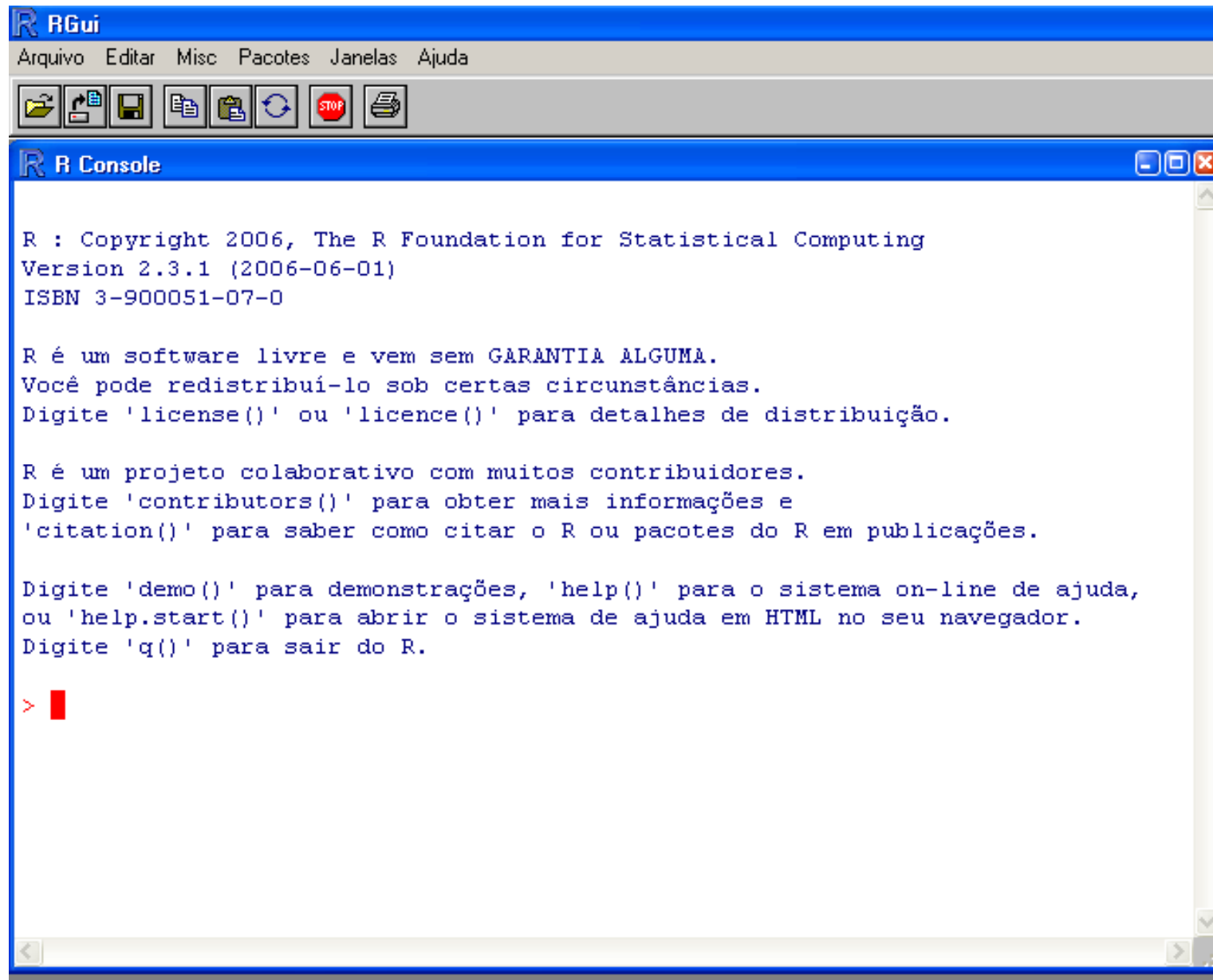




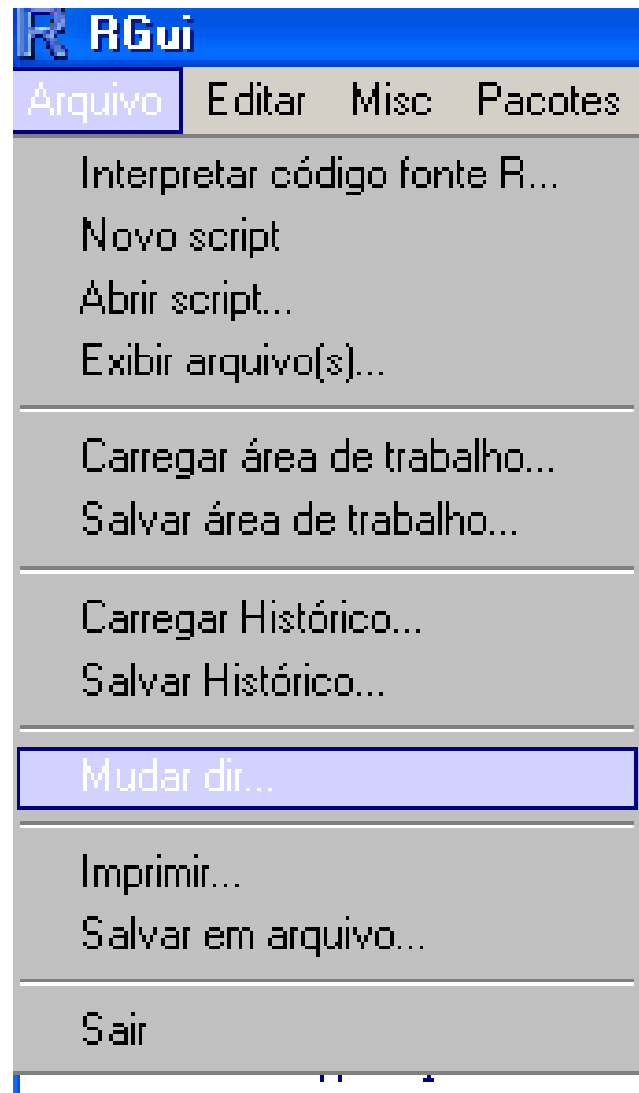
SÉRIES TEMPORAIS NO R

Comandos Básicos





Mudar diretório para leitura de dados





```
#Análise de Séries Temporais no R#
```

```
#Criar o arquivo de dados com a variável em uma  
coluna#
```

```
# PROD
```

```
694.84
```

```
645.52
```

```
690.91
```

```
661.98
```

```
706.46
```

```
690.49
```

```
732.28
```

```
701.09
```

```
702.20
```

```
.
```

```
.
```

```
.#
```



#comandos do R#

```
dados=read.table('prodR.txt', head=T)
```

#carrega o arquivo para o R e informa que a primeira linha e texto#

```
dados #mostra os dados#
```

PROD

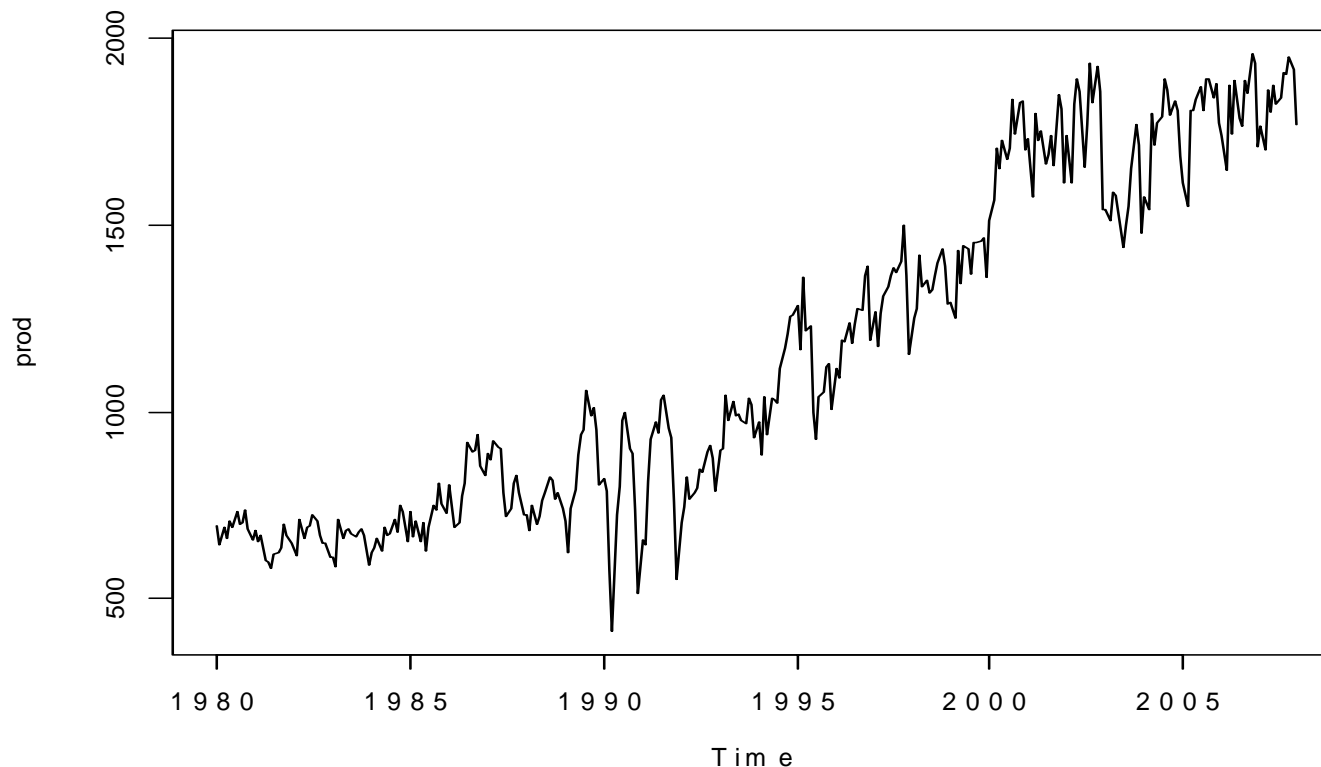
1	694.84
2	645.52
3	690.91
4	661.98
5	706.46
6	690.49
7	732.28
8	701.09



```
prod=ts(dados,start=1980,freq=12)
```

#atribui à variável prod a série contida nos "dados", que inicia em 1980 e tem a frequência mensal#

```
ts.plot(prod) #mostra o comportamento da série, por meio gráfico#
```





A função "decompose" estima as componentes de tendência e sazonal#

modelos aditivos ou multiplicativos via média móvel#

D=decompose(prod)

D

Parte dos resultados das componentes sazonal, tendência e aleatória

\$seasonal

	Jan	Feb	Mar	Apr	May	Jun
1980	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1981	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1982	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1983	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1984	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1985	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1986	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1987	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948
1988	-39.714009	-86.371910	22.581584	-23.617503	23.406247	-13.490948



trend

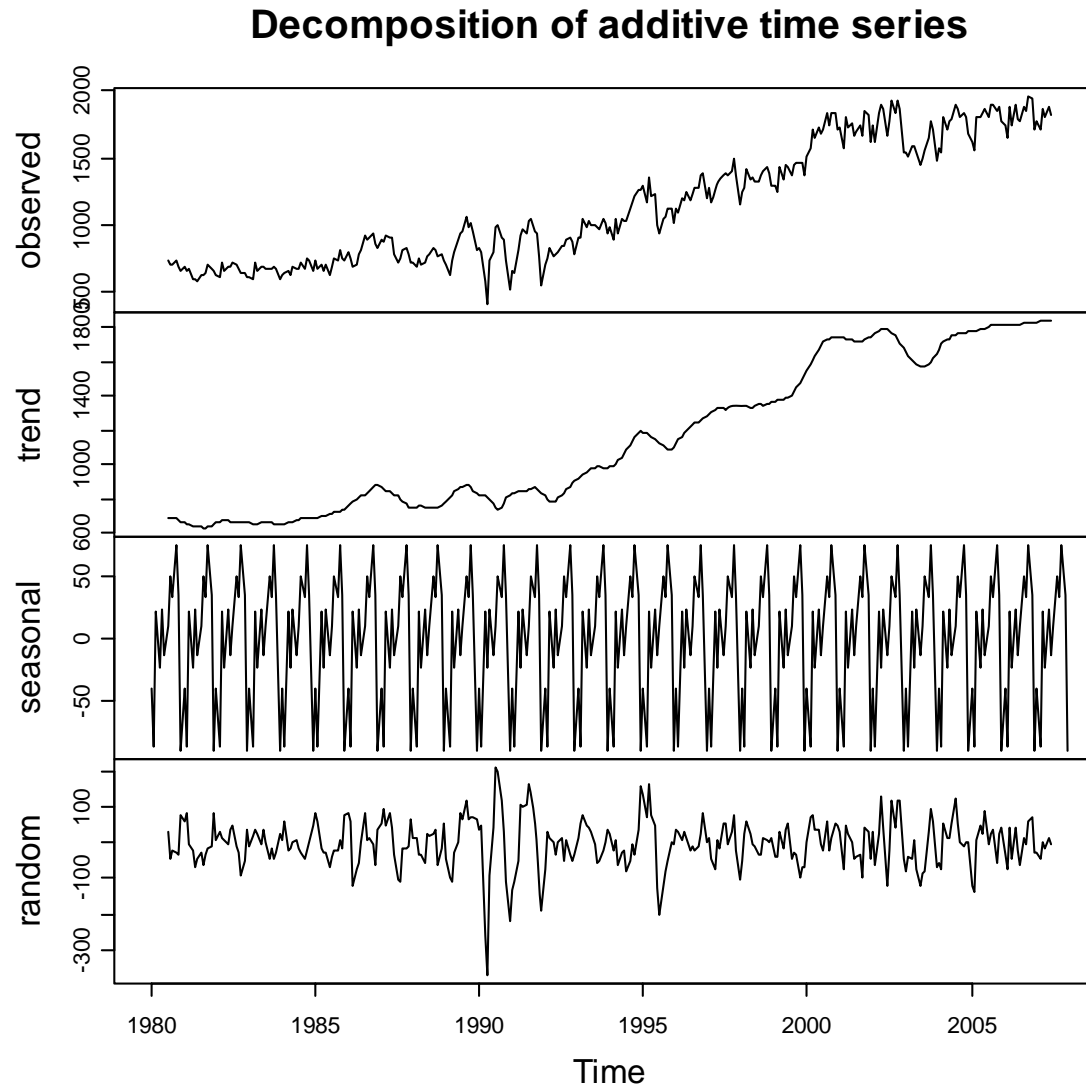
	Jan	Feb	Mar	Apr	May	Jun	Jul
1980	NA	NA	NA	NA	NA	NA	691.9688
1981	662.4492	654.4808	648.5400	644.2579	642.0583	641.0700	638.5275
1982	663.3950	671.2996	676.1754	675.3267	672.1375	669.5067	666.9925
1983	660.2871	656.5542	655.2687	657.3458	659.9717	660.1262	659.9375
1984	657.0304	658.8471	660.6050	663.0812	668.2433	673.3546	680.4008

random

	Jan	Feb	Mar	Apr	May
1980	NA	NA	NA	NA	NA
1981	60.3348424	85.2110764	-1.4415839	-18.4504140	-67.1145807
1982	7.0090091	30.0323264	13.8829995	9.2508360	-3.3037473
1983	-10.4430743	18.1277431	35.3696661	27.3816693	-1.8479140
1984	6.6535924	63.0448264	-19.7965839	-12.6637473	1.2104193
1985	81.7827591	58.1548264	-12.8582505	-26.1383307	-27.1012473
1986	83.1148424	59.9377431	-117.7107505	-71.5229140	-58.2762473
1987	52.6119257	98.4573264	47.5259161	85.4487527	43.9766693



plot(D) #mostra as componentes graficamente #

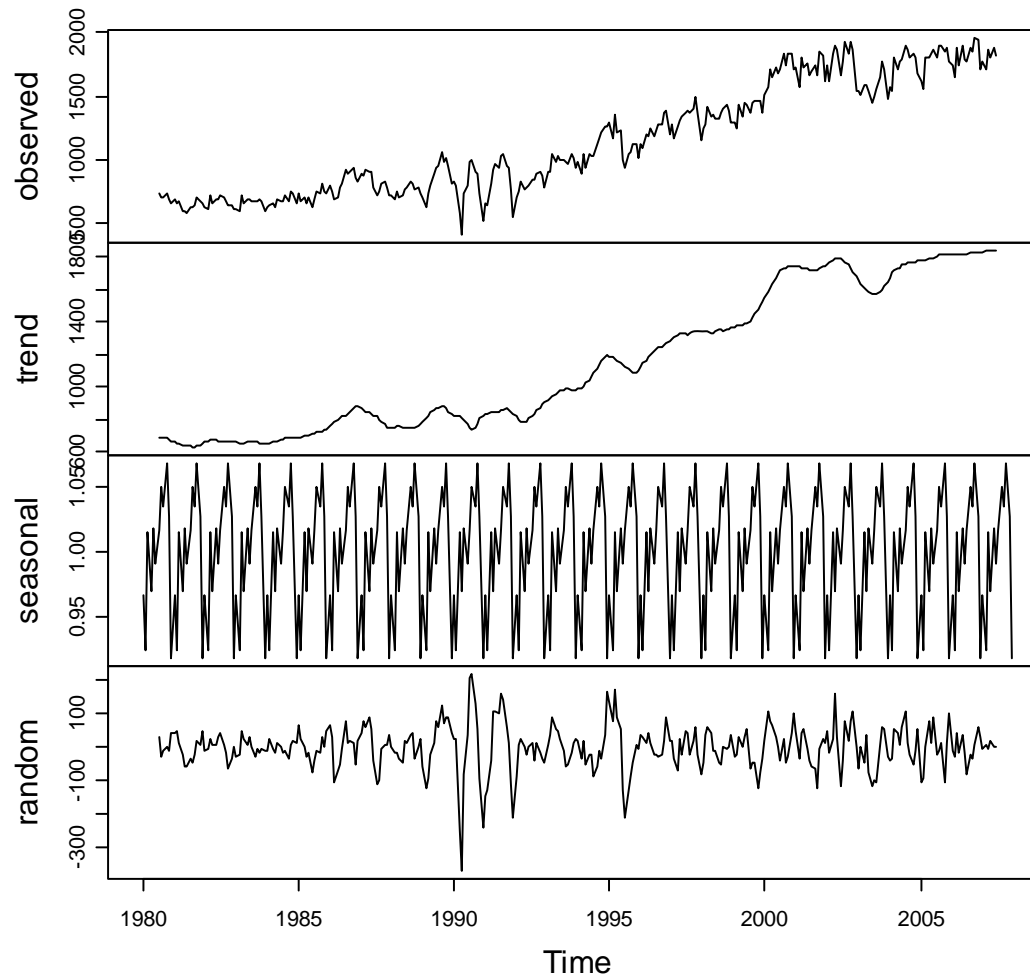




#Para modelo multiplicativo usar opção type='m'#

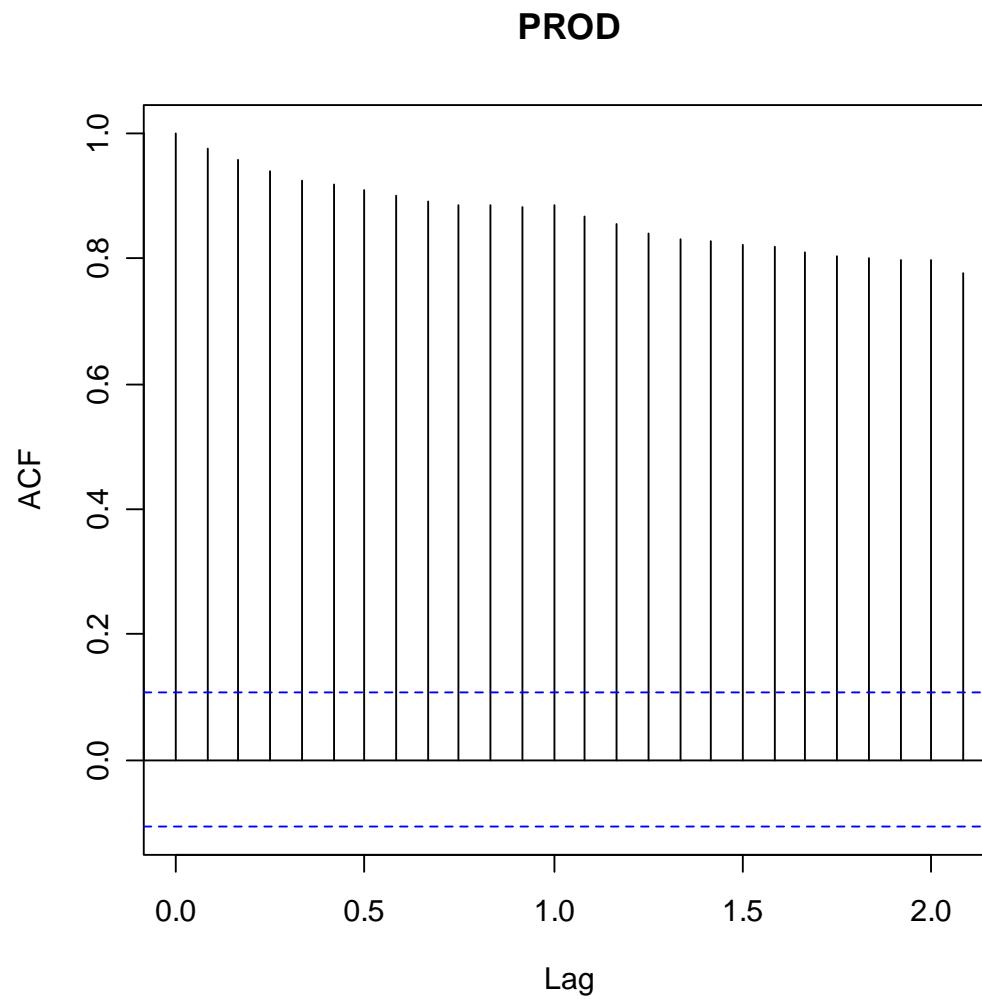
DM=decompose(prod, type="m")

Decomposition of multiplicative time series





#cálculo de autocorrelação#
acf(prod) #função autocorrelação#



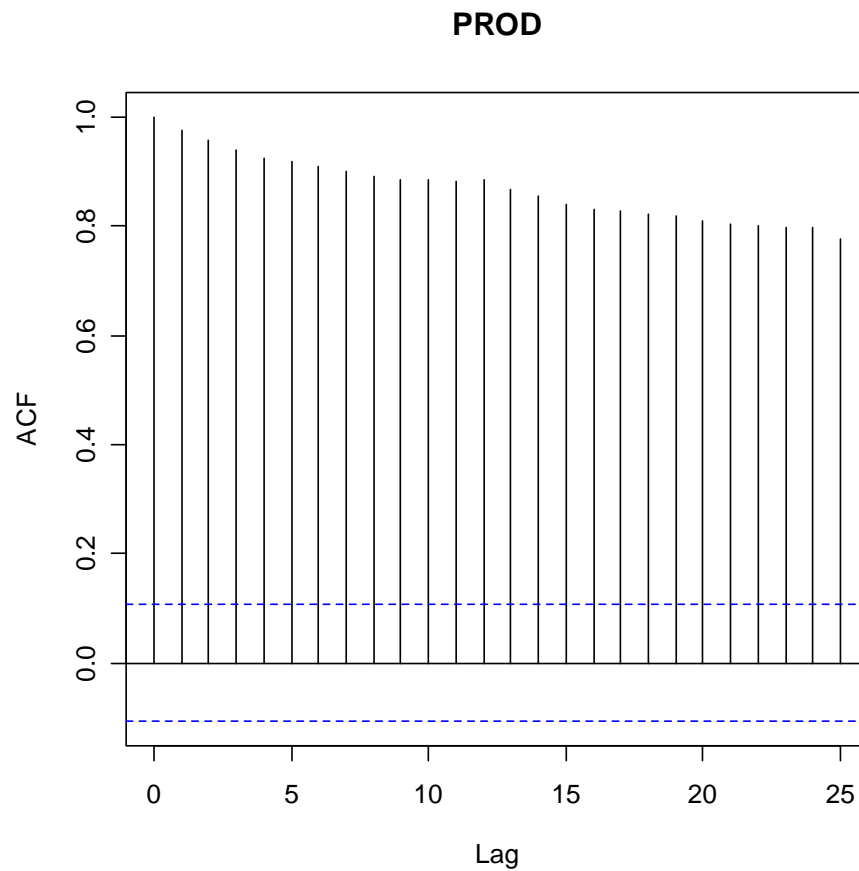


comandos abaixo é para apresentar o tempo no eixo X#

```
cor=acf(prod, plot=F)
```

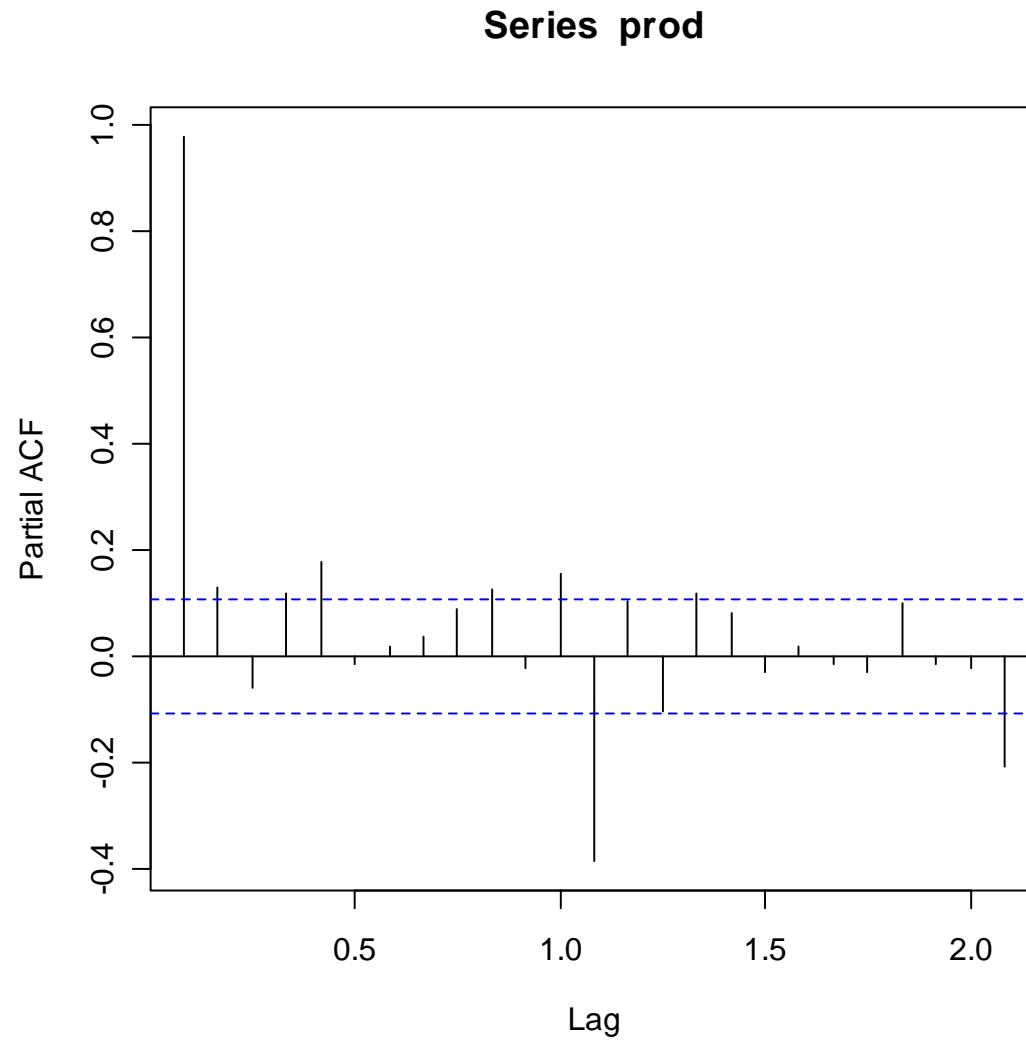
```
cor$lag=cor$lag*12
```

```
plot(cor)
```





comando `pacf(prod)` mostra a autocorrelação parcial#





```
#ajustando modelo SARIMA (0,1,4) (2,1,3) aos dados de prod#
```

```
fit=arima(prod,order=c(0,1,4),seasonal=list(order=c(2,1,3)))
```

```
#ajusta o modelo#
```

```
fit #mostra os parâmetros ajustados#
```

Call:

```
arima(x = prod, order = c(0, 1, 4), seasonal = list(order = c(2, 1, 3)))
```

Coefficients:

	ma1	ma2	ma3	ma4	sar1	sar2	sma1	sma2
	-0.0195	-0.2291	-0.0462	-0.2546	-0.9110	-0.8240	0.1771	0.1687
s.e.	0.0555	0.0560	0.0601	0.0592	0.0954	0.0485	0.0942	0.0853
	sma3							
	-0.8274							
s.e.	0.0894							

```
sigma^2 estimated as 3489: log likelihood = -1792.24, aic = 3604.47
```



`pacc=predict(fit,n.ahead=12,se.fit=T)#previsão dos próximos
12 meses com o modelo sarima#`

`pacc #mostra as previsões#`

`$pred`

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
2008	1812.611	1744.459	1944.437	1871.556	1913.141	1865.361	1893.720	1946.425
	Sep	Oct	Nov	Dec				
2008	1938.427	2021.042	1979.575	1833.632				

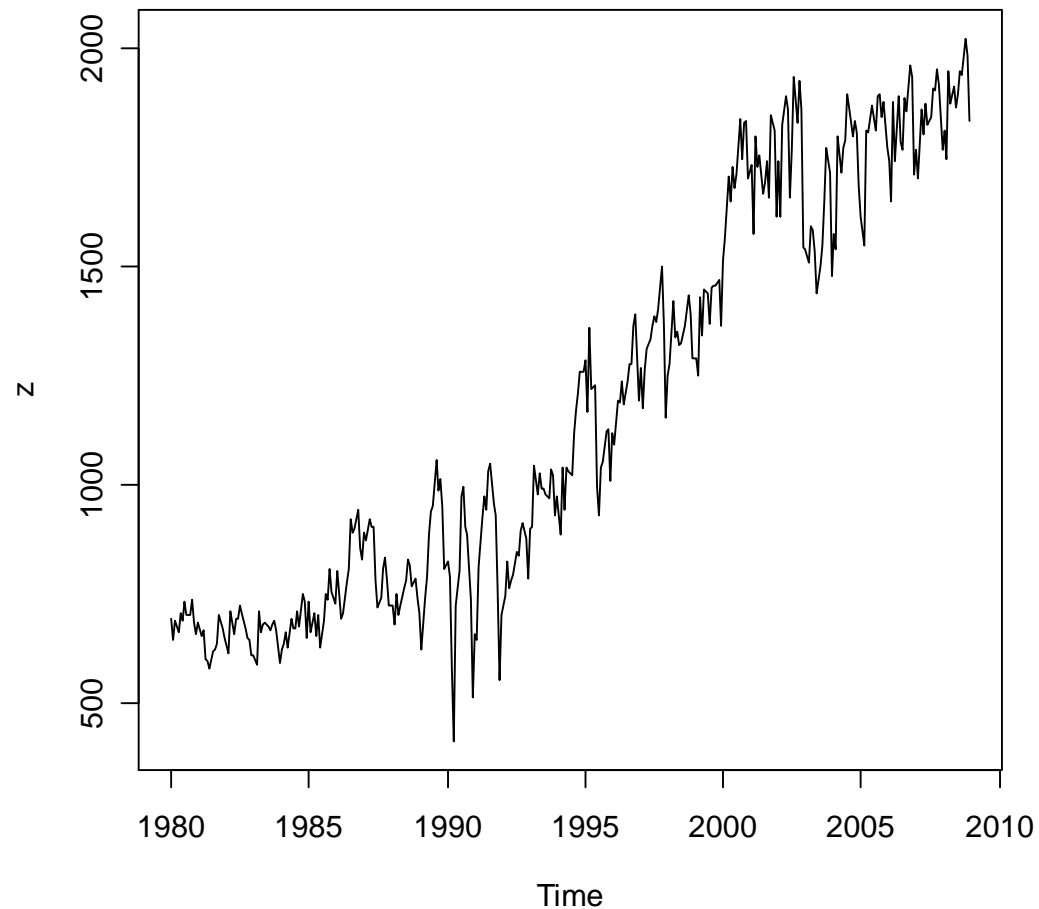
`$se`

	Jan	Feb	Mar	Apr	May	Jun	Jul
2008	60.29853	84.43310	95.81303	104.82039	108.28282	111.63791	114.89507
	Aug	Sep	Oct	Nov	Dec		
2008	118.06241	121.14696	124.15660	127.09483	129.96765		



`z=ts(c(prod,pacc$pred),frequency=12,start=c(1980,1))#comando
para montar o gráfico#`

`plot (z) #mostra o gráfico#`

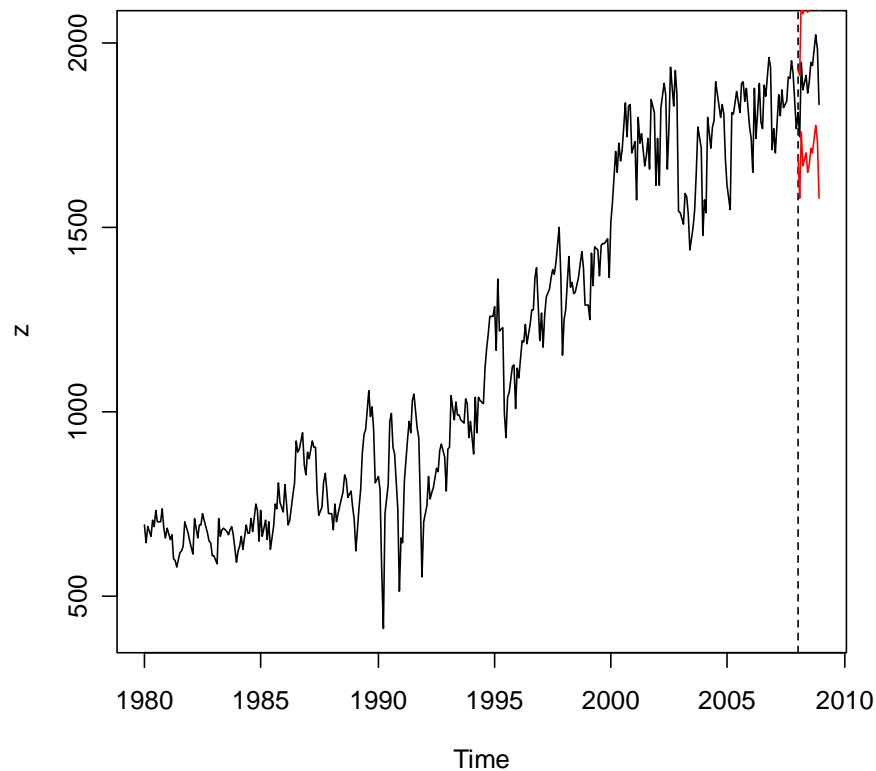




```
abline(v=c(2008,1),lty=2)#linha de corte tracejada#
```

```
lines(pacc$pred+1.96*pacc$se,col=2)#limite superior das  
previsões#
```

```
lines(pacc$pred-1.96*pacc$se,col=2)#limite inferior das  
previsões#
```





#ajustando outros modelos (exemplos de series do R)#

#ALISAMENTO EXPONENCIAL SIMPLES#

Função para escolha de alfa e ajuste por AES#

```
AES=function(x,interval){  
  e=NULL  
  for(alfa in interval){  
    e2=0  
    prev=x[1]  
    for (i in 2:length(x)){  
      prev=c(prev,alfa*x[i-1]+(1-alfa)*prev[i-1])  
      e2=e2+(x[i]-prev[i])**2  
    }  
    e=c(e,e2)  
  }  
}
```



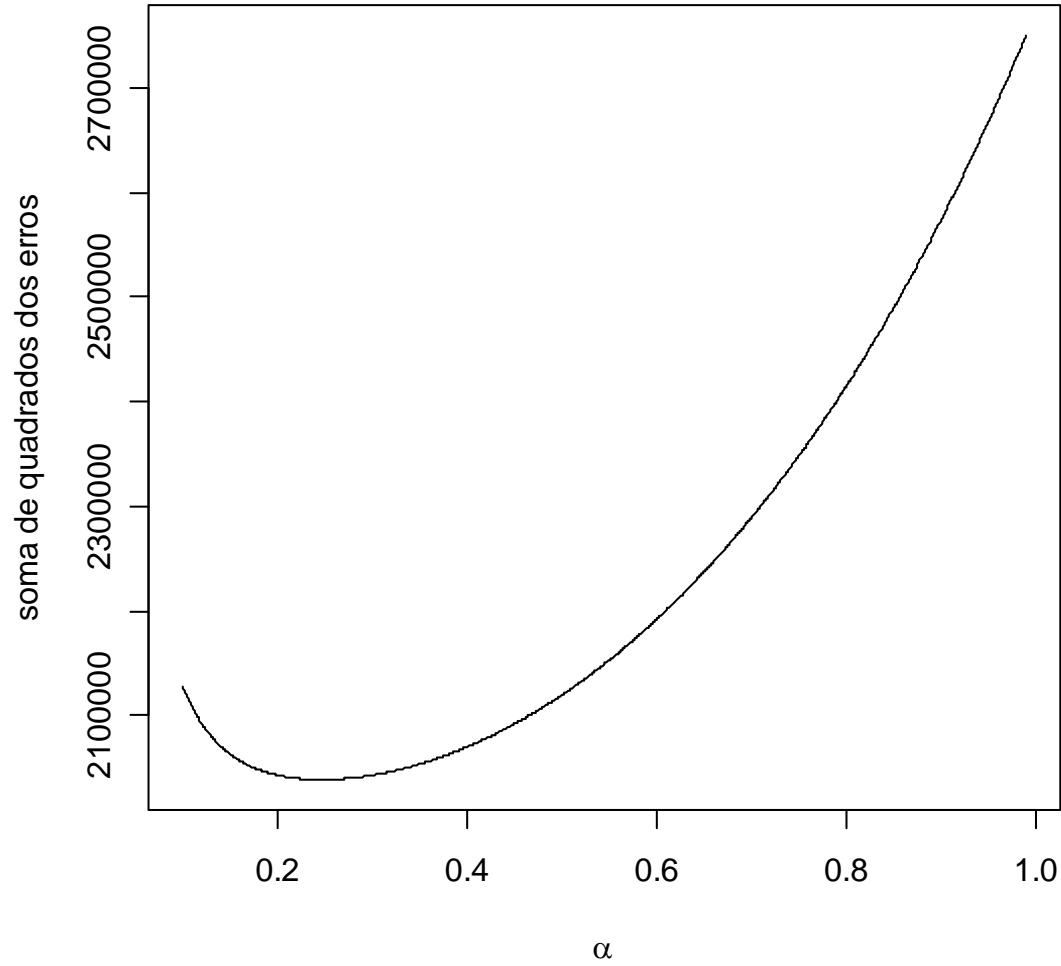
```
plot(interval,e,type='l',xlab=expression(alpha),ylab="soma de
quadrados dos erros")
e.min=min(e)
alfa=interval[e--e.min]
prev=x[1]
for (i in 2:length(x)){
prev=c(prev,alfa*x[i-1]+(1-alfa)*prev[i-1])
}
return(list(alfa=alfa,sq2=e.min,prev=prev))
}
```

aplicando o modelo, usando o exemplo da seirie Nile do R#

```
data(Nile) #serie#
x=Nile # x recebe a serie#
int=seq(0.1,0.99,0.001) #sequencia para alfa#
data=1871:1970 #periodo#
```

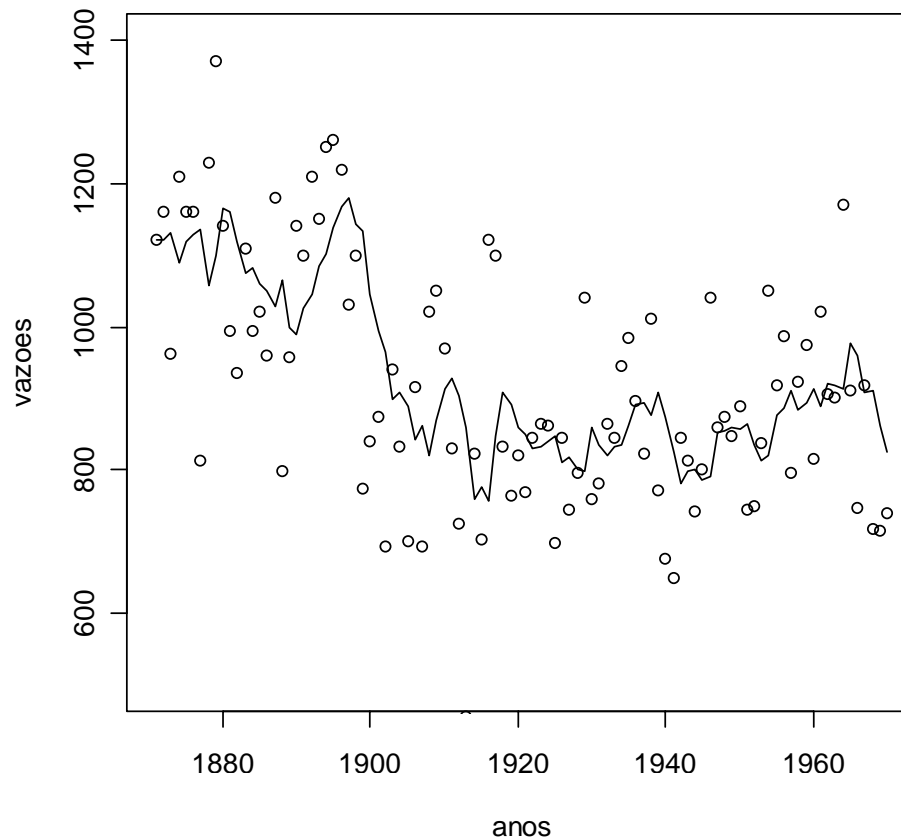


$m = \text{AES}(x, \text{int})$ # seleciona alfa, mostra grafico da SQErros#





```
plot(data,m$prev,ylab='vazoes',xlab='anos',ylim=c(500,1400),  
type="l")#grafico alisado#  
points(x)#pontos no gráfico#
```





#Alisamento de Holt-Winters#

#Um exemplo de modelo multiplicativo#

data(AirPassengers)# chama a série#

x=AirPassengers #atribui os valores da série para x#

m=HoltWinters(AirPassengers,seasonal="mult") #comando
para fazer o H-W modelo multiplicativo#

c(m\$alpha,m\$beta,m\$gamma)# mostra os valores dos coef. de
alisamento#

alpha	beta	gamma
0.27969398	0.01210922	0.63504222



`m$coefficients` #mostra as estimativas em (t=n) do nível,
tendência e componentes sazonais#

a	b	s1	s2	s3	s4
449.0549663	2.4790888	0.9879967	0.9222810	1.0168521	1.0787594
s5	s6	s7	s8	s9	s10
1.0962644	1.2355067	1.4229227	1.3962449	1.1610584	1.0343854
s11	s12				
0.8763223	0.9657513				

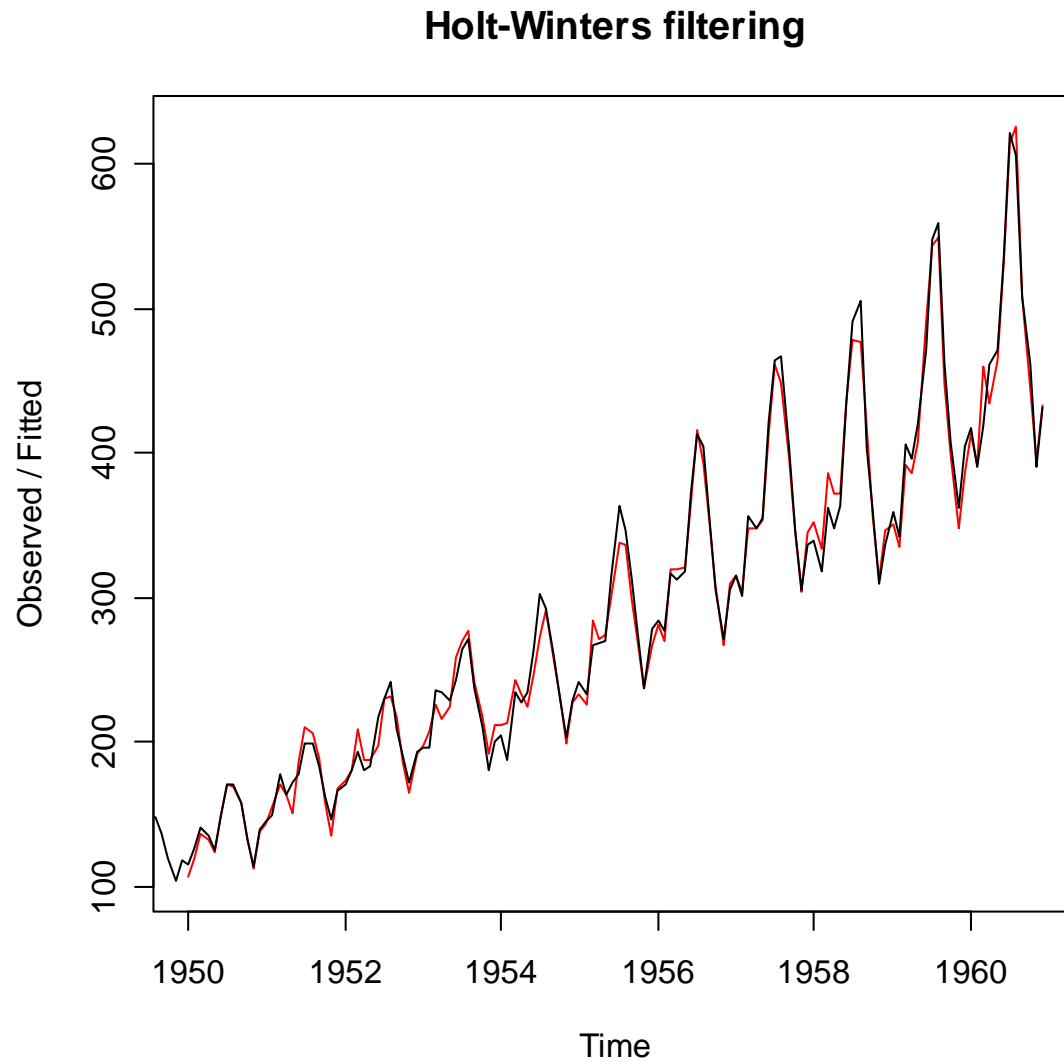
`m$fitted[1:15,]`#mostra os valores ajustados e as
componentes ao longo do tempo#



	xhat	level	trend	season
[1,]	107.3711	119.3075	1.935399	0.8855865
[2,]	120.2064	123.6524	1.964575	0.9569281
[3,]	136.5743	127.3103	1.985080	1.0562968
[4,]	132.4967	130.4673	1.999271	1.0002275
[5,]	124.2788	133.1665	2.007747	0.9193969
[6,]	149.1370	135.3937	2.010404	1.0853897
[7,]	169.9478	137.3688	2.009977	1.2193237
[8,]	169.7038	139.3907	2.010122	1.2001608
[9,]	157.2530	141.4699	2.010958	1.0959863
[10,]	131.9518	143.6715	2.013266	0.9057355
[11,]	112.5491	146.0084	2.017185	0.7603354
[12,]	137.7281	148.5593	2.023648	0.9146328
[13,]	143.3931	151.2777	2.032061	0.9353161
[14,]	155.2574	153.7903	2.037880	0.9963374
[15,]	170.2632	154.3523	2.020008	1.0888321



plot(m)#grafico da série original com a ajustada#





`p=predict(m,n.ahead=24,prediction.interval=T)#previsão para 24 meses, com o intervalo de previsão#`

`p #mostra os valores previstos e seu intervalos#`

		fit	upr	lwr
Jan	1961	446.1142	462.0041	430.2243
Feb	1961	418.7277	435.6078	401.8476
Mar	1961	464.1851	482.5739	445.7963
Apr	1961	495.1196	514.9468	475.2925
May	1961	505.8717	526.8389	484.9044
Jun	1961	573.1880	596.4924	549.8836
Jul	1961	663.6634	690.0524	637.2743
Aug	1961	654.6820	681.6209	627.7432
Sep	1961	547.2843	572.0435	522.5251
Oct	1961	490.1392	514.1133	466.1652
Nov	1961	417.4142	440.1252	394.7032
Dec	1961	462.4056	482.6685	442.1428



	fit	upr	lwr
Jan 1962	475.5062	505.3432	445.6691
Feb 1962	446.1647	475.8057	416.5236
Mar 1962	494.4355	526.3600	462.5110
Apr 1962	527.2117	560.9955	493.4279
May 1962	538.4845	573.3589	503.6101
Jun 1962	609.9432	648.4301	571.4563
Jul 1962	705.9940	749.4035	662.5845
Aug 1962	696.2190	739.7798	652.6582
Sep 1962	581.8247	620.6684	542.9811
Oct 1962	520.9112	557.5818	484.2407
Nov 1962	443.4839	477.2796	409.6882
Dec 1962	491.1358	521.6786	460.5931



`plot(m,p)` #gráfico mostra a serie original, alisada e a previsão#

Holt-Winters filtering

