9.

$\tilde{x}_9 = \alpha * x_9 + (1 - \alpha)\tilde{x}_8 = 160.332$
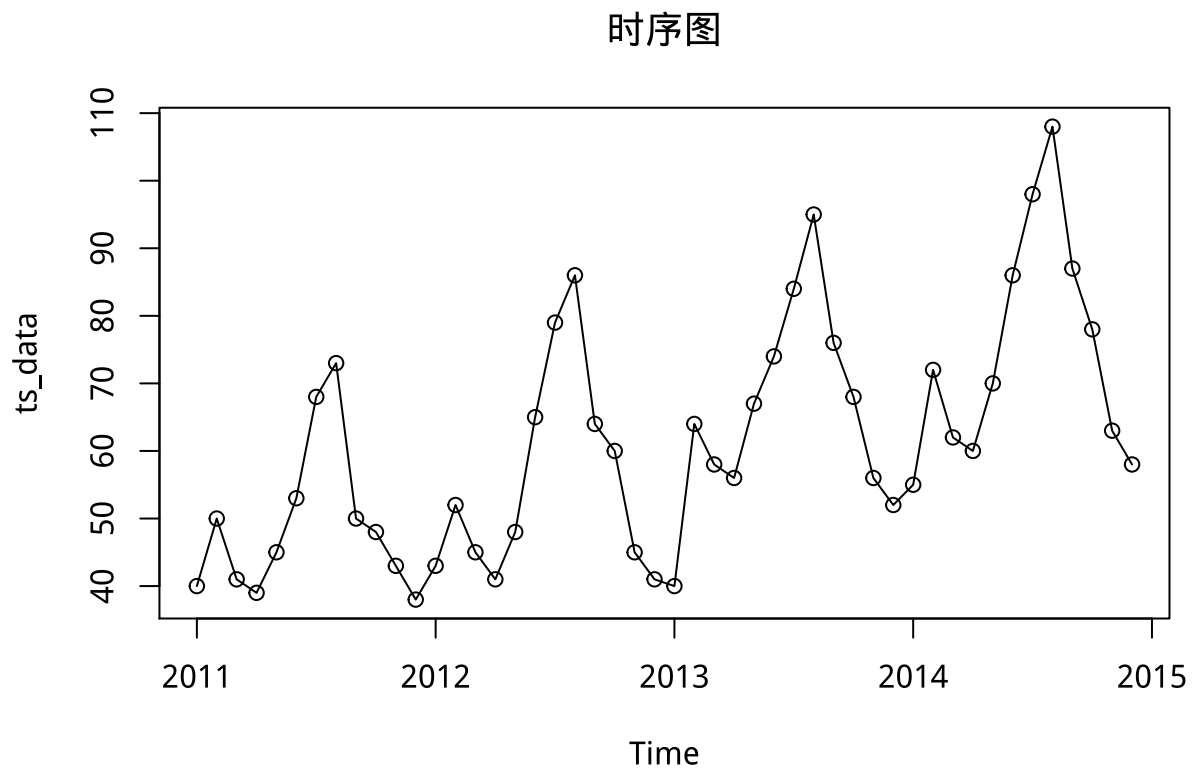$\tilde{x}_{10} = \tilde{x}_{11} = \tilde{x}_9 = 160.332$

14.

```r
library(TSA)
```

```r
data<-c(40,50,41,39,45,53,68,73,50,48,43,38,43,52,45,41,48,65,79,
        86,64,60,45,41,40,64,58,56,67,74,84,95,76,68,56,52,55,72,
        62,60,70,86,98,108,87,78,63,58)
ts_data<-ts(data,start = c(2011,1),frequency = 12)
```

(1)

```r
plot(ts_data,type='o',cex.axis=1.5,cex.lab=1.5,main=' 时序图')
```


时序图

(2)

GDP 序列呈现出明显的趋势性和季节效应，且季节效应随着时间的推移增大，故采用乘法模型。

```
ts_data.hw<-HoltWinters(ts_data,seasonal = 'multiplicative')
ts_data.hw
```

```
## Holt-Winters exponential smoothing with trend and multiplicative seasonal component.
##
## Call:
## HoltWinters(x = ts_data, seasonal = "multiplicative")
##
## Smoothing parameters:
##  alpha: 0.07995652
##  beta : 0.01695116
##  gamma: 0.5549871
##
## Coefficients:
##           [,1]
## a   76.7725117
## b    0.7302170
## s1   0.7852075
## s2   1.0474241
## s3   0.9031463
## s4   0.8500425
## s5   0.9840325
## s6   1.1865723
## s7   1.3552161
## s8   1.4841561
## s9   1.1502457
## s10  1.0294092
## s11  0.8286342
## s12  0.7523467
```

(3)

```
ts_data.for<-predict(ts_data.hw,n.ahead=12*3)
ts_data.for
```

```
##              Jan        Feb        Mar        Apr        May        Jun        Jul
## 2015   60.85573   81.94307   71.31529   67.74276   79.13943   96.29487 110.97056
## 2016   67.73619   91.12124   79.22921   75.19135   87.76212 106.69233 122.84578
## 2017   74.61665  100.29940   87.14312   82.63993   96.38481 117.08979 134.72100
##              Aug        Sep        Oct        Nov        Dec
## 2015 122.61244   95.86661   86.54725   70.27224   64.35206
## 2016 135.61751  105.94576   95.56756   77.53324   70.94458
## 2017 148.62258  116.02491  104.58786   84.79423   77.53709
```

```
plot(ts_data.for,main=' 未来三年 B 市每月汽车预期销量')
```
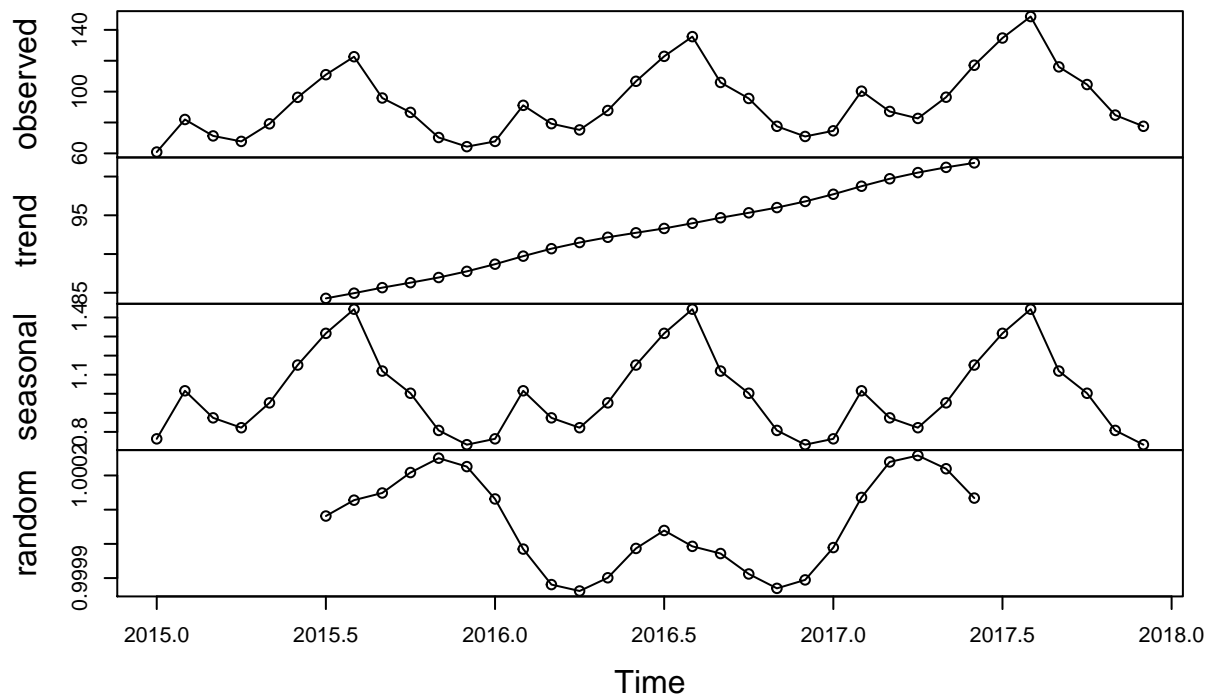
未来三年B市每月汽车预期销量
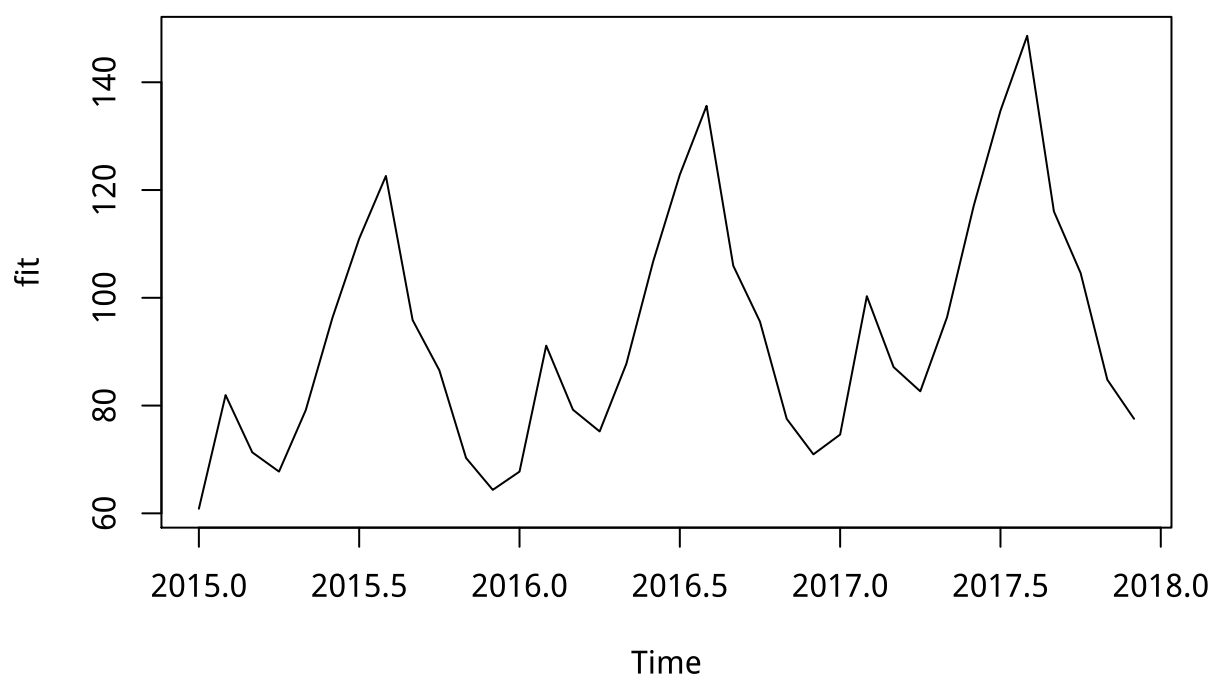
简要分析：

```r
ts_analysis<-decompose(ts_data.for,type='multiplicative')
plot(ts_analysis,type='o')
```

Decomposition of multiplicative time series

从趋势来看，三年后的预期值呈稳步上升形态，未来市场前景看好。