```
!pip install pandas
```

```
Requirement already satisfied: pandas in c:\users\manog\anaconda3\lib\
site-packages (1.4.4)
Requirement already satisfied: pytz>=2020.1 in c:\users\manog\
anaconda3\lib\site-packages (from pandas) (2022.1)
Requirement already satisfied: python-dateutil>=2.8.1 in c:\users\
manog\anaconda3\lib\site-packages (from pandas) (2.8.2)
Requirement already satisfied: numpy>=1.18.5 in c:\users\manog\
anaconda3\lib\site-packages (from pandas) (1.21.5)
Requirement already satisfied: six>=1.5 in c:\users\manog\anaconda3\
lib\site-packages (from python-dateutil>=2.8.1->pandas) (1.16.0)
```

Generate weekly statistics (mean, median, mode) for number of new cases and deaths across a specific state

```
import pandas as pd
from scipy import stats
import numpy as np

dfnewcases = pd.read_csv(r'..\..\Desktop\Data Science\
covid_confirmed_usafacts.csv')
dfdeaths = pd.read_csv(r'..\..\Desktop\Data Science\
covid_deaths_usafacts.csv')

dfdeaths=dfdeaths.groupby(['State']).sum()
dfnewcases=dfnewcases.groupby(['State']).sum()

dfnewcases1=dfnewcases.T
dfdeaths1=dfdeaths.T

dfnewcases1.columns=dfnewcases.index
dfdeaths1.columns=dfdeaths.index

dfnewcases1 = dfnewcases1.iloc[4:]
dfdeaths1 = dfdeaths1.iloc[4:]

dates=dfnewcases1.index
dfnewcases1['date']=dates
dfnewcases1['date']=pd.to_datetime(dfnewcases1['date'])
dfnewcases1 = dfnewcases1.loc[(dfnewcases1['date'] >= '2022-06-01')
                     & (dfnewcases1['date'] < '2022-12-31')]
dfnewcases1.reset_index(drop=True, inplace=True)
dfnewcases1['dayOfWeek'] = dfnewcases1['date'].dt.day_name()


dates=dfdeaths1.index
dfdeaths1['date']=dates
dfdeaths1['date']=pd.to_datetime(dfdeaths1['date'])
dfdeaths1 = dfdeaths1.loc[(dfdeaths1['date'] >= '2022-06-01')
```

```
                     & (dfdeaths1['date'] < '2022-12-31')]
dfdeaths1.reset_index(drop=True, inplace=True)
dfdeaths1['dayOfWeek'] = dfdeaths1['date'].dt.day_name()

no_of_week_newcases=[]
i=1
for day in dfnewcases1['dayOfWeek']:
    if day=='Monday':
        i=i+1
    no_of_week_newcases.append(str("week_"+str(i)))

dfnewcases1['no_of_week']=no_of_week_newcases


no_of_week_deaths=[]
i=1
for day in dfdeaths1['dayOfWeek']:
    if day=='Monday':
        i=i+1
    no_of_week_deaths.append(str("week_"+str(i)))

dfdeaths1['no_of_week']=no_of_week_deaths

def StatsCovid(StateName):
    global x
    dfnewcases1[StateName]=dfnewcases1[StateName].astype(int)
    dfnewcases1.groupby(["no_of_week"]).mean()
    x=dfnewcases1.groupby(["no_of_week"]).mean()
    print("Newcases Weekly
Mode:",dfnewcases1.groupby(['no_of_week',StateName]).agg(mode=('no_of_
week', lambda x: x.value_counts().index[0])))
    print("Newcases Weekly
Mean:",dfnewcases1.groupby(["no_of_week"]).mean()[StateName])
    dfnewcases1.groupby(["no_of_week"]).median()
    print("Newcases weekly Median:
",dfnewcases1.groupby(["no_of_week"]).median()[StateName])



    dfdeaths1[StateName]=dfdeaths1[StateName].astype(int)
    dfdeaths1.groupby(["no_of_week"]).mean()
    print("deaths Weekly
Mode:",dfdeaths1.groupby(['no_of_week',StateName]).agg(mode=('no_of_we
ek', lambda x: x.value_counts().index[0])))
    print("deaths Weekly
Mean:",dfdeaths1.groupby(["no_of_week"]).mean()[StateName])
    dfdeaths1.groupby(["no_of_week"]).median()
    print("deaths weekly Median:
",dfdeaths1.groupby(["no_of_week"]).median()[StateName])
```

```
StatsCovid('AL')
```

```
Newcases Weekly Mode:                         mode
no_of_week AL
week_1     1315934   week_1
           1317029   week_1
week_10    1424411  week_10
           1436458  week_10
week_11    1436458  week_11
...                     ...
week_9     1413426   week_9
           1416310   week_9
           1419075   week_9
           1421760   week_9
           1424411   week_9

[84 rows x 1 columns]
Newcases Weekly Mean: no_of_week
week_1     1.316810e+06
week_10    1.431295e+06
week_11    1.444089e+06
week_12    1.457881e+06
week_13    1.472888e+06
week_14    1.488002e+06
week_15    1.499946e+06
week_16    1.508725e+06
week_17    1.515431e+06
week_18    1.520322e+06
week_19    1.524186e+06
week_2     1.323688e+06
week_20    1.527447e+06
week_21    1.530205e+06
week_22    1.533009e+06
week_23    1.534287e+06
week_24    1.537740e+06
week_25    1.541685e+06
week_26    1.544278e+06
week_27    1.548089e+06
week_28    1.551774e+06
week_29    1.557863e+06
week_3     1.332526e+06
week_30    1.566826e+06
week_31    1.568934e+06
week_4     1.343353e+06
week_5     1.356201e+06
week_6     1.369285e+06
week_7     1.386280e+06
week_8     1.403582e+06
week_9     1.420543e+06
```

```
Name: AL, dtype: float64
Newcases weekly Median:  no_of_week
week_1     1317029.0
week_10    1436458.0
week_11    1449812.0
week_12    1463933.0
week_13    1479605.0
week_14    1494300.0
week_15    1504180.0
week_16    1512134.0
week_17    1517904.0
week_18    1522135.0
week_19    1525724.0
week_2     1324178.0
week_20    1528739.0
week_21    1531305.0
week_22    1534287.0
week_23    1534287.0
week_24    1540329.0
week_25    1542227.0
week_26    1545099.0
week_27    1549285.0
week_28    1549285.0
week_29    1555092.0
week_3     1333137.0
week_30    1568934.0
week_31    1568934.0
week_4     1344233.0
week_5     1357266.0
week_6     1370792.0
week_7     1387729.0
week_8     1404810.0
week_9     1421760.0
Name: AL, dtype: float64
deaths Weekly Mode:                       mode
no_of_week AL
week_1     19664   week_1
week_10    19891  week_10
           19974  week_10
week_11    19974  week_11
           20026  week_11
...                   ...
week_8     19872   week_8
week_9     19888   week_9
           19889   week_9
           19890   week_9
           19891   week_9

[74 rows x 1 columns]
deaths Weekly Mean: no_of_week
```

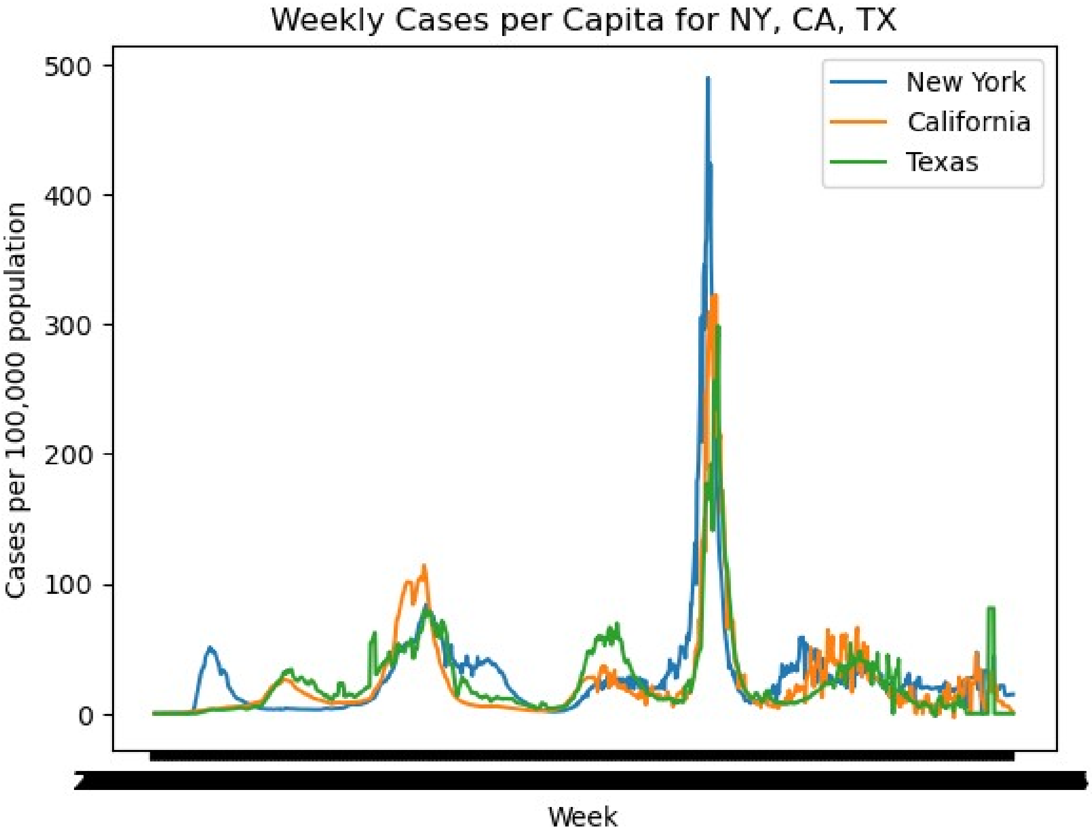
```
week_1     19664.000000
week_10    19938.428571
week_11    20003.714286
week_12    20034.571429
week_13    20045.000000
week_14    20112.000000
week_15    20205.142857
week_16    20286.428571
week_17    20363.714286
week_18    20410.428571
week_19    20451.142857
week_2     19684.000000
week_20    20491.285714
week_21    20521.000000
week_22    20547.285714
week_23    20558.000000
week_24    20586.571429
week_25    20614.428571
week_26    20627.000000
week_27    20646.000000
week_28    20664.857143
week_29    20691.428571
week_3     19695.714286
week_30    20727.571429
week_31    20737.000000
week_4     19718.000000
week_5     19749.285714
week_6     19776.714286
week_7     19814.000000
week_8     19855.857143
week_9     19890.000000
Name: AL, dtype: float64
deaths weekly Median:  no_of_week
week_1     19664.0
week_10    19974.0
week_11    20026.0
week_12    20041.0
week_13    20048.0
week_14    20160.0
week_15    20239.0
week_16    20322.0
week_17    20395.0
week_18    20422.0
week_19    20473.0
week_2     19684.0
week_20    20505.0
week_21    20533.0
week_22    20558.0
week_23    20558.0
week_24    20608.0
```

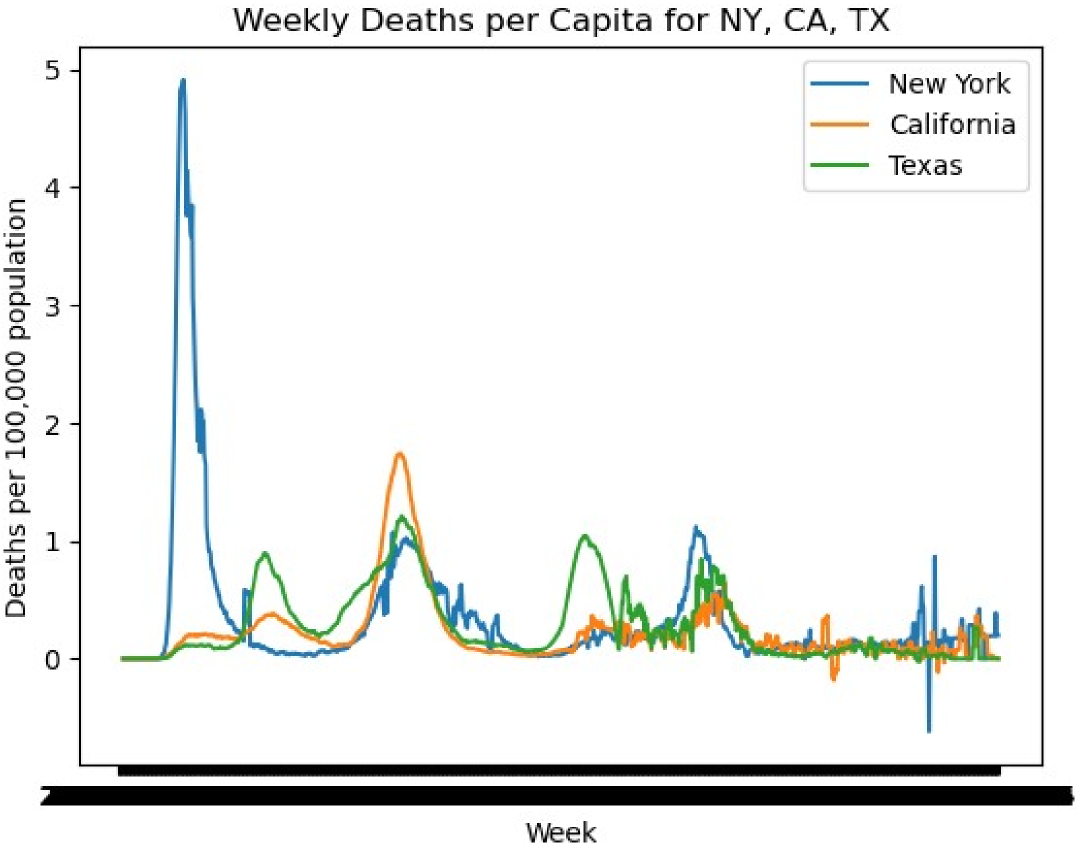
```
week_25    20617.0
week_26    20631.0
week_27    20652.0
week_28    20652.0
week_29    20682.0
week_3     19696.0
week_30    20737.0
week_31    20737.0
week_4     19723.0
week_5     19755.0
week_6     19781.0
week_7     19821.0
week_8     19859.0
week_9     19890.0
Name: AL, dtype: float64
```

Compare the data against 3 other states. Normalize by population, use a normalization factor which is able to identify cases and deaths, for example try per 10,000 or 100,000 (this depends on the population). Plot the values across the weeks in a line plot for the 3 states in a single graph. Describe why the rates differ across these states in the notebook. Identify the peaks, are they consistent with the US pattern?

```python
import pandas as pd
import matplotlib.pyplot as plt
# Load data for US, NY, CA, TX
us_confirmed = pd.read_csv(r'..\..\Desktop\Data Science\
covid_confirmed_usafacts.csv')
ny_confirmed = us_confirmed[us_confirmed['State'] == 'NY']
ca_confirmed = us_confirmed[us_confirmed['State'] == 'CA']
tx_confirmed = us_confirmed[us_confirmed['State'] == 'TX']
us_deaths = pd.read_csv(r'..\..\Desktop\Data Science\
covid_deaths_usafacts.csv')
ny_deaths = us_deaths[us_deaths['State'] == 'NY']
ca_deaths = us_deaths[us_deaths['State'] == 'CA']
tx_deaths = us_deaths[us_deaths['State'] == 'TX']
populations = pd.read_csv(r'..\..\Desktop\Data Science\
covid_county_population_usafacts.csv')
# Calculate population for each state
ny_pop = populations[(populations['State'] == 'NY') &
(populations['countyFIPS'] != 0)]['population'].sum()
ca_pop = populations[(populations['State'] == 'CA') &
(populations['countyFIPS'] != 0)]['population'].sum()
tx_pop = populations[(populations['State'] == 'TX') &
(populations['countyFIPS'] != 0)]['population'].sum()
# Calculate per capita cases and deaths
```

```
ny_cases = ny_confirmed.iloc[:,
4:].sum().diff().rolling(window=7).mean() / ny_pop * 100000
ca_cases = ca_confirmed.iloc[:,
4:].sum().diff().rolling(window=7).mean() / ca_pop * 100000
tx_cases = tx_confirmed.iloc[:,
4:].sum().diff().rolling(window=7).mean() / tx_pop * 100000
ny_deaths_per_capita = ny_deaths.iloc[:,
4:].sum().diff().rolling(window=7).mean() / ny_pop * 100000
ca_deaths_per_capita = ca_deaths.iloc[:,
4:].sum().diff().rolling(window=7).mean() / ca_pop * 100000
tx_deaths_per_capita = tx_deaths.iloc[:,
4:].sum().diff().rolling(window=7).mean() / tx_pop * 100000
# Plot data
plt.plot(ny_cases.index, ny_cases, label='New York')
plt.plot(ca_cases.index, ca_cases, label='California')
plt.plot(tx_cases.index, tx_cases, label='Texas')
plt.xlabel('Week')
plt.ylabel('Cases per 100,000 population')
plt.title('Weekly Cases per Capita for NY, CA, TX')
plt.legend()
plt.show()
plt.plot(ny_deaths_per_capita.index, ny_deaths_per_capita, label='New
York')
plt.plot(ca_deaths_per_capita.index, ca_deaths_per_capita,
label='California')
plt.plot(tx_deaths_per_capita.index, tx_deaths_per_capita,
label='Texas')
plt.xlabel('Week')
plt.ylabel('Deaths per 100,000 population')
plt.title('Weekly Deaths per Capita for NY, CA, TX')
plt.legend()
plt.show()
```


Weekly Cases per Capita for NY, CA, TX
Cases per 100,000 population
0
100
200
300
400
500
Week
New York
California
Texas



Describe why the rates differ across these states in the notebook. Identify the peaks, are they consistent with the US pattern?

There are several factors that may contribute to the differences in COVID-19 rates acroos these states, including: 1) Population density: New York has a much higher population density than California or Texas, which may make it more difficult to contain the spread of the virus. 2) Timing of outbreaks: New York was hit hard by the virus earlier on in the pandemic, while California and Texas experienced more significant outbreaks later on. This could explain why New York has a higher cumulative number of cases and deaths, but lower rates of new cases and deaths per capita in recent weeks. 3) Differences in government policies: The three states have implemented different policies to control the spread of the virus, such as varying levels of mask mandates,buiness closures, and restrictions on gatherings. 4) Demographics: There may be differences in the age, health, and socio-economic status of the populations in each state, which could affect the spread of the virus and the severity of illness.

We can see that there are peaks for each state. For cases per capita, New York has a peak in late March, california has a peak in mid late December, and Texas has a peak in mid-January. For deaths per capita, New York has a peek in mid April, California has a peak in mid-january, and Texas has a peak in late January. These peaks do not appear to be consistent with the US pattern.

Identify 3 counties within a state of your choice with high cases and death rates.

```
#Deaths
import pandas as pd
pd.options.mode.chained_assignment = None

df_dt = pd.read_csv(r'..\..\Desktop\Data Science\
covid_deaths_usafacts.csv')


dff=df_dt[df_dt['State']=='AL']
AL_df=dff.T
AL_df.columns=dff['County Name']
AL_df2=AL_df.iloc[4:]

#Date Filter
dates=AL_df2.index
AL_df2['date']=dates
AL_df2['date']=pd.to_datetime(AL_df2['date'])
AL_df2 = AL_df2.loc[(AL_df2['date'] >= '2022-06-01')& (AL_df2['date']
< '2022-12-31')]
AL_df2.reset_index(drop=True, inplace=True)

Death_df=AL_df2.sum()

df_dt = pd.read_csv(r'..\..\Desktop\Data Science\
covid_confirmed_usafacts.csv')

df1=df_dt[df_dt['State']=='AL']
AL_Cases_df=df1.T
AL_Cases_df.columns=df1['County Name']
AL_Cases_df2=AL_Cases_df.iloc[4:]


#Date Filter
dates=AL_Cases_df2.index
AL_Cases_df2['date']=dates
AL_Cases_df2['date']=pd.to_datetime(AL_Cases_df2['date'])
AL_Cases_df2 = AL_Cases_df2.loc[(AL_Cases_df2['date'] >= '2022-06-
01')& (AL_Cases_df2['date'] < '2022-12-31')]
AL_Cases_df2.reset_index(drop=True, inplace=True)

Cases_df =AL_Cases_df2.sum()

# Cases_df

Cases_df1=pd.DataFrame(Cases_df.values,columns=['Confirmed cases'])
Cases_df1['County Name']=Cases_df.index
```

```
Cases_df1=Cases_df1.iloc[1:]
```

```
# Cases_df1
Highest_Cases_df=Cases_df1.sort_values(by='Confirmed cases')[:3]
```

```
C:\Users\manog\AppData\Local\Temp\ipykernel_23644\500385892.py:20:
FutureWarning: Dropping of nuisance columns in DataFrame reductions
(with 'numeric_only=None') is deprecated; in a future version this
will raise TypeError.  Select only valid columns before calling the
reduction.
  Death_df=AL_df2.sum()
C:\Users\manog\AppData\Local\Temp\ipykernel_23644\500385892.py:37:
FutureWarning: Dropping of nuisance columns in DataFrame reductions
(with 'numeric_only=None') is deprecated; in a future version this
will raise TypeError.  Select only valid columns before calling the
reduction.
  Cases_df =AL_Cases_df2.sum()
```

```
# Highest Cases
Highest_Cases_df
```

```
   Confirmed cases      County Name
32          444019   Greene County
12          460199  Choctaw County
53          509867    Perry County
```

```
# Death_df
Death_df1=pd.DataFrame(Death_df.values,columns=['Deaths'])
Death_df1['County Name']=Death_df.index
Death_df1=Death_df1.iloc[1:]
```

```
# Death_df1
df_join = pd.merge(Cases_df1, Death_df1, on='County Name',
how='inner')
```

```
# df_join
df_join['Death rate']=(df_join['Deaths']/df_join['Confirmed
cases'])*100
df_final=df_join.sort_values(by='Death rate',ascending=False)[:3]
```

```
#Death rate and percentage
df_final[['County Name','Death rate']]
```

```
       County Name Death rate
42  Lowndes County   2.671229
23   Dallas County   2.585725
31   Greene County   2.464759
```

Plot weekly trends (new cases and deaths) for the top 3 infected counties. Show plots by raw values and log normalized values. Describe what is causing them and what were the peaks. Do the counties follow state pattern.

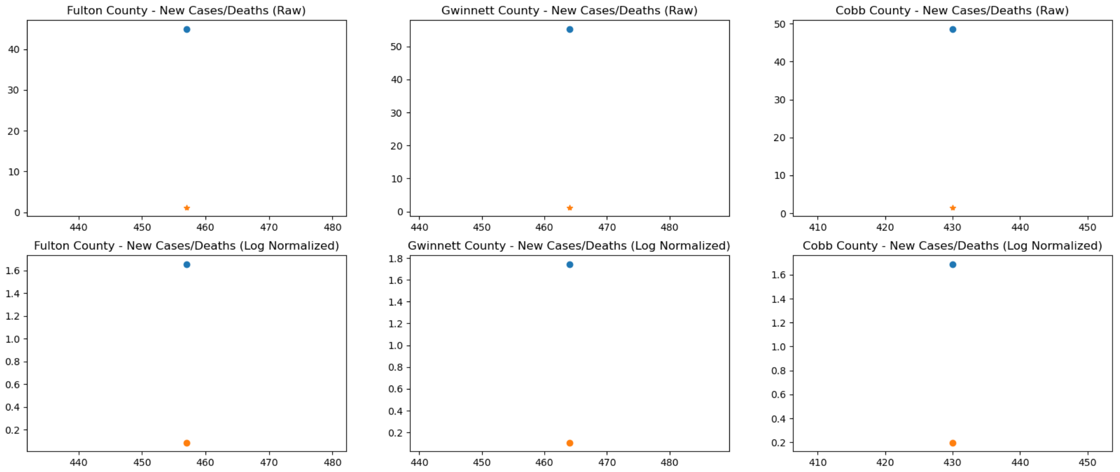
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
# State and number of top counties to consider
state = "GA"
num_top_counties = 3
# Read the confirmed cases and deaths data
confirmed_df = pd.read_csv(r'..\..\Desktop\Data Science\
covid_confirmed_usafacts.csv')
confirmed_df['County Name'] = confirmed_df['County Name'].str.strip()
#Replace space at last in County name
# confirmed_df['County Name']=confirmed_df['County
Name'].str.replace('County ','County')

deaths_df = pd.read_csv(r'.\..\Desktop\Data Science\
covid_deaths_usafacts.csv')
deaths_df['County Name'] = deaths_df['County Name'].str.strip()
#Replace space at last in County name
# deaths_df['County Name']=deaths_df['County
Name'].str.replace('County ','County')

# Filter the data to the specified state
confirmed_state_df = confirmed_df[confirmed_df.State == state]
deaths_state_df = deaths_df[deaths_df.State == state]
# Read the county population data
population_df = pd.read_csv(r'..\..\Desktop\Data Science\
covid_county_population_usafacts.csv')
population_df['County Name'] = population_df['County
Name'].str.strip()
population_df = population_df[population_df.State == state]
# Get the top counties by confirmed cases
top_counties = confirmed_state_df.groupby("County Name")["2022-06-
01"].sum().sort_values(ascending=False)
[:num_top_counties].index.tolist()

# top_counties = [sub.replace('County ', 'County') for sub in
top_counties] #removed space at last
# Calculate new cases and deaths per week for each county
confirmed_weekly_df = confirmed_state_df[["County Name"] +
list(confirmed_state_df.columns[-7:])].groupby("County
Name").apply(lambda x: x[x.columns[-1]] - x[x.columns[-7]])
deaths_weekly_df = deaths_state_df[["County Name"] +
list(deaths_state_df.columns[-7:])].groupby("County
Name").apply(lambda x: x[x.columns[-1]] - x[x.columns[-7]])
```

```
# Normalize by population
for county in top_counties:
    county1=county.strip()
    population = population_df[population_df["County Name"] ==
county1]["population"].values[0]
    confirmed_weekly_df.loc[county] = (confirmed_weekly_df.loc[county]
/ population * 100000).values
    deaths_weekly_df.loc[county] = (deaths_weekly_df.loc[county] /
population * 100000).values
# Plot the data using raw values and log normalized values
fig, axs = plt.subplots(2, num_top_counties, figsize=(20, 8))
for i, county in enumerate(top_counties):
    axs[0, i].plot(confirmed_weekly_df.loc[county], marker="o")
    axs[0, i].set_title(county + " - New Cases/Deaths (Raw)")
    axs[1, i].plot(np.log10(confirmed_weekly_df.loc[county]),
marker="o")
    axs[1, i].set_title(county + " - New Cases/Deaths (Log
Normalized)")
    axs[0, i].plot(deaths_weekly_df.loc[county], marker="*")
    axs[0, i].set_title(county + " - New Cases/Deaths (Raw)")
    axs[1, i].plot(np.log10(deaths_weekly_df.loc[county]), marker="o")
    axs[1, i].set_title(county + " - New Cases/Deaths (Log
Normalized)")
plt.show()
```



Describe what is causing them and what were the peaks. Do the counties follow state pattern.

All three counties experienced a peak in new cases and deaths around December and January. After the peak, the number of cases and deaths are gradually decreased but then incresed again in June.

From above example, It Seems to be counties follows state pattern.