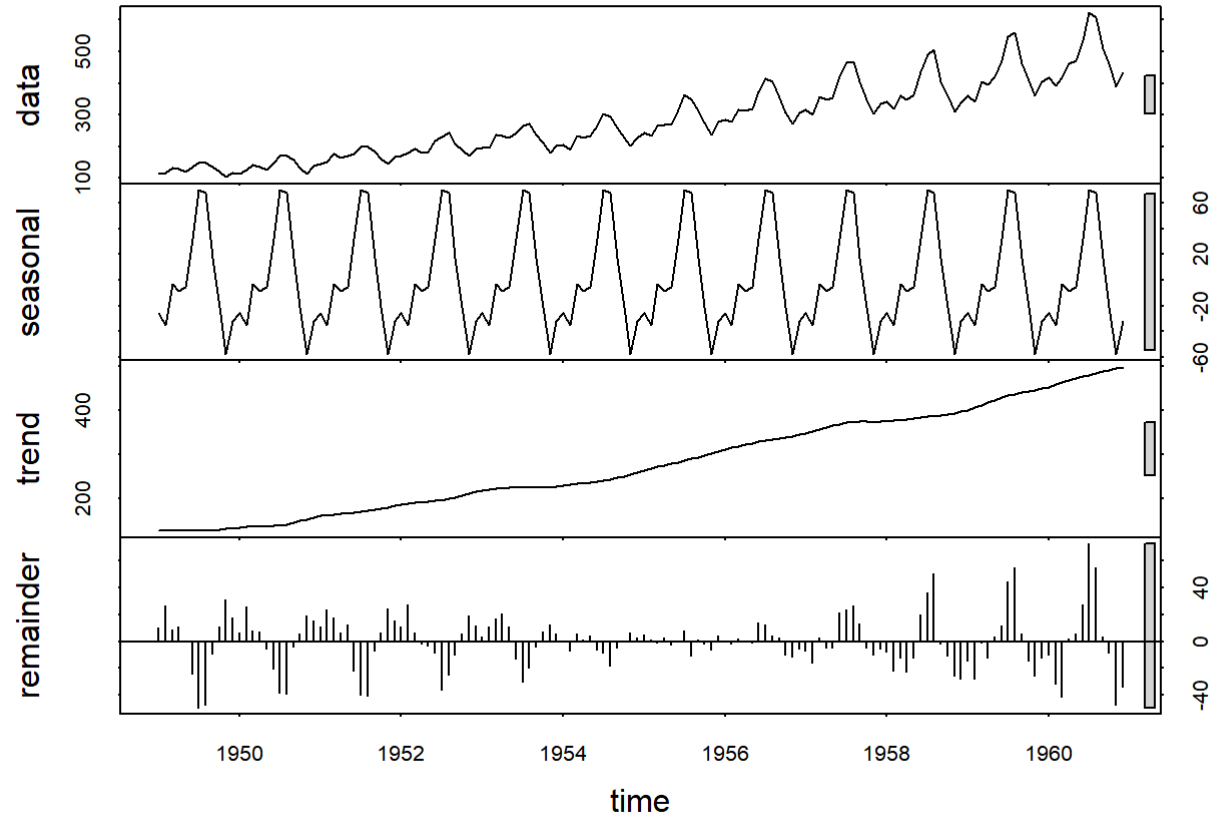
```
head(AirPassengers)
```

```
##      Jan Feb Mar Apr May Jun
## 1949 112 118 132 129 121 135
```

```
plot(AirPassengers)
```




```
stl_decomp <- stl(AirPassengers,s.window ="periodic")
plot(stl_decomp)
```




```
attributes(stl_decomp)
```

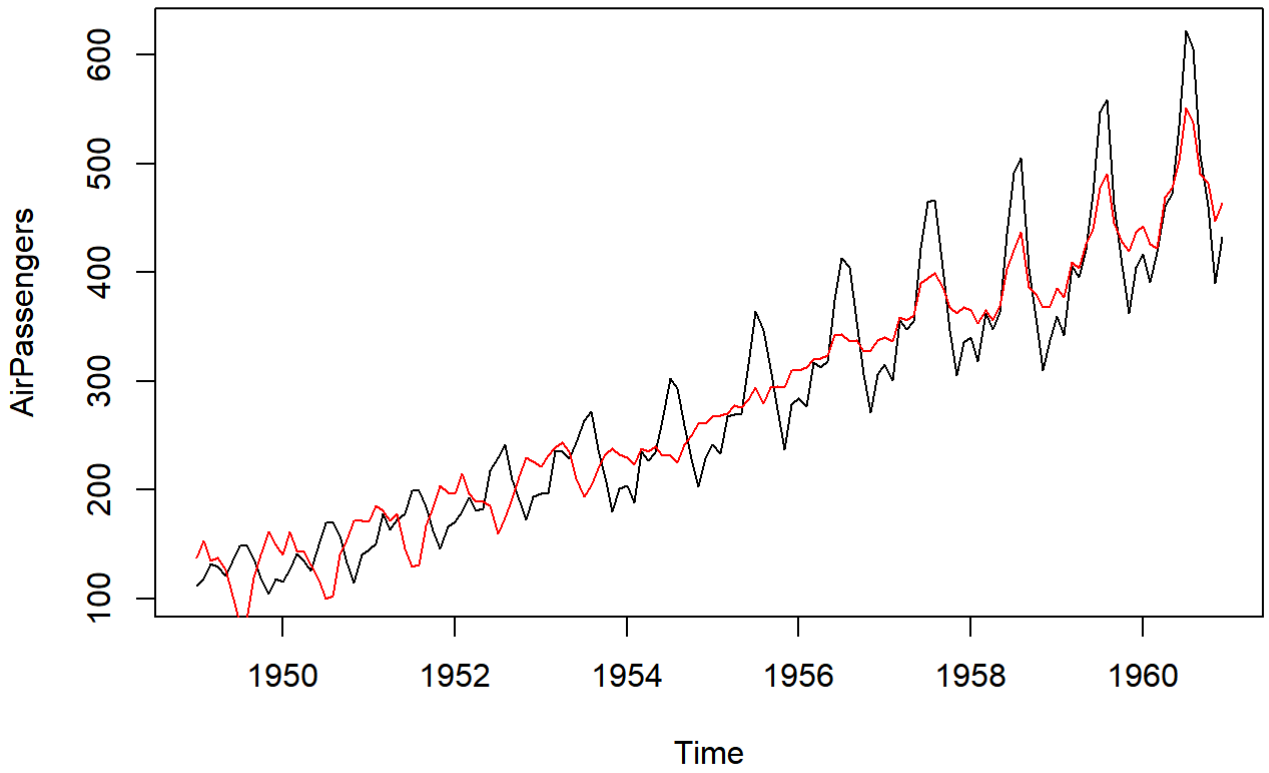
```
## $names
## [1] "time.series" "weights"     "call"        "win"         "deg"
## [6] "jump"        "inner"       "outer"
##
## $class
## [1] "stl"
```

```
#Decompose function is used to separate the the trend, seasonality and the irregularity in th
e data.

# Seasonal Adjustment
seasadj(stl_decomp)
```

```
##            Jan       Feb       Mar       Apr       May       Jun       Jul
## 1949 137.49772 153.22093 135.02748 137.29905 126.73729 102.66337  77.75612
## 1950 140.49772 161.22093 144.02748 143.29905 130.73729 116.66337  99.75612
## 1951 170.49772 185.22093 181.02748 171.29905 177.73729 145.66337 128.75612
## 1952 196.49772 215.22093 196.02748 189.29905 188.73729 185.66337 159.75612
## 1953 221.49772 231.22093 239.02748 243.29905 234.73729 210.66337 193.75612
## 1954 229.49772 223.22093 238.02748 235.29905 239.73729 231.66337 231.75612
## 1955 267.49772 268.22093 270.02748 277.29905 275.73729 282.66337 293.75612
## 1956 309.49772 312.22093 320.02748 321.29905 323.73729 341.66337 342.75612
## 1957 340.49772 336.22093 359.02748 356.29905 360.73729 389.66337 394.75612
## 1958 365.49772 353.22093 365.02748 356.29905 368.73729 402.66337 420.75612
## 1959 385.49772 377.22093 409.02748 404.29905 425.73729 439.66337 477.75612
## 1960 442.49772 426.22093 422.02748 469.29905 477.73729 502.66337 551.75612
##            Aug       Sep       Oct       Nov       Dec
## 1949  79.95057 118.56167 140.06343 161.48185 149.74052
## 1950 101.95057 140.56167 154.06343 171.48185 171.74052
## 1951 130.95057 166.56167 183.06343 203.48185 197.74052
## 1952 173.95057 191.56167 212.06343 229.48185 225.74052
## 1953 203.95057 219.56167 232.06343 237.48185 232.74052
## 1954 224.95057 241.56167 250.06343 260.48185 260.74052
## 1955 278.95057 294.56167 295.06343 294.48185 309.74052
## 1956 336.95057 337.56167 327.06343 328.48185 337.74052
## 1957 398.95057 386.56167 368.06343 362.48185 367.74052
## 1958 436.95057 386.56167 380.06343 367.48185 368.74052
## 1959 490.95057 445.56167 428.06343 419.48185 436.74052
## 1960 537.95057 490.56167 482.06343 447.48185 463.74052
```

```
# Ploting a graph
plot(AirPassengers)
lines(seasadj(stl_decomp), col="Red")
```

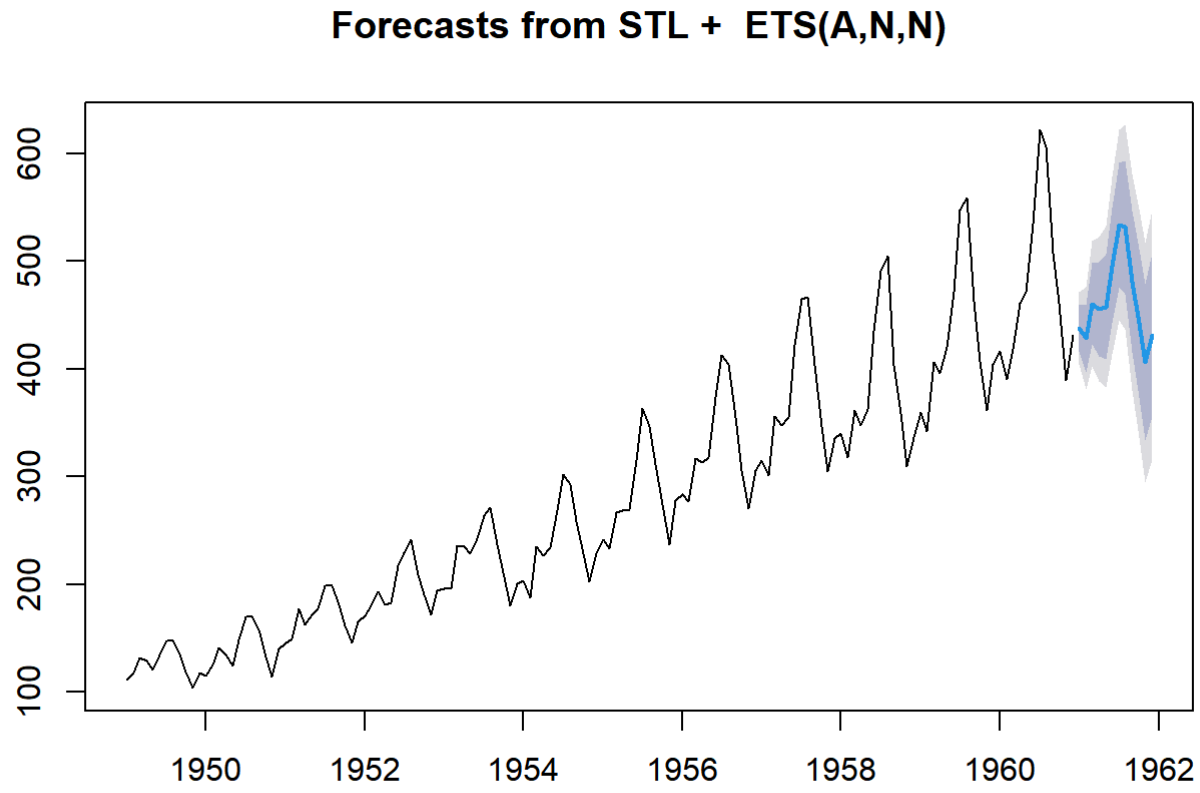



```
#The seasadj function adjusts the seasonality of the data and gives the data without the seas
onal component.The plot above shows the data without seasonal component in Red.

# Period forecast
f_stl <- forecast(stl_decomp)
f_stl <- forecast(stl_decomp,h=12)
f_stl
```

```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## Jan 1961       438.2412 416.3447 460.1376 404.7535 471.7289
## Feb 1961       428.5180 397.5533 459.4826 381.1616 475.8743
## Mar 1961       460.7114 422.7882 498.6346 402.7129 518.7099
## Apr 1961       455.4398 411.6503 499.2294 388.4695 522.4102
## May 1961       458.0016 409.0436 506.9596 383.1268 532.8764
## Jun 1961       496.0755 442.4449 549.7061 414.0546 578.0964
## Jul 1961       533.9828 476.0552 591.9103 445.3903 622.5753
## Aug 1961       531.7883 469.8613 593.7153 437.0791 626.4975
## Sep 1961       481.1772 415.4938 546.8607 380.7231 581.6314
## Oct 1961       442.6755 373.4391 511.9118 336.7876 548.5633
## Nov 1961       406.2570 333.6414 478.8727 295.2010 517.3131
## Dec 1961       431.9984 356.1539 507.8429 316.0042 547.9925
```

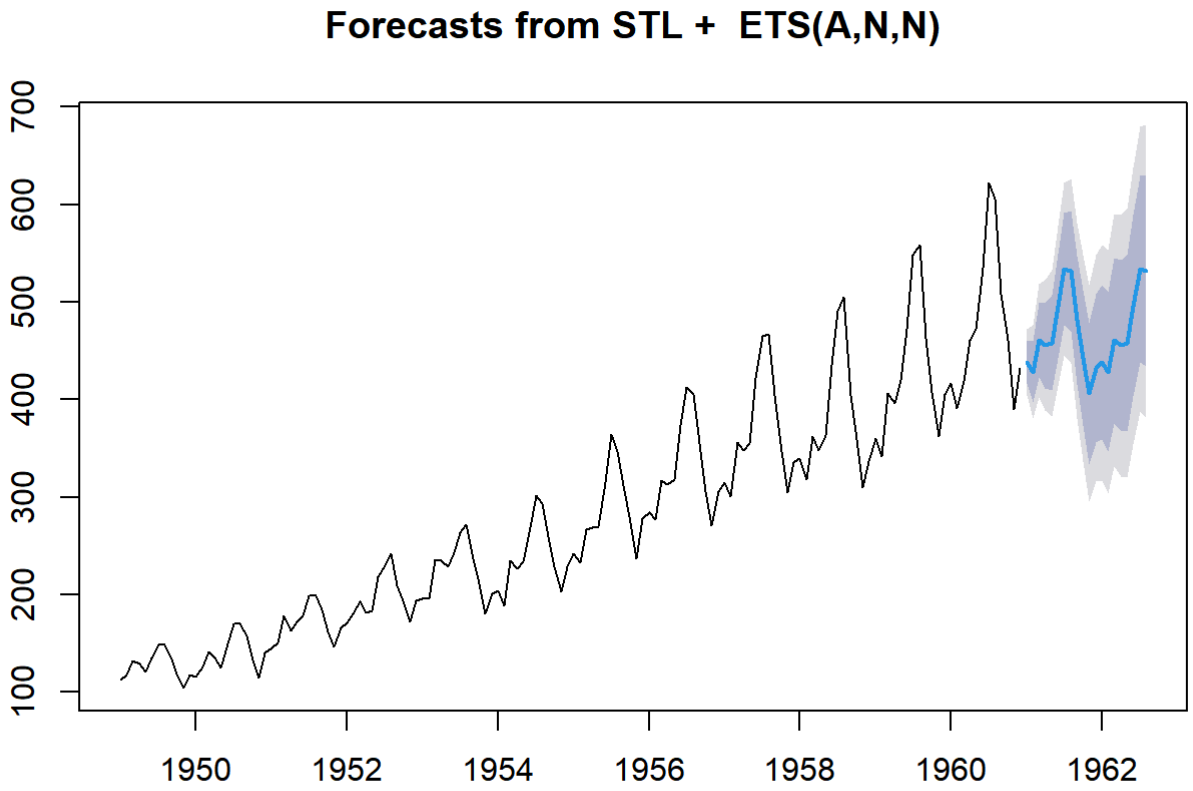
```
plot(f_stl)
```




```
f_stl <- forecast(stl_decomp,h=20)
f_stl
```

```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## Jan 1961       438.2412 416.3447 460.1376 404.7535 471.7289
## Feb 1961       428.5180 397.5533 459.4826 381.1616 475.8743
## Mar 1961       460.7114 422.7882 498.6346 402.7129 518.7099
## Apr 1961       455.4398 411.6503 499.2294 388.4695 522.4102
## May 1961       458.0016 409.0436 506.9596 383.1268 532.8764
## Jun 1961       496.0755 442.4449 549.7061 414.0546 578.0964
## Jul 1961       533.9828 476.0552 591.9103 445.3903 622.5753
## Aug 1961       531.7883 469.8613 593.7153 437.0791 626.4975
## Sep 1961       481.1772 415.4938 546.8607 380.7231 581.6314
## Oct 1961       442.6755 373.4391 511.9118 336.7876 548.5633
## Nov 1961       406.2570 333.6414 478.8727 295.2010 517.3131
## Dec 1961       431.9984 356.1539 507.8429 316.0042 547.9925
## Jan 1962       438.2412 359.2998 517.1826 317.5107 558.9716
## Feb 1962       428.5180 346.5966 510.4393 303.2301 553.8058
## Mar 1962       460.7114 375.9148 545.5080 331.0262 590.3966
## Apr 1962       455.4398 367.8623 543.0173 321.5016 589.3780
## May 1962       458.0016 367.7288 548.2744 319.9413 596.0619
## Jun 1962       496.0755 403.1856 588.9654 354.0127 638.1384
## Jul 1962       533.9828 438.5475 629.4180 388.0271 679.9384
## Aug 1962       531.7883 433.8738 629.7028 382.0410 681.5356
```

```
plot(f_stl)
```




```
#The more time we forecast, the more worse the forecast will be.have tried with h=12 & h=20.A
s time period of forecast increases, the confidence interval also increases.

decomp_elec <- decompose(AirPassengers)
attributes(decomp_elec)
```

```
## $names
## [1] "x"        "seasonal" "trend"    "random"   "figure"   "type"
##
## $class
## [1] "decomposed.ts"
```

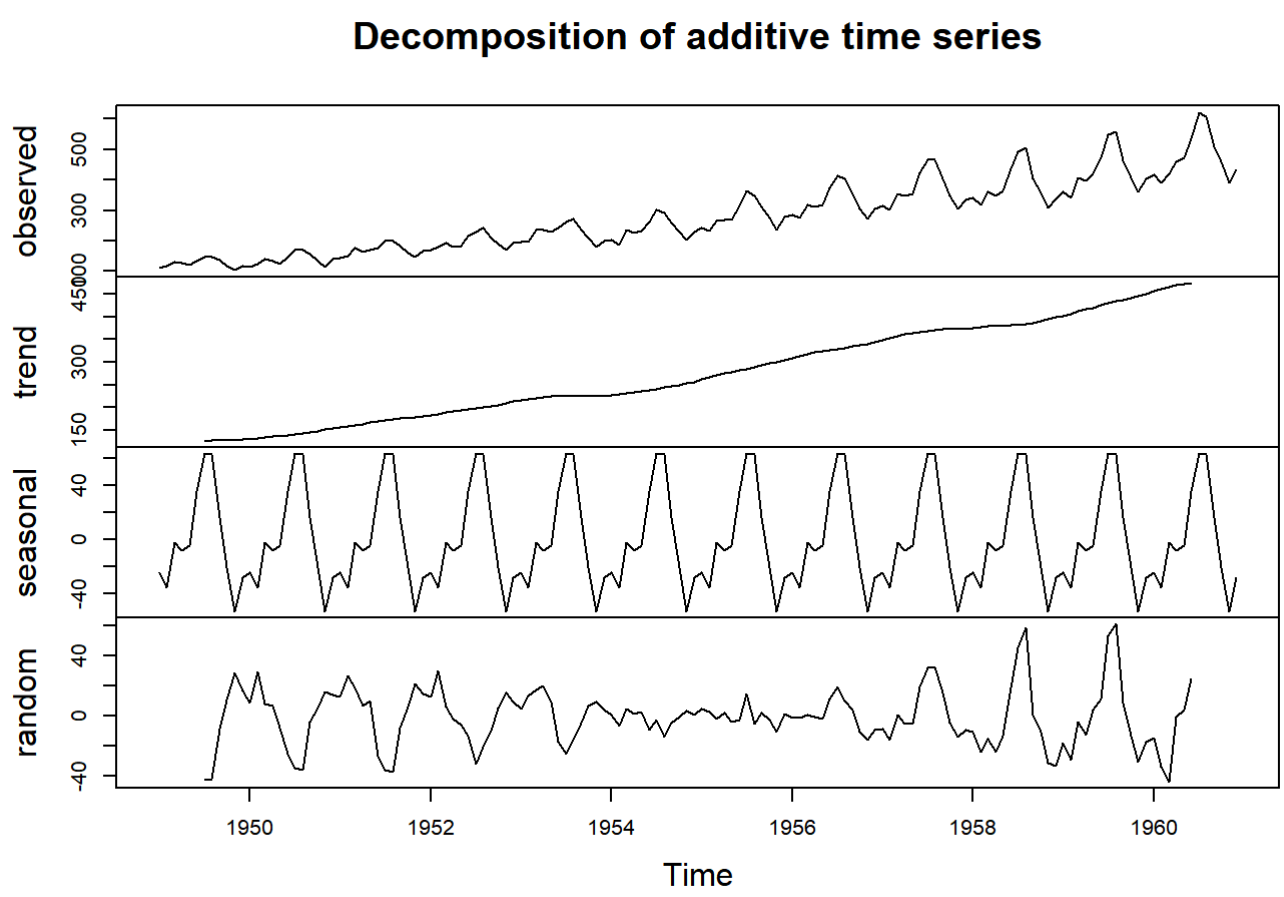
```
seasadj(decomp_elec)
```

```
##            Jan       Feb       Mar       Apr       May       Jun       Jul
## 1949 136.74874 154.18813 134.24116 137.03662 125.50631  99.59722  84.16919
## 1950 139.74874 162.18813 143.24116 143.03662 129.50631 113.59722 106.16919
## 1951 169.74874 186.18813 180.24116 171.03662 176.50631 142.59722 135.16919
## 1952 195.74874 216.18813 195.24116 189.03662 187.50631 182.59722 166.16919
## 1953 220.74874 232.18813 238.24116 243.03662 233.50631 207.59722 200.16919
## 1954 228.74874 224.18813 237.24116 235.03662 238.50631 228.59722 238.16919
## 1955 266.74874 269.18813 269.24116 277.03662 274.50631 279.59722 300.16919
## 1956 308.74874 313.18813 319.24116 321.03662 322.50631 338.59722 349.16919
## 1957 339.74874 337.18813 358.24116 356.03662 359.50631 386.59722 401.16919
## 1958 364.74874 354.18813 364.24116 356.03662 367.50631 399.59722 427.16919
## 1959 384.74874 378.18813 408.24116 404.03662 424.50631 436.59722 484.16919
## 1960 441.74874 427.18813 421.24116 469.03662 476.50631 499.59722 558.16919
##            Aug       Sep       Oct       Nov       Dec
## 1949  85.17677 119.47980 139.64268 157.59343 146.61995
## 1950 107.17677 141.47980 153.64268 167.59343 168.61995
## 1951 136.17677 167.47980 182.64268 199.59343 194.61995
## 1952 179.17677 192.47980 211.64268 225.59343 222.61995
## 1953 209.17677 220.47980 231.64268 233.59343 229.61995
## 1954 230.17677 242.47980 249.64268 256.59343 257.61995
## 1955 284.17677 295.47980 294.64268 290.59343 306.61995
## 1956 342.17677 338.47980 326.64268 324.59343 334.61995
## 1957 404.17677 387.47980 367.64268 358.59343 364.61995
## 1958 442.17677 387.47980 379.64268 363.59343 365.61995
## 1959 496.17677 446.47980 427.64268 415.59343 433.61995
## 1960 543.17677 491.47980 481.64268 443.59343 460.61995
```

```
summary(decomp_elec)
```

```
##          Length Class  Mode
## x        144    ts     numeric
## seasonal 144    ts     numeric
## trend    144    ts     numeric
## random   144    ts     numeric
## figure    12    -none- numeric
## type       1    -none- character
```

```
plot(decomp_elec)
```




```
#Since the seasonal plot is not increasing in the decomp_elec, it is an additive time series.
Suppose if the seasonal plot is increasing then it is a multiplicative time series.This funct
ion seperates, classifies and shows seperate plots for random,trend & seasonal.
```