STAGE2 TEAM

March 13, 2023

[1]:
```
import pandas as pd
import os
import numpy as np
import scipy.stats as stats
import matplotlib.pyplot as plt
import datetime as dt
from  scipy.signal import find_peaks
```

0.0.1 1. Compare the weekly statistics (mean, median, mode) for number of new cases and deaths across US.

[2]:
```
'''Reading data from files and initializing'''
#reading the data for the confirmed number of COVID cases and displaying them
confirmedCases = pd.read_csv(r"..\..\DATASETS\COVID␣
 ↪DATASETS\covid_confirmed_usafacts.csv")

# reading the confirmed number of COVID Deaths and displaying them
confirmedDeaths = pd.read_csv(r"..\..\DATASETS\COVID␣
 ↪DATASETS\covid_deaths_usafacts.csv")

#reading the data for the population of number of people and displaying them
populationOriginalUSA = pd.read_csv(r"..\..\DATASETS\COVID␣
 ↪DATASETS\covid_county_population_usafacts.csv")
```

[3]:
```
confirmedCasesNew = confirmedCases[~confirmedCases['County Name'].str.
 ↪contains('Statewide Unallocated')]
confirmedDeathsNew = confirmedDeaths[~confirmedDeaths['County Name'].str.
 ↪contains('Statewide Unallocated')]
populationOriginalUSANew = populationOriginalUSA[~populationOriginalUSA['County␣
 ↪Name'].str.contains('Statewide Unallocated')]
#confirmedCasesNew
```

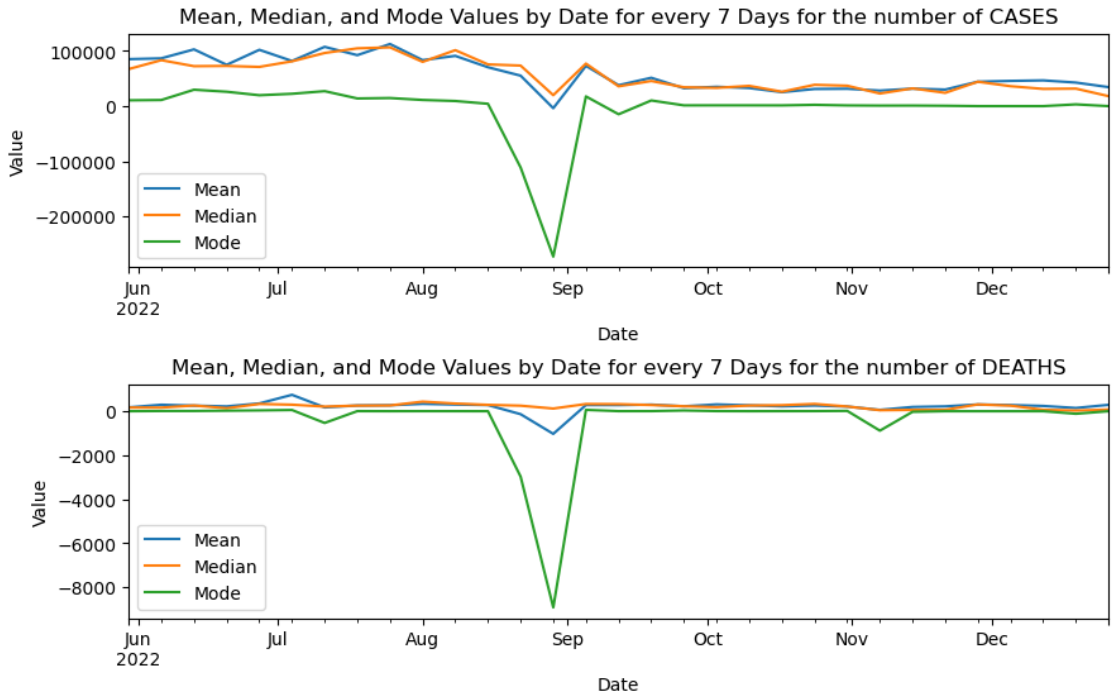
[4]:
```
'''FOR NUMBER OF CASES'''
x = confirmedCasesNew.iloc[:, 4:].fillna(0)
confirmedCasesNew_integral = x.diff(axis = 1)
#confirmedCasesNJ_integral
```

```
confirmedCasesNew1 = confirmedCasesNew.iloc[:, :3]

# Delete columns outside the date range of June 1st to December 31st
confirmedCasesNew2 =  confirmedCasesNew_integral.loc[:, '2022-05-30':
 ↪'2023-01-01']
confirmedCasesNew2
confirmedCasesNews = pd.concat([confirmedCasesNew1, confirmedCasesNew2], axis=1)
#confirmendCasesNJNew

ccnew =  confirmedCasesNew_integral.loc[:, '2022-05-30':'2023-01-01']
ccnewSum = ccnew.sum()
#ccnewSum
#ccnewSum.to_csv(r"C:\Users\ashdh\Documents\ccnewSum1.csv")


'''FOR NUMBER OF DEATHS'''

y = confirmedDeathsNew.iloc[:, 4:].fillna(0)
confirmedDeathsNew_integral = y.diff(axis = 1)
#confirmedDeathsNJ_integral.sum(axis =1 )

confirmedDeathsNew1 = confirmedDeathsNew.iloc[:, :3]

# Delete columns outside the date range of June 1st to December 31st
confirmedDeathsNew2 =  confirmedDeathsNew_integral.loc[:, '2022-05-30':
 ↪'2023-01-01']
confirmedDeathsNew2

confirmedDeathsNews = pd.concat([confirmedDeathsNew1, confirmedDeathsNew2],␣
 ↪axis=1)
#confirmedDeathsNJNew

cdnew =  confirmedDeathsNew_integral.loc[:, '2022-05-30':'2023-01-01']
cdnewSum = cdnew.sum()
```

[5]:
```
'''FOR NUMBER OF CASES'''
date_range = pd.date_range(start='2022-05-30', end='2023-01-01')
ccnewSum.index = date_range

ccnewSum.index = pd.to_datetime(ccnewSum.index)
#ccnj1.index = ccnj1.index.strftime('%Y-%m-%d')
ccnew_resampled = ccnewSum.resample('7D')

ccnew_resampled_mean = ccnew_resampled.mean()
ccnew_resampled_mean.columns = ['Mean']
ccnew_resampled_median = ccnew_resampled.median()
ccnew_resampled_median.columns = ['Median']
```

```
ccnew_resampled_mode = ccnew_resampled.apply(lambda mcnew: mcnew.mode().iloc[0])
#print(ccnew_resampled_mean)

'''FOR NUMBER OF DEATHS'''
date_range = pd.date_range(start='2022-05-30', end='2023-01-01')
cdnewSum.index = date_range

cdnewSum.index = pd.to_datetime(cdnewSum.index)
#ccnj1.index = ccnj1.index.strftime('%Y-%m-%d')
cdnew_resampled = cdnewSum.resample('7D')

cdnew_resampled_mean = cdnew_resampled.mean()
cdnew_resampled_mean.columns = ['Mean']
cdnew_resampled_median = cdnew_resampled.median()
cdnew_resampled_median.columns = ['Median']
cdnew_resampled_mode = cdnew_resampled.apply(lambda mdnew: mdnew.mode().iloc[0])


#PLOTTING THE DATA
# Create a new figure and axis object
fig, ax = plt.subplots(2,1, figsize=(10, 6))
# Plot the mean data as a line chart
ccnew_resampled_mean.plot(kind='line', ax=ax[0], label='Mean')
cdnew_resampled_mean.plot(kind='line', ax=ax[1], label='Mean')

# Plot the median data as a line chart
ccnew_resampled_median.plot(kind='line', ax=ax[0], label='Median')
cdnew_resampled_median.plot(kind='line', ax=ax[1], label='Median')

# Plot the ccnew_resampled_mode data as a line chart
ccnew_resampled_mode.plot(kind='line', ax=ax[0], label='Mode')
cdnew_resampled_mode.plot(kind='line', ax=ax[1], label='Mode')

# Set the axis labels and title
ax[0].set_xlabel('Date')
ax[0].set_ylabel('Value')
ax[0].set_title('Mean, Median, and Mode Values by Date for every 7 Days for the␣
 ↪number of CASES')

ax[1].set_xlabel('Date')
ax[1].set_ylabel('Value')
ax[1].set_title('Mean, Median, and Mode Values by Date for every 7 Days for the␣
 ↪number of DEATHS')

# Add a legend to the plot
ax[0].legend()
ax[1].legend()
```

```
#adding padding between the graphs
fig.subplots_adjust(hspace=0.5)

# Show the plot
plt.show()
```



0.0.2 2. Calculate mean (rounded to integer value) number of new cases/deaths per week and then calculate basic statistics (mean, median, mode) on that data.

[6]:
```
#GET THE MEAN OF EVERY 7 DAYS FROM THE ABOVE CODE IN THE VARIABLES THAT WERE␣
↪PRESENT

#ccnew_resampled_mean
#cdnew_resampled_mean
```

[7]:
```
#CALCULATING THE BASIC STATISTICS OF MEAN MEDIAN AND MODE ON THE ABOVE
'''NUMBER OF CASES'''
confirmedCasesMeanWhole = ccnew_resampled_mean.mean()
confirmedCasesMedianWhole = ccnew_resampled_median.median()
confirmedCasesModeWhole = ccnew_resampled_mode.mode()
int(confirmedCasesMeanWhole)
int(confirmedCasesMedianWhole)
int(confirmedCasesModeWhole)
```

```
print('\033[1m' +"The Mean, Median and the mode of the mean of number of cases␣
 ↪of weekly data is as follows: ")
print("Mean:   ", int(confirmedCasesMeanWhole))
print("Median: ", int(confirmedCasesMedianWhole))
print("Mode:   ", int(confirmedCasesModeWhole))
print("")

'''NUMBER OF DEATHS'''
confirmedDeathsMeanWhole = cdnew_resampled_mean.mean()
confirmedDeathsMedianWhole = cdnew_resampled_median.mean()
confirmedDeathsModeWhole = cdnew_resampled_mode.mean()

print('\033[1m' +"The Mean, Median and the mode of the mean of number of deaths␣
 ↪of weekly data is as follows: ")
print("Mean:   ", int(confirmedDeathsMeanWhole))
print("Median: ", int(confirmedDeathsMedianWhole))
print("Mode:   ", int(confirmedDeathsModeWhole))
```

```
The Mean, Median and the mode of the mean of number of cases of weekly data
is as follows:
Mean:   58002
Median: 44243
Mode:   0
The Mean, Median and the mode of the mean of number of deaths of weekly data
is as follows:
Mean:   212
Median: 221
Mode:   -425
```

0.0.3 Compare the data against other countries of the world.

Here for comparing the USA data with other countries with similar population, we are considering the following countries: Indonesia, Pakisthan and Nigeria .

The reason we chose these 3 countries is because according to the sensex conducted (https://www.worldometers.info/world-population/) we can see that the 3 countries with a similar population base are these 3 even though they are approx a hundered million people lesser than USA

[8]:
```
'''Reading data from files and initializing'''
#reading the data for the confirmed number of COVID cases and displaying them
CasesWorld = pd.read_csv(r"..\..\DATASETS\COVID DATASETS\owid-covid-data.csv")
#CasesWorld
```

[9]:
```
#FOR CLEANING AND KEEPING ONLY THE DATA THATS REQUIRED

CasesWorldNew  = CasesWorld.loc[(CasesWorld['iso_code'] == 'PAK')|␣
 ↪(CasesWorld['iso_code'] == 'IDN') |
                                 (CasesWorld['iso_code'] == 'NGA') |␣
 ↪(CasesWorld['iso_code'] == 'USA'),
                                ␣
 ↪['iso_code','continent','location','date','new_cases', 'new_deaths',␣
 ↪'population',] ]

'''creating a new .CSV for the cleaned data which only consists of the required␣
 ↪for better ease
a. countries = Indonesia, Pakistan, Nigeria
b. columns = new_cases, new_deaths,
'''
CasesWorldNew.to_csv(r"..\..\DATASETS\COVID DATASETS\owid-covid-data-clean.
 ↪csv", index = False)
#CasesWorldNew
```

[10]:
```
#creating variables for individual countries for better ease of understanding

CasesWorldIDN = CasesWorldNew.loc[CasesWorldNew['iso_code'] == 'IDN'] #INDONESIA
CasesWorldPAK = CasesWorldNew.loc[CasesWorldNew['iso_code'] == 'PAK'] #PAKISTHAN
CasesWorldNGA = CasesWorldNew.loc[CasesWorldNew['iso_code'] == 'NGA'] #NIGERIA
CasesWorldUSA = CasesWorldNew.loc[CasesWorldNew['iso_code'] == 'USA'] #NIGERIA
```

[11]:
```
#Creating a date range that is required for the data and making the data into␣
 ↪that date range
start_date = '2022-05-30'
end_date = '2023-01-01'
date_range = pd.date_range(start=start_date, end=end_date)

CasesWorldNewIDN = CasesWorldIDN[(CasesWorldIDN['date']>= start_date) &␣
 ↪(CasesWorldIDN['date']<= end_date)]
CasesWorldNewPAK = CasesWorldPAK[(CasesWorldPAK['date']>= start_date) &␣
 ↪(CasesWorldPAK['date']<= end_date)]
CasesWorldNewNGA = CasesWorldNGA[(CasesWorldNGA['date']>= start_date) &␣
 ↪(CasesWorldNGA['date']<= end_date)]
CasesWorldNewUSA = CasesWorldUSA[(CasesWorldUSA['date']>= start_date) &␣
 ↪(CasesWorldUSA['date']<= end_date)]
```

[12]:
```
CasesWorldNewIDN.loc[:, 'date'] = pd.to_datetime(CasesWorldNewIDN['date'])
CasesWorldNewPAK.loc[:, 'date'] = pd.to_datetime(CasesWorldNewPAK['date'])
CasesWorldNewNGA.loc[:, 'date'] = pd.to_datetime(CasesWorldNewNGA['date'])
#CasesWorldNewUSA.loc[:, 'date'] = pd.to_datetime(CasesWorldNewUSA['date'])
```

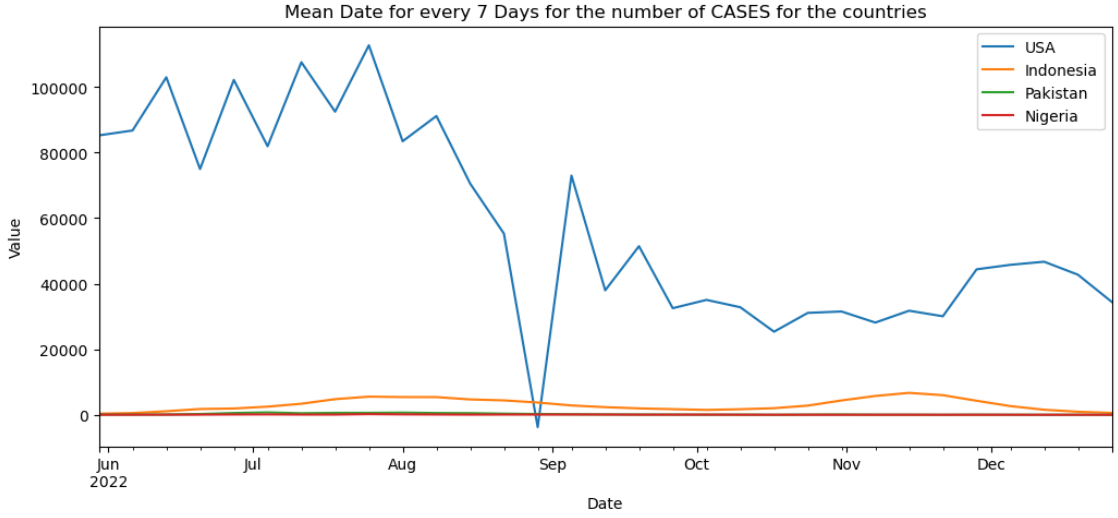
```
CasesWorldNewIDN = CasesWorldNewIDN.set_index('date')
CasesWorldNewPAK = CasesWorldNewPAK.set_index('date')
CasesWorldNewNGA = CasesWorldNewNGA.set_index('date')
#CasesWorldNewUSA = CasesWorldNewUSA.set_index('date')
```

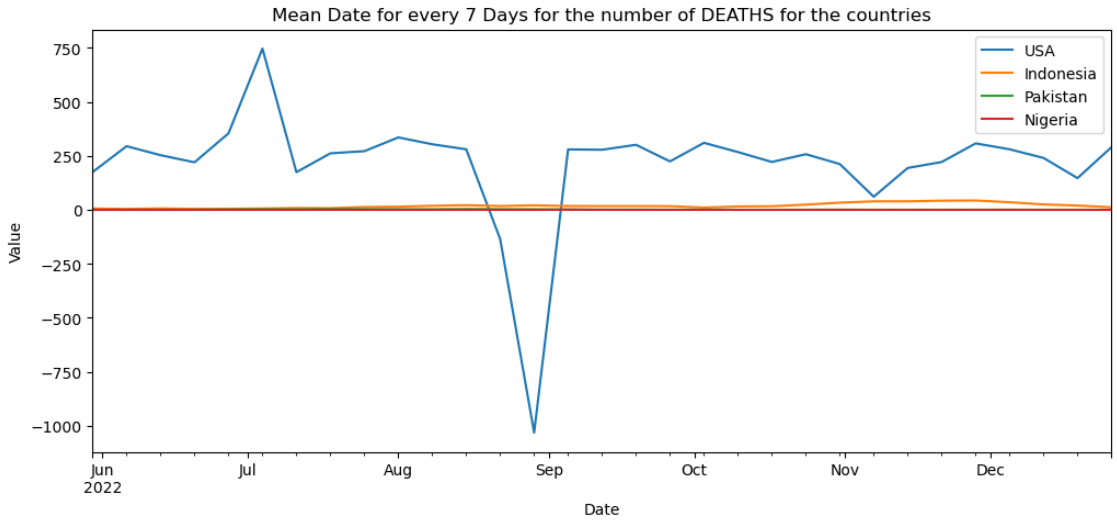
```
C:\Users\ashdh\AppData\Local\Temp\ipykernel_32204\1539505485.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  CasesWorldNewIDN.loc[:, 'date'] = pd.to_datetime(CasesWorldNewIDN['date'])
C:\Users\ashdh\AppData\Local\Temp\ipykernel_32204\1539505485.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  CasesWorldNewPAK.loc[:, 'date'] = pd.to_datetime(CasesWorldNewPAK['date'])
C:\Users\ashdh\AppData\Local\Temp\ipykernel_32204\1539505485.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  CasesWorldNewNGA.loc[:, 'date'] = pd.to_datetime(CasesWorldNewNGA['date'])
```

[13]:
```
#CREATING RESAMPLED DATA FOR 7DAYS
'''NUMBER OF CASES'''
CasesWorldNewResampledIDN = CasesWorldNewIDN['new_cases'].resample('7D')
CasesWorldNewResampledPAK = CasesWorldNewPAK['new_cases'].resample('7D')
CasesWorldNewResampledNGA = CasesWorldNewNGA['new_cases'].resample('7D')

'''NUMBER OF DEATHS'''
CasesWorldNewDeathsResampledIDN = CasesWorldNewIDN['new_deaths'].resample('7D')
CasesWorldNewDeathsResampledPAK = CasesWorldNewPAK['new_deaths'].resample('7D')
CasesWorldNewDeathsResampledNGA = CasesWorldNewNGA['new_deaths'].resample('7D')


'''NUMBER OF CASES'''
weeklyCasesMeanIDN = CasesWorldNewResampledIDN.mean()
weeklyCasesMeanPAK = CasesWorldNewResampledPAK.mean()
weeklyCasesMeanNGA = CasesWorldNewResampledNGA.mean()
#weeklyCasesMeanUSA = CasesWorldNewUSA['new_cases'].resample('7D').mean()
```

```
#print(weeklyMeanPAK)

#PLOTTING THE DATA
# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(12, 5))

# Plot the mean,median and mode for the number of cases ax[0] data as a line␣
 ↪chart

ccnew_resampled_mean.plot(kind='line', ax=ax, label='USA')
weeklyCasesMeanIDN.plot(kind='line', ax=ax, label='Indonesia')
weeklyCasesMeanPAK.plot(kind='line', ax=ax, label='Pakistan')
weeklyCasesMeanNGA.plot(kind='line', ax=ax, label='Nigeria')


# Set the axis labels and title
ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Mean Date for every 7 Days for the number of CASES for the␣
 ↪countries')

# Add a legend to the plot
ax.legend()
#ax[1].legend()

# Show the plot
plt.show()


'''NUMBER OF DEATHS'''
weeklyDeathsMeanIDN = CasesWorldNewDeathsResampledIDN.mean()
weeklyDeathsMeanPAK = CasesWorldNewDeathsResampledPAK.mean()
weeklyDeathsMeanNGA = CasesWorldNewDeathsResampledNGA.mean()
#weeklyDeathsMeanUSA = CasesWorldNewUSA['new_deaths'].resample('7D').mean()

#print(weeklyMeanPAK)

#PLOTTING THE DATA
# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(12, 5))

# Plot the mean,median and mode for the number of cases ax[0] data as a line␣
 ↪chart

cdnew_resampled_mean.plot(kind='line', ax=ax, label='USA')
weeklyDeathsMeanIDN.plot(kind='line', ax=ax, label='Indonesia')
```

```
weeklyDeathsMeanPAK.plot(kind='line', ax=ax, label='Pakistan')
weeklyDeathsMeanNGA.plot(kind='line', ax=ax, label='Nigeria')


# Set the axis labels and title
ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Mean Date for every 7 Days for the number of DEATHS for the␣
 ↪countries')

# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()
```



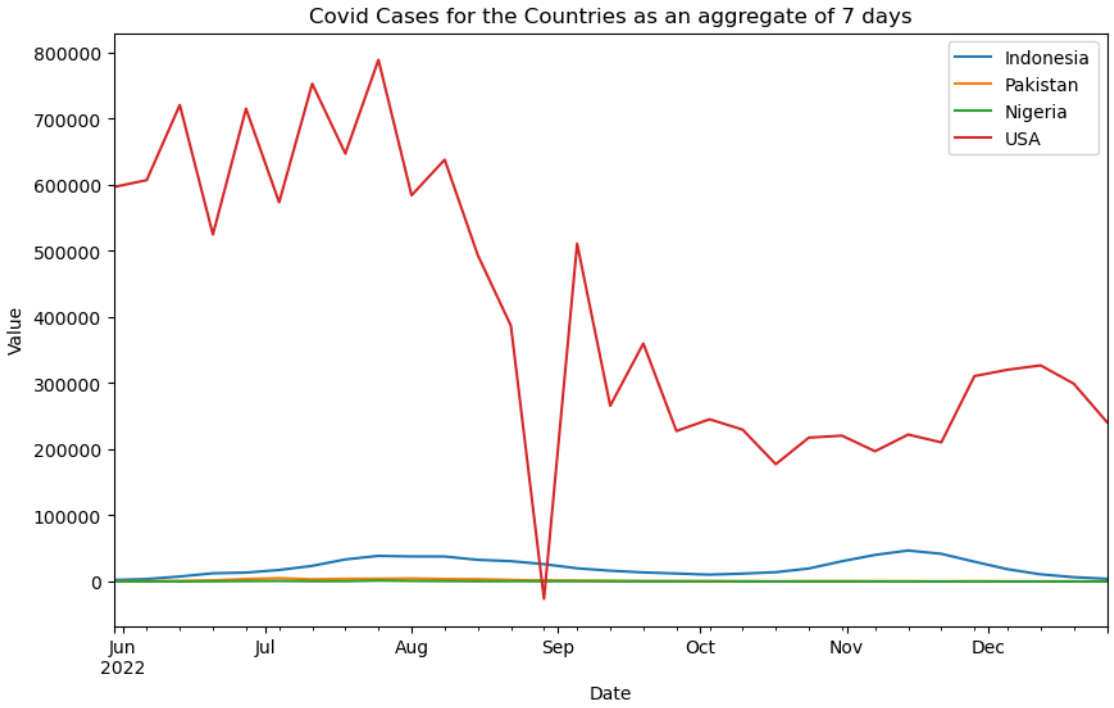


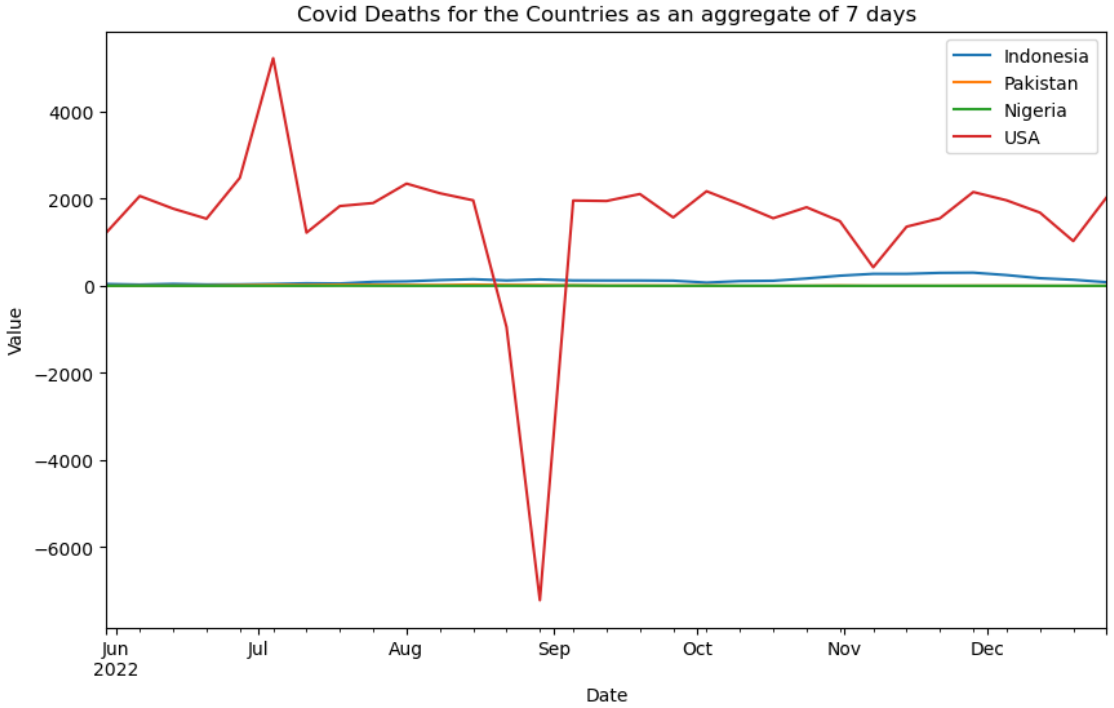
0.0.4 3. Plot weekly trends (cases and deaths) of US and compare to other countries. Utilize aggregrate, normalized by population (ex: number of cases per 100,000), difference in new cases, and log normalized values.

[14]:
```
#GETTING THE POPULATION OF ALL THE COUNTRIES THAT ARE CONSIDERED
populationIDN = CasesWorldNewIDN['population'][0]
populationPAK = CasesWorldNewPAK['population'][0]
populationNGA = CasesWorldNewNGA['population'][0]
populationUSA = populationOriginalUSANew['population'].sum()

#NORMALIZING FACTORS
'''NUMBER OF CASES'''
normalizeCasesIDN = (CasesWorldNewIDN['new_cases'] / populationIDN) * 100000
normalizeCasesPAK = (CasesWorldNewPAK['new_cases'] / populationPAK) * 100000
normalizeCasesNGA = (CasesWorldNewNGA['new_cases'] / populationNGA) * 100000
normalizeCasesUSA = (ccnewSum / populationUSA)*100000

'''NUMBER OF DEATHS'''
normalizeDeathsIDN = (CasesWorldNewIDN['new_deaths'] / populationIDN) * 100000
normalizeDeathsPAK = (CasesWorldNewPAK['new_deaths'] / populationPAK) * 100000
normalizeDeathsNGA = (CasesWorldNewNGA['new_deaths'] / populationNGA) * 100000
normalizeDeathsUSA = (cdnewSum / populationUSA)*100000
```

[15]:
```
#PLOTTING WEEKLY AGGREGATE DATA
'''NUMBER OF CASES'''
# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
```

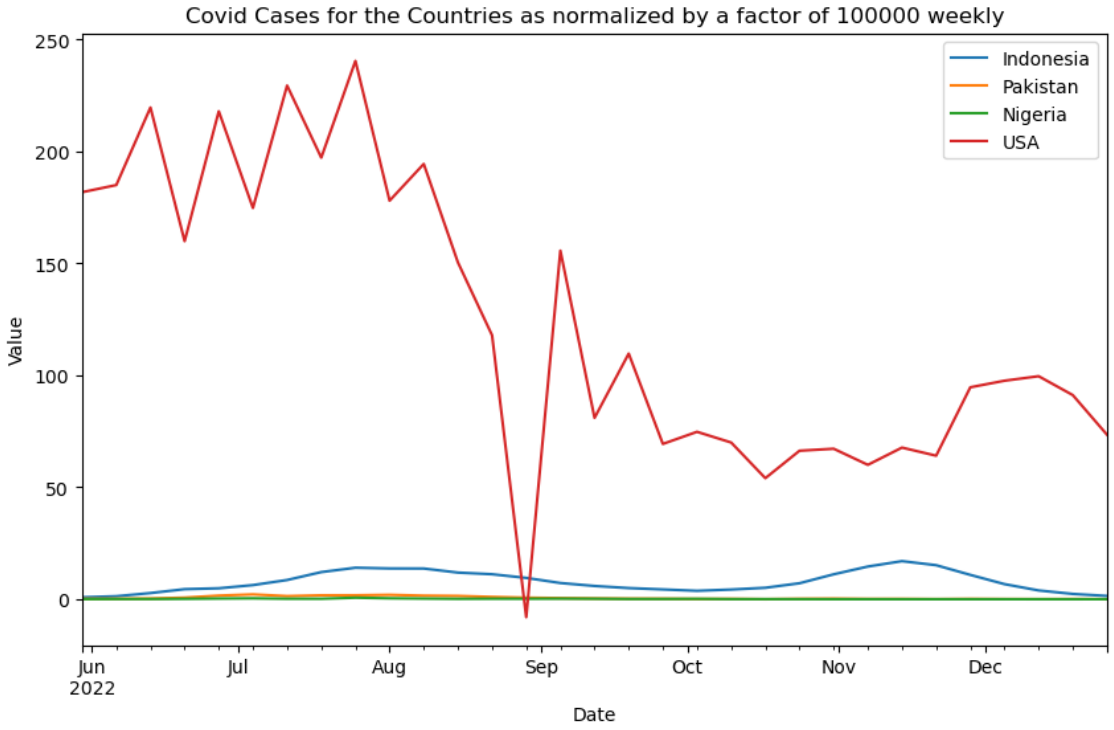
```
CasesWorldNewResampledIDN.sum().plot(kind='line', ax=ax ,label='Indonesia')
CasesWorldNewResampledPAK.sum().plot(kind='line', ax=ax ,label='Pakistan' )
CasesWorldNewResampledNGA.sum().plot(kind='line', ax=ax ,label='Nigeria')
ccnew_resampled.sum().plot(kind='line', ax=ax ,label='USA')


ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Cases for the Countries as an aggregate of 7 days')

# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()

'''NUMBER OF DEATHS'''

# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
CasesWorldNewDeathsResampledIDN.sum().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
CasesWorldNewDeathsResampledPAK.sum().plot(kind='line', ax=ax ,label='Pakistan'␣
 ↪)
CasesWorldNewDeathsResampledNGA.sum().plot(kind='line', ax=ax ,label='Nigeria')
cdnew_resampled.sum().plot(kind='line', ax=ax ,label='USA')


ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Deaths for the Countries as an aggregate of 7 days')

# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()
```

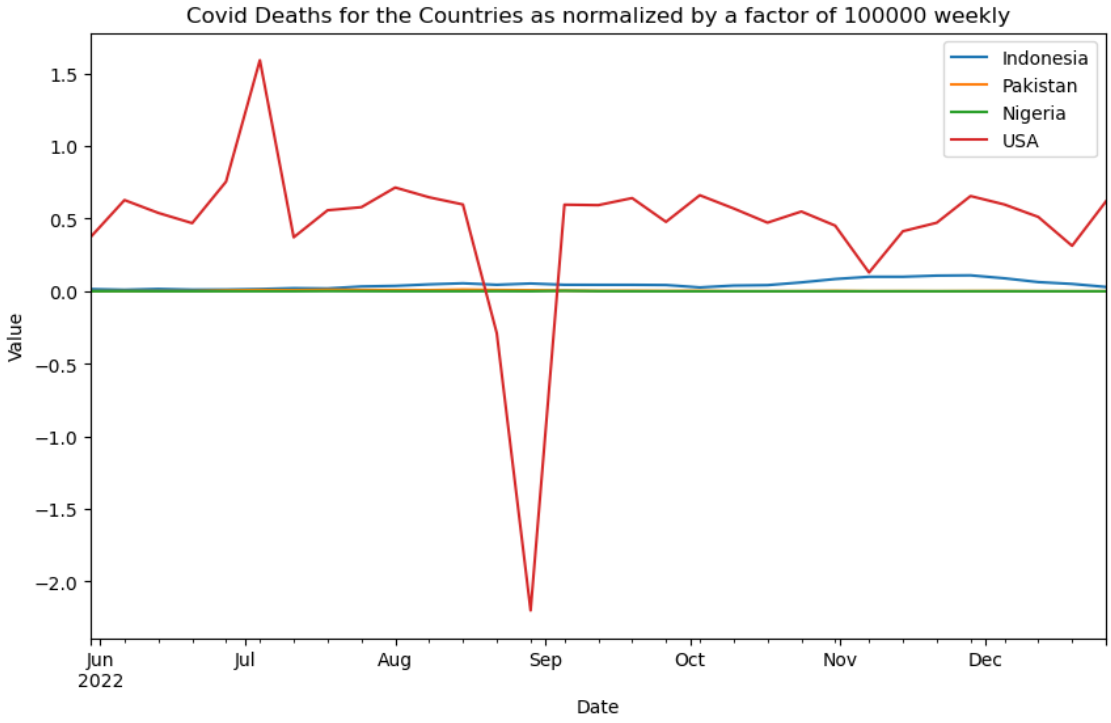

Covid Cases for the Countries as an aggregate of 7 days
Indonesia
Pakistan
Nigeria
USA
800000
700000
600000
500000
400000
300000
200000
100000
0
Value
Jun
2022
Jul
Aug
Sep
Oct
Nov
Dec
Date


Covid Deaths for the Countries as an aggregate of 7 days
Indonesia
Pakistan
Nigeria
USA
4000
2000
0
−2000
−4000
−6000
Value
Jun
2022
Jul
Aug
Sep
Oct
Nov
Dec
Date

[16]:
```
#PLOTTING WEEKLY FOR NORMALIZED VALUES

'''NUMBER OF CASES'''
# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
normalizeCasesIDN.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
normalizeCasesPAK.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Pakistan' )
normalizeCasesNGA.resample('7D').sum().plot(kind='line', ax=ax ,label='Nigeria')
normalizeCasesUSA.resample('7D').sum().plot(kind='line', ax=ax ,label='USA')


ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Cases for the Countries as normalized by a factor of 100000␣
 ↪weekly')


#ax.set_ylim(0, 1000)
# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()

'''NUMBER OF DEATHS'''

# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
normalizeDeathsIDN.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
normalizeDeathsPAK.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Pakistan' )
normalizeDeathsNGA.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Nigeria')
normalizeDeathsUSA.resample('7D').sum().plot(kind='line', ax=ax ,label='USA')


ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Deaths for the Countries as normalized by a factor of␣
 ↪100000 weekly')
```

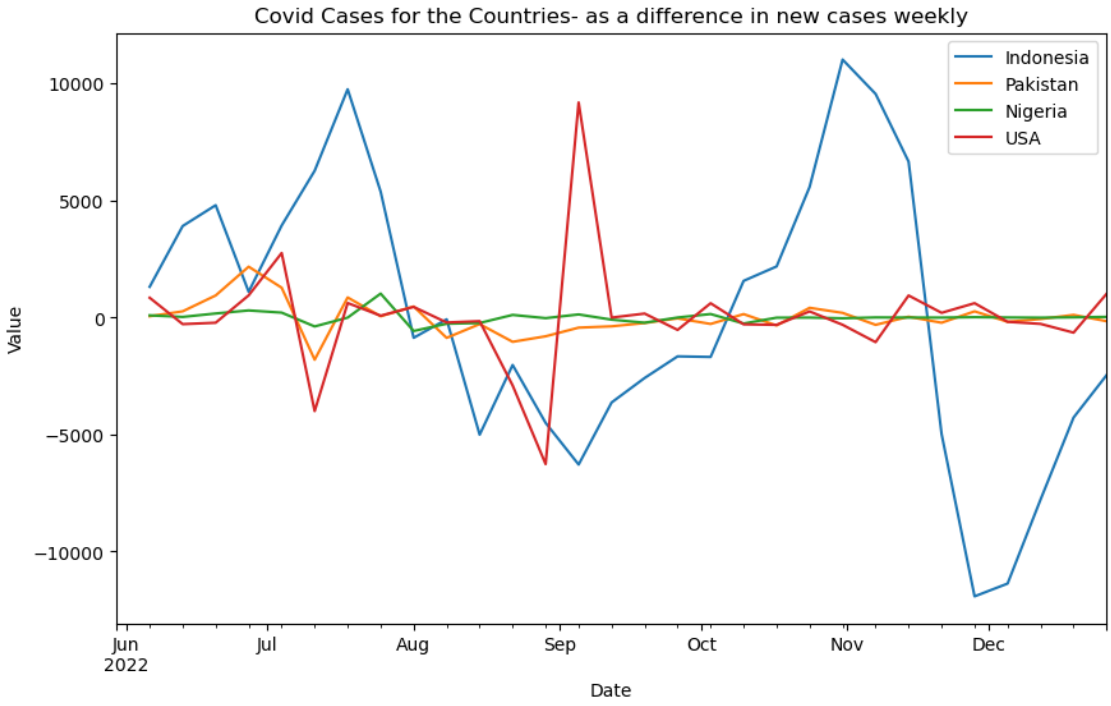
```
# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()
```





[17]:
```
#PLOTTING DIFFERENCE IN NEW CASES WEEKLY

# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
CasesWorldNewResampledIDN.sum().diff().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
CasesWorldNewResampledPAK.sum().diff().plot(kind='line', ax=ax␣
 ↪,label='Pakistan' )
CasesWorldNewResampledNGA.sum().diff().plot(kind='line', ax=ax ,label='Nigeria')
cdnew_resampled.sum().diff().plot(kind='line', ax=ax ,label='USA')


ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Cases for the Countries- as a difference in new cases␣
 ↪weekly')


#ax.set_ylim(0, 1000)
# Add a legend to the plot
ax.legend()
```

```
# Show the plot
plt.show()
#CasesWorldNewResampledNGA.sum().diff()
```



Description for Log Normalized Values:

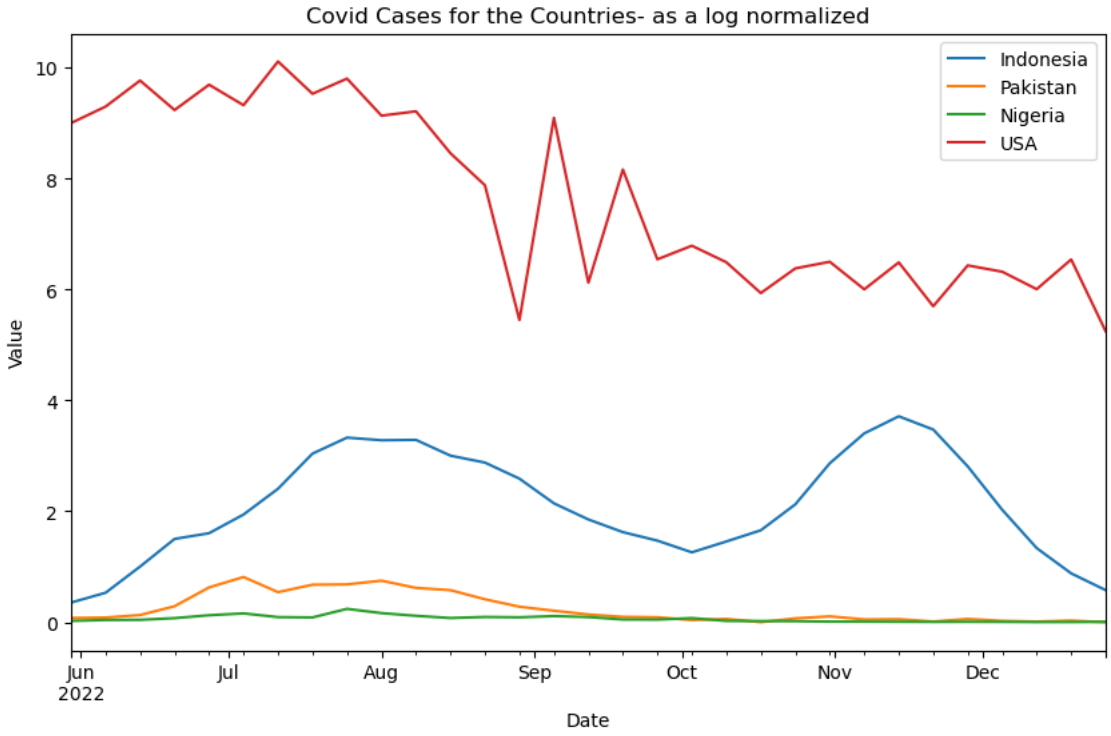
- Here we are adding the 1 before taking the log as to avoid logging a zero/ negative value. Its a very common practice done by mathematicians
- The purpose of taking log values is to reduce the scale of the data and make it easier to compare between countries. The actual values of the data are less important in this context, as the focus is on the trends and patterns in the data. Hence, there may be log values plotted that are not in between the range of 0 and 1.

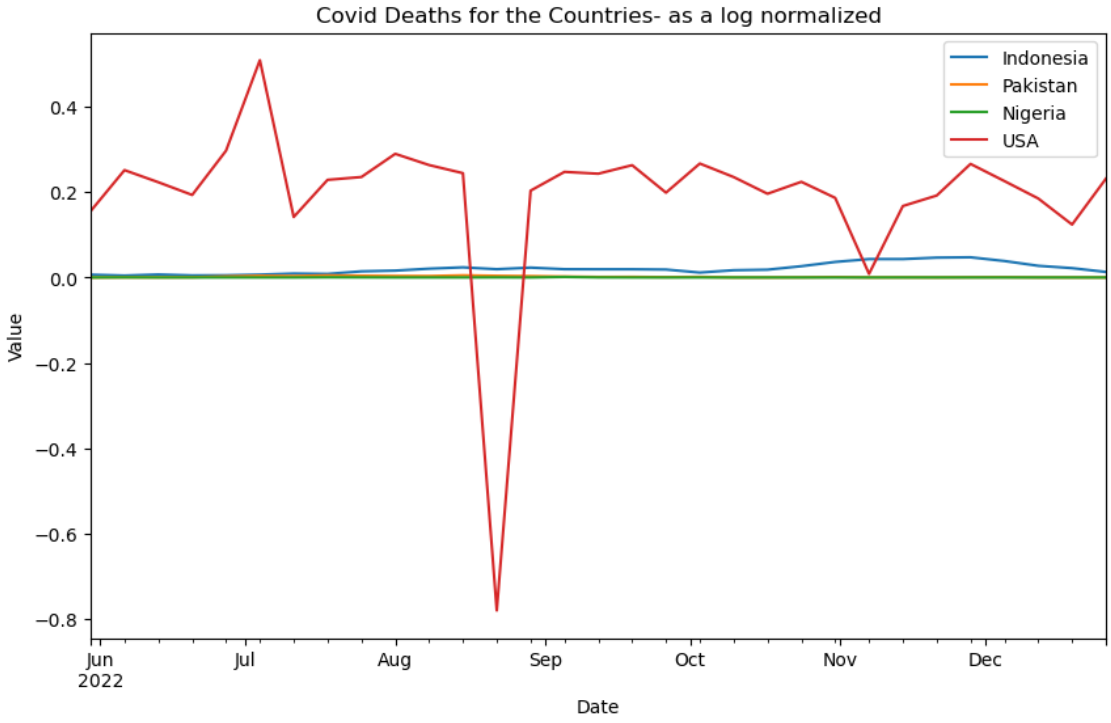
[18]:
```
#PLOTTING THE LOG NORMALIZED VALUES

'''NUMBER OF CASES'''
logNormalizeCasesIDN = np.log10(normalizeCasesIDN+1)
logNormalizeCasesPAK = np.log10(normalizeCasesPAK+1)
logNormalizeCasesNGA = np.log10(normalizeCasesNGA+1)
logNormalizeCasesUSA = np.log10(normalizeCasesUSA+1)


'''NUMBER OF DEATHS'''
```

```
logNormalizeDeathsIDN = np.log10(normalizeDeathsIDN+1)
logNormalizeDeathsPAK = np.log10(normalizeDeathsPAK+1)
logNormalizeDeathsNGA = np.log10(normalizeDeathsNGA+1)
logNormalizeDeathsUSA = np.log10(normalizeDeathsUSA+1)

# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
logNormalizeCasesIDN.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
logNormalizeCasesPAK.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Pakistan' )
logNormalizeCasesNGA.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Nigeria')
logNormalizeCasesUSA.resample('7D').sum().plot(kind='line', ax=ax ,label='USA')

ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Cases for the Countries- as a log normalized')


#ax.set_ylim(0, 1000)
# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()

# Create a new figure and axis object
fig, ax = plt.subplots(figsize=(10, 6))

# Plot the mean data as a line chart
logNormalizeDeathsIDN.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Indonesia')
logNormalizeDeathsPAK.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Pakistan' )
logNormalizeDeathsNGA.resample('7D').sum().plot(kind='line', ax=ax␣
 ↪,label='Nigeria')
logNormalizeDeathsUSA.resample('7D').sum().plot(kind='line', ax=ax ,label='USA')

ax.set_xlabel('Date')
ax.set_ylabel('Value')
ax.set_title('Covid Deaths for the Countries- as a log normalized')
```

```
#ax.set_ylim(0, 1000)
# Add a legend to the plot
ax.legend()

# Show the plot
plt.show()
```

```
C:\Users\ashdh\anaconda3\lib\site-packages\pandas\core\arraylike.py:397:
RuntimeWarning: invalid value encountered in log10
  result = getattr(ufunc, method)(*inputs, **kwargs)
```





0.0.5 Identify the peak weeks of the cases and deaths in US and other countries.

[19]:
```
CasesWorldNewResampledIDN.sum().sort_values(ascending = False).head(1).index[0].
 ↪strftime("%Y-%m-%d")
int(CasesWorldNewResampledIDN.sum().sort_values(ascending = False).head(1)[0])

#FOR FINDING THE PEAK WEEKS FOR THE NUMBER OF CASES AND DEATHS

'''NUMBER OF CASES'''
print('\033[1m' +"The peaks weeks for the cases in the US and the other␣
 ↪countries are:")
dict = {'Country' : ['USA', 'Indonesia', 'Pakistan', 'Nigeria'],
        'Date' : [ccnew_resampled.sum().sort_values(ascending = False).head(1).
 ↪index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewResampledIDN.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewResampledPAK.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewResampledNGA.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d")],
        'cases' : [ccnew_resampled.sum().sort_values(ascending = False).
 ↪head(1)[0],
```

```
                    int(CasesWorldNewResampledIDN.sum().sort_values(ascending =␣
 ↪False).head(1)[0]),
                    int(CasesWorldNewResampledPAK.sum().sort_values(ascending =␣
 ↪False).head(1)[0]),
                    int(CasesWorldNewResampledNGA.sum().sort_values(ascending =␣
 ↪False).head(1)[0])]}


peakWeekCases = pd.DataFrame(dict)
display(peakWeekCases)

print("")

'''NUMBER OF DEATHS'''

print('\033[1m' +"The peaks weeks for the deaths in the US and the other␣
 ↪countries are:")
dict = {'Country' : ['USA', 'Indonesia', 'Pakistan', 'Nigeria'],
        'Date' : [cdnew_resampled.sum().sort_values(ascending = False).head(1).
 ↪index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewDeathsResampledIDN.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewDeathsResampledPAK.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d"),
                  CasesWorldNewDeathsResampledNGA.sum().sort_values(ascending =␣
 ↪False).head(1).index[0].strftime("%Y-%m-%d")],
        'cases' : [cdnew_resampled.sum().sort_values(ascending = False).
 ↪head(1)[0],
                   int(CasesWorldNewDeathsResampledIDN.sum().
 ↪sort_values(ascending = False).head(1)[0]),
                   int(CasesWorldNewDeathsResampledPAK.sum().
 ↪sort_values(ascending = False).head(1)[0]),
                   int(CasesWorldNewDeathsResampledNGA.sum().
 ↪sort_values(ascending = False).head(1)[0])]}


peakWeekCases = pd.DataFrame(dict)
display(peakWeekCases)
```

The peaks weeks for the cases in the US and the other countries are:

	Country	Date	cases
0	USA	2022-07-25	789033
1	Indonesia	2022-11-14	46863
2	Pakistan	2022-07-04	5080
3	Nigeria	2022-07-25	1492

The peaks weeks for the deaths in the US and the other countries are:

	Country	Date	cases
0	USA	2022-07-04	5225
1	Indonesia	2022-11-28	302
2	Pakistan	2022-08-15	27
3	Nigeria	2022-09-05	6

Note: Here we are considering the highest peak for the number of cases and deaths in the respective contries and showing the them from the date of starting of that week

According to the research that we did, we go the following findings as to why there were sudden rise in COVID-19 cases/deaths: **1. USA** There were many cases reported in the months of June, July and August. During these months there were a lot of reasons for people to gather together which could explain the reason for the increase: a. *Roe vs Wade rally*: in the months of May and June, there were many rallys and protests conducted which made huge number of people to gather together, which could hav caused a increase in COVID b. *4th of July celebration(Independence Day)*: it's one of the most celebrated holidays of USA, where many people(friends and family gather together to celebrate) c. *Oak Fire incident*: In the month of July and August, there were loads of forest fires that occured in the west coast, due to which lots of people had to relocate and migrate to other areas, if even a few people had any symptoms of COVID, when they migrated to another place they could have transmitted them to others.

2. Indonesia There were cases reported in the months of August and November. The reasons for the increase in COVID cases is: a. *Outbreak of Monkey Pox*: There was sudden outbreak of Monkey pox in the country which cause panic in the masses. Becassue of this people started migrating from the infected areas to other places. During this migration, COVID cases increased. b. *Earthquake*: In the month of November there was and earthquake which struck the island of Cianjur Regency, in West Java, which caused many people to lose their homes and people had to relocate to different places which may have caused an increase in COVID cases

3. Pakistan There were cases reported in the months of July and August. The reason for this increase is because during these months there were few festivals, namely **Mohurrum** and **Eid - ul - Azah** which are considered national holidays. During these festivals the whole family gathers together to celebrate which may been a reason for increase in COVID cases.

4. Nigeria There was rise in the number of cases from the month following July, the reason is because the government up until then had strict regulations regarding COVID and gathering of people but in July they had relaxed the regulations on COVID, and because of this there was a rise in COVID.