Covid 19 Project

Data set - https://drive.google.com/drive/folders/1ByRa_qP3LgDes1Ec1CsPRhv6sgVm_Ynv?usp=sharing

```
# Importing necessary Libraries
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
```

```
# Reading dataset
df = pd.read_csv('https://drive.google.com/drive/folders/1ByRa_qP3LgDes1Ec1CsPRhv6sgVm_Ynv?usp=sharing')
df.head()
```

	Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
0	NaN	Afghanistan	33.93911	67.709953	2020-01-22	0	0	0	0	Eastern Mediterranean
1	NaN	Albania	41.15330	20.168300	2020-01-22	0	0	0	0	Europe
2	NaN	Algeria	28.03390	1.659600	2020-01-22	0	0	0	0	Africa
3	NaN	Andorra	42.50630	1.521800	2020-01-22	0	0	0	0	Europe
4	NaN	Angola	-11.20270	17.873900	2020-01-22	0	0	0	0	Africa

```
# Shape of dataset
df.shape
```

```
(49068, 10)
```

```
# Checking info of dataset
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 49068 entries, 0 to 49067
Data columns (total 10 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   Province/State  14664 non-null  object 
 1   Country/Region  49068 non-null  object 
 2   Lat             49068 non-null  float64
 3   Long            49068 non-null  float64
 4   Date            49068 non-null  object 
 5   Confirmed       49068 non-null  int64  
 6   Deaths          49068 non-null  int64  
 7   Recovered       49068 non-null  int64  
 8   Active          49068 non-null  int64  
 9   WHO Region      49068 non-null  object 
dtypes: float64(2), int64(4), object(4)
memory usage: 3.7+ MB
```

```
# Renaming correct columns
df.rename(columns={'Province/State':'State',
           'Country/Region':'Country'}, inplace = True)
df.head()
```

	State	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
0	NaN	Afghanistan	33.93911	67.709953	2020-01-22	0	0	0	0	Eastern Mediterranean
1	NaN	Albania	41.15330	20.168300	2020-01-22	0	0	0	0	Europe
2	NaN	Algeria	28.03390	1.659600	2020-01-22	0	0	0	0	Africa
3	NaN	Andorra	42.50630	1.521800	2020-01-22	0	0	0	0	Europe
4	NaN	Angola	-11.20270	17.873900	2020-01-22	0	0	0	0	Africa

```
# getting value count of Date field
df.Date.value_counts()
```

Date	count
2020-01-22	261
2020-05-30	261
2020-05-21	261
2020-05-22	261
2020-05-23	261
...	...
2020-03-26	261
2020-03-27	261
2020-03-28	261
2020-03-29	261
2020-07-27	261

188 rows × 1 columns

dtype: int64

we can see that max date will be **2020-07-27**

```
# check max date
df['Date'].max()
```

```
'2020-07-27'
```

```
# poulating rows with max date in top
top = df[df['Date'] == '2020-07-27']
top.head()
```

	State	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
48807	NaN	Afghanistan	33.93911	67.709953	2020-07-27	36263	1269	25198	9796	Eastern Mediterranean
48808	NaN	Albania	41.15330	20.168300	2020-07-27	4880	144	2745	1991	Europe
48809	NaN	Algeria	28.03390	1.659600	2020-07-27	27973	1163	18837	7973	Africa
48810	NaN	Andorra	42.50630	1.521800	2020-07-27	907	52	803	52	Europe
48811	NaN	Angola	-11.20270	17.873900	2020-07-27	950	41	242	667	Africa

```
# Grouping all rows absed on country
top.groupby(by='Country')[['Confirmed', 'Deaths', 'Recovered', 'Active']].sum().reset_index()
```

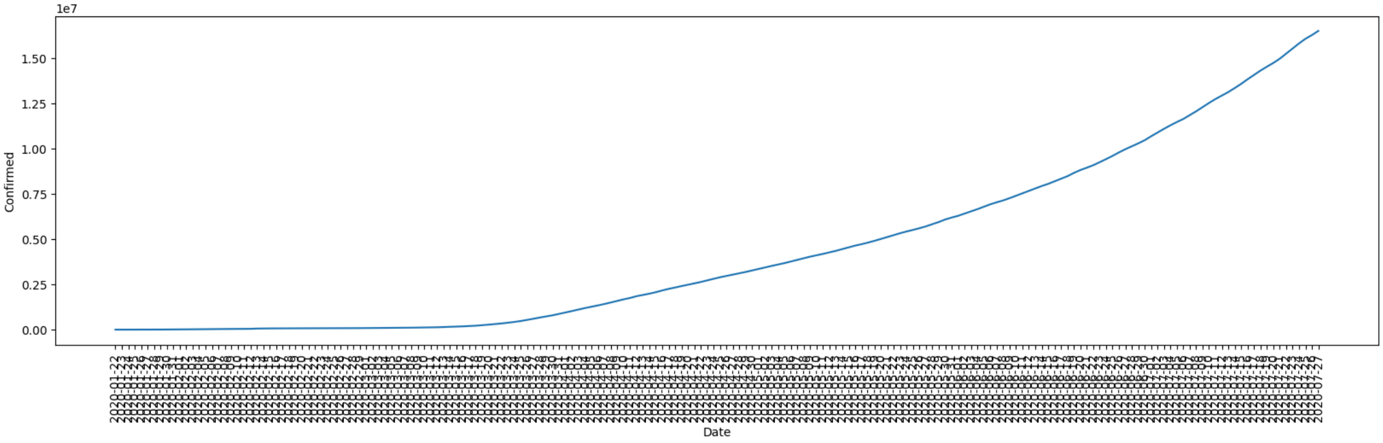
	Country	Confirmed	Deaths	Recovered	Active
0	Afghanistan	36263	1269	25198	9796
1	Albania	4880	144	2745	1991
2	Algeria	27973	1163	18837	7973
3	Andorra	907	52	803	52
4	Angola	950	41	242	667
...	...	...	...	...	...
182	West Bank and Gaza	10621	78	3752	6791
183	Western Sahara	10	1	8	1
184	Yemen	1691	483	833	375
185	Zambia	4552	140	2815	1597
186	Zimbabwe	2704	36	542	2126

187 rows × 5 columns

```
# Populating all confirmed case in confirmed dataset
# Populating all confirmed case in confirmed dataset
confirmed = df.groupby(by='Date')['Confirmed'].sum().reset_index()
confirmed.head()
```

	Date	Confirmed
0	2020-01-22	555
1	2020-01-23	654
2	2020-01-24	941
3	2020-01-25	1434
4	2020-01-26	2118

```
# Visualizing confirmed case
plt.figure(figsize = (20,5))
sns.lineplot(data=confirmed, x='Date', y='Confirmed')
plt.xticks(rotation=90)
plt.show()
```

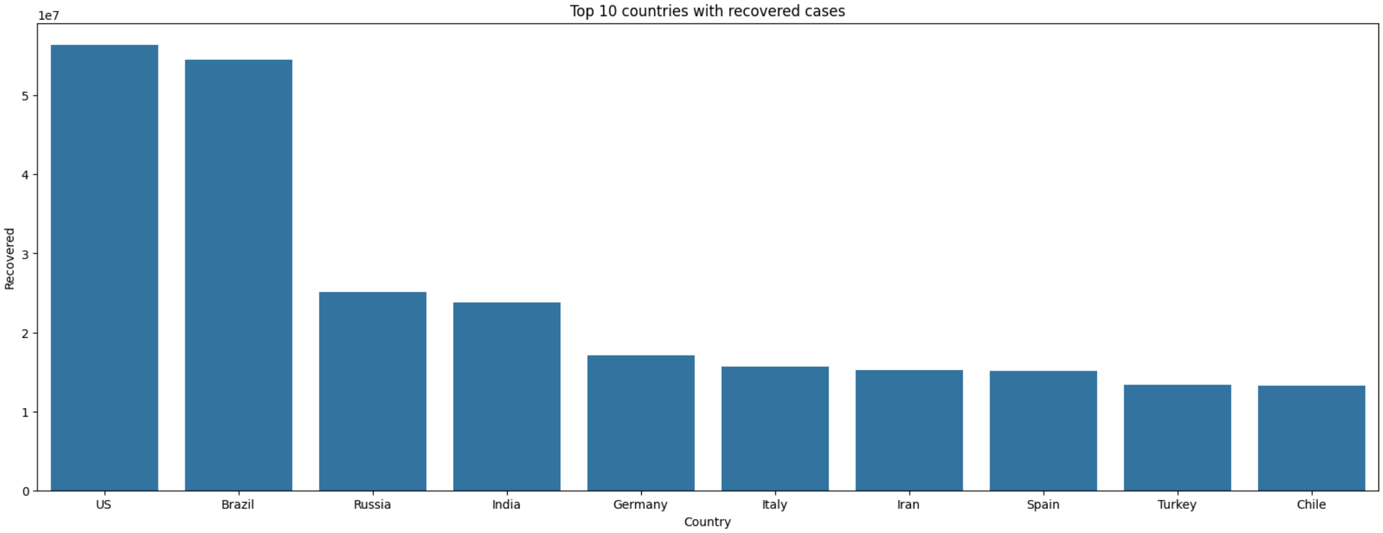


Top 10 countries with the most recovered cases

```
top_10_recovered = df.groupby(by='Country')['Recovered'].sum().sort_values(ascending = False).head(10).reset_index()
top_10_recovered
```

	Country	Recovered
0	US	56353416
1	Brazil	54492873
2	Russia	25120448
3	India	23783720
4	Germany	17107839
5	Italy	15673910
6	Iran	15200895
7	Spain	15093583
8	Turkey	13345389
9	Chile	13292593

```
# Visualizing recovered case
plt.figure(figsize = (20,7))
sns.barplot(data = top_10_recovered, x = 'Country', y='Recovered')
plt.title('Top 10 countries with recovered cases')
plt.show()
```

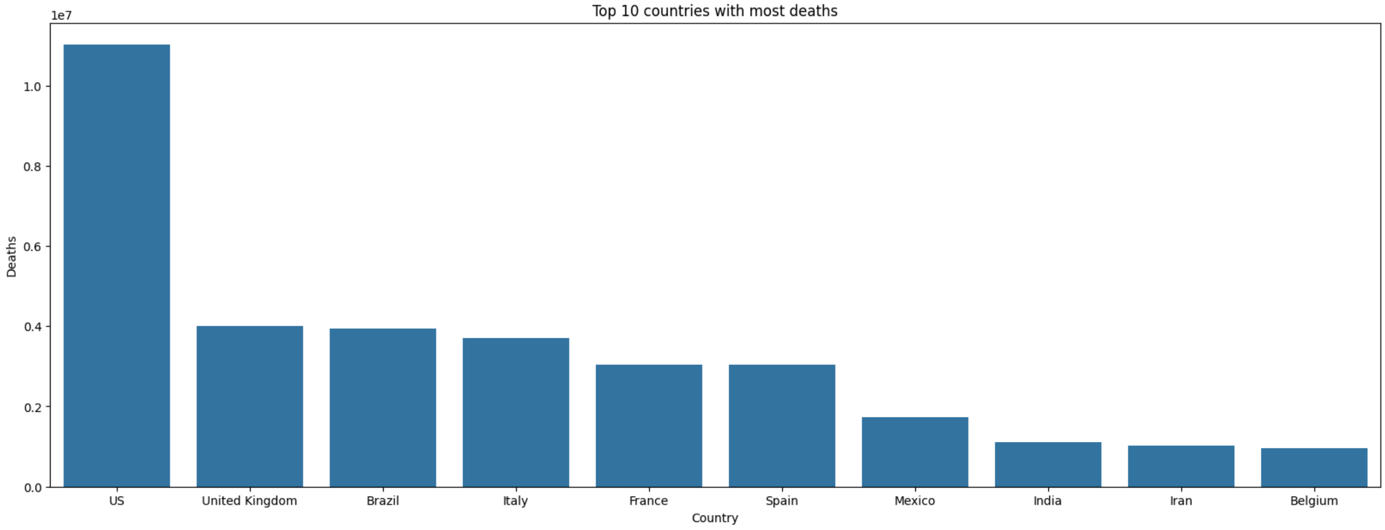


Top 10 countries with deaths

```
top_10_deaths = df.groupby(by='Country')['Deaths'].sum().sort_values(ascending = False).head(10).reset_index()
top_10_deaths
```

```
          Country    Deaths
0              US  11011411
1  United Kingdom   3997775
2          Brazil   3938034
3           Italy   3707717
4          France   3048524
5           Spain   3033030
6          Mexico   1728277
7           India   1111831
8            Iran   1024136
9         Belgium    963679
```

```
# Visualizing deaths case
plt.figure(figsize = (20,7))
sns.barplot(data = top_10_deaths, x = 'Country', y = 'Deaths')
plt.title('Top 10 countries with most deaths')
plt.show()
```

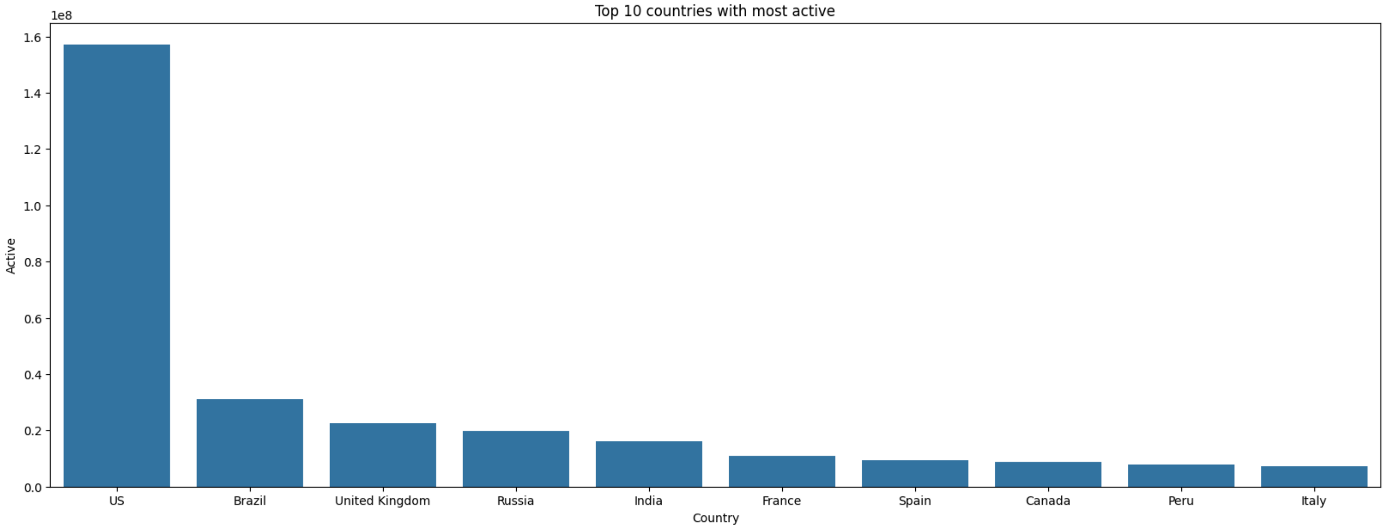


Top 10 countries with most active cases

```
top_10_active = df.groupby(by='Country')['Active'].sum().sort_values(ascending = False).head(10).reset_index()
top_10_active
```

```
          Country     Active
0              US  156981121
1          Brazil   31094060
2  United Kingdom   22624595
3          Russia   19668578
4           India   15987913
5          France   10980287
6           Spain    9277432
7          Canada    8656985
8            Peru    7748957
9           Italy    7363518
```

```
# Visualizing active case
plt.figure(figsize = (20,7))
sns.barplot(data = top_10_active, x = 'Country', y = 'Active')
plt.title('Top 10 countries with most active')
plt.show()
```



Country Based Analysis

1st **US**

2nd **China**

3rd **India**

```
# Creating US dataset which have country as US
US = df[df['Country'] == 'US']
US.head()
```

	State	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
223	NaN	US	40.0	-100.0	2020-01-22	1	0	0	1	Americas
484	NaN	US	40.0	-100.0	2020-01-23	1	0	0	1	Americas
745	NaN	US	40.0	-100.0	2020-01-24	2	0	0	2	Americas
1006	NaN	US	40.0	-100.0	2020-01-25	2	0	0	2	Americas
1267	NaN	US	40.0	-100.0	2020-01-26	5	0	0	5	Americas

```
US = US.groupby(by='Date')[['Confirmed', 'Deaths', 'Recovered', 'Active']].sum().reset_index()
US
```

	Date	Confirmed	Deaths	Recovered	Active
0	2020-01-22	1	0	0	1
1	2020-01-23	1	0	0	1
2	2020-01-24	2	0	0	2
3	2020-01-25	2	0	0	2
4	2020-01-26	5	0	0	5
...	...	...	...	...	...
183	2020-07-23	4038816	144430	1233269	2661117
184	2020-07-24	4112531	145560	1261624	2705347
185	2020-07-25	4178970	146465	1279414	2753091
186	2020-07-26	4233923	146935	1297863	2789125
187	2020-07-27	4290259	148011	1325804	2816444

188 rows × 5 columns

```
# Creating China dataset which have country as China
China = df[df['Country'] == 'China']
China.head()
```

	State	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
48	Anhui	China	31.8257	117.2264	2020-01-22	1	0	0	1	Western Pacific
49	Beijing	China	40.1824	116.4142	2020-01-22	14	0	0	14	Western Pacific
50	Chongqing	China	30.0572	107.8740	2020-01-22	6	0	0	6	Western Pacific
51	Fujian	China	26.0789	117.9874	2020-01-22	1	0	0	1	Western Pacific
52	Gansu	China	35.7518	104.2861	2020-01-22	0	0	0	0	Western Pacific

```
China = China.groupby(by='Date')[['Confirmed', 'Deaths', 'Recovered', 'Active']].sum().reset_index()
China
```

	Date	Confirmed	Deaths	Recovered	Active
0	2020-01-22	548	17	28	503
1	2020-01-23	643	18	30	595
2	2020-01-24	920	26	36	858
3	2020-01-25	1406	42	39	1325
4	2020-01-26	2075	56	49	1970
...	...	...	...	...	...
183	2020-07-23	86045	4649	78701	2695
184	2020-07-24	86202	4650	78745	2807
185	2020-07-25	86381	4652	78813	2916
186	2020-07-26	86570	4652	78862	3056
187	2020-07-27	86783	4656	78869	3258

188 rows × 5 columns

```
# Creating India dataset which have country as India
India = df[df['Country'] == 'India']
India.head()
```

	State	Country	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
129	NaN	India	20.593684	78.96288	2020-01-22	0	0	0	0	South-East Asia
390	NaN	India	20.593684	78.96288	2020-01-23	0	0	0	0	South-East Asia
651	NaN	India	20.593684	78.96288	2020-01-24	0	0	0	0	South-East Asia
912	NaN	India	20.593684	78.96288	2020-01-25	0	0	0	0	South-East Asia
1173	NaN	India	20.593684	78.96288	2020-01-26	0	0	0	0	South-East Asia

```
India = India.groupby(by='Date')[['Confirmed','Deaths','Recovered','Active']].sum().reset_index()
India
```

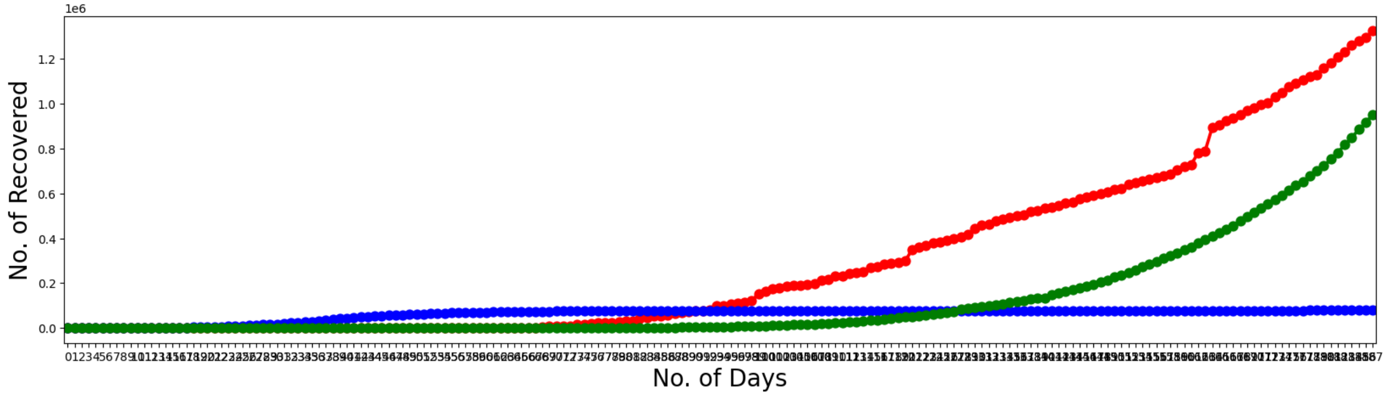
	Date	Confirmed	Deaths	Recovered	Active
0	2020-01-22	0	0	0	0
1	2020-01-23	0	0	0	0
2	2020-01-24	0	0	0	0
3	2020-01-25	0	0	0	0
4	2020-01-26	0	0	0	0
...	...	...	...	...	...
183	2020-07-23	1288108	30601	817209	440298
184	2020-07-24	1337024	31358	849432	456234
185	2020-07-25	1385635	32060	885573	468002
186	2020-07-26	1435616	32771	917568	485277
187	2020-07-27	1480073	33408	951166	495499

188 rows × 5 columns

Compare these countries on the basis of **Recovered** cases

```
# Visualizing using point plot
plt.figure(figsize=(20,5))

sns.pointplot(x=US.index, y = US.Recovered, color = 'Red')
sns.pointplot(x=China.index, y=China.Recovered, color = 'Blue')
sns.pointplot(x=India.index, y=India.Recovered, color = 'Green')

plt.xlabel('No. of Days', fontsize = 20)
plt.ylabel('No. of Recovered', fontsize = 20)
```

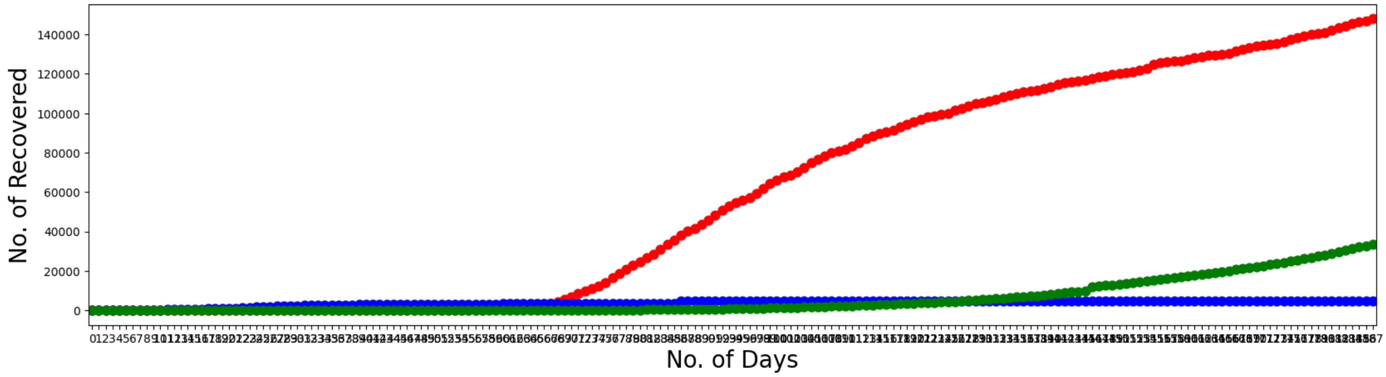
```
Text(0, 0.5, 'No. of Recovered')
```



Compare these countries on the basis of **Deaths** cases

```
# Visualizing using point plot
plt.figure(figsize=(20,5))

sns.pointplot(x=US.index, y = US.Deaths, color = 'Red')
sns.pointplot(x=China.index, y=China.Deaths, color = 'Blue')
sns.pointplot(x=India.index, y=India.Deaths, color = 'Green')

plt.xlabel('No. of Days', fontsize = 20)
plt.ylabel('No. of Recovered', fontsize = 20)
```

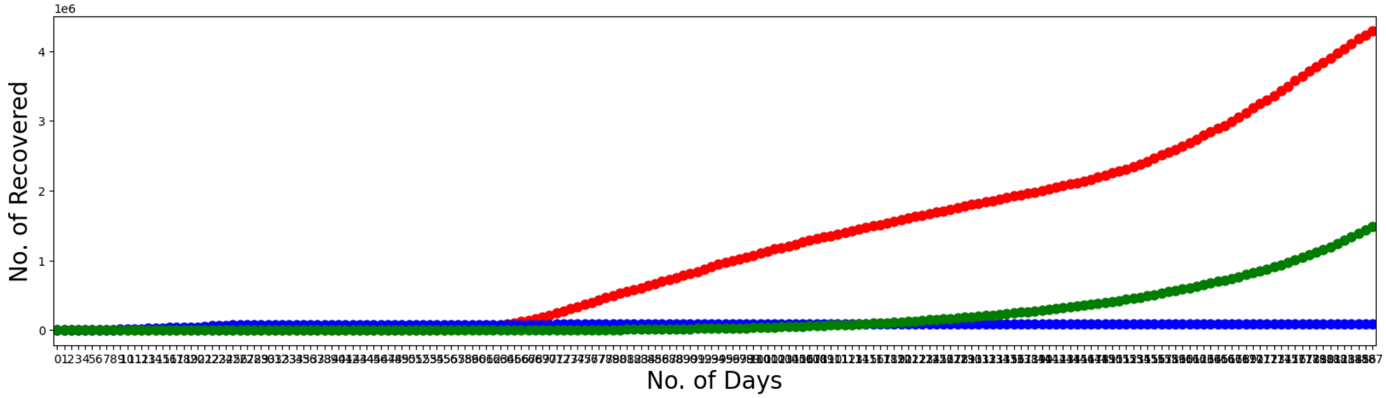
```
Text(0, 0.5, 'No. of Recovered')
```



Compare these countries on the basis of **Active** cases

```
# Visualizing using point plot
plt.figure(figsize=(20,5))

sns.pointplot(x=US.index, y = US.Confirmed, color = 'Red')
sns.pointplot(x=China.index, y=China.Confirmed, color = 'Blue')
sns.pointplot(x=India.index, y=India.Confirmed, color = 'Green')

plt.xlabel('No. of Days', fontsize = 20)
plt.ylabel('No. of Recovered', fontsize = 20)
```

```
Text(0, 0.5, 'No. of Recovered')
```



Model Building

```
# Intalling prophet
!pip install prophet

'''
Prophet is a time series forecasting tool developed by Facebook that’s designed to be easy to use and effective for a wide range
of time series data. It’s particularly useful for data that has strong seasonal effects (like daily or weekly patterns) and includes
important dates or events that can impact the forecast.
'''
```

```
Requirement already satisfied: prophet in /usr/local/lib/python3.10/dist-packages (1.1.6)
Requirement already satisfied: cmdstanpy>=1.0.4 in /usr/local/lib/python3.10/dist-packages (from prophet) (1.2.4)
Requirement already satisfied: numpy>=1.15.4 in /usr/local/lib/python3.10/dist-packages (from prophet) (1.26.4)
Requirement already satisfied: matplotlib>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from prophet) (3.8.0)
Requirement already satisfied: pandas>=1.0.4 in /usr/local/lib/python3.10/dist-packages (from prophet) (2.2.2)
Requirement already satisfied: holidays<1,>=0.25 in /usr/local/lib/python3.10/dist-packages (from prophet) (0.61)
Requirement already satisfied: tqdm>=4.36.1 in /usr/local/lib/python3.10/dist-packages (from prophet) (4.66.6)
Requirement already satisfied: importlib-resources in /usr/local/lib/python3.10/dist-packages (from prophet) (6.4.5)
Requirement already satisfied: stanio<2.0.0,>=0.4.0 in /usr/local/lib/python3.10/dist-packages (from cmdstanpy>=1.0.4->prophet) (0.5.1)
Requirement already satisfied: python-dateutil in /usr/local/lib/python3.10/dist-packages (from holidays<1,>=0.25->prophet) (2.8.2)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (1.3.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (4.55.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (1.4.7)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (24.2)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (11.0.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=2.0.0->prophet) (3.2.0)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.4->prophet) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.0.4->prophet) (2024.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil->holidays<1,>=0.25->prophet) (1
'\nProphet is a time series forecasting tool developed by Facebook that’s designed to be easy to use and effective for a wide range\nof
time series data. It’s particularly useful for data that has strong seasonal effects (like daily or weekly patterns) and includes\nimpo
```

```
# Reading dataset
df1 = pd.read_csv('/content/Covid_19_Clean_Complete.csv', parse_dates=['Date'])
df1.head()
```

	Province/State	Country/Region	Lat	Long	Date	Confirmed	Deaths	Recovered	Active	WHO Region
0	NaN	Afghanistan	33.93911	67.709953	2020-01-22	0	0	0	0	Eastern Mediterranean
1	NaN	Albania	41.15330	20.168300	2020-01-22	0	0	0	0	Europe
2	NaN	Algeria	28.03390	1.659600	2020-01-22	0	0	0	0	Africa
3	NaN	Andorra	42.50630	1.521800	2020-01-22	0	0	0	0	Europe
4	NaN	Angola	-11.20270	17.873900	2020-01-22	0	0	0	0	Africa

```
# Checking info of dataset
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 49068 entries, 0 to 49067
Data columns (total 10 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   Province/State  14664 non-null  object
 1   Country/Region  49068 non-null  object
 2   Lat             49068 non-null  float64
 3   Long            49068 non-null  float64
 4   Date            49068 non-null  datetime64[ns]
 5   Confirmed       49068 non-null  int64
 6   Deaths          49068 non-null  int64
 7   Recovered       49068 non-null  int64
 8   Active          49068 non-null  int64
 9   WHO Region      49068 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(4), object(3)
memory usage: 3.7+ MB
```

```
# creating new dataset of Confirmed cases
confirmed = df1.groupby(by='Date').sum()['Confirmed'].reset_index()
confirmed.head()
```

	Date	Confirmed
0	2020-01-22	555
1	2020-01-23	654
2	2020-01-24	941
3	2020-01-25	1434
4	2020-01-26	2118

```
# creating new dataset of Deaths cases
deaths = df1.groupby(by='Date').sum()['Deaths'].reset_index()
```

```
deaths.head()
```

	Date	Deaths
0	2020-01-22	17
1	2020-01-23	18
2	2020-01-24	26
3	2020-01-25	42
4	2020-01-26	56

```
# creating new dataset of Recovered cases
recovered = df1.groupby(by='Date').sum()['Recovered'].reset_index()
recovered.head()
```

	Date	Recovered
0	2020-01-22	28
1	2020-01-23	30
2	2020-01-24	36
3	2020-01-25	39
4	2020-01-26	52

```
# creating new dataset of Active cases
active = df1.groupby(by='Date').sum()['Active'].reset_index()
active.head()
```

	Date	Active
0	2020-01-22	510
1	2020-01-23	606
2	2020-01-24	879
3	2020-01-25	1353
4	2020-01-26	2010

Forecasting for confirmed cases

```
# renaming confirmed columns to ds and y
confirmed.columns = ['ds','y']
confirmed.head()
```

	ds	y
0	2020-01-22	555
1	2020-01-23	654
2	2020-01-24	941
3	2020-01-25	1434
4	2020-01-26	2118

```
# importing prophet library
from prophet import Prophet
m = Prophet()
```

```
m.fit(confirmed)
```

```
INFO:prophet:Disabling yearly seasonality. Run prophet with yearly_seasonality=True to override this.
INFO:prophet:Disabling daily seasonality. Run prophet with daily_seasonality=True to override this.
DEBUG:cmdstanpy:input tempfile: /tmp/tmp5uod_idu/g_p2amud.json
DEBUG:cmdstanpy:input tempfile: /tmp/tmp5uod_idu/x0hry4rs.json
DEBUG:cmdstanpy:idx 0
DEBUG:cmdstanpy:running CmdStan, num_threads: None
```

```
DEBUG:cmdstanpy:CmdStan args: ['/usr/local/lib/python3.10/dist-packages/prophet/stan_model/prophet_model.bin', 'random', 'seed=78668', '
16:08:03 - cmdstanpy - INFO - Chain [1] start processing
INFO:cmdstanpy:Chain [1] start processing
16:08:03 - cmdstanpy - INFO - Chain [1] done processing
INFO:cmdstanpy:Chain [1] done processing
<prophet.forecaster.Prophet at 0x7a91cb77d5a0>
```

```
# Making prediction for next 7 month
future = m.make_future_dataframe(periods=7)
forecast = m.predict(future)
forecast
```

	ds	trend	yhat_lower	yhat_upper	trend_lower	trend_upper	additive_terms	additive_terms_lower	additive_terms_u
0	2020-01-22	-9.613281e+03	-1.291137e+05	7.751383e+04	-9.613281e+03	-9.613281e+03	-11063.561776	-11063.561776	-11063.56
1	2020-01-23	-6.933404e+03	-1.060978e+05	9.618306e+04	-6.933404e+03	-6.933404e+03	-1117.543336	-1117.543336	-1117.54
2	2020-01-24	-4.253528e+03	-9.896994e+04	1.072612e+05	-4.253528e+03	-4.253528e+03	10080.982351	10080.982351	10080.98
3	2020-01-25	-1.573651e+03	-9.840211e+04	1.201960e+05	-1.573651e+03	-1.573651e+03	13750.330594	13750.330594	13750.33
4	2020-01-26	1.106226e+03	-9.549676e+04	1.069908e+05	1.106226e+03	1.106226e+03	7298.794381	7298.794381	7298.79
...	...	...	...	...	...	...	...	...	
190	2020-07-30	1.674503e+07	1.663434e+07	1.685129e+07	1.674037e+07	1.675039e+07	-1117.543336	-1117.543336	-1117.54
191	2020-07-31	1.694902e+07	1.685030e+07	1.706723e+07	1.693922e+07	1.696041e+07	10080.982351	10080.982351	10080.98
192	2020-08-01	1.715301e+07	1.705761e+07	1.727635e+07	1.713554e+07	1.717243e+07	13750.330594	13750.330594	13750.33
193	2020-08-02	1.735700e+07	1.724805e+07	1.747144e+07	1.732827e+07	1.738756e+07	7298.794381	7298.794381	7298.79
194	2020-08-03	1.756099e+07	1.745125e+07	1.767775e+07	1.752322e+07	1.760358e+07	-2102.756726	-2102.756726	-2102.75

195 rows × 16 columns

Columns in the Output

ds:

The timestamps for which predictions are made (from the input DataFrame or future DataFrame).

yhat:

The predicted value (forecasted output) for the corresponding date in ds.

yhat_lower and yhat_upper:

The lower and upper bounds of the uncertainty interval for the forecast. These values are derived from the model's uncertainty settings and provide a confidence interval.

trend:

The estimated trend component of the forecast, capturing long-term movement.

trend_lower and trend_upper:

The lower and upper bounds for the uncertainty interval of the trend component.

seasonal:

The aggregated seasonal component of the forecast (sum of all seasonalities like daily, weekly, yearly).

seasonal_lower and seasonal_upper:

The uncertainty intervals for the aggregated seasonal component.

seasonal_X (e.g., seasonal_weekly, seasonal_yearly, etc.):

These columns correspond to specific seasonal components if multiple seasonalities were specified during model setup.

additive_terms:

The sum of all additive components (e.g., trend, seasonal, extra regressors if applicable).

additive_terms_lower and additive_terms_upper:

Uncertainty intervals for the additive terms.

multiplicative_terms (if applicable):

The sum of all multiplicative components, used when the model is set to multiplicative seasonality.

multiplicative_terms_lower and multiplicative_terms_upper:

Uncertainty intervals for the multiplicative terms.

How to Use the Output

Forecast Plotting:

Use ds and yhat to plot the main forecast, while yhat_lower and yhat_upper are used for confidence intervals.

Component Analysis:

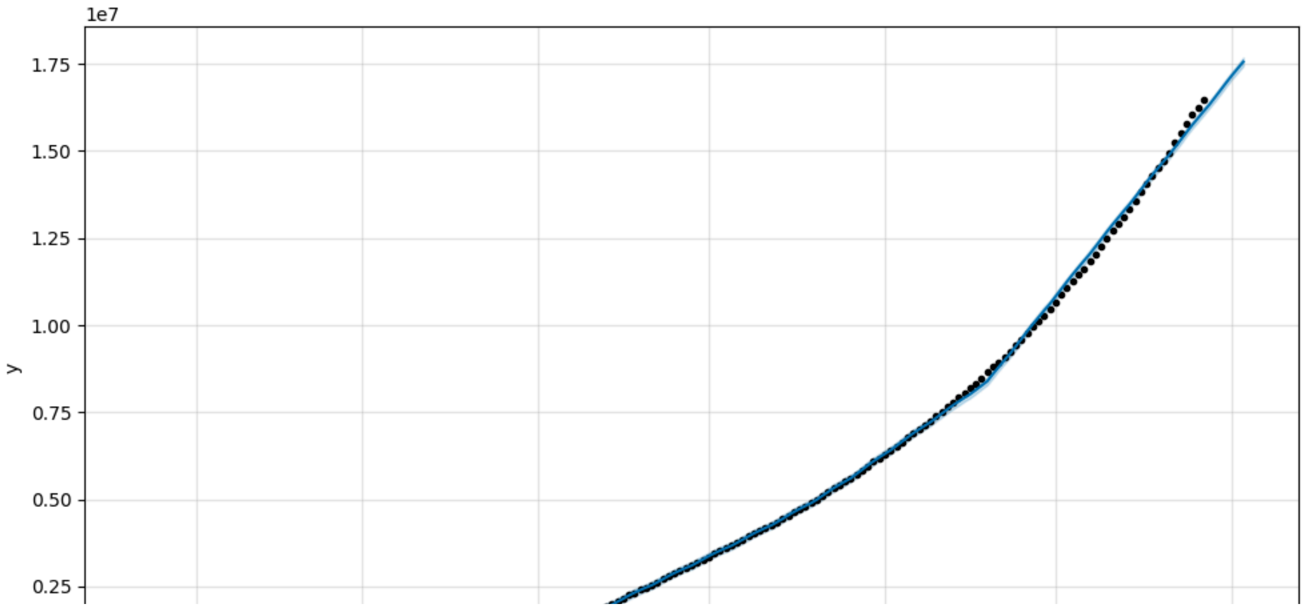
Analyze the contributions of trend, seasonal, and other components (e.g., extra regressors) to the forecast.

```
Start coding or generate with AI.
```

```
forecast[['ds','yhat','yhat_upper','yhat_lower']]
'''
ds:
This column contains the dates for which the predictions have been made. It stands for "date stamp."

yhat:
This is the predicted value (forecast) for the given date in the ds column. It represents the model's best estimate for that point in time.

yhat_upper:
This column represents the upper bound of the predicted value, which indicates the higher end of the confidence interval.
It suggests that the actual value is unlikely to exceed this amount, giving you an idea of the prediction's uncertainty.

yhat_lower:
This column represents the lower bound of the predicted value, indicating the lower end of the confidence interval. It suggests that the act
'''
```

```
             ds          yhat    yhat_upper    yhat_lower
  0  2020-01-22 -2.067684e+04  8.287702e+04 -1.230623e+05
  1  2020-01-23 -8.050948e+03  1.024932e+05 -1.159612e+05
  2  2020-01-24  5.827455e+03  1.146562e+05 -9.819989e+04
  3  2020-01-25  1.217668e+04  1.157340e+05 -8.517287e+04
  4  2020-01-26  8.405020e+03  1.117541e+05 -1.087521e+05
...         ...           ...           ...           ...
190  2020-07-30  1.674391e+07  1.684926e+07  1.663597e+07
191  2020-07-31  1.695910e+07  1.707203e+07  1.685463e+07
192  2020-08-01  1.716676e+07  1.727758e+07  1.706229e+07
193  2020-08-02  1.736430e+07  1.747985e+07  1.724670e+07
194  2020-08-03  1.755889e+07  1.767938e+07  1.744374e+07

195 rows × 4 columns
```

```
# Visualizing
m.plot(forecast)
plt.show()
```



```
# Importing plotly library
import plotly
import plotly.express as px
```

```
world = df1.groupby(by='Country/Region')[['Confirmed','Active','Deaths','Recovered']].sum().reset_index()
world
```

	Country/Region	Confirmed	Active	Deaths	Recovered
0	Afghanistan	1936390	1089052	49098	798240
1	Albania	196702	72117	5708	118877
2	Algeria	1179755	345886	77972	755897
3	Andorra	94404	19907	5423	69074
4	Angola	22662	15011	1078	6573
...	...	...	...	...	...
182	West Bank and Gaza	233461	170967	1370	61124
183	Western Sahara	901	190	63	648
184	Yemen	67180	25694	17707	23779
185	Zambia	129421	43167	2643	83611
186	Zimbabwe	50794	37706	881	12207

187 rows × 5 columns

```
# visualizing using plotly library
figure = px.choropleth(world,locations='Country/Region',
```