In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings

warnings.filterwarnings("ignore")
```

In [ ]:
```
df = pd.read_csv('./dados/covid19_casos_brasil.csv')

df.describe()
```

Out [ ]:

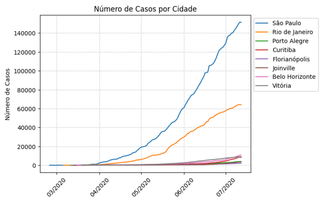
	city_ibge_code	epidemiological_week	estimated_population_2019	last_available_confirmed	last_available_confirmed_per_100k_inhabitants	last_available_death_rate	last_available_deaths	order_for_place	new_confirmed	new_deaths
count	3.520880e+05	353913.000000	3.520880e+05	353913.000000	344064.000000	353913.000000	353913.000000	353913.000000	353913.000000	353913.000000
mean	3.142813e+06	23.132716	1.347397e+05	324.471347	253.029025	0.051116	15.467372	39.052058	10.504983	0.406764
std	1.024140e+06	3.749478	1.242127e+06	4142.775779	507.736947	0.140634	240.762890	26.185864	126.202119	5.666664
min	1.100000e+01	9.000000	8.370000e+02	0.000000	0.002180	0.000000	0.000000	1.000000	-1578.000000	-82.000000
25%	2.411106e+06	21.000000	7.655000e+03	2.000000	20.935020	0.000000	0.000000	17.000000	0.000000	0.000000
50%	3.134004e+06	24.000000	1.705500e+04	11.000000	75.443230	0.000000	0.000000	35.000000	0.000000	0.000000
75%	4.104209e+06	26.000000	3.816600e+04	53.000000	260.831717	0.041700	2.000000	57.000000	2.000000	0.000000
max	5.300108e+06	29.000000	4.591905e+07	371997.000000	13089.322510	1.000000	17848.000000	139.000000	19030.000000	434.000000

1. Apresentar gráfico do crescimento de casos e mortes de Joinville e os das capitais das regiões Sul e Sudeste. Descreva observações sobre estes gráficos.

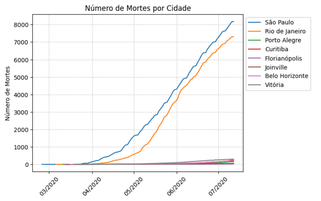
In [ ]:
```
cities = {
    'Sul': ['Florianópolis', 'Curitiba', 'Porto Alegre', 'Joinville'],
    'Sudeste': ['Vitória', 'Belo Horizonte', 'Rio de Janeiro', 'São Paulo']
}

df_filtered = df[df['city'].isin(cities['Sul'] + cities['Sudeste'])]

df_filtered['date'] = pd.to_datetime(df_filtered['date'])

print(df_filtered)
```

```
             city  city_ibge_code        date  epidemiological_week  \
0       São Paulo         3550308.0 2020-02-25                     9
2       São Paulo         3550308.0 2020-02-26                     9
4       São Paulo         3550308.0 2020-02-27                     9
6       São Paulo         3550308.0 2020-02-28                     9
8       São Paulo         3550308.0 2020-02-29                     9
...           ...               ...        ...                   ...
352063  Rio de Janeiro    3304557.0 2020-07-12                    29
352605  Porto Alegre      4314902.0 2020-07-12                    29
352842  Florianópolis     4205407.0 2020-07-12                    29
352892  Joinville         4209102.0 2020-07-12                    29
353684  São Paulo         3550308.0 2020-07-12                    29

       estimated_population_2019  is_last  is_repeated  \
0                      12252023.0    False        False
2                      12252023.0    False        False
4                      12252023.0    False        False
6                      12252023.0    False        False
8                      12252023.0    False        False
...                           ...      ...          ...
352063                  6718903.0     True        False
352605                   148771.0     True        False
352842                   500973.0     True        False
352892                   590466.0     True        False
353684                 12252023.0    False         True

       last_available_confirmed  \
0                             1
2                             1
4                             1
6                             2
8                             2
...                         ...
352063                    64110
352605                     3928
352842                     2064
352892                     3431
353684                   151365

       last_available_confirmed_per_100k_inhabitants last_available_date  \
0                                            0.00816           2020-02-25
2                                            0.00816           2020-02-26
4                                            0.00816           2020-02-27
6                                            0.01632           2020-02-28
8                                            0.01632           2020-02-29
...                                              ...                  ...
352063                                     954.17362           2020-07-12
352605                                     264.73088           2020-07-12
352842                                     411.99825           2020-07-12
352892                                     581.06648           2020-07-12
353684                                    1235.42863           2020-07-11

       last_available_death_rate  last_available_deaths  order_for_place  \
0                         0.0000                      0                1
2                         0.0000                      0                2
4                         0.0000                      0                3
6                         0.0000                      0                4
8                         0.0000                      0                5
...                          ...                    ...              ...
352063                    0.1140                   7310              129
352605                    0.0400                    157              124
352842                    0.0126                     26              123
352892                    0.0163                     56              122
353684                    0.0540                   8176              139

       place_type state  new_confirmed  new_deaths
0           city    SP              1           0
2           city    SP              0           0
4           city    SP              0           0
6           city    SP              1           0
8           city    SP              0           0
...          ...   ...            ...         ...
352063      city    RJ              8           8
352605      city    MS             16           5
352842      city    SC             23           0
352892      city    SC             46           2
353684      city    SP              0           0

[995 rows x 17 columns]
```

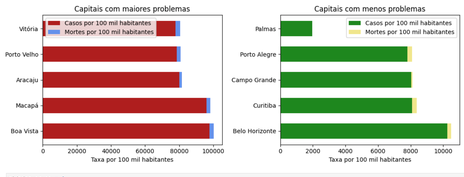
In [ ]:
```
from matplotlib import pyplot as plt
import seaborn as sns
import matplotlib.dates as mdates

sns.lineplot(data=df_filtered, x='date', y='last_available_confirmed', hue='city', palette='tab10')
plt.xlabel('')
plt.ylabel('Número de Casos')
plt.title('Número de Casos por Cidade')
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%m/%Y'))

plt.xticks(rotation=45)
plt.legend(loc='upper left', bbox_to_anchor=(1, 1))
plt.grid(True, linestyle='--', color='lightgray')

plt.show()
```



In [ ]:
```
from matplotlib import pyplot as plt
import seaborn as sns
import matplotlib.dates as mdates

sns.lineplot(data=df_filtered, x='date', y='last_available_deaths', hue='city', palette='tab10')
plt.xlabel('')
plt.ylabel('Número de Mortes')
plt.title('Número de Mortes por Cidade')
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%m/%Y'))

plt.xticks(rotation=45)
plt.legend(loc='upper left', bbox_to_anchor=(1, 1))
plt.grid(True, linestyle='--', color='lightgray')

plt.show()
```



In [ ]:
```
capitais_brasileiras = [
    "Rio Branco", "Maceió", "Macapá", "Manaus", "Salvador", "Fortaleza", "Brasília", "Vitória", "Goiânia",
    "São Luís", "Cuiabá", "Campo Grande", "Belo Horizonte", "Belém", "João Pessoa", "Curitiba", "Recife",
    "Teresina", "Rio de Janeiro", "Natal", "Porto Alegre", "Porto Velho", "Boa Vista", "Florianópolis",
    "São Paulo", "Aracaju", "Palmas"
]

capitais = df[df['city'].isin(capitais_brasileiras)]

capitais = capitais.drop_duplicates(subset=['city_ibge_code', 'last_available_date'])

grouped = capitais.groupby('city_ibge_code').agg({
    'city': 'last',
    'estimated_population_2019': 'last',
    'last_available_confirmed': 'sum',
    'last_available_deaths': 'sum'
})

grouped['cases_per_100k'] = (grouped['last_available_confirmed'] / grouped['estimated_population_2019'] * 100000).round(2)
grouped['deaths_per_100k'] = (grouped['last_available_deaths'] / grouped['estimated_population_2019'] * 100000).round(2)

grouped = grouped.sort_values(by='cases_per_100k', ascending=False)

maiores_problemas = grouped.head(5)
pouco_sem_problema = grouped.tail(5)

plt.figure(figsize=(11, 4))

plt.subplot(1, 2, 1)
plt.barh(maiores_problemas['city'], maiores_problemas['cases_per_100k'], color='firebrick', label='Casos por 100 mil habitantes', height=0.6)
plt.barh(maiores_problemas['city'], maiores_problemas['deaths_per_100k'], color='cornflowerblue', left=maiores_problemas['cases_per_100k'], label='Mortes por 100 mil habitantes', height=0.6)
plt.xlabel('Taxa por 100 mil habitantes')
plt.title('Capitais com maiores problemas')
plt.legend(loc='upper left')

plt.subplot(1, 2, 2)
plt.barh(pouco_sem_problema['city'], pouco_sem_problema['cases_per_100k'], color='forestgreen', label='Casos por 100 mil habitantes', height=0.6)
plt.barh(pouco_sem_problema['city'], pouco_sem_problema['deaths_per_100k'], color='khaki', left=pouco_sem_problema['cases_per_100k'], label='Mortes por 100 mil habitantes', height=0.6)
plt.xlabel('Taxa por 100 mil habitantes')
plt.title('Capitais com menos problemas')
plt.legend(loc='upper right')

plt.tight_layout()
plt.show()
```



In [ ]:
```
cidades_grupo = [
    "Duque de Caxias", "Nova Iguaçu", "Campos dos Goytacazes", "Belford Roxo",
    "Ananindeua", "Santarém", "Parauapebas", "Marabá", "Castanhal",
    "Florianópolis", "Ponta Grossa"
]

grupo = df[df['city'].isin(cidades_grupo)]

grupo = grupo.drop_duplicates(subset=['city_ibge_code', 'last_available_date'])

grouped = grupo.groupby('city_ibge_code').agg({
    'city': 'last',
    'estimated_population_2019': 'last',
    'last_available_confirmed': 'sum',
    'last_available_deaths': 'sum'
})

grouped['cases_per_100k'] = (grouped['last_available_confirmed'] / grouped['estimated_population_2019'] * 100000).round(2)
grouped['deaths_per_100k'] = (grouped['last_available_deaths'] / grouped['estimated_population_2019'] * 100000).round(2)

grouped = grouped.sort_values(by='cases_per_100k', ascending=False)

maiores_problemas = grouped.head(3)
pouco_sem_problema = grouped.tail(3)

plt.figure(figsize=(11, 4))

x_values = np.linspace(0, max(maiores_problemas['cases_per_100k']), 7)
x_values = [int(x) for x in x_values]

y_values = np.linspace(0, max(pouco_sem_problema['cases_per_100k']), 7)
y_values = [int(x) for x in y_values]

plt.subplot(1, 2, 1)
plt.barh(maiores_problemas['city'], maiores_problemas['cases_per_100k'], color='firebrick', label='Casos por 100 mil habitantes', height=0.6)
plt.barh(maiores_problemas['city'], maiores_problemas['deaths_per_100k'], color='cornflowerblue', left=maiores_problemas['cases_per_100k'], label='Mortes por 100 mil habitantes', height=0.6)
plt.xlabel('Taxa por 100 mil habitantes')
plt.title('Cidades com maiores problemas')
plt.xticks(x_values)
plt.legend(loc='upper right')

plt.subplot(1, 2, 2)
plt.barh(pouco_sem_problema['city'], pouco_sem_problema['cases_per_100k'], color='forestgreen', label='Casos por 100 mil habitantes', height=0.6)
plt.barh(pouco_sem_problema['city'], pouco_sem_problema['deaths_per_100k'], color='khaki', left=pouco_sem_problema['cases_per_100k'], label='Mortes por 100 mil habitantes', height=0.6)
plt.xlabel('Taxa por 100 mil habitantes')
plt.title('Cidades com menos problemas')
plt.xticks(y_values)
plt.legend(loc='upper right')

plt.tight_layout()
plt.show()
```