Series Temporais

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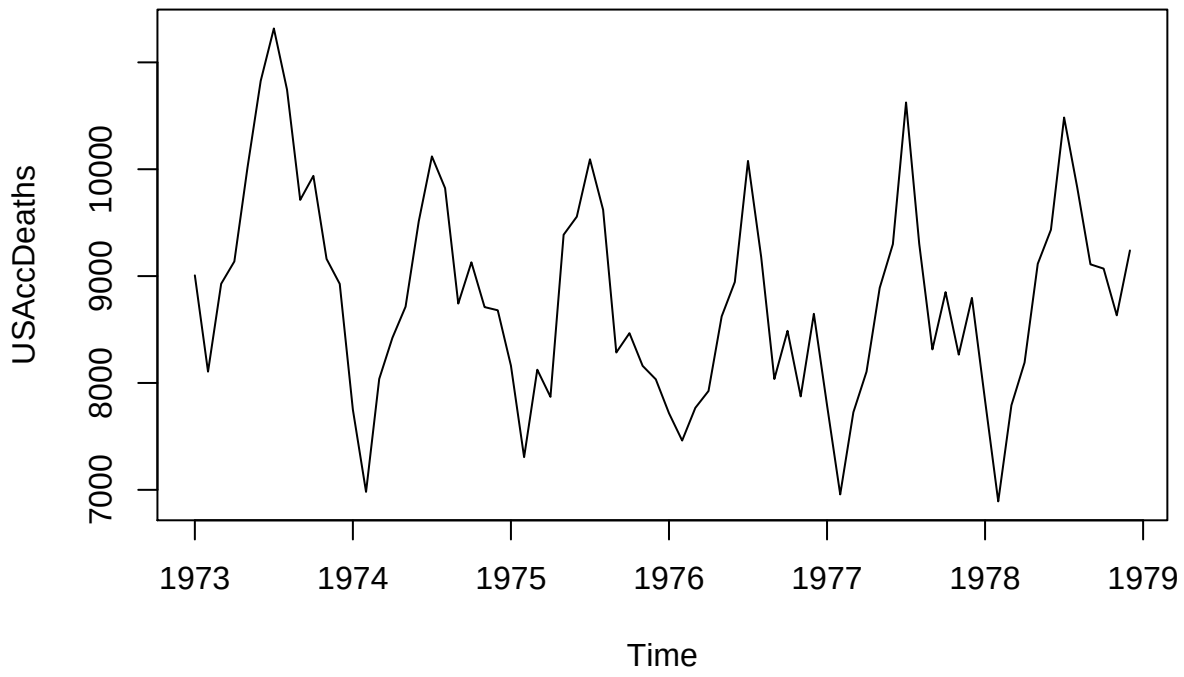
Aulas de séries temporais usando R

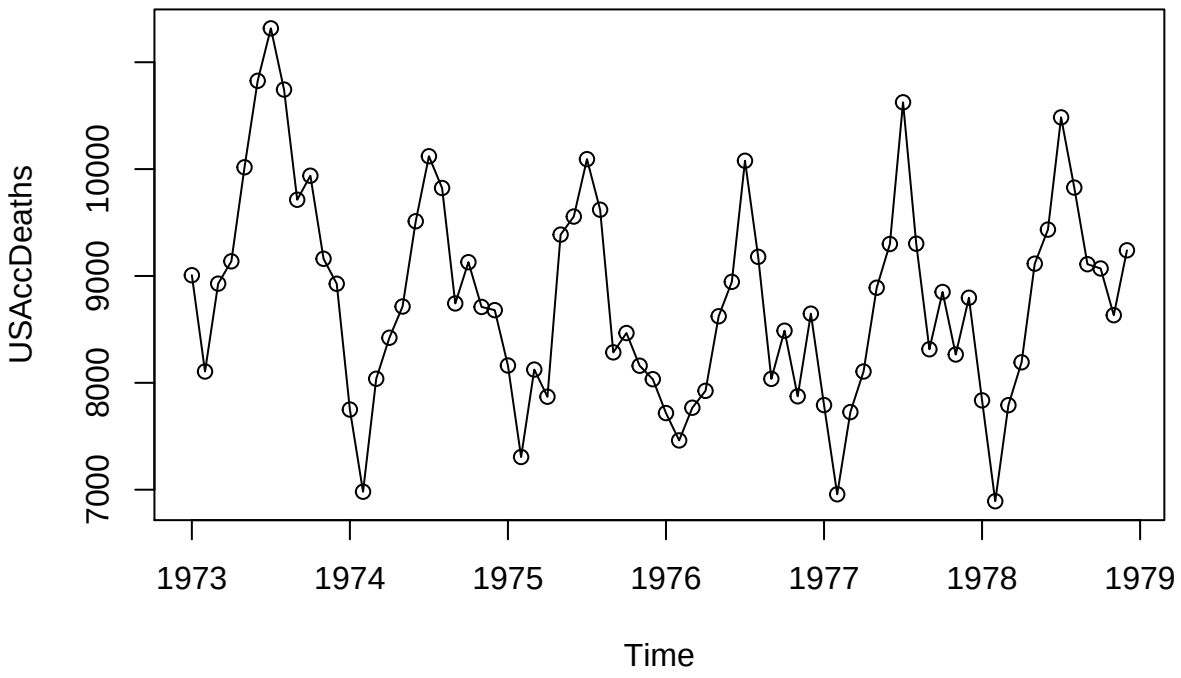
A aulas estão disponiveis no link https://www.youtube.com/watch?v=YEVKVWu2NLQ



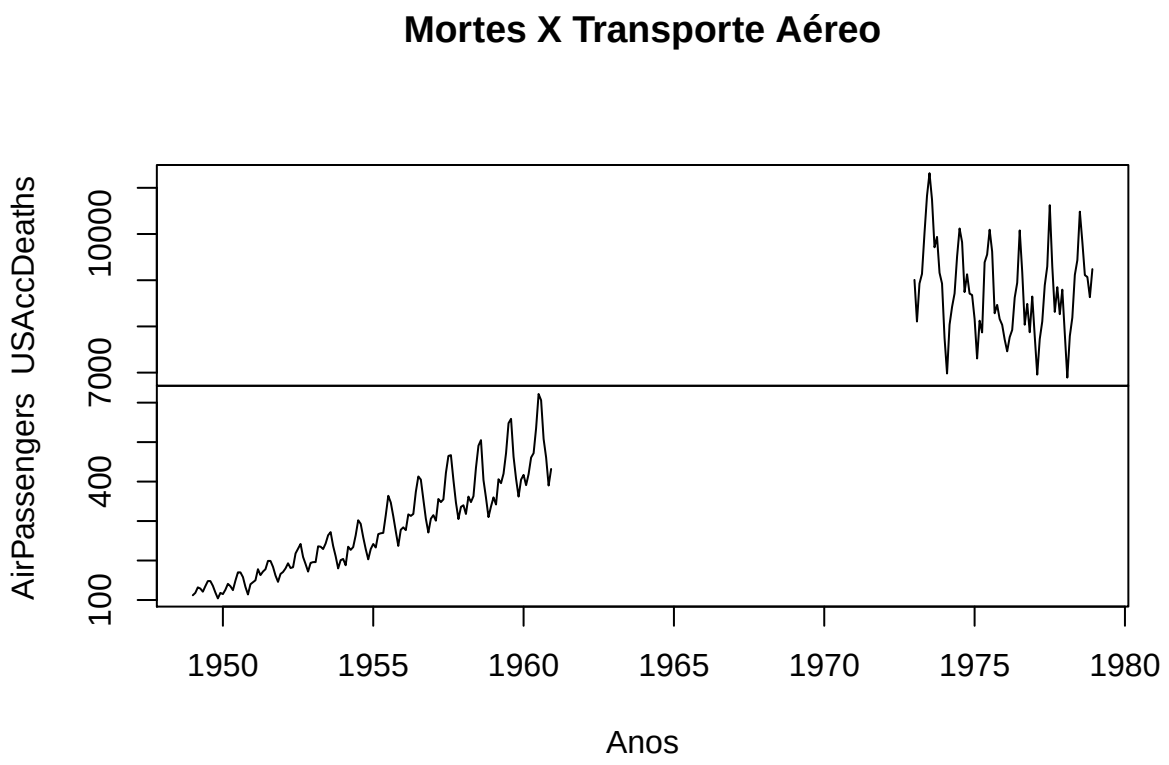

```
summary(USAccDeaths)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    6892    8089    8728    8789    9323   11317
```

```
plot(USAccDeaths, type='o')
```




```
plot.ts(cbind(USAccDeaths, AirPassengers), main='Mortes X Transporte Aéreo', xlab='Anos')
```



Criando uma amostragem por trimestres.

```
aggregate(USAccDeaths, nfrequency = 4, FUN = sum)
```

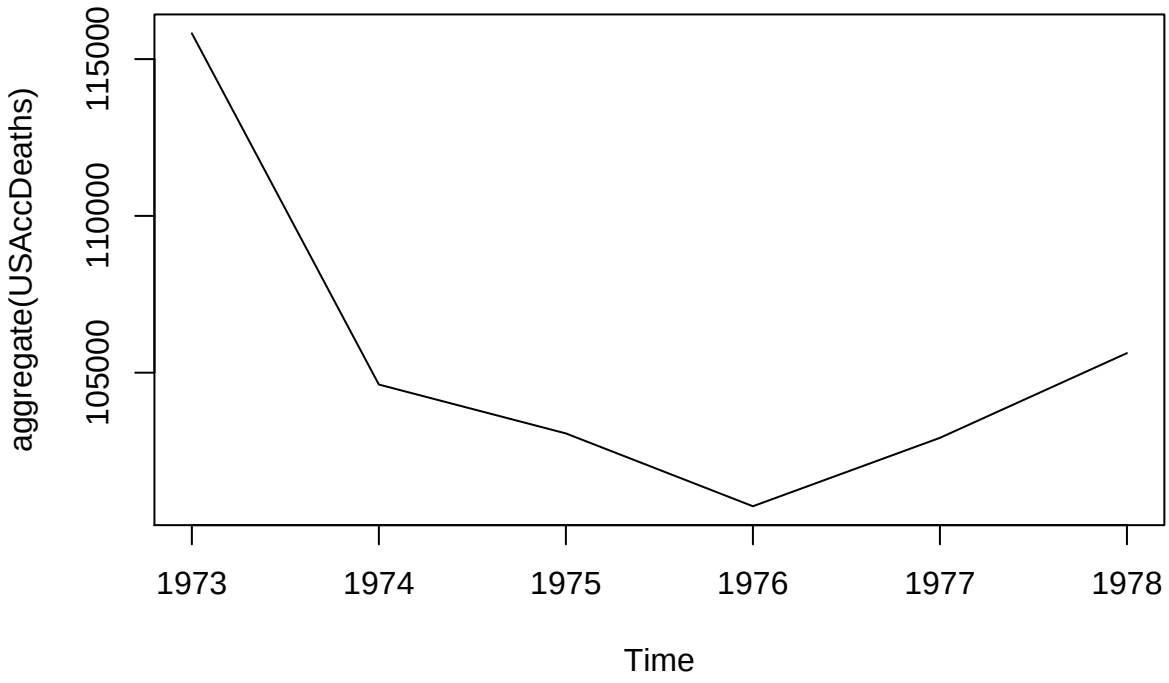
```
##       Qtr1  Qtr2  Qtr3  Qtr4
## 1973 26041 29980 31774 28026
## 1974 22769 26648 28686 26519
## 1975 23592 26813 27998 24660
## 1976 22945 25493 27294 25009
## 1977 22475 26295 28241 25911
## 1978 22519 26741 29421 26943
```

Agregando pelas medias anuais.

```
aggregate(USAccDeaths, nfreq=1, FUN = mean)
```

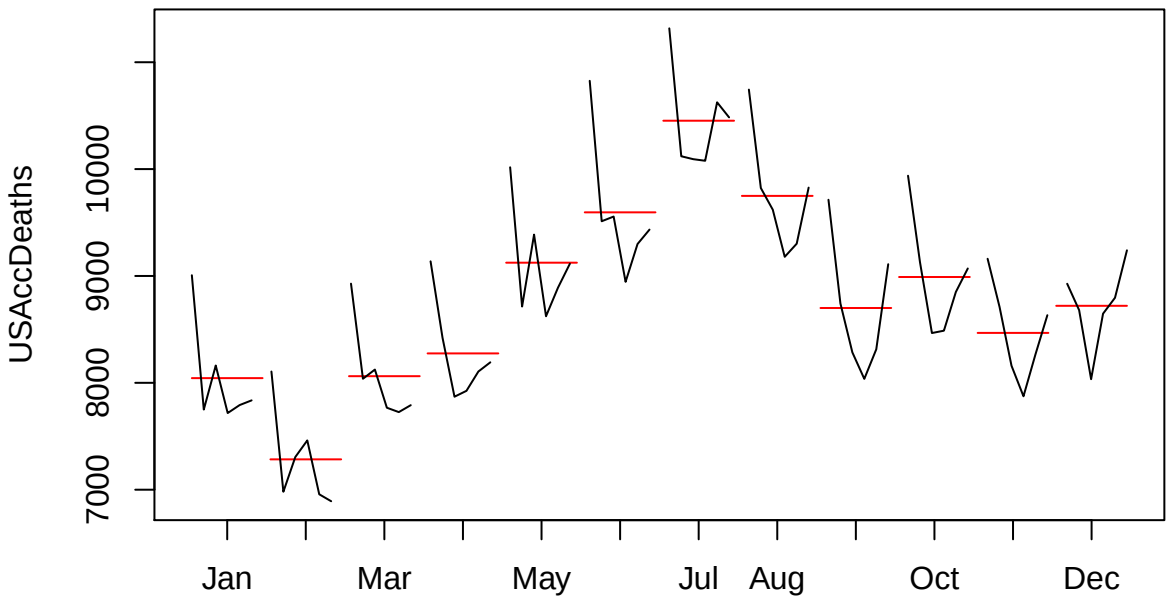
```
## Time Series:
## Start = 1973
## End = 1978
## Frequency = 1
## [1] 9651.750 8718.500 8588.583 8395.083 8576.833 8802.000
```

```
plot(aggregate(USAccDeaths))
```



Plotando por meses.

```
monthplot(USAccDeaths, col.base = 2, labels = month.abb)
```



Usando uma janela de tempo

```
window(USAccDeaths, start=c(1973,5), end=c(1978,1))
```

```
##        Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
## 1973                         10017 10826 11317 10744  9713  9938  9161  8927
## 1974  7750  6981  8038  8422  8714  9512 10120  9823  8743  9129  8710  8680
## 1975  8162  7306  8124  7870  9387  9556 10093  9620  8285  8466  8160  8034
## 1976  7717  7461  7767  7925  8623  8945 10078  9179  8037  8488  7874  8647
## 1977  7792  6957  7726  8106  8890  9299 10625  9302  8314  8850  8265  8796
## 1978  7836
```

Calculando a diferença de meses a meses

```
diff(USAccDeaths)
```

```
##        Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
## 1973         -901   822   209   880   809   491  -573 -1031   225  -777  -234
## 1974 -1177  -769  1057   384   292   798   608  -297 -1080   386  -419   -30
## 1975  -518  -856   818  -254  1517   169   537  -473 -1335   181  -306  -126
## 1976  -317  -256   306   158   698   322  1133  -899 -1142   451  -614   773
## 1977  -855  -835   769   380   784   409  1326 -1323  -988   536  -585   531
## 1978  -960  -944   899   401   923   319  1050  -657  -717   -40  -437   607
```

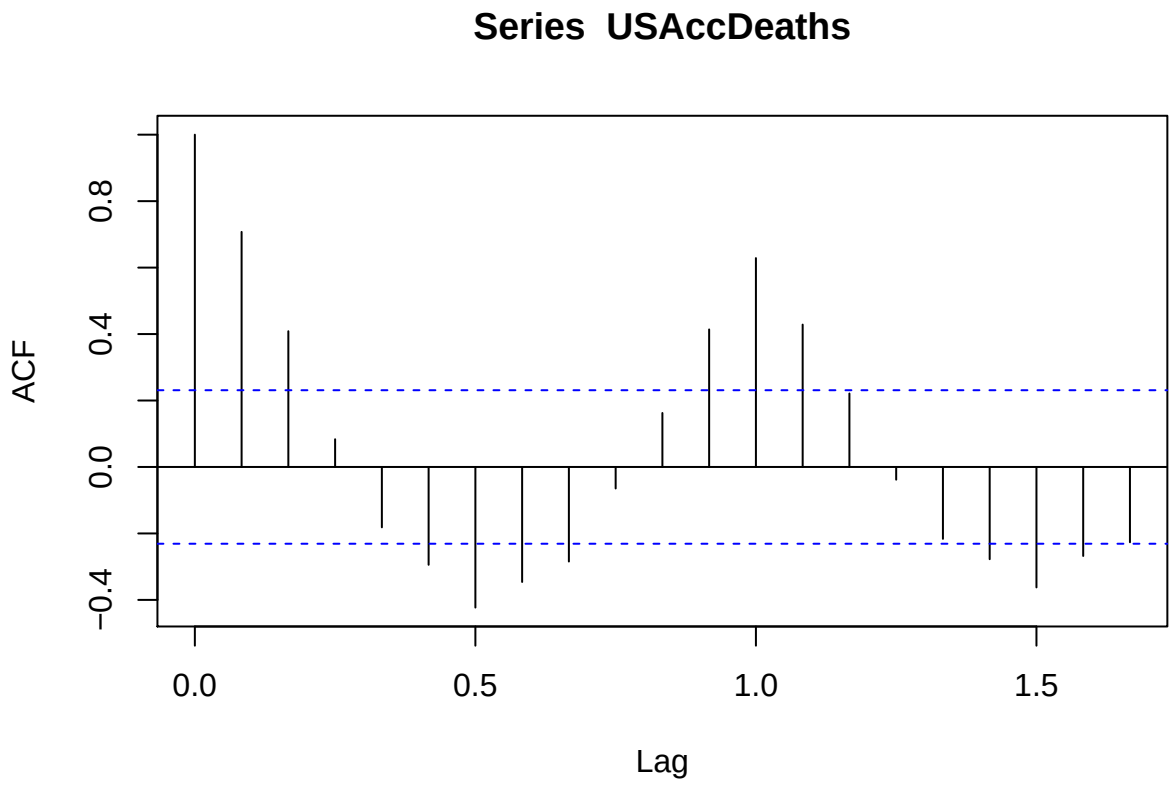
Calculando o logaritmo

```
log(USAccDeaths)
```

```
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 1973 9.105757 9.000360 9.096948 9.120087 9.212039 9.289706 9.334061 9.282103
## 1974 8.955448 8.850947 8.991936 9.038603 9.072686 9.160309 9.222269 9.192482
## 1975 9.007245 8.896451 9.002578 8.970813 9.147081 9.164925 9.219597 9.171600
## 1976 8.951181 8.917445 8.957639 8.977778 9.062188 9.098850 9.218110 9.124674
## 1977 8.960853 8.847504 8.952347 9.000360 9.092682 9.137662 9.270965 9.137985
## 1978 8.966484 8.838117 8.960725 9.010913 9.117677 9.152075 9.257606 9.192889
##           Sep      Oct      Nov      Dec
## 1973 9.181220 9.204121 9.122711 9.096836
## 1974 9.076009 9.119211 9.072227 9.068777
## 1975 9.022202 9.043813 9.006999 8.991438
## 1976 8.991811 9.046409 8.971321 9.064968
## 1977 9.025696 9.088173 9.019785 9.082052
## 1978 9.117128 9.112728 9.063347 9.131297
```

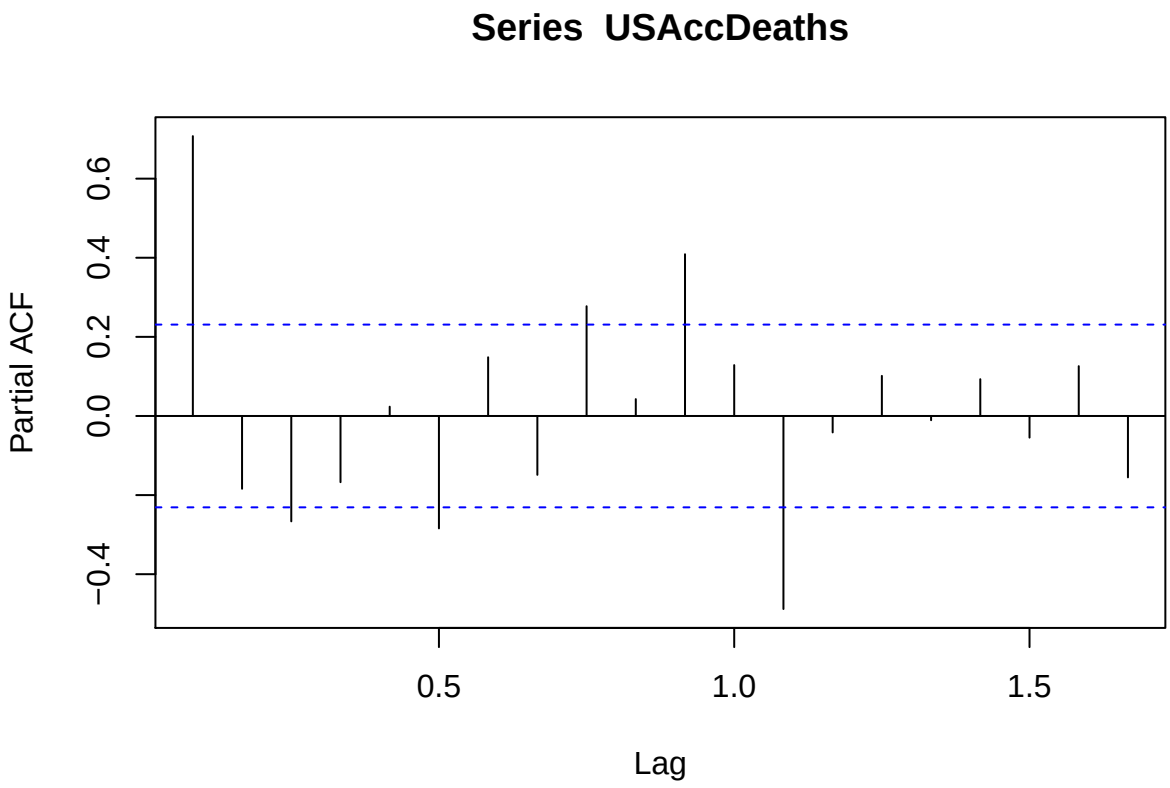
Analise da função autocorrelação

```
acf(USAccDeaths, lag.max = 20)
```



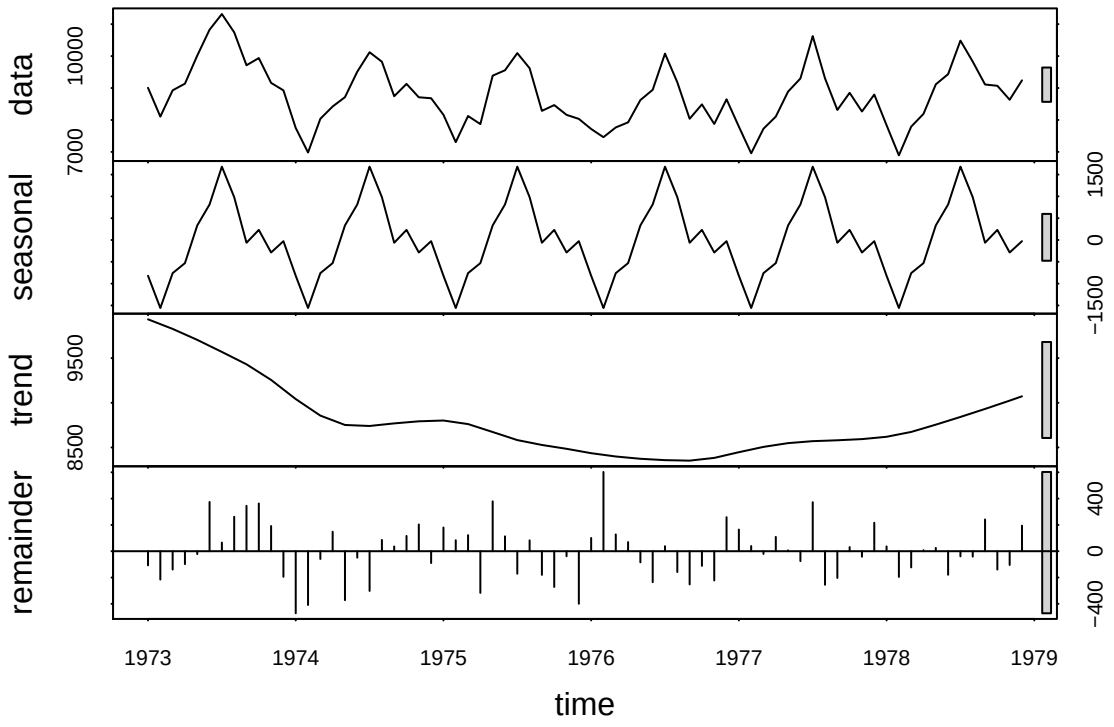
Analise da funação parcial de autocorrelação

```r
pacf(USAccDeaths, lag.max = 20)
```



Verificando a sazionalidade.

```r
plot(stl(USAccDeaths, "periodic"))
```



Iniciando aula 2. https://www.youtube.com/watch?v=eFfXRke1PXg

```
decompose(USAccDeaths)
```

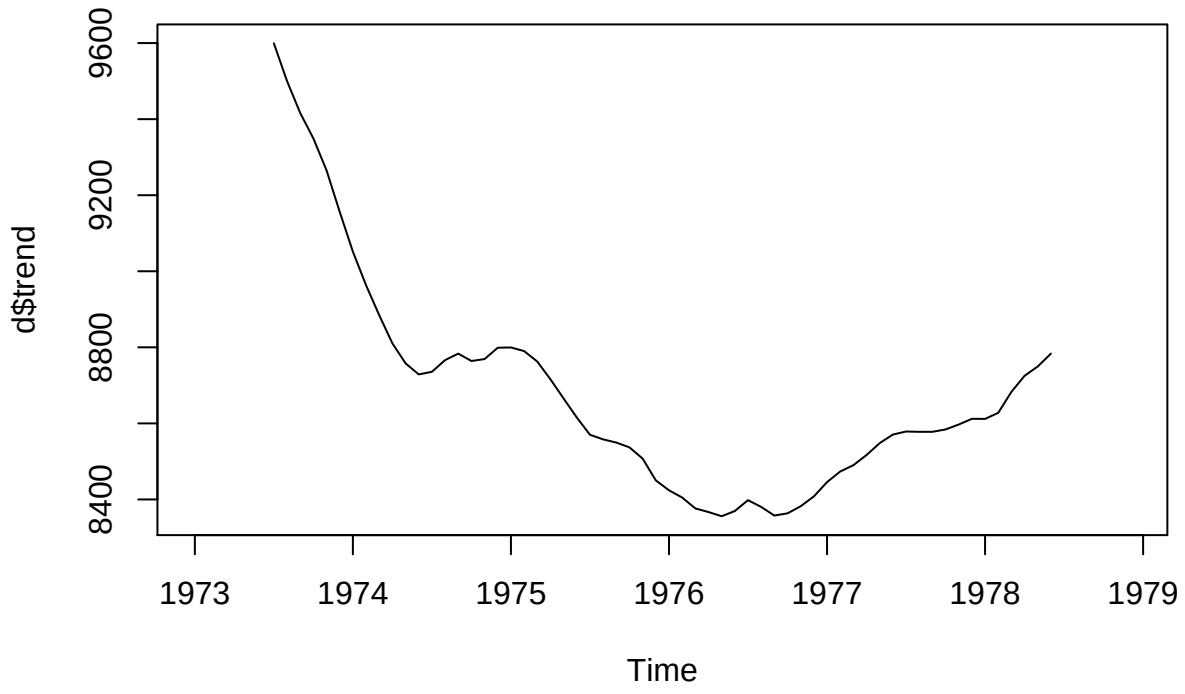
```
## $x
##        Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
## 1973  9007  8106  8928  9137 10017 10826 11317 10744  9713  9938  9161  8927
## 1974  7750  6981  8038  8422  8714  9512 10120  9823  8743  9129  8710  8680
## 1975  8162  7306  8124  7870  9387  9556 10093  9620  8285  8466  8160  8034
## 1976  7717  7461  7767  7925  8623  8945 10078  9179  8037  8488  7874  8647
## 1977  7792  6957  7726  8106  8890  9299 10625  9302  8314  8850  8265  8796
## 1978  7836  6892  7791  8192  9115  9434 10484  9827  9110  9070  8633  9240
##
## $seasonal
##              Jan         Feb         Mar         Apr         May         Jun
## 1973  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
## 1974  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
## 1975  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
## 1976  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
## 1977  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
## 1978  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
##              Jul         Aug         Sep         Oct         Nov         Dec
## 1973  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
## 1974  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
## 1975  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
## 1976  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
```

```
## 1977  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
## 1978  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
##
## $trend
##           Jan      Feb      Mar      Apr      May      Jun      Jul      Aug
## 1973       NA       NA       NA       NA       NA       NA 9599.375 9500.125
## 1974 9051.542 8963.292 8884.500 8810.375 8757.875 8728.792 8735.667 8766.375
## 1975 8799.708 8790.125 8762.583 8715.875 8665.333 8615.500 8570.042 8557.958
## 1976 8424.042 8405.042 8376.333 8366.917 8355.917 8369.542 8398.208 8380.333
## 1977 8445.542 8473.458 8490.125 8516.750 8548.125 8570.625 8578.667 8577.792
## 1978 8611.792 8627.792 8682.833 8725.167 8749.667 8783.500       NA       NA
##           Sep      Oct      Nov      Dec
## 1973 9416.167 9349.292 9265.208 9156.167
## 1974 8783.500 8764.083 8769.125 8799.000
## 1975 8549.542 8536.958 8507.417 8450.125
## 1976 8357.625 8363.458 8382.125 8408.000
## 1977 8577.792 8584.083 8597.042 8612.042
## 1978       NA       NA       NA       NA
##
## $random
##               Jan          Feb          Mar          Apr          May
## 1973           NA           NA           NA           NA           NA
## 1974 -495.6493056 -458.9826389 -105.6576389  126.4090278 -383.5243056
## 1975  168.1840278   39.1840278  102.2590278 -331.0909722  382.0173611
## 1976   98.8506944  579.2673611  131.5090278   72.8673611  -72.5659722
## 1977  152.3506944    6.8506944  -23.2826389  104.0340278    2.2256944
## 1978   30.1006944 -212.4826389 -150.9909722  -18.3826389   25.6840278
##               Jun          Jul          Aug          Sep          Oct
## 1973           NA   38.1840278  257.5590278  406.1256944  324.8506944
## 1974   38.3673611 -295.1076389   70.3090278   68.7923611  101.0590278
## 1975  195.6590278 -156.4826389   75.7256944 -155.2493056 -334.8159722
## 1976 -169.3826389    0.3506944 -187.6493056 -211.3326389 -139.3159722
## 1977  -16.4659722  366.8923611 -262.1076389 -154.4993056    2.0590278
## 1978  -94.3409722           NA           NA           NA           NA
##               Nov          Dec
## 1973  156.7423611 -170.1326389
## 1974  201.8256944  -59.9659722
## 1975  -86.4659722 -357.0909722
## 1976 -247.1743056  298.0340278
## 1977  -71.0909722  242.9923611
## 1978           NA           NA
##
## $figure
##  [1]  -805.89236 -1523.30903  -740.84236  -514.78403   339.64931   744.84097
##  [7]  1679.44097   986.31597  -109.29236   263.85764  -260.95069   -59.03403
##
## $type
## [1] "additive"
##
## attr(,"class")
## [1] "decomposed.ts"
```

```
d = decompose(USAccDeaths)
```

Visualizando separadamente

```
plot(d$trend)
```



Trabalhando com previsoes

```
library(forecast)
```

Usando a media movel

```
mm = ma(USAccDeaths, order = 6)

mm
```

```
##           Jan       Feb       Mar       Apr       May       Jun       Jul
## 1973       NA        NA        NA  9529.333  9941.667 10226.917 10359.083
## 1974 8339.500  8175.917  8187.417  8433.667  8868.000  9163.583  9281.250
## 1975 8246.917  8198.417  8327.833  8561.750  8915.500  9121.750  9184.833
## 1976 7889.083  7882.583  7997.083  8269.750  8609.667  8775.333  8844.750
## 1977 7882.167  7935.000  8074.000  8364.417  8795.917  9040.333  9151.333
## 1978 8016.833  8032.833  8156.833  8430.667  8895.917  9250.417  9433.500
##           Aug       Sep       Oct       Nov       Dec
## 1973 10354.500 10124.917  9669.417  9058.583  8605.417
## 1974  9339.833  9270.167  9037.667  8664.750  8403.417
## 1975  9132.250  8903.167  8578.333  8200.417  7977.333
```

```
## 1976  8829.250  8742.000  8526.667  8151.000  7939.917
## 1977  9161.250  9067.250  8792.917  8359.667  8115.250
## 1978  9466.500  9410.167        NA        NA        NA
```

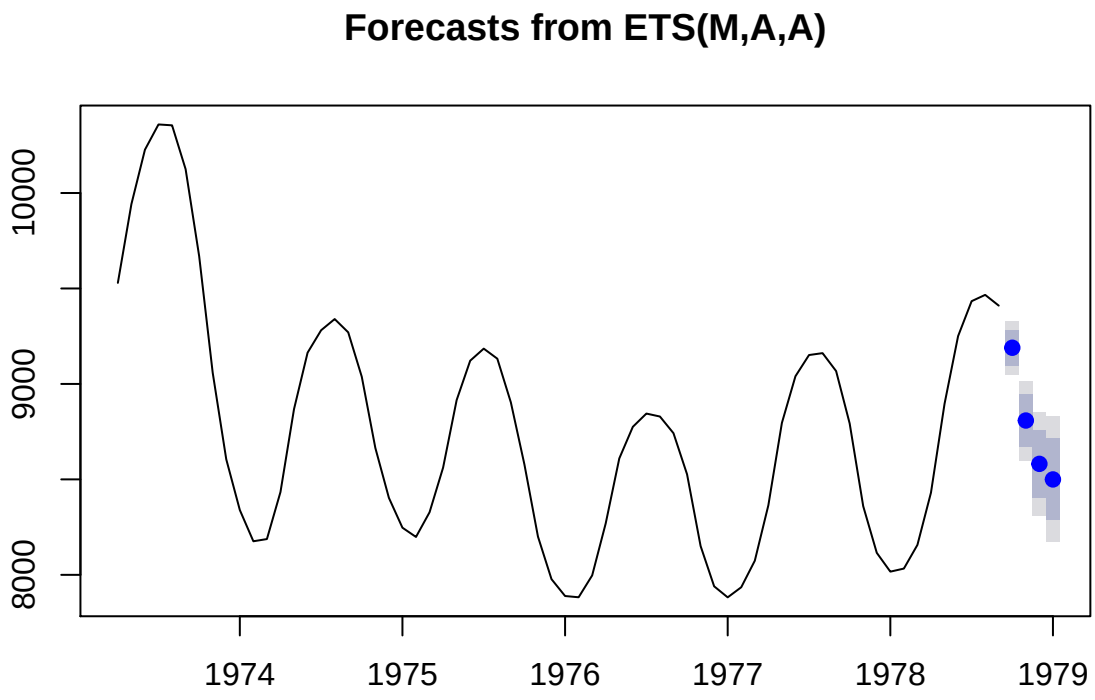
```
previsao = forecast(mm, h = 4)
```

```
## Warning in ets(object, lambda = lambda, biasadj = biasadj,
## allow.multiplicative.trend = allow.multiplicative.trend, : Missing values
## encountered. Using longest contiguous portion of time series
```

```
previsao
```

```
##          Point Forecast    Lo 80    Hi 80    Lo 95    Hi 95
## Oct 1978       9189.474 9097.106 9281.842 9048.209 9330.739
## Nov 1978       8808.310 8671.291 8945.330 8598.758 9017.863
## Dec 1978       8581.292 8404.759 8757.825 8311.308 8851.277
## Jan 1979       8499.727 8284.957 8714.497 8171.265 8828.189
```

```
plot(previsao)
```



Criando um modelo arima.

```r
x = arima(USAccDeaths, order = c(0,1,1))

y = arima(USAccDeaths, order = c(0,1,1), seasonal = list(order=c(0,1,1), period = 6))

previsao = predict(y, n.ahead = 4)

previsao
```

```
## $pred
##           Jan      Feb      Mar      Apr
## 1979 9356.129 8624.213 8489.049 8740.468
##
## $se
##            Jan       Feb       Mar       Apr
## 1979  690.2176  967.0612 1180.6838 1361.1837
```

Fazendo a previsao usando a função autoarima

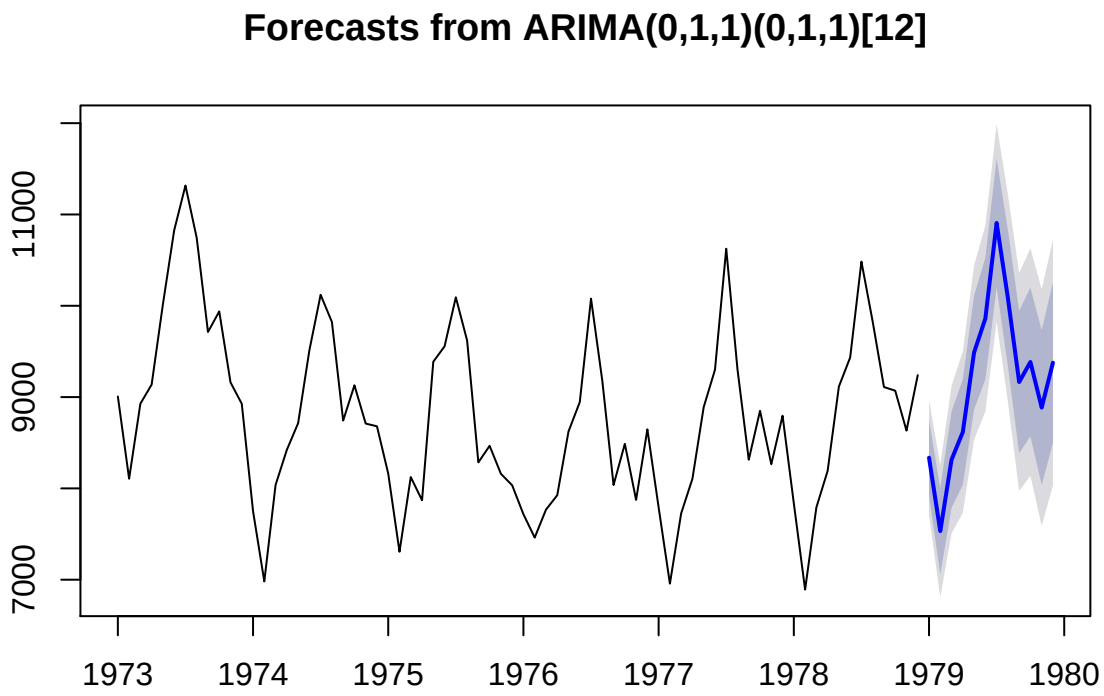
```r
ar = auto.arima(USAccDeaths)
ar
```

```
## Series: USAccDeaths
## ARIMA(0,1,1)(0,1,1)[12]
##
## Coefficients:
##           ma1     sma1
##       -0.4303  -0.5528
## s.e.   0.1228   0.1784
##
## sigma^2 estimated as 102860:  log likelihood=-425.44
## AIC=856.88   AICc=857.32   BIC=863.11
```

```r
previsao = forecast(ar, h=12)
previsao
```

```
##          Point Forecast     Lo 80     Hi 80    Lo 95     Hi 95
## Jan 1979       8336.061  7924.712  8747.410 7706.957  8965.166
## Feb 1979       7531.829  7058.464  8005.194 6807.880  8255.778
## Mar 1979       8314.644  7786.496  8842.792 7506.911  9122.377
## Apr 1979       8616.869  8039.109  9194.629 7733.261  9500.477
## May 1979       9488.913  8865.476 10112.349 8535.449 10442.376
## Jun 1979       9859.757  9193.770 10525.745 8841.218 10878.297
## Jul 1979      10907.470 10201.492 11613.448 9827.770 11987.171
## Aug 1979      10086.508  9342.686 10830.331 8948.930 11224.086
## Sep 1979       9164.959  8385.127  9944.791 7972.309 10357.609
## Oct 1979       9384.259  8570.009 10198.510 8138.971 10629.548
## Nov 1979       8884.974  8037.702  9732.246 7589.183 10180.765
## Dec 1979       9376.574  8497.519 10255.628 8032.176 10720.971
```

```r
plot(previsao)
```


Forecasts from ARIMA(0,1,1)(0,1,1)[12]
11000
9000
7000
1973
1974
1975
1976
1977
1978
1979
1980