hw5

2022-10-11

```
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 --
```

```
## v ggplot2 3.3.6
```

```
##
```

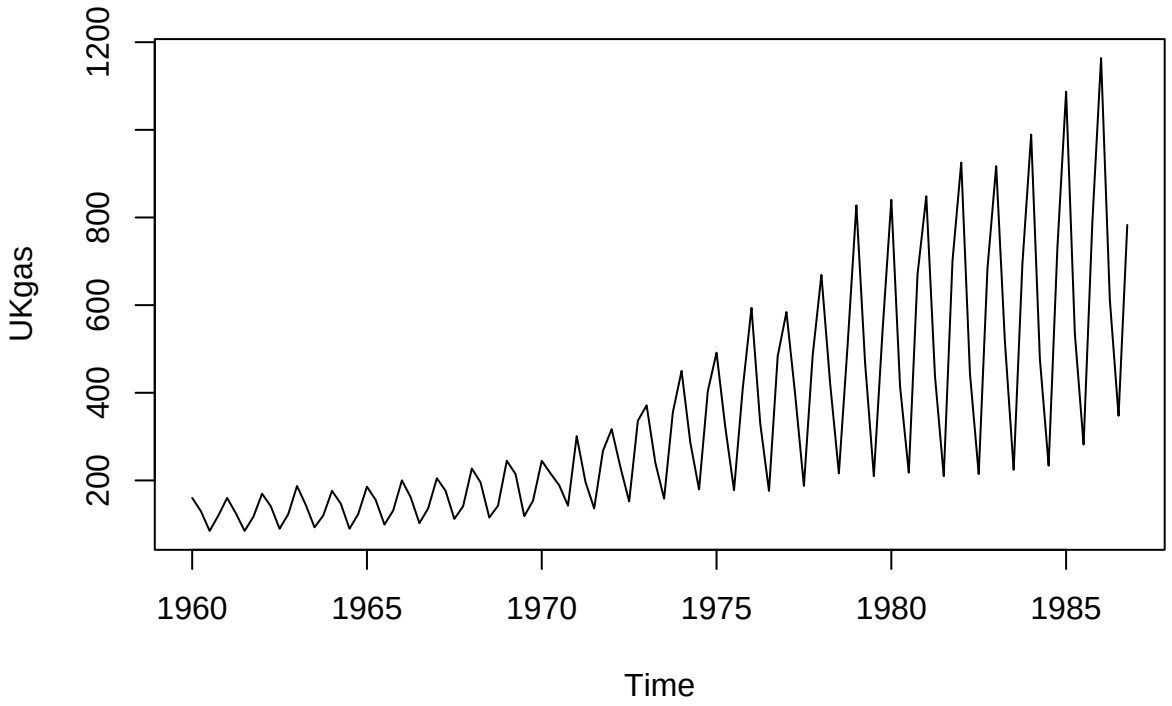
```
##
## Attaching package: 'fpp2'
```

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

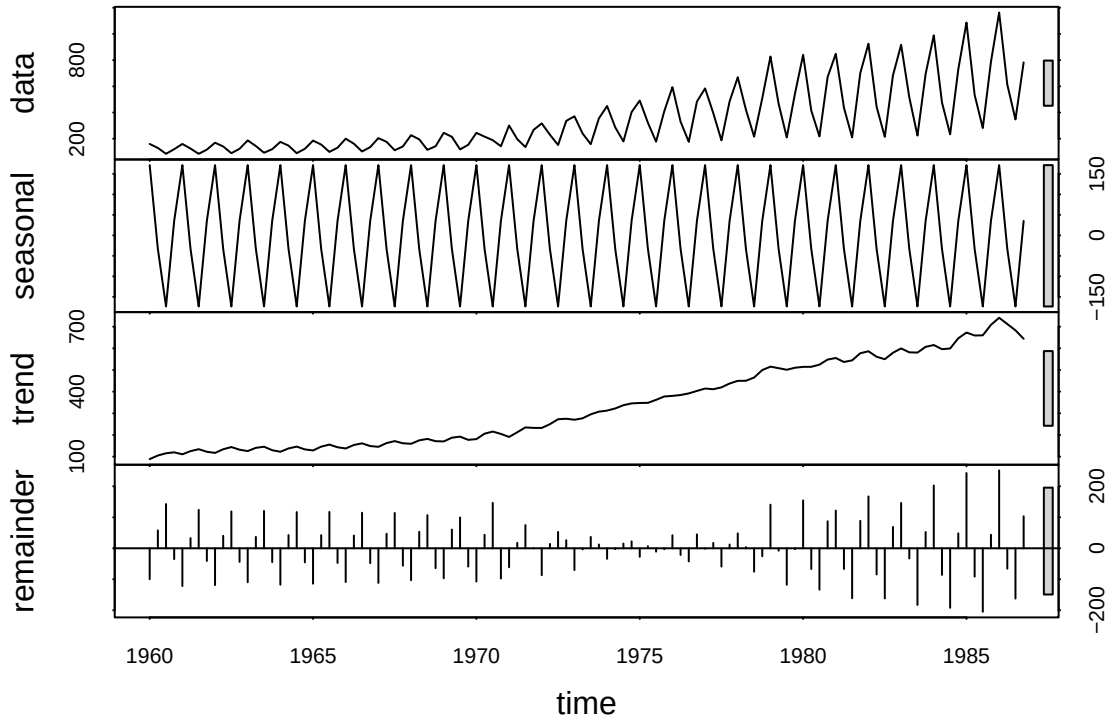
```
##We are still  using  the UKgas dataset
head(UKgas)
```

```
##       Qtr1  Qtr2  Qtr3  Qtr4
## 1960 160.1 129.7  84.8 120.1
## 1961 160.1 124.9
```

```
plot(UKgas)
```




```
#STL Decompose a time series into seasonal, trend and irregular components using loess, acronym STL.
#periodic = identical across years
stl_decomp <- stl(UKgas,s.window ="periodic")
?stl
#we can see that the trend is obviously positive of all time(>100) and show a increasing trend this mea
#seasonal show a steady wave like graph which indicates that there is no seasonal variation over time.
#remainder are generally  bigger in the left and right hand side,  but much smaller near 1975 which mea
plot(stl_decomp)
```



```
attributes(stl_decomp)
```

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

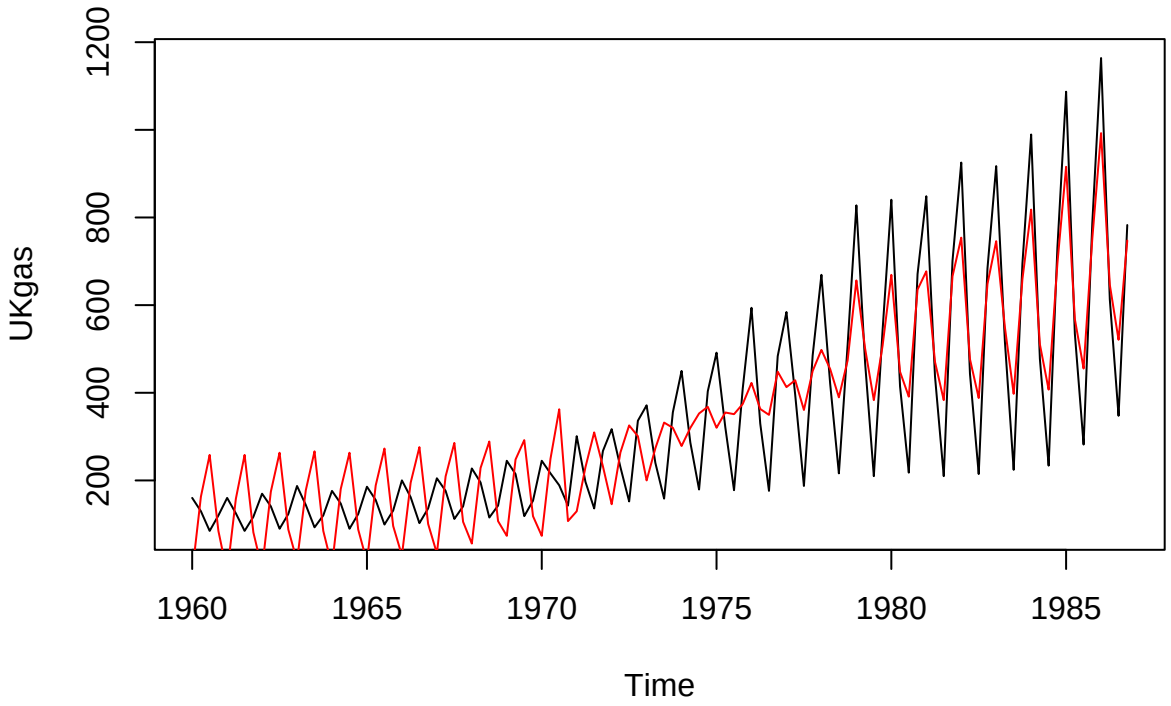
```
#apply seasonal adjust.
seasadj(stl_decomp)
```

```
##            Qtr1       Qtr2       Qtr3       Qtr4
## 1960 -11.266482 162.919518 258.278229  84.768980
## 1961 -11.266482 158.119518 258.278229  81.568980
## 1962  -1.666482 174.119518 263.178229  87.968980
## 1963  15.933518 177.319518 266.378229  84.768980
## 1964   4.733518 180.519518 263.178229  87.968980
## 1965  14.333518 188.519518 272.778229  95.968980
## 1966  28.733518 194.919518 275.978229 100.768980
## 1967  33.533518 209.319518 285.578229 105.568980
## 1968  55.933518 228.519518 288.778229 107.168980
## 1969  73.533518 247.719518 291.978229 118.368980
## 1970  73.533518 249.319518 362.378229 107.168980
## 1971 129.633518 230.119518 309.578229 231.968980
## 1972 145.633518 263.719518 325.578229 300.868980
## 1973 200.033518 273.319518 331.978229 320.068980
## 1974 278.533518 319.819518 352.778229 368.068980
## 1975 320.133518 355.019518 351.178229 374.468980
## 1976 422.533518 363.019518 349.578229 448.168980
## 1977 412.933518 428.619518 360.778229 449.768980
## 1978 497.833518 454.219518 389.578229 473.768980
## 1979 656.333518 500.719518 383.178229 507.368980
## 1980 669.133518 447.819518 391.178229 635.468980
## 1981 677.133518 470.219518 383.178229 665.868980
## 1982 753.933518 476.619518 387.978229 648.268980
## 1983 745.933518 548.719518 397.578229 659.468980
## 1984 818.033518 510.319518 407.178229 694.668980
## 1985 915.633518 567.919518 455.278229 752.268980
## 1986 992.533518 646.319518 520.878229 747.468980
```

```
attributes(seasadj(stl_decomp))
```

```
## $tsp
## [1] 1960.00 1986.75    4.00
##
## $class
## [1] "ts"
```

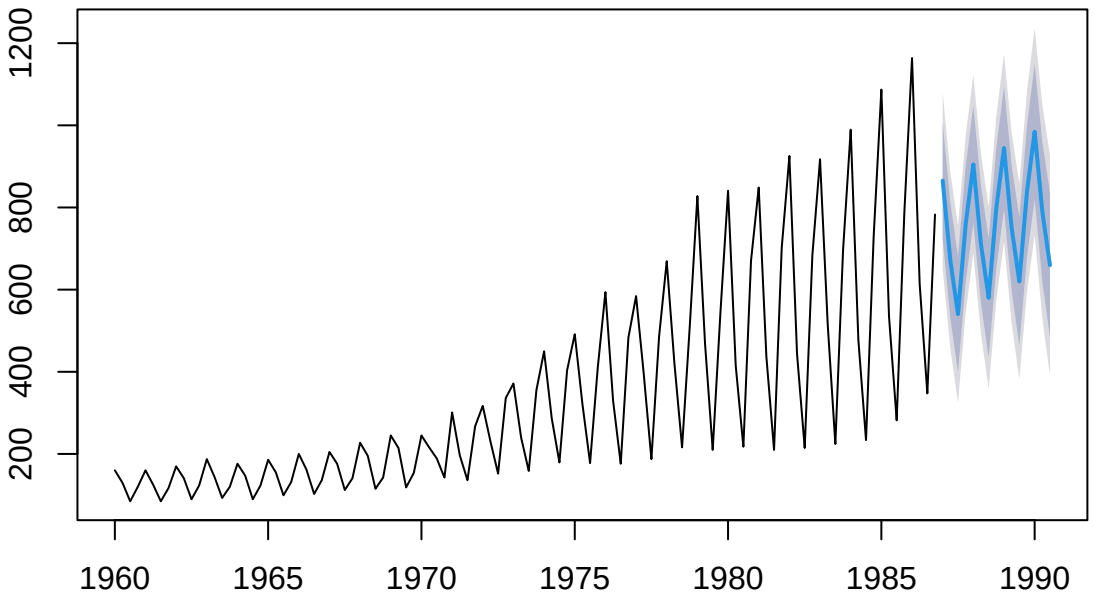
```
# Plot a line on the graph
plot(UKgas)
lines(seasadj(stl_decomp), col="Red")
```



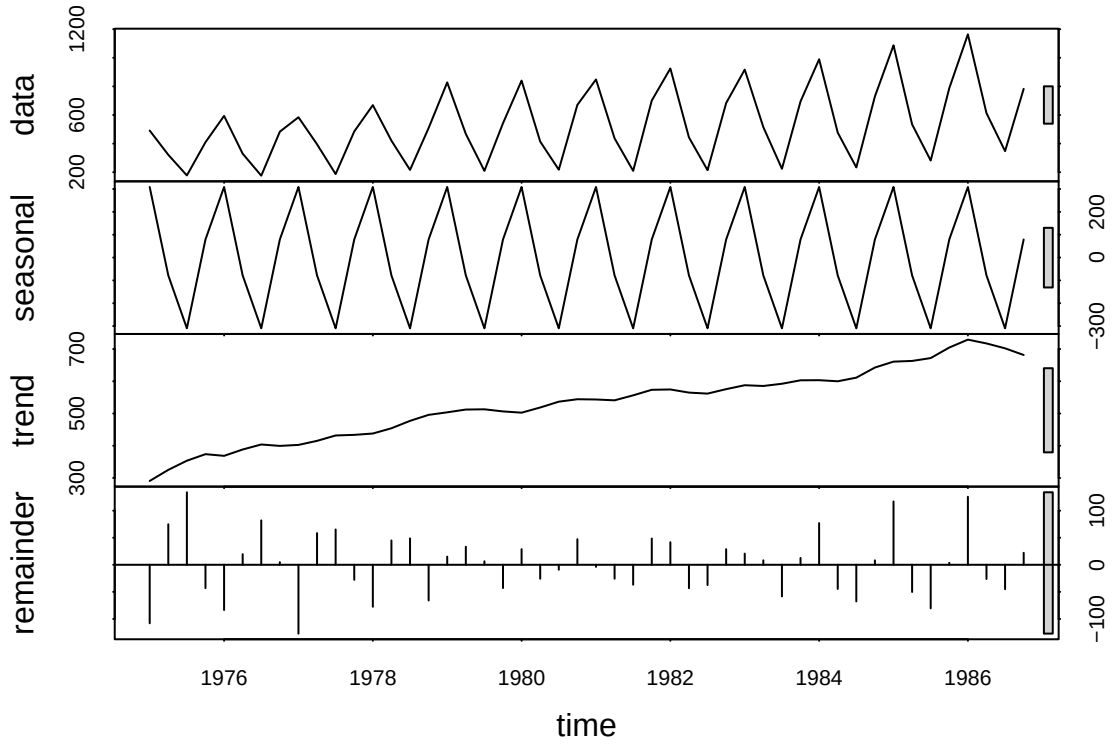

```
# Default period forecast
f_stl <- forecast(stl_decomp)
# you can pass the # of period
f_stl <- forecast(stl_decomp,h=15)
f_stl
```

```
##         Point Forecast    Lo 80     Hi 80    Lo 95     Hi 95
## 1987 Q1       865.2376 724.9641 1005.5110 650.7078 1079.7673
## 1987 Q2       670.5955 530.1935  810.9975 455.8692  885.3218
## 1987 Q3       540.2807 399.5902  680.9712 325.1132  755.4483
## 1987 Q4       759.0339 617.8320  900.2358 543.0843  974.9835
## 1988 Q1       905.0133 763.0162 1047.0104 687.8475 1122.1791
## 1988 Q2       710.3713 567.2370  853.5055 491.4663  929.2762
## 1988 Q3       580.0565 435.3889  724.7241 358.8065  801.3065
## 1988 Q4       798.8097 652.1636  945.4557 574.5339 1023.0855
## 1989 Q1       944.7891 795.6768 1093.9014 716.7415 1172.8367
## 1989 Q2       750.1470 598.0452  902.2488 517.5274  982.7666
## 1989 Q3       619.8322 464.1900  775.4744 381.7980  857.8664
## 1989 Q4       838.5854 678.8322  998.3387 594.2639 1082.9069
## 1990 Q1       984.5648 820.1179 1149.0117 733.0650 1236.0647
## 1990 Q2       789.9228 620.1949  959.6506 530.3464 1049.4991
## 1990 Q3       659.6080 484.0136  835.2023 391.0596  928.1564
```

```
plot(f_stl)
```




```
### try period after 1975
gasA1975 <- window(UKgas, start=c(1975, 1), end=c(1986, 4))
stl_gasA1975 <- stl(gasA1975,s.window ="periodic")
plot(stl_gasA1975)
```

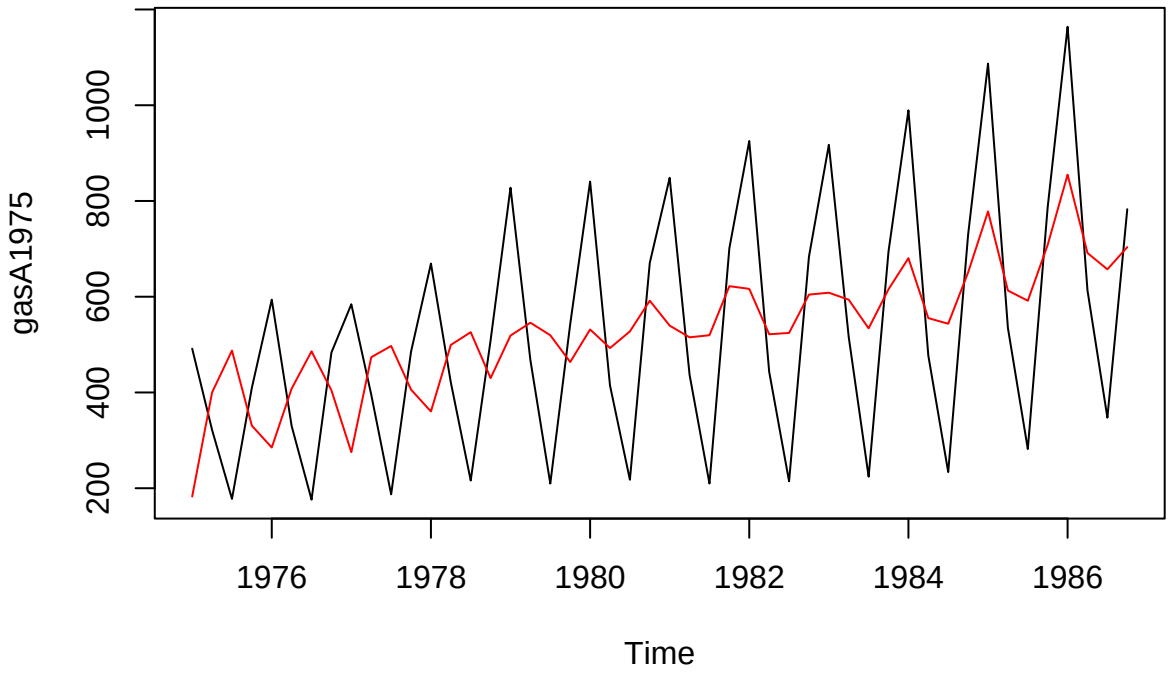



```
seasadj(stl_gasA1975)
```

```
##           Qtr1     Qtr2     Qtr3     Qtr4
## 1975 182.5970 400.0097 487.5351 330.6585
```

```
## 1976 284.9970 408.0097 485.9351 404.3585
## 1977 275.3970 473.6097 497.1351 405.9585
## 1978 360.2970 499.2097 525.9351 429.9585
## 1979 518.7970 545.7097 519.5351 463.5585
## 1980 531.5970 492.8097 527.5351 591.6585
## 1981 539.5970 515.2097 519.5351 622.0585
## 1982 616.3970 521.6097 524.3351 604.4585
## 1983 608.3970 593.7097 533.9351 615.6585
## 1984 680.4970 555.3097 543.5351 650.8585
## 1985 778.0970 612.9097 591.6351 708.4585
## 1986 854.9970 691.3097 657.2351 703.6585
```

```
plot(gasA1975)
lines(seasadj(stl_gasA1975), col="Red")
```

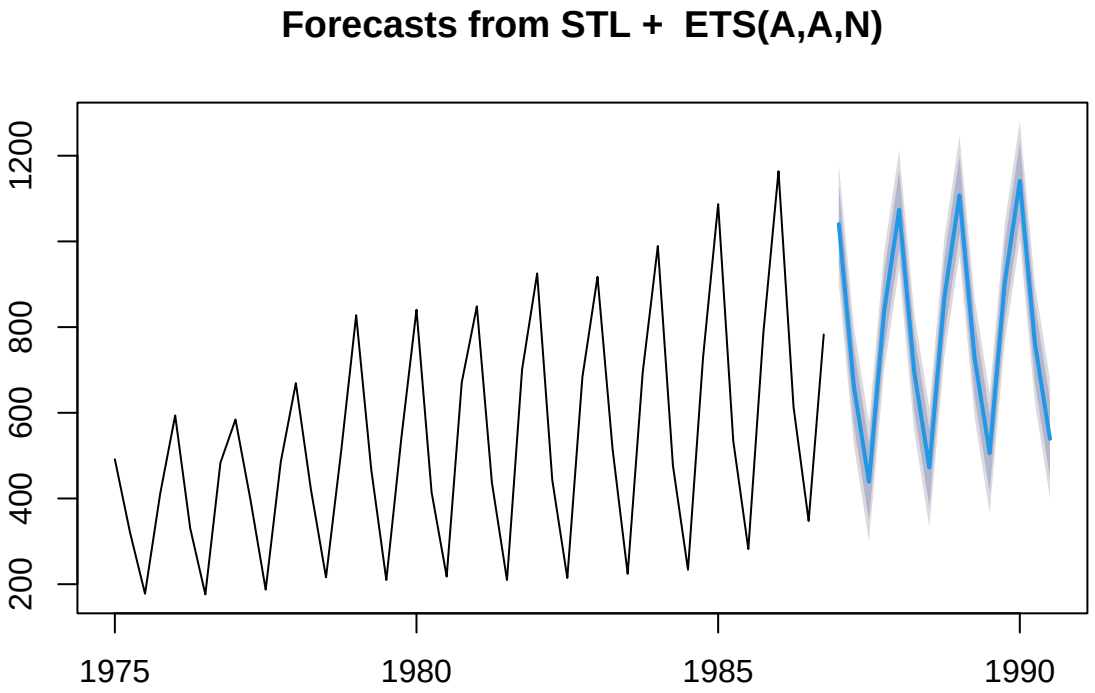



```
# Default period forecast
f_stl1975 <- forecast(stl_gasA1975)
# you can pass the # of period
f_stl1975 <- forecast(stl_gasA1975,h=15)
f_stl1975
```

```
##         Point Forecast     Lo 80     Hi 80     Lo 95     Hi 95
## 1987 Q1      1040.4938  949.8634 1131.1242  901.8866 1179.1010
## 1987 Q2       661.7764  571.1460  752.4068  523.1692  800.3836
## 1987 Q3       438.5462  347.9158  529.1766  299.9390  577.1534
## 1987 Q4       835.9181  745.2877  926.5485  697.3108  974.5253
## 1988 Q1      1074.0749  983.4445 1164.7053  935.4676 1212.6821
## 1988 Q2       695.3574  604.7270  785.9879  556.7502  833.9647
## 1988 Q3       472.1272  381.4968  562.7577  333.5199  610.7346
## 1988 Q4       869.4991  778.8686  960.1296  730.8918 1008.1065
## 1989 Q1      1107.6559 1017.0254 1198.2864  969.0485 1246.2633
## 1989 Q2       728.9385  638.3079  819.5690  590.3310  867.5460
## 1989 Q3       505.7083  415.0777  596.3389  367.1007  644.3159
## 1989 Q4       903.0802  812.4495  993.7108  764.4725 1041.6878
```

```
## 1990 Q1      1141.2370 1050.6062 1231.8677 1002.6292 1279.8447
## 1990 Q2       762.5195  671.8887  853.1504  623.9116  901.1275
## 1990 Q3       539.2893  448.6584  629.9203  400.6813  677.8974
```

```
plot(f_stl1975)
```




```
attributes(f_stl1975)
```

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

```
# There is more than one way to do things
attributes(UKgas)
```

```
## $tsp
## [1] 1960.00 1986.75    4.00
##
## $class
## [1] "ts"
```

```
window(UKgas)
```

```
##        Qtr1   Qtr2   Qtr3   Qtr4
## 1960  160.1  129.7   84.8  120.1
## 1961  160.1  124.9   84.8  116.9
## 1962  169.7  140.9   89.7  123.3
## 1963  187.3  144.1   92.9  120.1
## 1964  176.1  147.3   89.7  123.3
## 1965  185.7  155.3   99.3  131.3
## 1966  200.1  161.7  102.5  136.1
## 1967  204.9  176.1  112.1  140.9
```

```
## 1968  227.3  195.3  115.3  142.5
## 1969  244.9  214.5  118.5  153.7
## 1970  244.9  216.1  188.9  142.5
## 1971  301.0  196.9  136.1  267.3
## 1972  317.0  230.5  152.1  336.2
## 1973  371.4  240.1  158.5  355.4
## 1974  449.9  286.6  179.3  403.4
## 1975  491.5  321.8  177.7  409.8
## 1976  593.9  329.8  176.1  483.5
## 1977  584.3  395.4  187.3  485.1
## 1978  669.2  421.0  216.1  509.1
## 1979  827.7  467.5  209.7  542.7
## 1980  840.5  414.6  217.7  670.8
## 1981  848.5  437.0  209.7  701.2
## 1982  925.3  443.4  214.5  683.6
## 1983  917.3  515.5  224.1  694.8
## 1984  989.4  477.1  233.7  730.0
## 1985 1087.0  534.7  281.8  787.6
## 1986 1163.9  613.1  347.4  782.8
```

```
#cut from 1975
str(UKgas)
```

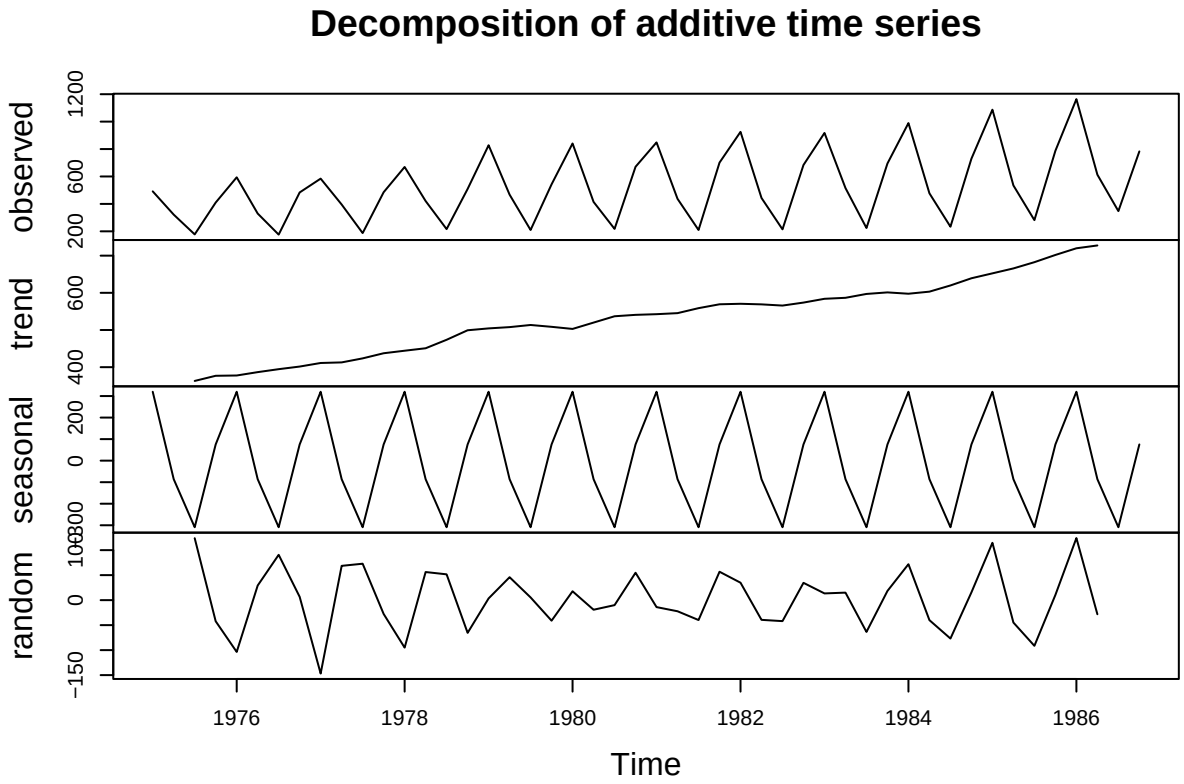
```
##  Time-Series [1:108] from 1960 to 1987: 160.1 129.7 84.8 120.1 160.1 ...
```

```
gasA1975 <- window(UKgas, start=c(1975, 1), end=c(1986, 4))
str(gasA1975)
```

```
##  Time-Series [1:48] from 1975 to 1987: 492 322 178 410 594 ...
```

```
decompose_uk <- decompose(gasA1975)

plot(decompose_uk)
```



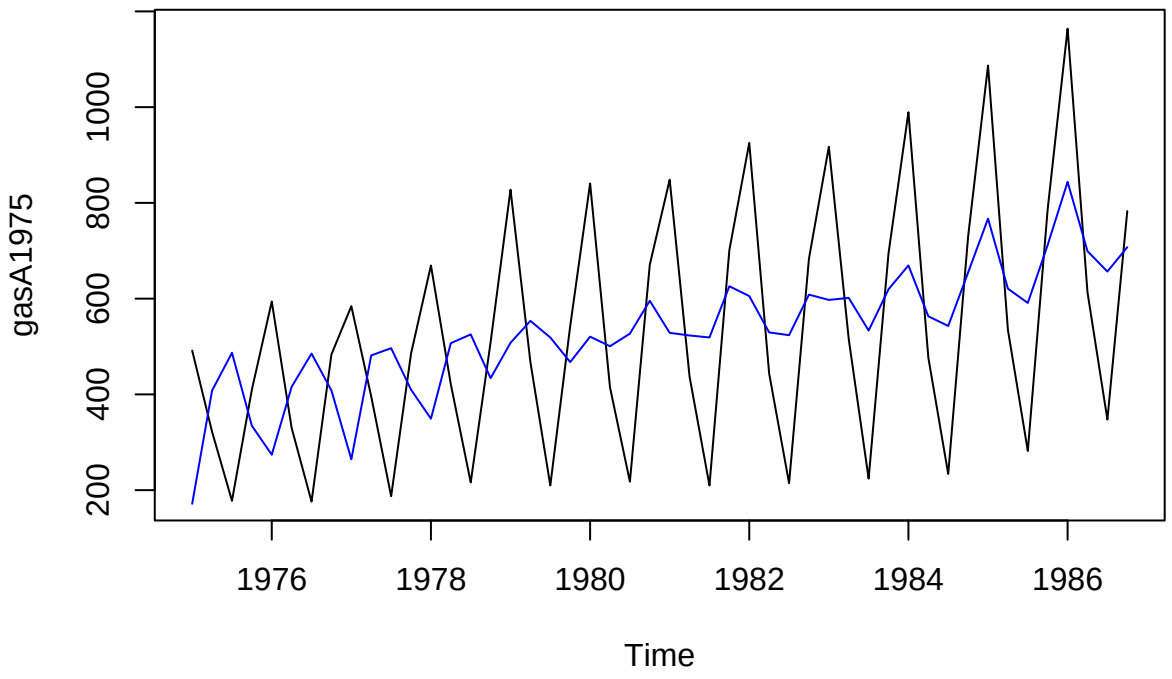

```
attributes(decompose_uk)
```

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

```
seasadj(decompose_uk)
```

```
##          Qtr1     Qtr2     Qtr3     Qtr4
## 1975 171.5585 407.8347 486.8960 334.5108
## 1976 273.9585 415.8347 485.2960 408.2108
## 1977 264.3585 481.4347 496.4960 409.8108
## 1978 349.2585 507.0347 525.2960 433.8108
## 1979 507.7585 553.5347 518.8960 467.4108
## 1980 520.5585 500.6347 526.8960 595.5108
## 1981 528.5585 523.0347 518.8960 625.9108
## 1982 605.3585 529.4347 523.6960 608.3108
## 1983 597.3585 601.5347 533.2960 619.5108
## 1984 669.4585 563.1347 542.8960 654.7108
## 1985 767.0585 620.7347 590.9960 712.3108
## 1986 843.9585 699.1347 656.5960 707.5108
```

```
plot(gasA1975)
lines(seasadj(decompose_uk), col="Blue")
```


gasA1975
200
400
600
800
1000
1976
1978
1980
1982
1984
1986
Time