Import Libraries

In [ ]:
```
# pip install folium
```

In [ ]:
```
# pip install --upgrade matplotlib
```

In [ ]:
```
# storing and anaysis
import numpy as np
import pandas as pd

# visualization
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import folium
```

Import Dataset

In [ ]:
```
# data from Kaggle:
# https://www.kaggle.com/datasets/cptspark/novel-coronavirus-cdr-202011feb?resou
```

In [ ]:
```
# importing datasets
conf_df = pd.read_csv('time_series_2019-ncov-Confirmed.csv')
deaths_df = pd.read_csv('time_series_2019-ncov-Deaths.csv')
recv_df = pd.read_csv('time_series_2019-ncov-Recovered.csv')
```

In [ ]:
```
conf_df.head()
# deaths_df.head()
# recv_df.head()
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	1/21/2020 22:00	1/22/2020 12:00	1/23/20 12:
0	Anhui	Mainland China	31.82571	117.2264	NaN	1.0	9
1	Beijing	Mainland China	40.18238	116.4142	10.0	14.0	22
2	Chongqing	Mainland China	30.05718	107.8740	5.0	6.0	9
3	Fujian	Mainland China	26.07783	117.9895	NaN	1.0	5
4	Gansu	Mainland China	36.06110	103.8343	NaN	NaN	2

5 rows × 43 columns

In [ ]:
```
conf_df.columns
# deaths_df.columns
# recv_df.columns
```

```
Out[ ]:  Index(['Province/State', 'Country/Region', 'Lat', 'Long', '1/21/2020 22:00',
                '1/22/2020 12:00', '1/23/2020 12:00', '1/24/2020 0:00',
                '1/24/2020 12:00', '1/25/2020 0:00', '1/25/2020 12:00',
                '1/25/2020 22:00', '1/26/2020 11:00', '1/26/2020 23:00',
                '1/27/2020 9:00', '1/27/2020 19:00', '1/27/2020 20:30',
                '1/28/2020 13:00', '1/28/2020 18:00', '1/28/2020 23:00',
                '1/29/2020 13:30', '1/29/2020 14:30', '1/29/2020 21:00',
                '1/30/2020 11:00', '1/31/2020 14:00', '2/1/2020 10:00',
                '2/2/2020 21:00', '2/3/2020 21:00', '2/4/2020 9:40', '2/4/2020 22:00',
                '2/5/2020 9:00', '2/5/2020 23:00', '2/6/2020 9:00', '2/6/2020 14:20',
                '2/7/2020 20:13', '2/7/2020 22:50', '2/8/2020 22:04', '2/8/2020 23:04',
                '2/9/2020 10:30', '2/9/2020 23:20', '2/10/2020 10:30',
                '2/10/2020 19:30', '2/11/2020 10:50'],
               dtype='object')
```

```
In [ ]: conf_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73 entries, 0 to 72
Data columns (total 43 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   Province/State   52 non-null     object 
 1   Country/Region   73 non-null     object 
 2   Lat              73 non-null     float64
 3   Long             73 non-null     float64
 4   1/21/2020 22:00  16 non-null     float64
 5   1/22/2020 12:00  29 non-null     float64
 6   1/23/2020 12:00  37 non-null     float64
 7   1/24/2020 0:00   38 non-null     float64
 8   1/24/2020 12:00  40 non-null     float64
 9   1/25/2020 0:00   42 non-null     float64
 10  1/25/2020 12:00  43 non-null     float64
 11  1/25/2020 22:00  43 non-null     float64
 12  1/26/2020 11:00  49 non-null     float64
 13  1/26/2020 23:00  49 non-null     float64
 14  1/27/2020 9:00   50 non-null     float64
 15  1/27/2020 19:00  51 non-null     float64
 16  1/27/2020 20:30  52 non-null     float64
 17  1/28/2020 13:00  53 non-null     float64
 18  1/28/2020 18:00  53 non-null     float64
 19  1/28/2020 23:00  53 non-null     float64
 20  1/29/2020 13:30  56 non-null     float64
 21  1/29/2020 14:30  55 non-null     float64
 22  1/29/2020 21:00  57 non-null     float64
 23  1/30/2020 11:00  59 non-null     float64
 24  1/31/2020 14:00  65 non-null     float64
 25  2/1/2020 10:00   67 non-null     float64
 26  2/2/2020 21:00   68 non-null     float64
 27  2/3/2020 21:00   69 non-null     float64
 28  2/4/2020 9:40    70 non-null     float64
 29  2/4/2020 22:00   70 non-null     float64
 30  2/5/2020 9:00    70 non-null     float64
 31  2/5/2020 23:00   71 non-null     float64
 32  2/6/2020 9:00    71 non-null     float64
 33  2/6/2020 14:20   71 non-null     float64
 34  2/7/2020 20:13   72 non-null     float64
 35  2/7/2020 22:50   72 non-null     float64
 36  2/8/2020 22:04   72 non-null     float64
 37  2/8/2020 23:04   72 non-null     float64
 38  2/9/2020 10:30   72 non-null     float64
 39  2/9/2020 23:20   72 non-null     float64
 40  2/10/2020 10:30  72 non-null     float64
 41  2/10/2020 19:30  72 non-null     float64
 42  2/11/2020 10:50  73 non-null     int64  
dtypes: float64(40), int64(1), object(2)
memory usage: 24.6+ KB
```

In [ ]:

```
# Filter the DataFrame to select rows where the 'Province/State' column is 'Diam
ship_Confirmed = conf_df[conf_df['Province/State'] == 'Diamond Princess cruise s

# Display the resulting DataFrame containing confirmed cases on the Diamond Prin
ship_Confirmed
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	1/21/2020 22:00	1/22/2020 12:00	1/23/202 12:0
71	Diamond Princess cruise ship	Others	35.4437	129.638	NaN	NaN	Nal

1 rows × 43 columns

```
In [ ]: deaths_df.head()
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	1/21/20 22:00	1/22/20 12:00	1/23/20 12:00	1/2
0	Anhui	Mainland China	31.82571	117.2264	NaN	NaN	NaN	
1	Beijing	Mainland China	40.18238	116.4142	NaN	NaN	NaN	
2	Chongqing	Mainland China	30.05718	107.8740	NaN	NaN	NaN	
3	Fujian	Mainland China	26.07783	117.9895	NaN	NaN	NaN	
4	Gansu	Mainland China	36.06110	103.8343	NaN	NaN	NaN	

5 rows × 43 columns

```
In [ ]: recv_df.head()
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	1/21/20 22:00	1/22/20 12:00	1/23/20 12:00	1/2
0	Anhui	Mainland China	31.82571	117.2264	NaN	NaN	NaN	
1	Beijing	Mainland China	40.18238	116.4142	NaN	NaN	NaN	
2	Chongqing	Mainland China	30.05718	107.8740	NaN	NaN	NaN	
3	Fujian	Mainland China	26.07783	117.9895	NaN	NaN	NaN	
4	Gansu	Mainland China	36.06110	103.8343	NaN	NaN	NaN	

5 rows × 43 columns

Data Wrangling

```
In [ ]: dates = ['1/22/20', '1/23/20', '1/24/20', '1/25/20', '1/26/20', '1/27/20', '1/28
                 '1/29/20', '1/30/20', '1/31/20', '2/1/20', '2/2/20', '2/3/20', '2/4/20'
                 '2/5/20', '2/6/20', '2/7/20', '2/8/20', '2/9/20', '2/10/20', '2/11/20',
                 '2/13/20', '2/14/20', '2/15/20', '2/16/20', '2/17/20', '2/18/20', '2/19
        dates
```

Out[ ]:

```
['1/22/20',
 '1/23/20',
 '1/24/20',
 '1/25/20',
 '1/26/20',
 '1/27/20',
 '1/28/20',
 '1/29/20',
 '1/30/20',
 '1/31/20',
 '2/1/20',
 '2/2/20',
 '2/3/20',
 '2/4/20',
 '2/5/20',
 '2/6/20',
 '2/7/20',
 '2/8/20',
 '2/9/20',
 '2/10/20',
 '2/11/20',
 '2/12/20',
 '2/13/20',
 '2/14/20',
 '2/15/20',
 '2/16/20',
 '2/17/20',
 '2/18/20',
 '2/19/20']
```

In [ ]:

```
conf_df_long = conf_df.melt(id_vars=['Province/State', 'Country/Region', 'Lat', 
                            value_vars=conf_df.columns[4:], var_name='Date', val

deaths_df_long = deaths_df.melt(id_vars=['Province/State', 'Country/Region', 'La
                            value_vars=deaths_df.columns[4:], var_name='Date', v

recv_df_long = recv_df.melt(id_vars=['Province/State', 'Country/Region', 'Lat', 
                            value_vars=recv_df.columns[4:], var_name='Date', val

full_table = pd.concat([conf_df_long, deaths_df_long['Deaths'], recv_df_long['Re
                       axis=1, sort=False)
full_table.head()
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths
0	Anhui	Mainland China	31.82571	117.2264	1/21/2020 22:00	NaN	NaN
1	Beijing	Mainland China	40.18238	116.4142	1/21/2020 22:00	10.0	NaN
2	Chongqing	Mainland China	30.05718	107.8740	1/21/2020 22:00	5.0	NaN
3	Fujian	Mainland China	26.07783	117.9895	1/21/2020 22:00	NaN	NaN
4	Gansu	Mainland China	36.06110	103.8343	1/21/2020 22:00	NaN	NaN

Data Cleaning and Preprocessing

In [ ]:

```
# Step 1: Convert 'Date' Column to DateTime Format
full_table['Date'] = pd.to_datetime(full_table['Date'])
# This line converts the 'Date' column to a proper datetime format. This is impo

# Step 2: Replace 'Mainland China' with 'China' in 'Country/Region' Column
full_table['Country/Region'] = full_table['Country/Region'].replace('Mainland Ch
# This line replaces occurrences of 'Mainland China' with 'China' in the 'Countr

# Step 3: Fill Missing Values in 'Confirmed', 'Deaths', and 'Recovered' Columns
full_table[['Confirmed', 'Deaths', 'Recovered']] = full_table[['Confirmed', 'Dea
# Missing values in the 'Confirmed', 'Deaths', and 'Recovered' columns are fille

# Step 4: Convert 'Recovered' Column to Integer Data Type
full_table['Recovered'] = full_table['Recovered'].astype('int')
# The 'Recovered' column is converted to integer data type. This ensures that th

# Step 5: Fill Missing Values in 'Province/State' Column
full_table[['Province/State']] = full_table[['Province/State']].fillna('NA')
# Missing values in the 'Province/State' column are filled with 'NA' to indicate

full_table[['Province/State']] = full_table[['Province/State']].fillna('Diamond 

# Step 6: Extract Data Related to Diamond Princess Cruise Ship
ship = full_table[full_table['Province/State'] == 'Diamond Princess cruise ship'
# A new DataFrame 'ship' is created, containing data related to the Diamond Prin

# Step 7: Remove Diamond Princess Data from 'full_table'
full_table = full_table[full_table['Province/State'] != 'Diamond Princess cruise
# Data related to the Diamond Princess cruise ship is removed from the 'full_tab

# Step 8: Display the First Few Rows of the Cleaned DataFrame
full_table.head()
```

Out[ ]:

	Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths	Re
0	Anhui	China	31.82571	117.2264	2020-01-21 22:00:00	0.0	0.0	
1	Beijing	China	40.18238	116.4142	2020-01-21 22:00:00	10.0	0.0	
2	Chongqing	China	30.05718	107.8740	2020-01-21 22:00:00	5.0	0.0	
3	Fujian	China	26.07783	117.9895	2020-01-21 22:00:00	0.0	0.0	
4	Gansu	China	36.06110	103.8343	2020-01-21 22:00:00	0.0	0.0	

In [ ]:

```
# cases in the Diamond Princess cruise ship
ship = full_table[full_table['Province/State']=='Diamond Princess cruise ship']

ship.head()
```

Out[ ]:

Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths	Recovered

In [ ]:

```
# full_table.info()
```

In [ ]:

```
# Create a DataFrame 'china' containing data only for the 'China' country
china = full_table[full_table['Country/Region']=='China']

# Create a DataFrame 'row' containing data for countries/regions other than 'Chi
row = full_table[full_table['Country/Region']!='China']

# Create a DataFrame 'full_latest' with data for the latest date in the dataset
full_latest = full_table[full_table['Date'] == max(full_table['Date'])].reset_ir

# Create a DataFrame 'china_latest' with data for the latest date only for 'Chin
china_latest = full_latest[full_latest['Country/Region']=='China']

# Create a DataFrame 'row_latest' with data for the latest date for countries/re
row_latest = full_latest[full_latest['Country/Region']!='China']

# Group the 'full_latest' DataFrame by 'Country/Region' and calculate the sum of
full_latest_grouped = full_latest.groupby('Country/Region')['Confirmed', 'Deaths

# Group the 'china_latest' DataFrame by 'Province/State' and calculate the sum c
china_latest_grouped = china_latest.groupby('Province/State')['Confirmed', 'Deat

# Group the 'row_latest' DataFrame by 'Country/Region' and calculate the sum of
row_latest_grouped = row_latest.groupby('Country/Region')['Confirmed', 'Deaths',
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_3208\1272672933.py:17: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be dep
recated, use a list instead.

C:\Users\ADMIN\AppData\Local\Temp\ipykernel_3208\1272672933.py:20: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be dep
recated, use a list instead.

C:\Users\ADMIN\AppData\Local\Temp\ipykernel_3208\1272672933.py:23: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be dep
recated, use a list instead.
```

EDA

Current Situation

In [ ]:

```
# Group the 'full_latest' DataFrame by both 'Country/Region' and 'Province/State
# Calculate the maximum values of 'Confirmed', 'Deaths', and 'Recovered' for eac
temp = full_latest.groupby(['Country/Region', 'Province/State'])['Confirmed', 'D

# Apply a background gradient style to the 'temp' DataFrame
# The 'background_gradient' function applies a color gradient to cells based on
# Here, 'cmap' specifies the color map used for the gradient, 'Pastel1_r' in thi
styled_temp = temp.style.background_gradient(cmap='Pastel1_r')

# The styled DataFrame 'styled_temp' now has the background gradient applied
# It can be displayed to visualize the data with color-coded cells
styled_temp
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_3208\487413045.py:3: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be dep
recated, use a list instead.
```

Out[ ]:

		Confirmed	Deaths	Recovered
Country/Region	**Province/State**			
Australia	**New South Wales**	4.000000	0.000000	2
	Queensland	5.000000	0.000000	0
	South Australia	2.000000	0.000000	0
	Victoria	4.000000	0.000000	0
Belgium	**NA**	1.000000	0.000000	0
Cambodia	**NA**	1.000000	0.000000	0
Canada	**British Columbia**	4.000000	0.000000	0
	London, ON	1.000000	0.000000	0
	Toronto, ON	2.000000	0.000000	0
China	**Anhui**	860.000000	4.000000	105
	Beijing	342.000000	3.000000	48
	Chongqing	489.000000	2.000000	72
	Fujian	267.000000	0.000000	45
	Gansu	86.000000	2.000000	24
	Guangdong	1177.000000	1.000000	212
	Guangxi	215.000000	1.000000	33
	Guizhou	127.000000	1.000000	17
	Hainan	144.000000	3.000000	20
	Hebei	239.000000	2.000000	48
	Heilongjiang	360.000000	8.000000	28
	Henan	1105.000000	7.000000	218
	Hubei	31728.000000	974.000000	2310
	Hunan	912.000000	1.000000	247
	Inner Mongolia	58.000000	0.000000	5
	Jiangsu	515.000000	0.000000	93
	Jiangxi	804.000000	1.000000	128
	Jilin	81.000000	1.000000	18
	Liaoning	111.000000	0.000000	19
	Ningxia	53.000000	0.000000	22
	Qinghai	18.000000	0.000000	5
	Shaanxi	219.000000	0.000000	32
	Shandong	487.000000	1.000000	80

		Confirmed	Deaths	Recovered
Country/Region	**Province/State**			
	Shanghai	303.000000	1.000000	52
	Shanxi	122.000000	0.000000	30
	Sichuan	417.000000	1.000000	85
	Tianjin	105.000000	2.000000	10
	Tibet	1.000000	0.000000	0
	Xinjiang	55.000000	0.000000	3
	Yunnan	153.000000	0.000000	20
	Zhejiang	1117.000000	0.000000	270
Finland	**NA**	1.000000	0.000000	0
France	**NA**	11.000000	0.000000	0
Germany	**NA**	14.000000	0.000000	0
Hong Kong	**Hong Kong**	49.000000	0.000000	3
India	**NA**	3.000000	0.000000	0
Italy	**NA**	3.000000	0.000000	0
Japan	**NA**	26.000000	0.000000	1
Macau	**Macau**	10.000000	0.000000	10
Malaysia	**NA**	18.000000	0.000000	3
Nepal	**NA**	1.000000	0.000000	0
Philippines	**NA**	3.000000	1.000000	0
Russia	**NA**	2.000000	0.000000	0
Singapore	**NA**	45.000000	0.000000	7
South Korea	**NA**	28.000000	0.000000	1
Spain	**NA**	2.000000	0.000000	0
Sri Lanka	**NA**	1.000000	0.000000	1
Sweden	**NA**	1.000000	0.000000	0
Taiwan	**Taiwan**	18.000000	0.000000	1
Thailand	**NA**	32.000000	1.000000	0
UK	**NA**	8.000000	0.000000	0
US	**Boston, MA**	1.000000	0.000000	0
	Chicago, IL	2.000000	0.000000	0
	Los Angeles, CA	1.000000	0.000000	0
	Madison, WI	1.000000	0.000000	0

		Confirmed	Deaths	Recovered
Country/Region	**Province/State**			
	Orange, CA	1.000000	0.000000	0
	San Benito, CA	2.000000	0.000000	0
	San Diego County, CA	1.000000	0.000000	0
	Santa Clara, CA	2.000000	0.000000	0
	Seattle, WA	1.000000	0.000000	2
	Tempe, AZ	1.000000	0.000000	9
United Arab Emirates	**NA**	8.000000	0.000000	0
Vietnam	**NA**	15.000000	0.000000	1

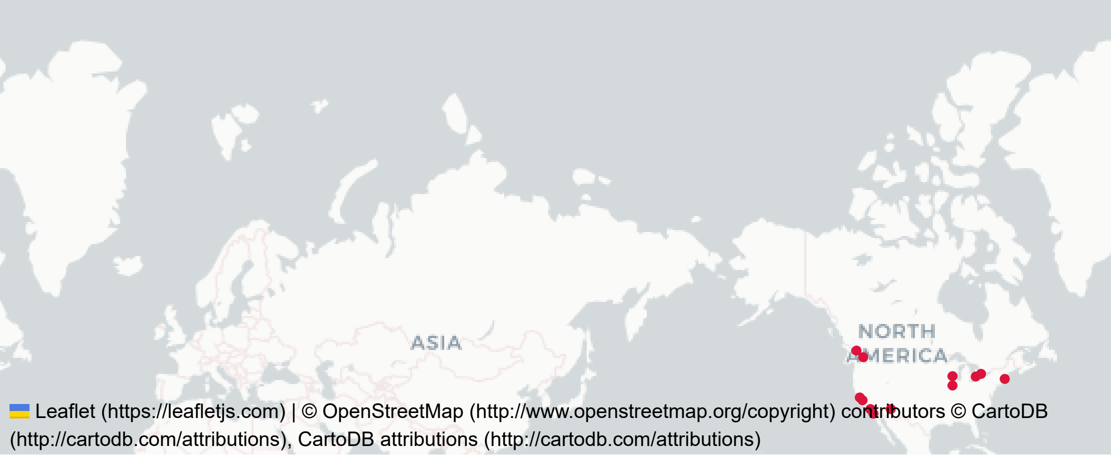
In [ ]:

```python
# World wide

m = folium.Map(location=[0, 0], tiles='cartodbpositron',
               min_zoom=1, max_zoom=4, zoom_start=1)

for i in range(0, len(full_latest)):
    folium.Circle(
        location=[full_latest.iloc[i]['Lat'], full_latest.iloc[i]['Long']],
        color='crimson',
        tooltip =   '<li><bold>Country : '+str(full_latest.iloc[i]['Country/Regi
                    '<li><bold>Province : '+str(full_latest.iloc[i]['Province/St
                    '<li><bold>Confirmed : '+str(full_latest.iloc[i]['Confirmed'
                    '<li><bold>Deaths : '+str(full_latest.iloc[i]['Deaths'])+
                    '<li><bold>Recovered : '+str(full_latest.iloc[i]['Recovered'
        radius=int(full_latest.iloc[i]['Confirmed'])).add_to(m)
m
```

Out[ ]: Make this Notebook Trusted to load map: File -> Trust Notebook

+

−



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Top 10 Countries with most no. of reported cases

In [ ]:

```
temp_f = full_latest_grouped[['Country/Region', 'Confirmed']]
temp_f = temp_f.sort_values(by='Confirmed', ascending=False)
temp_f = temp_f.reset_index(drop=True)
temp_f.head(10).style.background_gradient(cmap='Pastel1_r')
```

Out[ ]:

```
   Country/Region       Confirmed
0           China  42670.000000
1       Hong Kong     49.000000
2       Singapore     45.000000
3        Thailand     32.000000
4     South Korea     28.000000
5           Japan     26.000000
6          Taiwan     18.000000
7        Malaysia     18.000000
8       Australia     15.000000
9         Vietnam     15.000000
```

- Massive number of cases are reported in Mainland China Compared to reset of the world
- The next few countries are infact are the neighbours of China

In [ ]:

```
fig = px.choropleth(full_latest_grouped, locations="Country/Region",
                    locationmode='country names', color="Confirmed",
                    hover_name="Country/Region", range_color=[1,50],
                    color_continuous_scale="Sunsetdark",
                    title='Countries with Confirmed Cases')
fig.update(layout_coloraxis_showscale=False)
fig.show()
```

Top 10 Provinces in China with most no. of reported cases

In [ ]:

```
temp_c = china_latest_grouped[['Province/State', 'Confirmed']]
temp_c = temp_c.sort_values(by='Confirmed', ascending=False)
temp_c = temp_c.reset_index(drop=True)
temp_c.head(10).style.background_gradient(cmap='Pastel1_r')
```

Out[ ]:

	Province/State	Confirmed
0	Hubei	31728.000000
1	Guangdong	1177.000000
2	Zhejiang	1117.000000
3	Henan	1105.000000
4	Hunan	912.000000
5	Anhui	860.000000
6	Jiangxi	804.000000
7	Jiangsu	515.000000
8	Chongqing	489.000000
9	Shandong	487.000000

In [ ]:

```
# China
m = folium.Map(location=[30, 116], tiles='cartodbpositron',
               min_zoom=2, max_zoom=5, zoom_start=3)

for i in range(0, len(china_latest)):
    folium.Circle(
        location=[china_latest.iloc[i]['Lat'], china_latest.iloc[i]['Long']],
        color='crimson',
        tooltip =   '<li><bold>Country : '+str(china_latest.iloc[i]['Country/Reg
                    '<li><bold>Province : '+str(china_latest.iloc[i]['Province/S
                    '<li><bold>Confirmed : '+str(china_latest.iloc[i]['Confirmec
                    '<li><bold>Deaths : '+str(china_latest.iloc[i]['Deaths'])+
                    '<li><bold>Recovered : '+str(china_latest.iloc[i]['Recoverec
        radius=int(china_latest.iloc[i]['Confirmed'])**1).add_to(m)
m
```

Out[ ]:

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- Even in China most of the cases reported are from a particular Province Hubei.

- It is no surprise, because Hubei's capital is **Wuhan**, where the the first cases are reported

Countries with deaths reported

In [ ]:

```
temp_flg = full_latest_grouped[['Country/Region', 'Deaths']]
temp_flg = temp_flg.sort_values(by='Deaths', ascending=False)
temp_flg = temp_flg.reset_index(drop=True)
temp_flg = temp_flg[temp_flg['Deaths']>0]
temp_flg.style.background_gradient(cmap='Pastel1_r')
```

Out[ ]:

	Country/Region	Deaths
0	China	1016.000000
1	Philippines	1.000000
2	Thailand	1.000000

In [ ]:

```
fig = px.choropleth(full_latest_grouped[full_latest_grouped['Deaths']>0],
                    locations="Country/Region", locationmode='country names',
                    color="Deaths", hover_name="Country/Region",
                    range_color=[1,50], color_continuous_scale="Peach",
                    title='Countries with Deaths Reported')
fig.update(layout_coloraxis_showscale=False)
fig.show()
```

- Outside China, there hasn't been a lot of deaths due to COVID-19 has reported

Countries with all the cases recovered

In [ ]:

```
# Countries with all the cases recovered
temp = row_latest_grouped[row_latest_grouped['Confirmed']==row_latest_grouped['R
temp = temp[['Country/Region', 'Confirmed', 'Recovered']]
temp = temp.sort_values('Confirmed', ascending=False)
temp = temp.reset_index(drop=True)
temp.style.background_gradient(cmap='Greens')
```

Out[ ]:

	Country/Region	Confirmed	Recovered
0	Macau	10.000000	10
1	Sri Lanka	1.000000	1

Most Recent Stats

In [ ]:

```
temp = full_table.groupby('Date')['Confirmed', 'Deaths', 'Recovered'].sum()
temp = temp.reset_index()
temp = temp.sort_values('Date', ascending=False)
temp.head(1).style.background_gradient(cmap='Pastel1')
```

```
C:\Users\ADMIN\AppData\Local\Temp\ipykernel_3208\894495828.py:1: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be dep
recated, use a list instead.
```

Out[ ]:

	Date	Confirmed	Deaths	Recovered
38	2020-02-11 10:50:00	43006.000000	1018.000000	4340

- There are more recovered cases than deaths at this point of time

Diamond Princess Cruise ship Status

In [ ]:

```
ship.head()
```

Out[ ]:

Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths	Recovered

In [ ]:

```
# Cases in the Diamond Princess Cruise Ship
temp = ship.sort_values(by='Date', ascending=False).head(1)
temp = temp[['Province/State', 'Confirmed', 'Deaths', 'Recovered']].reset_index(
temp.style.background_gradient(cmap='Pastel1')
```

Out[ ]:

Province/State	Confirmed	Deaths	Recovered

In [ ]:

```
# China

temp = ship[ship['Date'] == max(ship['Date'])].reset_index()

m = folium.Map(location=[35.4437, 139.638], tiles='cartodbpositron',
               min_zoom=8, max_zoom=12, zoom_start=10)

folium.Circle(location=[temp.iloc[0]['Lat'], temp.iloc[0]['Long']],
        color='crimson',
        tooltip =   '<li><bold>Ship : '+str(temp.iloc[0]['Province/State'])+
                    '<li><bold>Confirmed : '+str(temp.iloc[0]['Confirmed'])+
                    '<li><bold>Deaths : '+str(temp.iloc[0]['Deaths'])+
                    '<li><bold>Recovered : '+str(temp.iloc[0]['Recovered']),
        radius=int(temp.iloc[0]['Confirmed'])**1).add_to(m)
m
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
d:\Data science & Python  2022\0. Data Analyst_2023\Portfolio_Thach\I. Beginner l
evel\3. COVID-19 - Analysis, Visualization & Comparisons\Covid-19 analysis visual
ization comparisons.ipynb Cell 46 in 3
      <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=0'>1</a> # China
----> <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=2'>3</a> temp = ship[ship['Dat
e'] == max(ship['Date'])].reset_index()
      <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=4'>5</a> m = folium.Map(location
=[35.4437, 139.638], tiles='cartodbpositron',
      <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=5'>6</a>                min_zoom
=8, max_zoom=12, zoom_start=10)
      <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=7'>8</a> folium.Circle(location=
[temp.iloc[0]['Lat'], temp.iloc[0]['Long']],
      <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%20202
2/0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20
-%20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visuali
zation%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=8'>9</a>         color='crimso
n',
     <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%202022/
0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20-%
20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visualiza
tion%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=9'>10</a>         tooltip =   '<li
><bold>Ship : '+str(temp.iloc[0]['Province/State'])+
   (...)
     <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%202022/
0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20-%
20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visualiza
tion%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=12'>13</a>                     '<l
i><bold>Recovered : '+str(temp.iloc[0]['Recovered']),
     <a href='vscode-notebook-cell:/d%3A/Data%20science%20%26%20Python%20%202022/
0.%20Data%20Analyst_2023/Portfolio_Thach/I.%20Beginner%20level/3.%20COVID-19%20-%
20Analysis%2C%20Visualization%20%26%20Comparisons/Covid-19%20analysis%20visualiza
tion%20comparisons.ipynb#X61sZmlsZQ%3D%3D?line=13'>14</a>         radius=int(tem
p.iloc[0]['Confirmed'])**1).add_to(m)

ValueError: max() arg is an empty sequence
```

- The ship was carrying 3,700 people in total
- https://www.princess.com/news/notices_and_advisories/notices/diamond-princess-update.html

In [ ]:

```
# Number of Countries/Regions to which COVID-19 spread
print(len(temp_f))
```

```
30
```

In [ ]:

```
# Number of Province/State in Mainland China to which COVID-19 spread
len(temp_c)
```

Out[ ]:

```
31
```

In [ ]:

```
# Number of countries with deaths reported
len(temp_flg)
```

Out[ ]:

```
7
```

Visual EDA

Spread Across the Globe

In [ ]:

```
formated_gdf = full_table.groupby(['Date', 'Country/Region'])['Confirmed', 'Deat
formated_gdf = formated_gdf.reset_index()
formated_gdf = formated_gdf[formated_gdf['Country/Region']!='China']
formated_gdf['Date'] = pd.to_datetime(formated_gdf['Date'])
formated_gdf['Date'] = formated_gdf['Date'].dt.strftime('%m/%d/%Y')

fig = px.scatter_geo(formated_gdf[formated_gdf['Country/Region']!='China'],
                     locations="Country/Region", locationmode='country names',
                     color="Confirmed", size='Confirmed', hover_name="Country/Re
                     range_color= [0, max(formated_gdf['Confirmed'])+2],
                     projection="natural earth", animation_frame="Date",
                     title='Spread outside China over time')
fig.update(layout_coloraxis_showscale=False)
fig.show()

# ------------------------------------------------------------------------------

china_map = china.groupby(['Date', 'Province/State'])['Confirmed', 'Deaths', 'Re
                                                      'Lat', 'Long'].max()
china_map = china_map.reset_index()
china_map['size'] = china_map['Confirmed'].pow(0.5)
china_map['Date'] = pd.to_datetime(china_map['Date'])
china_map['Date'] = china_map['Date'].dt.strftime('%m/%d/%Y')
china_map.head()

fig = px.scatter_geo(china_map, lat='Lat', lon='Long', scope='asia',
                     color="size", size='size', hover_name='Province/State',
                     hover_data=['Confirmed', 'Deaths', 'Recovered'],
                     projection="natural earth", animation_frame="Date",
                     title='Spread in China over time')
fig.update(layout_coloraxis_showscale=False)
fig.show()
```

Number of Places to which COVID-19 Spread

In [ ]:

```
c_spread = china[china['Confirmed']!=0].groupby('Date')['Province/State'].unique
c_spread = pd.DataFrame(c_spread).reset_index()

fig = px.line(c_spread, x='Date', y='Province/State',
              title='Number of Provinces/States/Regions of China to which COVID-
fig.show()
```

- COVID-19 spread to all the provinces of the China really fast and early

In [ ]:

```
spread = full_table[full_table['Confirmed']!=0].groupby('Date')['Country/Region'
spread = pd.DataFrame(spread).reset_index()

fig = px.line(spread, x='Date', y='Country/Region',
              title='Number of Countries/Regions to which COVID-19 spread over t
fig.show()
```

- Number of countries to which COVID-19 spread hasn't increased that much after first few weeks

Recovery and Mortality Rate Over The Time

In [ ]:

```
temp = full_table.groupby('Date').sum().reset_index()
temp.head()

# adding two more columns
temp['No. of Deaths to 100 Confirmed Cases'] = round(temp['Deaths']/temp['Confir
temp['No. of Recovered to 100 Confirmed Cases'] = round(temp['Recovered']/temp['
temp['No. of Recovered to 1 Death Case'] = round(temp['Recovered']/temp['Deaths'

temp = temp.melt(id_vars='Date',
                 value_vars=['No. of Deaths to 100 Confirmed Cases',
                             'No. of Recovered to 100 Confirmed Cases',
                             'No. of Recovered to 1 Death Case'],
                 var_name='Ratio',
                 value_name='Value')
fig = px.line(temp, x="Date", y="Value", color='Ratio',
              title='Recovery and Mortality Rate Over The Time')
fig.show()
```

- During the first few weeks the there were more Deaths reported per day than Recoverd cases
- Over the time that has changed drastically
- Although the death rate hasn't come down, the number of recovered cases has defenitly increased

Proportion of Cases

In [ ]:

```
rl = row_latest.groupby('Country/Region')['Confirmed', 'Deaths', 'Recovered'].su
rl = rl.reset_index().sort_values(by='Confirmed', ascending=False).reset_index(d
rl.head().style.background_gradient(cmap='rainbow')

ncl = rl.copy()
ncl['Affected'] = ncl['Confirmed'] - ncl['Deaths'] - ncl['Recovered']
ncl = ncl.melt(id_vars="Country/Region", value_vars=['Affected', 'Recovered', 'D

fig = px.bar(ncl.sort_values(['variable', 'value']),
             x="Country/Region", y="value", color='variable', orientation='v', h
             # height=600, width=1000,
             title='Number of Cases outside China')
fig.update_layout(uniformtext_minsize=8, uniformtext_mode='hide')
fig.show()

# ------------------------------------------
```

```
cl = china_latest.groupby('Province/State')['Confirmed', 'Deaths', 'Recovered'].
cl = cl.reset_index().sort_values(by='Confirmed', ascending=False).reset_index(d
# cl.head().style.background_gradient(cmap='rainbow')

ncl = cl.copy()
ncl['Affected'] = ncl['Confirmed'] - ncl['Deaths'] - ncl['Recovered']
ncl = ncl.melt(id_vars="Province/State", value_vars=['Affected', 'Recovered', 'D

fig = px.bar(ncl.sort_values(['variable', 'value']),
             y="Province/State", x="value", color='variable', orientation='h', h
             # height=600, width=1000,
             title='Number of Cases in China')
fig.update_layout(uniformtext_minsize=8, uniformtext_mode='hide')
fig.show()
```

In [ ]:

```
gdf = gdf = full_table.groupby(['Date', 'Country/Region'])['Confirmed', 'Deaths'
gdf = gdf.reset_index()
```

In [ ]:

```
temp.melt?
```

In [ ]:

```
temp = gdf[gdf['Country/Region']=='China'].reset_index()
temp = temp.melt(id_vars='Date', value_vars=['Confirmed', 'Deaths', 'Recovered']
                 var_name='Case', value_name='Count')
fig = px.bar(temp, x="Date", y="Count", color='Case', facet_col="Case",
             title='Cases in China')
fig.show()
```

In [ ]:

```
temp = gdf[gdf['Country/Region']!='China'].groupby('Date').sum().reset_index()
temp = temp.melt(id_vars='Date', value_vars=['Confirmed', 'Deaths', 'Recovered']
                 var_name='Case', value_name='Count')
fig = px.bar(temp, x="Date", y="Count", color='Case', facet_col="Case",
             title='Cases Outside China')
fig.show()
```

In [ ]:

```
fig = px.treemap(china_latest.sort_values(by='Confirmed', ascending=False).reset
             path=["Province/State"], values="Confirmed", title='Number of Confirm
fig.show()

fig = px.treemap(china_latest.sort_values(by='Deaths', ascending=False).reset_in
             path=["Province/State"], values="Deaths", title='Number of Deaths Rep
fig.show()

fig = px.treemap(china_latest.sort_values(by='Recovered', ascending=False).reset
             path=["Province/State"], values="Recovered", title='Number of Recover
fig.show()
```

In [ ]:

```
fig = px.treemap(row_latest, path=["Country/Region"],
                 values="Confirmed", title='Number of Confirmed Cases outside ch
fig.show()

fig = px.treemap(row_latest, path=["Country/Region"],
                 values="Deaths", title='Number of Deaths outside china')
fig.show()

fig = px.treemap(row_latest, path=["Country/Region"],
                 values="Recovered", title='Number of Recovered Cases outside ch
fig.show()
```