group_stage2

September 27, 2024

0.1 Imports

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.image as mping
import os
%matplotlib inline
```

1 Stage 2

1.1 Task 1

Compare the weekly statistics (Mean, Median, Mode) for cases and deaths across the US.

[2]:
```
super_covid = pd.read_csv('./data/super_covid_data.csv')
covid_cases = pd.read_csv('./data/covid_confirmed_usafacts.csv')
covid_deaths = pd.read_csv('./data/covid_deaths_usafacts.csv')

# It will be easier to handle these separately so I'm importing the deaths and␣
 ↪cases CSVs again.

# Create a dataframe I actually want to manipulate
cd_date = covid_deaths.drop(covid_deaths.columns[[0, 1, 2, 3]], axis=1,␣
 ↪inplace=False)

#Transpose
cd_date = cd_date.transpose()

# Rename the columns after the countyFIPS so that I can merge later.
cd_date.columns = covid_deaths['countyFIPS']

# Change the index to a date and time so that I can resample it.
cd_date.index = pd.to_datetime(cd_date.index)

#Repeat this process for Cases
cc_date = covid_cases.drop(covid_cases.columns[[0, 1, 2, 3]], axis=1,␣
 ↪inplace=False)
```

```
cc_date = cc_date.transpose()
cc_date.columns = covid_cases['countyFIPS']
cc_date.index = pd.to_datetime(cc_date.index)

start_date = pd.to_datetime('2020-06-01')  #Selecting the start and ending dates
end_date = pd.to_datetime('2021-01-03')

cd_date = cd_date.T
cd_date = cd_date[[col for col in cd_date.columns if start_date <= col <=␣
 ↪end_date]]

cc_date = cc_date.T
cc_date = cc_date[[col for col in cc_date.columns if start_date <= col <=␣
 ↪end_date]]

cd_last_date = cd_date.iloc[:, -1:]
cd_date = cd_date.loc[:, ::7]
cd_date = pd.concat([cd_date, cd_last_date], axis=1)  #Selecting columns from␣
 ↪dataframe to use, ensuring that it will be weekly data with 2021-01-03␣
 ↪included
cd_date
```

[2]:

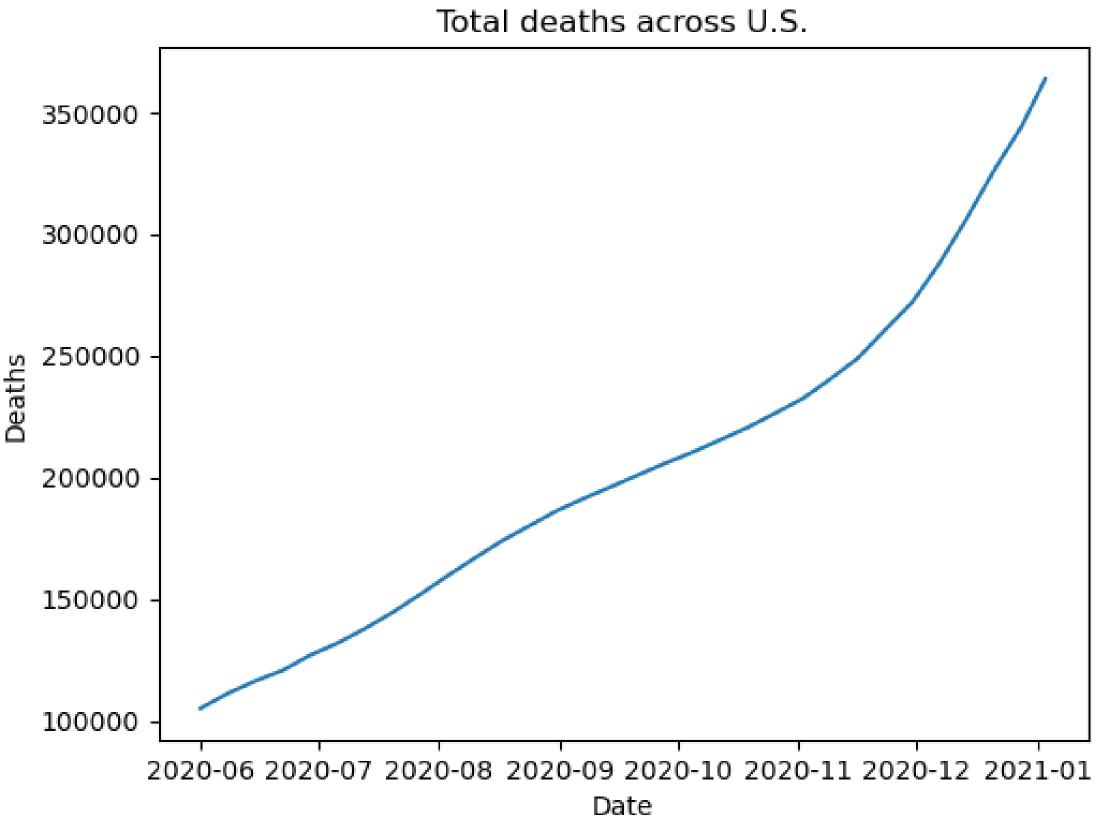
```
            2020-06-01  2020-06-08  2020-06-15  2020-06-22  2020-06-29  \
countyFIPS
0                    0           0           0           0           0
1001                 5           5           6           9          12
1003                 9           9           9           9          10
1005                 1           1           1           1           1
1007                 1           1           1           1           1
…                …         …         …         …         …
56037                0           0           0           0           0
56039                1           1           1           1           1
56041                0           0           0           0           0
56043                3           3           3           5           5
56045                0           0           0           0           0

            2020-07-06  2020-07-13  2020-07-20  2020-07-27  2020-08-03  …  \
countyFIPS                                                              …
0                    0           0           0           0           0  …
1001                13          16          21          21          21  …
1003                10          12          15          18          24  …
1005                 2           2           4           4           5  …
1007                 1           1           2           2           3  …
…                …         …         …         …         …  …
56037                0           0           2           2           2  …
56039                1           1           1           1           1  …
56041                0           0           0           0           0  …
```

```
56043                5           5           5           5           5  …
56045                0           0           0           0           0  …

            2020-11-02  2020-11-09  2020-11-16  2020-11-23  2020-11-30  \
countyFIPS
0                    0           0           0           0           0
1001                30          30          36          39          41
1003                71          83          84          84          98
1005                 9           9           9          10          11
1007                15          16          17          17          17
…                …         …         …         …         …
56037                2           4           4           6           6
56039                1           2           2           2           2
56041                3           3           4           4           4
56043                7           7           7           7           8
56045                0           0           0           1           1

            2020-12-07  2020-12-14  2020-12-21  2020-12-28  2021-01-03
countyFIPS
0                    0           0           0           0           0
1001                41          41          44          47          50
1003               138         141         147         152         169
1005                29          30          32          32          33
1007                39          39          42          42          46
…                …         …         …         …         …
56037               11          14          15          15          16
56039                2           2           2           3           4
56041                6           7           7           7           7
56043               10          11          11          16          19
56045                2           2           2           2           2

[3193 rows x 32 columns]
```

1.2 Total deaths across the U.S. Graph generation

[3]:

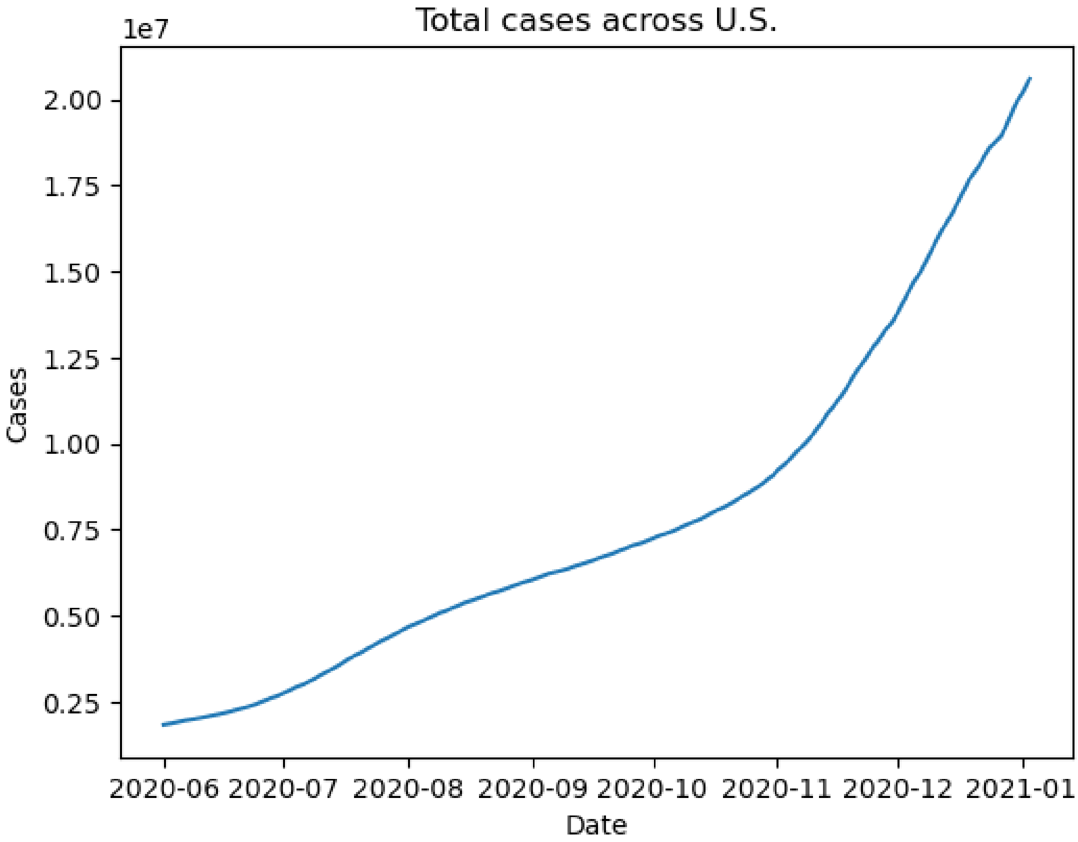
```
cd_date_total = cd_date.T.sum(axis=1)
plt.plot(cd_date_total)
plt.title('Total deaths across U.S.')  #Graph formatting
plt.xlabel('Date')
plt.ylabel('Deaths')
plt.show()
```



1.3 Total cases across the U.S. Graph generation

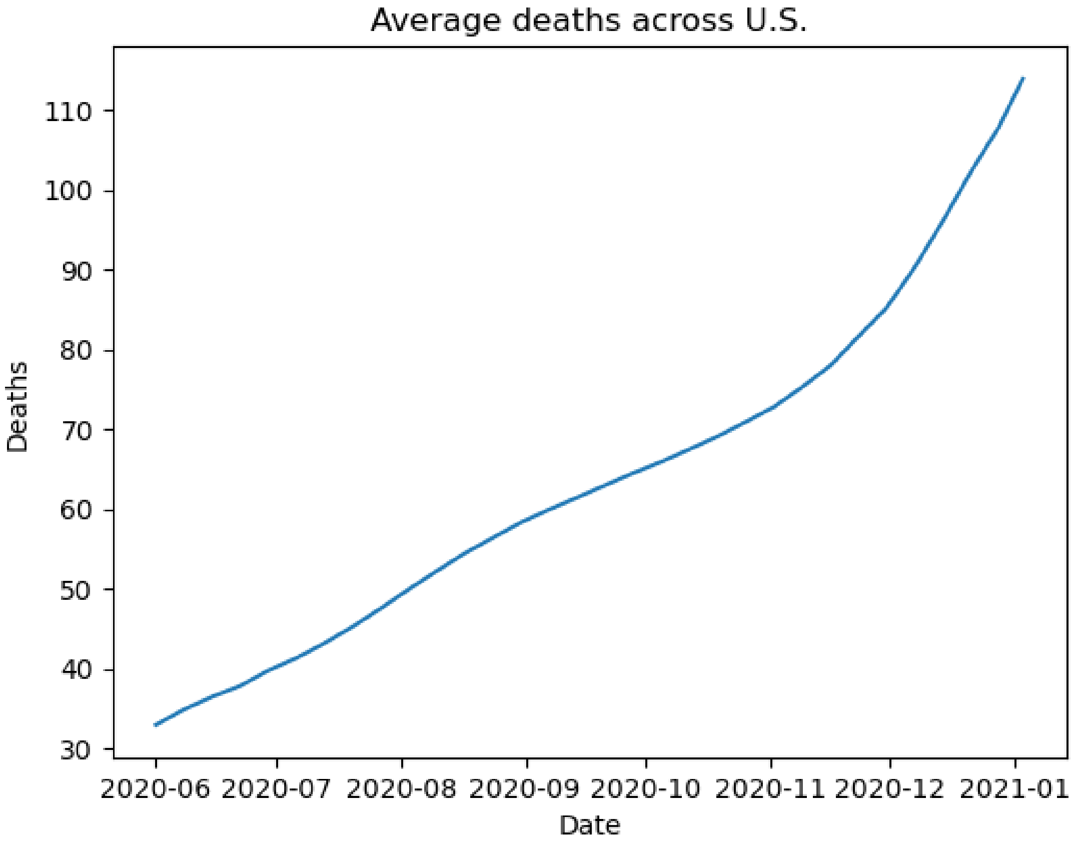
[4]:

```
cc_date_total = cc_date.T.sum(axis=1)
plt.plot(cc_date_total)
plt.title('Total cases across U.S.')  #Graph detailing
plt.xlabel('Date')
plt.ylabel('Cases')
plt.show()
```



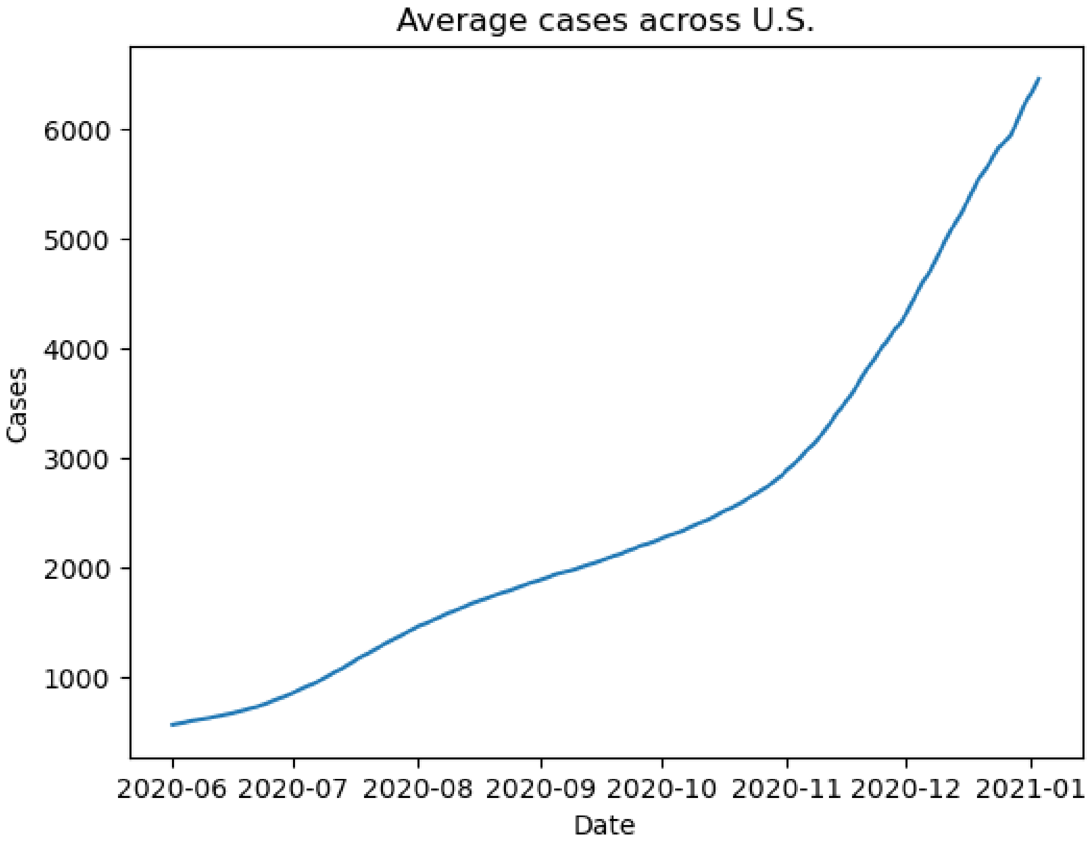
1.4 Average deaths across the U.S. Graph generation

[5]:
```
cd_date_mean = cd_date.T.mean(axis=1)
plt.plot(cd_date_mean)
plt.title('Average deaths across U.S.') #Graph detailing
plt.xlabel('Date')
plt.ylabel('Deaths')
plt.show()
```



1.5 Average cases across the U.S Graph generation

[6]:
```
cc_date_mean = cc_date.T.mean(axis=1)
plt.plot(cc_date_mean)
plt.title('Average cases across U.S.') #Graph detailing
plt.xlabel('Date')
plt.ylabel('Cases')
plt.show()
```



2 Widening the scope to examine case and death totals in other countries.

Importing base data from csv.

```
[7]: world_covid_deaths = pd.read_csv('./data/world_covid_deaths.csv')
     world_covid_deaths
```

```
[7]:              Entity Code         Day  Weekly deaths
     0       Afghanistan  AFG  2020-01-10              0
     1       Afghanistan  AFG  2020-01-11              0
     2       Afghanistan  AFG  2020-01-12              0
     3       Afghanistan  AFG  2020-01-13              0
     4       Afghanistan  AFG  2020-01-14              0
     …                 …   …           …             …
     424693     Zimbabwe  ZWE  2024-09-04              0
     424694     Zimbabwe  ZWE  2024-09-05              0
     424695     Zimbabwe  ZWE  2024-09-06              0
     424696     Zimbabwe  ZWE  2024-09-07              0
```

```
424697     Zimbabwe   ZWE  2024-09-08            0

[424698 rows x 4 columns]
```

2.1 Comparingn U.S. data with other countires.

2.1.1 While looking for other countries of a similar caliber to the U.S, we selected Germany, Mexico, Canada, Australia, and India.

These countries are massive and did pretty good reporting on their covid cases + deaths, but have enough of a difference between them to make for interesting data comparison.

[8]:
```
countries = ['Germany', 'Mexico', 'Canada', 'Australia', 'India']  #Selecting␣
 ↪countries to be used from dataset

country_dfs = []
for country in countries:
    country_df = world_covid_deaths[world_covid_deaths['Entity'] == country].
 ↪reset_index(drop=True)
    country_df.drop(labels=['Code', 'Entity'], axis=1, inplace=True)
    country_df.set_index('Day', inplace=True)
    country_df.rename(columns={'Weekly deaths': country}, inplace=True)
    country_df = country_df.T
    country_dfs.append(country_df)
```

2.1.2 Reducing the data time frame to 2020-06-01 - 2021-01-03, as outlined.

[9]:
```
all_countries = pd.concat(country_dfs, axis=0)
start_date = pd.to_datetime('2020-06-01')  #Start and ending dates
end_date = pd.to_datetime('2021-01-03')
all_countries.columns = pd.to_datetime(all_countries.columns)
all_countries_date_range = all_countries[[col for col in all_countries.columns␣
 ↪if col <= end_date]]
```

2.1.3 Reducing the data to it's final form, all 5 countries' data within the outlined range.

[10]:
```
last_date = all_countries_date_range.iloc[:, -1:]
weekly = all_countries_date_range.iloc[:, 3::7]  #Weekly reporting numbers,␣
 ↪with the final date included

final = pd.concat([weekly, last_date], axis=1)  #Combinging the weekly and late␣
 ↪late dataframes.
cumulative_deaths = final.cumsum(axis='columns')
cumulative_deaths = cumulative_deaths[[col for col in cumulative_deaths.columns␣
 ↪if start_date <= col]]
cumulative_deaths
```

```
[10]: Day         2020-06-01  2020-06-08  2020-06-15  2020-06-22  2020-06-29  \
      Germany           9133        9177        9212        9253        9274
      Mexico           19598       24110       29001       33987       38556
      Canada            6959        7683        8021        8318        8475
      Australia          107         107         107         107         108
      India             5164        6929        9195       13254       16095

      Day         2020-07-06  2020-07-13  2020-07-20  2020-07-27  2020-08-03  …  \
      Germany           9300        9325        9356        9389        9426  …
      Mexico           43527       48901       54435       59899       65157  …
      Canada            8627        8723        8802        8844        8897  …
      Australia          109         113         129         174         269  …
      India            19268       22674       26816       32063       37364  …

      Day         2020-11-02  2020-11-09  2020-11-16  2020-11-23  2020-11-30  \
      Germany          13303       15213       17749       20975       24576
      Mexico          109267      112749      116310      120019      124079
      Canada           10060       10380       10771       11271       11822
      Australia          914         914         917         917         918
      India           122111      126121      129635      133227      136696

      Day         2020-12-07  2020-12-14  2020-12-21  2020-12-28  2021-01-03
      Germany          29056       34818       41278       47006       52750
      Mexico          128314      132958      138115      143890      150442
      Canada           12418       13166       13947       14734       15632
      Australia          919         919         919         920         922
      India           140182      143019      145477      147622      149435

      [5 rows x 32 columns]
```

2.1.4 Calculating the cumulative total from the U.S.

```
[11]: america = cd_date_total
      america.rename('America', inplace=True)
```

```
[11]: 2020-06-01    105073
      2020-06-08    111212
      2020-06-15    116310
      2020-06-22    120632
      2020-06-29    126840
      2020-07-06    131791
      2020-07-13    137763
      2020-07-20    144338
      2020-07-27    151670
      2020-08-03    159346
      2020-08-10    166687
      2020-08-17    173809
```

```
2020-08-24    179988
2020-08-31    186151
2020-09-07    191287
2020-09-14    196097
2020-09-21    201050
2020-09-28    205926
2020-10-05    210434
2020-10-12    215462
2020-10-19    220561
2020-10-26    226403
2020-11-02    232382
2020-11-09    240311
2020-11-16    248807
2020-11-23    260531
2020-11-30    271983
2020-12-07    288120
2020-12-14    306639
2020-12-21    326365
2020-12-28    344373
2021-01-03    363775
Name: America, dtype: int64
```

2.1.5 Comparing U.S. total with other countries'

First, combining the total from the U.S. with the total from other countries. Then normalizing the data before displaying it as a graph.

[12]:

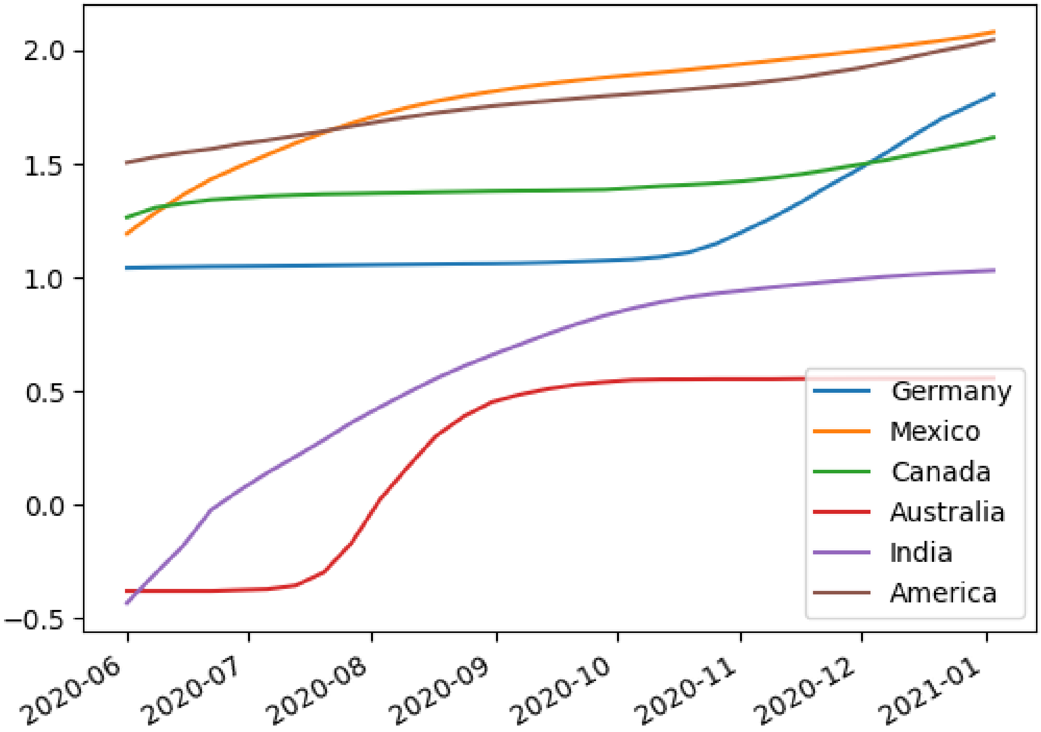
```
world_countries_deaths_compare = pd.concat([cumulative_deaths, america.
  ↪to_frame().T])
```

[13]:

```
country_pops = {
    'Germany': 83.16e6,
    'Mexico': 126e6,
    'Canada': 38.01e6,
    'Australia': 25.65e6,    #Adding in each countries' populations
    'India': 1.396e9,
    'America': 329.5e6
}

norm = 100_000  #Normalization value
normalized_data = pd.DataFrame()
for country, pop in country_pops.items():
    normalized_data[country] = np.log10(world_countries_deaths_compare.
  ↪T[country].div(pop) * norm)  #Normalizing the data for the graph
normalized_data.plot()
```

[13]:

```
<Axes: >
```



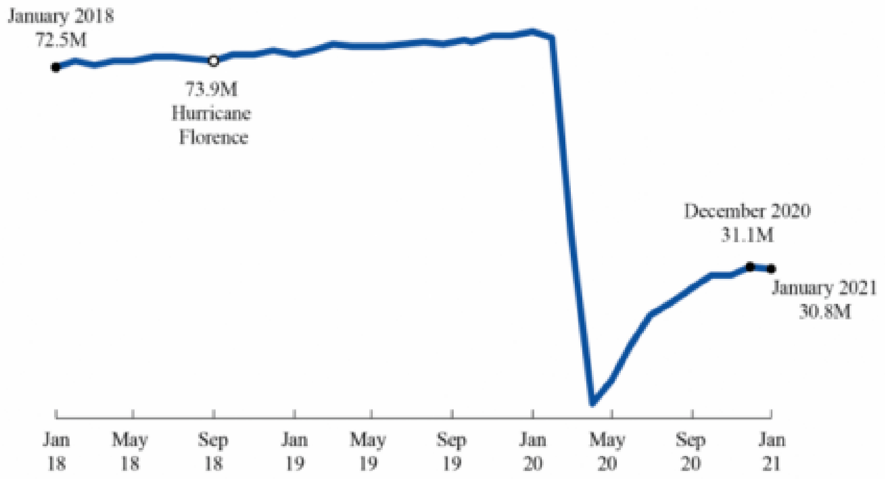
2.2 As we can see, all countries had an increase in cases over the 7 month window.

2.2.1 Some noticable peak weeks were during 2020-08 to 2020-09 and almost every country (save Australia) saw a pretty sizable increase between 2020-11 and 2021-01, which surely continued to climb.

This increase between 2020-11 to 2021-01 can easily be attributed to cold weather and holiday travel, especially since it seems to have impacted countries in the Northern Hemisphere the most. This graph taken from the Bureau of Transportation Statistics show the increasing amount of passengers on flights through and within the US from 2018 to 2021. While the volume of people flying had not yet returned to pre-pandemic levels, there is an increase in travel across all of 2020, which would lead to higher rates of exposure.

[14]:
```
img = mping.imread('./data/Air Traffic Figure 1 Jan2021.png')
plt.imshow(img)
plt.axis('off')
plt.show()
```

Figure 1. Monthly Passengers on U.S. Scheduled Airlines (Domestic + International), Seasonally Adjusted
January 2018–January 2021



3 What caused the 2020-08 spike in Australia?

While Australia had been doing a good job enforcing quarentine, another massive wave of infections occured in Victoria, sourced from an outbreak at a quarentine hotel in Melbourne, Victora. This second wave lasted from roughly June to October, where numbers gradually decreased into the flat line we see at the top of the curve.

3.0.1 Some final date on the total death counts in every country.

[15]:
```
largest_values = world_countries_deaths_compare.max(axis=1)
largest_indices = world_countries_deaths_compare.idxmax(axis=1) #Compares the␣
 ↪largest values and indices when looking at the compiled data from all used␣
 ↪countries.

mostdeaths = pd.DataFrame({
    'Death Count': largest_values,
    'Day': largest_indices
})

mostdeaths
```

[15]:
```
           Death Count        Day
Germany          52750 2021-01-03
Mexico          150442 2021-01-03
```

```
Canada           15632 2021-01-03
Australia          922 2021-01-03
India           149435 2021-01-03
America         363775 2021-01-03
```