Prática_3_Respostas

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1 Prática 3

Aprendizado Dinâmico

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MBA em Ciências de Dados

Considere as duas bases de dados a seguir

- Dados de fechamento do papel PETR4 a partir de 18/3 no arquivo PETR4.csv.
- Dados de mortes por COVID-19 no estado de SP.

Nesta prática, aplicaremos os conhecimentos adquiridos na Aula 3 a esses dados, a saber:

- Função de autocorrelação
- Função de autocorrelação parcial
- Repetir a modelagem para os dados de PETR4 visto em aula.
- Desafio para COVID-19: Um modelo ARIMA sazonal.

1. Carregue as bibliotecas

[49]:
```
# Bibliotecas

import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

%matplotlib inline

import matplotlib.pyplot as plt
from statsmodels.graphics.tsaplots import plot_acf,plot_pacf # para determinar
 ↪(p,q)
```

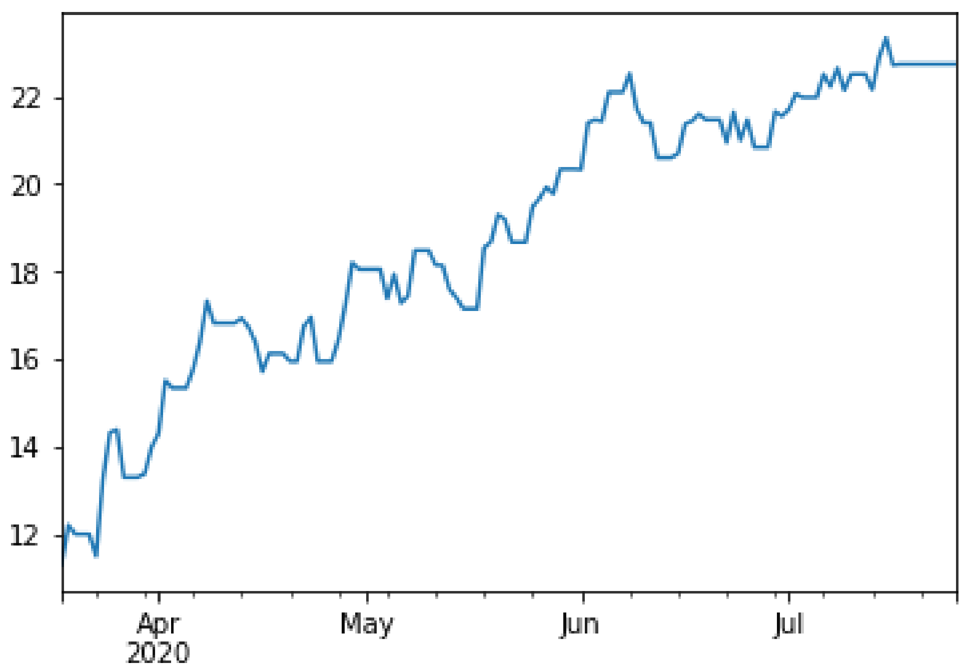
2. Faça a leitura dos dados de PETR4 em df1 e de COVID-19 no estado de SP em df2. Para os dados PETR4 usaremos a variável Close e para os dados de COVID-19 usaremos a variável deaths. Complete as bases de dados usando reindex e fillna.

[50]:
```python
pkgdir = '/home/cibele/CibelePython/AprendizadoDinamico/Data'

# PETR4 - Leitura dos dados
df1 = pd.read_csv(f'{pkgdir}/PETR4.csv', index_col='Date', parse_dates=True)

idx1 = pd.date_range(start=df1.index.min(), end=df2.index.max(), freq='D')
df1 = df1.reindex(idx1)
df1.fillna(method='ffill', inplace=True)



# COVID-19 no estado de SP
df2 = pd.read_csv(f'{pkgdir}/covidSP.csv', index_col='date', parse_dates=True)

idx2 = pd.date_range(start=df2.index.min(), end=df2.index.max(), freq='D')
df2 = df2.reindex(idx2)
df2.fillna(0,inplace=True)
```

3. Verifique graficamente se os dados foram lidos de forma correta.

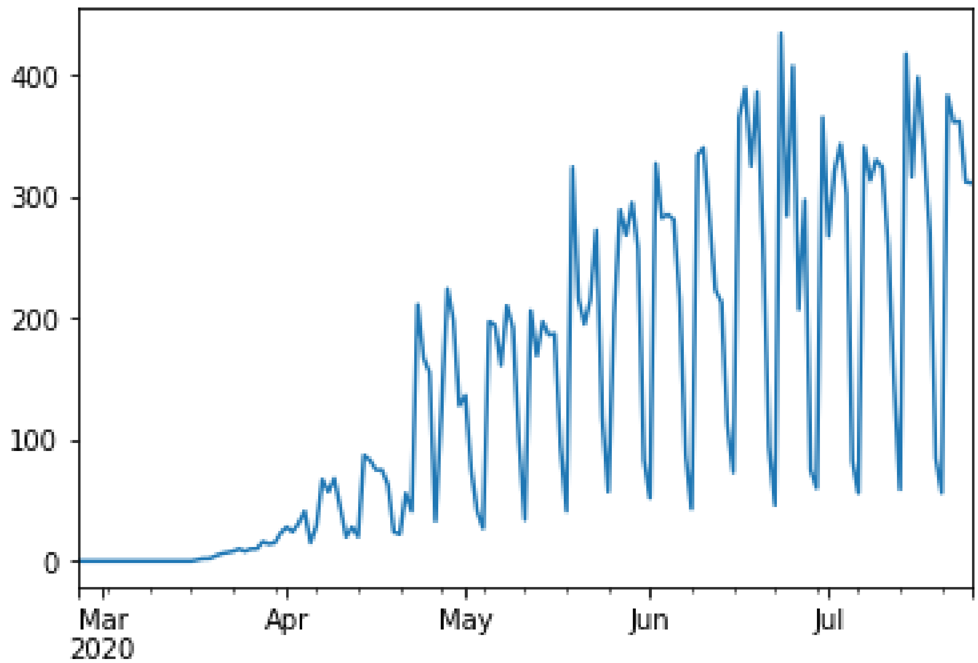
[51]:
```python
df1['Close'].plot()
```

[51]: <matplotlib.axes._subplots.AxesSubplot at 0x7f27ed35d050>



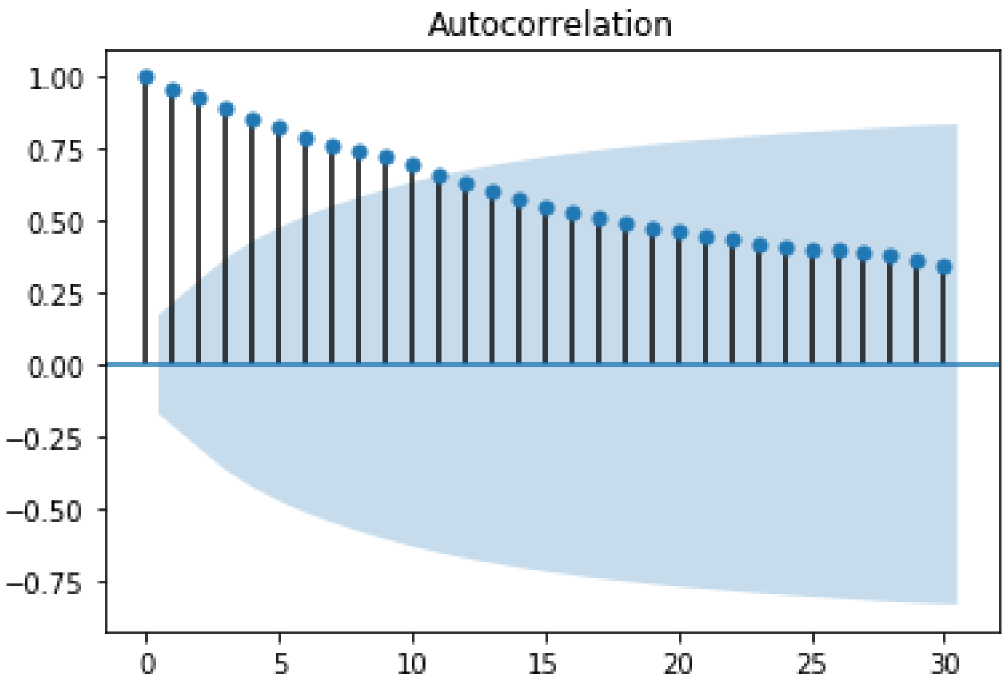
[52]:
```python
df2['deaths'].plot()
```

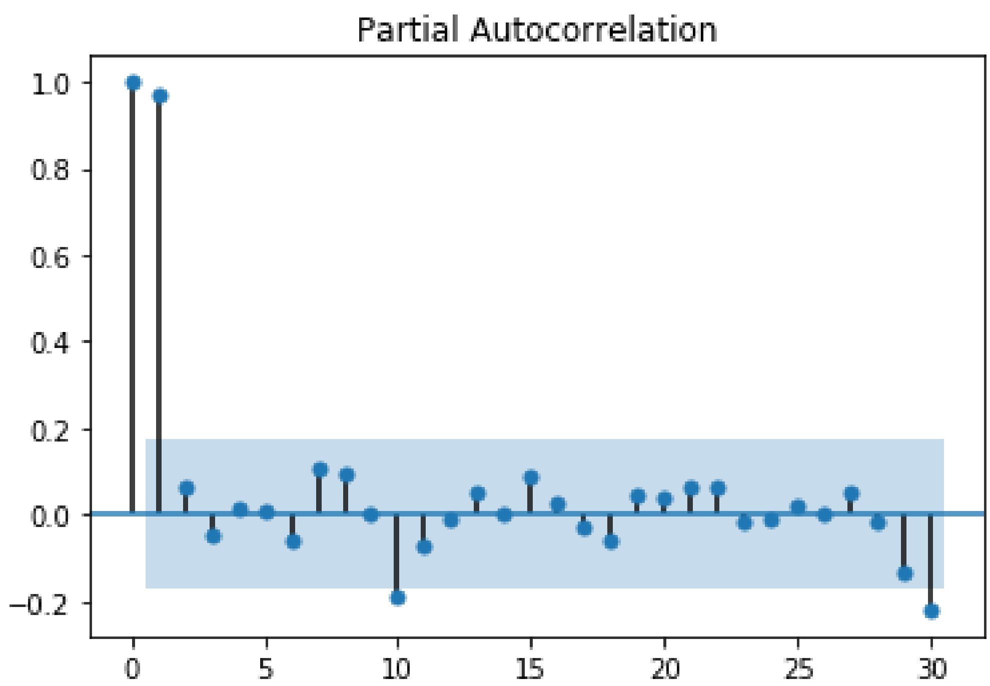
[52]: <matplotlib.axes._subplots.AxesSubplot at 0x7f27ed557fd0>



4. Obtenha os gráficos de autocorrelação e autocorrelação parcial para ambas as aplicações. Que características você observa nesses gráficos? Que modelo sugeriria com base nos correlogramas?

[53]:
```
# Correlograma

plot_acf(df1['Close'], lags=30)
plot_pacf(df1['Close'], lags=30)
plt.show()
```

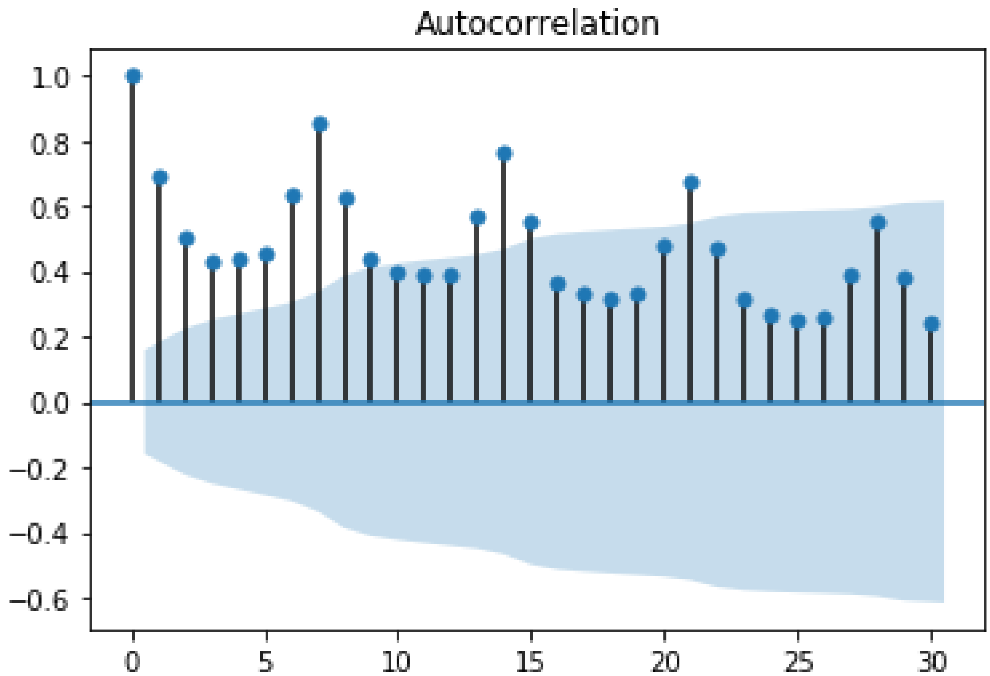


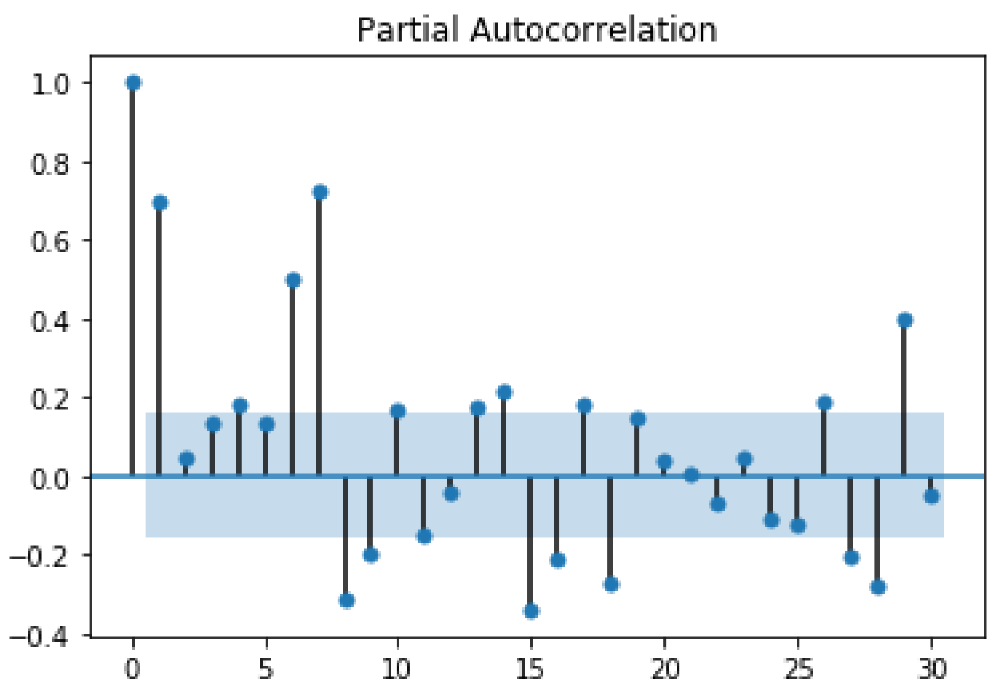


[54]:

```
# Correlograma
```

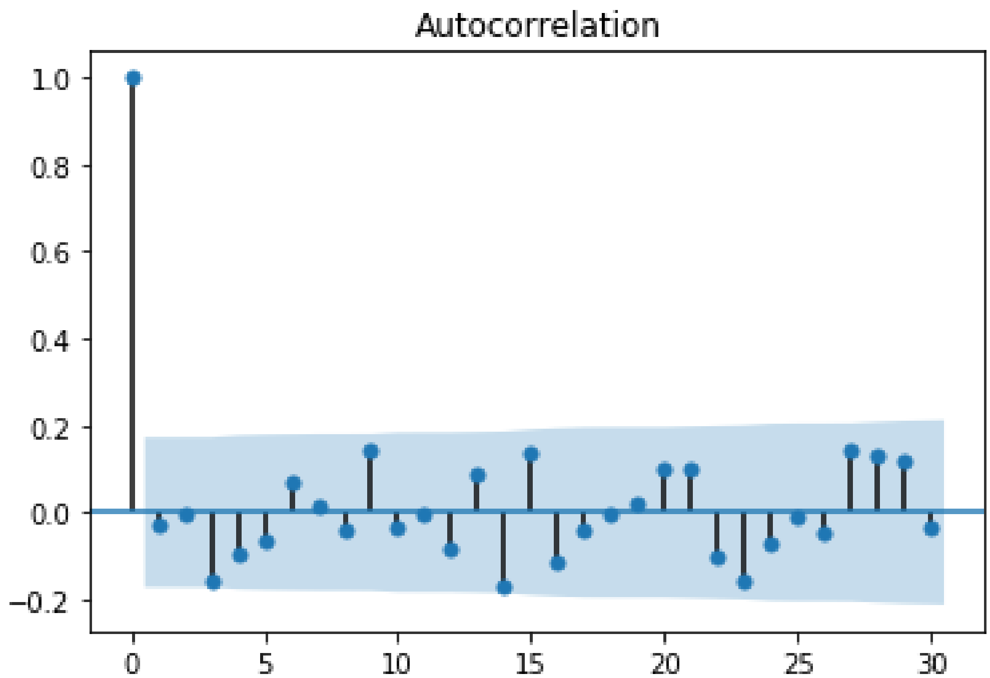
```
plot_acf(df2['deaths'], lags=30)
plot_pacf(df2['deaths'], lags=30)
plt.show()
```

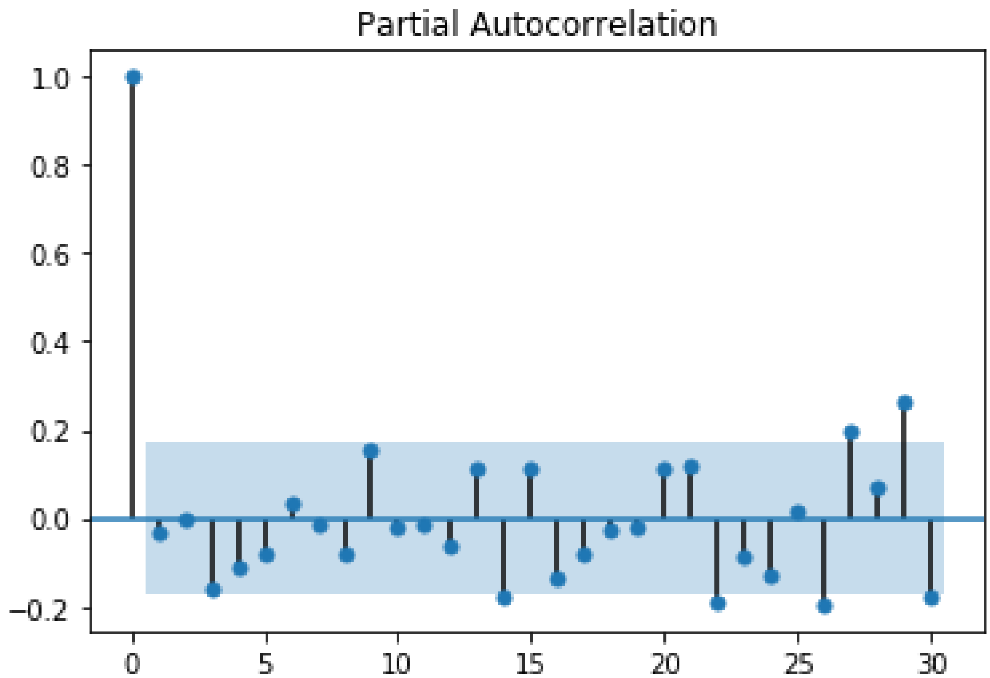




5. Repita os gráficos de autocorrelação e autocorrelação parcial para a primeira diferença de cada aplicação. O que você pode concluir?

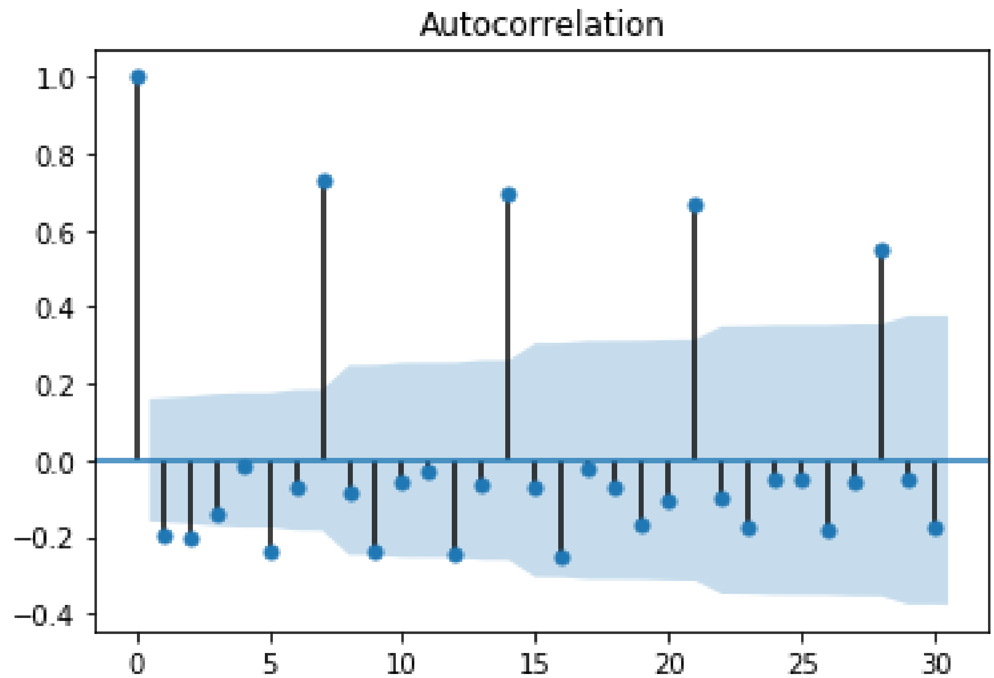
[55]:
```
# Correlograma

plot_acf(np.diff(df1['Close']), lags=30)
plot_pacf(np.diff(df1['Close']), lags=30)
plt.show()
```

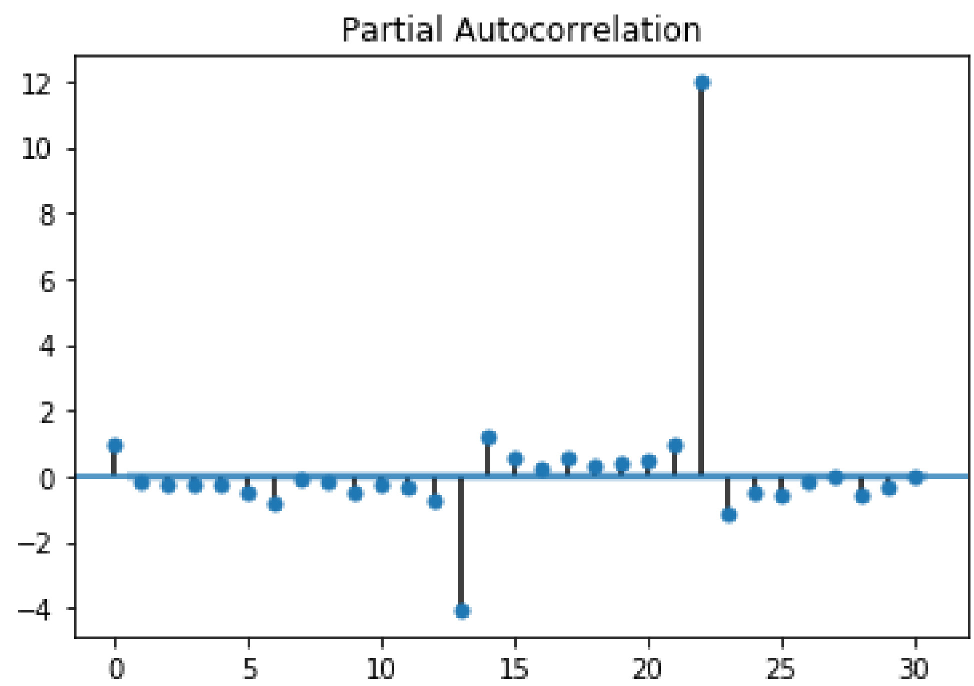




[56]:
```
# Correlograma

plot_acf(np.diff(df2['deaths']), lags=30)
plot_pacf(np.diff(df2['deaths']), lags=30)
plt.show()
```

```
/home/cibele/anaconda3/lib/python3.7/site-
packages/statsmodels/regression/linear_model.py:1406: RuntimeWarning: invalid
value encountered in sqrt
  return rho, np.sqrt(sigmasq)
```





6. Para os dados de PETR4, refaça a modelagem vista em aula.

7. Desafio: Ainda não vimos o modelo SARIMA, mas já sabemos que a série de COVID-19

tem sazonalidade. Como os dados de COVID-19 apresentam sazonalidade, vamos arriscar no tema da próxima aula? Altere seasonal para True e escolha o melhor modelo entre os SARIMA propostos. Discutiremos com detalhes este modelo na Aula 4.

[60]:
```python
stepwise_fit = auto_arima(df2['deaths'], start_p=0, start_q=0,
                          max_p=6, max_q=3, m=7,
                          seasonal=True,
                          d=0, trace=True,
                          error_action='ignore',    # we don't want to know if an␣
 ↪order does not work
                          suppress_warnings=True,   # we don't want convergence␣
 ↪warnings
                          stepwise=True)            # set to stepwise

stepwise_fit.summary()
```

```
Performing stepwise search to minimize aic
Fit ARIMA(0,0,0)x(1,1,1,7) [intercept=True]; AIC=1503.140, BIC=1515.019,
Time=0.461 seconds
Fit ARIMA(0,0,0)x(0,1,0,7) [intercept=True]; AIC=1546.346, BIC=1552.285,
Time=0.023 seconds
Fit ARIMA(1,0,0)x(1,1,0,7) [intercept=True]; AIC=1506.697, BIC=1518.577,
Time=0.418 seconds
Fit ARIMA(0,0,1)x(0,1,1,7) [intercept=True]; AIC=1504.764, BIC=1516.643,
Time=0.394 seconds
Fit ARIMA(0,0,0)x(0,1,0,7) [intercept=False]; AIC=1553.312, BIC=1556.281,
Time=0.019 seconds
Fit ARIMA(0,0,0)x(0,1,1,7) [intercept=True]; AIC=1505.935, BIC=1514.844,
Time=0.261 seconds
Fit ARIMA(0,0,0)x(1,1,0,7) [intercept=True]; AIC=1506.823, BIC=1515.733,
Time=0.550 seconds
Fit ARIMA(0,0,0)x(2,1,1,7) [intercept=True]; AIC=1501.191, BIC=1516.040,
Time=1.153 seconds
Fit ARIMA(0,0,0)x(2,1,0,7) [intercept=True]; AIC=1500.211, BIC=1512.091,
Time=0.795 seconds
Fit ARIMA(1,0,0)x(2,1,0,7) [intercept=True]; AIC=1497.094, BIC=1511.944,
Time=1.094 seconds
Fit ARIMA(1,0,0)x(2,1,1,7) [intercept=True]; AIC=1498.545, BIC=1516.364,
Time=1.546 seconds
Fit ARIMA(1,0,0)x(1,1,1,7) [intercept=True]; AIC=1500.782, BIC=1515.631,
Time=0.597 seconds
Fit ARIMA(2,0,0)x(2,1,0,7) [intercept=True]; AIC=1495.055, BIC=1512.874,
Time=1.300 seconds
Fit ARIMA(2,0,0)x(1,1,0,7) [intercept=True]; AIC=1502.469, BIC=1517.319,
Time=0.488 seconds
Fit ARIMA(2,0,0)x(2,1,1,7) [intercept=True]; AIC=1496.087, BIC=1516.875,
Time=1.940 seconds
Fit ARIMA(2,0,0)x(1,1,1,7) [intercept=True]; AIC=1498.097, BIC=1515.916,
```

```
Time=0.679 seconds
Fit ARIMA(3,0,0)x(2,1,0,7) [intercept=True]; AIC=1491.535, BIC=1512.324,
Time=1.537 seconds
Fit ARIMA(3,0,0)x(1,1,0,7) [intercept=True]; AIC=1496.157, BIC=1513.976,
Time=0.851 seconds
Fit ARIMA(3,0,0)x(2,1,1,7) [intercept=True]; AIC=1492.478, BIC=1516.237,
Time=1.934 seconds
Fit ARIMA(3,0,0)x(1,1,1,7) [intercept=True]; AIC=1493.818, BIC=1514.606,
Time=1.109 seconds
Fit ARIMA(4,0,0)x(2,1,0,7) [intercept=True]; AIC=1488.717, BIC=1512.476,
Time=2.341 seconds
Fit ARIMA(4,0,0)x(1,1,0,7) [intercept=True]; AIC=1493.623, BIC=1514.412,
Time=0.921 seconds
Fit ARIMA(4,0,0)x(2,1,1,7) [intercept=True]; AIC=1490.135, BIC=1516.864,
Time=3.059 seconds
Fit ARIMA(4,0,0)x(1,1,1,7) [intercept=True]; AIC=1490.818, BIC=1514.577,
Time=1.425 seconds
Fit ARIMA(5,0,0)x(2,1,0,7) [intercept=True]; AIC=1490.106, BIC=1516.835,
Time=2.722 seconds
Fit ARIMA(4,0,1)x(2,1,0,7) [intercept=True]; AIC=1488.725, BIC=1515.453,
Time=3.578 seconds
Fit ARIMA(3,0,1)x(2,1,0,7) [intercept=True]; AIC=1490.816, BIC=1514.575,
Time=2.565 seconds
Fit ARIMA(5,0,1)x(2,1,0,7) [intercept=True]; AIC=1490.307, BIC=1520.005,
Time=4.308 seconds
Total fit time: 38.161 seconds
```

[60]:
```
<class 'statsmodels.iolib.summary.Summary'>
"""
                                     SARIMAX Results
================================================================================
=========
Dep. Variable:                                y   No. Observations:
151
Model:             SARIMAX(4, 0, 0)x(2, 1, 0, 7)   Log Likelihood
-736.359
Date:                          Tue, 28 Jul 2020   AIC
1488.717
Time:                                  00:28:50   BIC
1512.476
Sample:                                       0   HQIC
1498.371
                                          - 151
Covariance Type:                            opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
```

```
intercept     16.9028      5.491      3.078      0.002      6.140      27.665
ar.L1          0.2212      0.072      3.065      0.002      0.080       0.363
ar.L2          0.1651      0.071      2.325      0.020      0.026       0.304
ar.L3         -0.2270      0.086     -2.652      0.008     -0.395      -0.059
ar.L4          0.1806      0.075      2.412      0.016      0.034       0.327
ar.S.L7       -0.6434      0.073     -8.836      0.000     -0.786      -0.501
ar.S.L14      -0.2184      0.095     -2.288      0.022     -0.406      -0.031
sigma2      1579.5096    162.146      9.741      0.000   1261.709    1897.310
================================================================================
===
Ljung-Box (Q):                      31.23   Jarque-Bera (JB):
14.88
Prob(Q):                             0.84   Prob(JB):
0.00
Heteroskedasticity (H):              8.88   Skew:
0.49
Prob(H) (two-sided):                 0.00   Kurtosis:
4.23
================================================================================
===

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-
step).
"""
```