Import Libraries

In [83]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

Load Dataset

In [84]:
```
cv_dataset=pd.read_csv('/content/corona_virus.csv' , encoding="ISO-8859-1")
print(cv_dataset.head())
```

```
  Country,Other   Total Cases New Cases Total Deaths  New Deaths  \
0           USA  10,66,27,427       NaN    11,59,824         NaN
1         India   4,49,39,515       NaN     5,31,508         NaN
2        France   3,99,80,570       NaN     1,66,556         NaN
3       Germany   3,84,03,667       NaN     1,73,044         NaN
4        Brazil   3,74,49,418       NaN     7,01,494         NaN

  Total Recovered New Recovered Active Cases Serious,Critical  \
0    10,45,49,551           NaN     9,18,052            1,368
1     4,43,56,693           NaN       51,314              NaN
2     3,96,77,000           NaN     1,37,014              869
3     3,81,92,900           600       37,723              NaN
4     3,62,49,161           NaN     4,98,763              NaN

  Tot Cases/1M pop Deaths/1M pop     Total Tests Tests/1M pop      Population
0         3,18,476         3,464  1,17,68,34,935    35,14,983    33,48,05,269
1           31,948           378    92,64,96,579     6,58,663  1,40,66,31,776
2         6,09,604         2,540    27,14,90,188    41,39,547     6,55,84,518
3         4,57,821         2,063    12,23,32,384    14,58,359     8,38,83,596
4         1,73,897         3,257     6,37,76,166     2,96,146    21,53,53,593
```

In [85]:
```
# shape
cv_dataset.shape
```

Out[85]: (232, 14)

Data Preprocessing - EDA

In [86]:
```
# identify the null values columns name
cv_dataset.isna().sum()
```

Out[86]:
```
Country,Other         0
Total Cases           0
New Cases           227
Total Deaths          6
New Deaths          230
Total Recovered      21
New Recovered       220
Active Cases         19
Serious,Critical    105
Tot Cases/1M pop      2
Deaths/1M pop         8
Total Tests          19
Tests/1M pop         19
Population            3
dtype: int64
```

In [87]:
```
cv_dataset.head()
```

Out[87]:

	Country,Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	New Recovered	Active Cases	Serious,Critical	Tot Cases/1M pop	Deaths/1M pop	Total Tests	Tests/1M pop	Population
0	USA	10,66,27,427	NaN	11,59,824	NaN	10,45,49,551	NaN	9,18,052	1,368	3,18,476	3,464	1,17,68,34,935	35,14,983	33,48,05,269
1	India	4,49,39,515	NaN	5,31,508	NaN	4,43,56,693	NaN	51,314	NaN	31,948	378	92,64,96,579	6,58,663	1,40,66,31,776
2	France	3,99,80,570	NaN	1,66,556	NaN	3,96,77,000	NaN	1,37,014	869	6,09,604	2,540	27,14,90,188	41,39,547	6,55,84,518
3	Germany	3,84,03,667	NaN	1,73,044	NaN	3,81,92,900	600	37,723	NaN	4,57,821	2,063	12,23,32,384	14,58,359	8,38,83,596
4	Brazil	3,74,49,418	NaN	7,01,494	NaN	3,62,49,161	NaN	4,98,763	NaN	1,73,897	3,257	6,37,76,166	2,96,146	21,53,53,593

In [88]:
```
cv_dataset.columns
```

Out[88]:
```
Index(['Country,Other', 'Total Cases', 'New Cases', 'Total Deaths',
       'New Deaths', 'Total Recovered', 'New Recovered', 'Active Cases',
       'Serious,Critical', 'Tot Cases/1M pop', 'Deaths/1M pop', 'Total Tests',
       'Tests/1M pop', 'Population'],
      dtype='object')
```

Split the Columns

In [89]:
```
cv_dataset=cv_dataset.replace(to_replace =',', value = '', regex = True)
cv_dataset['Total Cases']=cv_dataset['Total Cases'].astype(np.float)
cv_dataset['Total Deaths']=cv_dataset['Total Deaths'].astype(np.float)
cv_dataset['Total Recovered']=cv_dataset['Total Recovered'].astype(np.float)
cv_dataset['Active Cases']=cv_dataset['Active Cases'].astype(np.float)
cv_dataset['Serious,Critical']=cv_dataset['Serious,Critical'].astype(np.float)
# cv_dataset['Tot Cases/1M pop']=cv_dataset['Tot Cases/1M pop'].astype(np.float)
cv_dataset['Deaths/1M pop']=cv_dataset['Deaths/1M pop'].astype(np.float)
cv_dataset['Total Tests']=cv_dataset['Total Tests'].astype(np.float)
cv_dataset['Tests/1M pop']=cv_dataset['Tests/1M pop'].astype(np.float)
cv_dataset['Population']=cv_dataset['Population'].astype(np.float)
```

```
<ipython-input-89-34eaec324b9a>:2: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Total Cases']=cv_dataset['Total Cases'].astype(np.float)
<ipython-input-89-34eaec324b9a>:3: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Total Deaths']=cv_dataset['Total Deaths'].astype(np.float)
<ipython-input-89-34eaec324b9a>:4: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Total Recovered']=cv_dataset['Total Recovered'].astype(np.float)
<ipython-input-89-34eaec324b9a>:5: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Active Cases']=cv_dataset['Active Cases'].astype(np.float)
<ipython-input-89-34eaec324b9a>:6: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Serious,Critical']=cv_dataset['Serious,Critical'].astype(np.float)
<ipython-input-89-34eaec324b9a>:8: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Deaths/1M pop']=cv_dataset['Deaths/1M pop'].astype(np.float)
<ipython-input-89-34eaec324b9a>:9: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Total Tests']=cv_dataset['Total Tests'].astype(np.float)
<ipython-input-89-34eaec324b9a>:10: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify a
ny behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Tests/1M pop']=cv_dataset['Tests/1M pop'].astype(np.float)
<ipython-input-89-34eaec324b9a>:11: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify a
ny behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['Population']=cv_dataset['Population'].astype(np.float)
```

In [90]:
```
# replace the null values with '0'
cv_dataset=cv_dataset.fillna(0)
```

In [91]:
```
# rename the columns name
cv_dataset=cv_dataset.rename(columns={'Country,Other' : 'Country_name', 'Total Cases' : 'Total_Case', 'New Cases' : 'New_Cases', 'Total Deaths' : 'Total_Deaths','New Deaths' : 'New Deaths',
print(cv_dataset)
```

```
       Country_name   Total_Case New_Cases  Total_Deaths  New Deaths  \
0               USA  106627427.0         0     1159824.0         0.0
1             India   44939515.0         0      531508.0         0.0
2            France   39980570.0         0      166556.0         0.0
3           Germany   38403667.0         0      173044.0         0.0
4            Brazil   37449418.0         0      701494.0         0.0
..              ...          ...       ...           ...         ...
227    Vatican City         29.0         0           0.0         0.0
228  Western Sahara         10.0         0           1.0         0.0
229      MS Zaandam          9.0         0           2.0         0.0
230         Tokelau          5.0         0           0.0         0.0
231          Total:  687021745.0     14511     6863517.0         3.0

     Total_Recovered New Recovered  Active_Cases  Critical_Cases  \
0        104549551.0             0      918052.0          1368.0
1         44356693.0             0       51314.0             0.0
2         39677000.0             0      137014.0           869.0
3         38192900.0           600       37723.0             0.0
4         36249161.0             0      498763.0             0.0
..               ...           ...           ...             ...
227             29.0             0           0.0             0.0
228              9.0             0           0.0             0.0
229              7.0             0           0.0             0.0
230              0.0             0           5.0             0.0
231      659552126.0         20724    20606102.0         39292.0

    Tot Cases/1M pop  Deaths pop  Totals_Deaths  Tests_pop    Population
0             318476      3464.0   1.176835e+09  3514983.0  3.348053e+08
1              31948       378.0   9.264966e+08   658663.0  1.406632e+09
2             609604      2540.0   2.714902e+08  4139547.0  6.558452e+07
3             457821      2063.0   1.223324e+08  1458359.0  8.388360e+07
4             173897      3257.0   6.377617e+07   296146.0  2.153536e+08
..               ...         ...            ...        ...           ...
227            36295         0.0   0.000000e+00        0.0  7.990000e+02
228               16         2.0   0.000000e+00        0.0  6.261610e+05
229                0         0.0   0.000000e+00        0.0  0.000000e+00
230             3628         0.0   0.000000e+00        0.0  1.378000e+03
231         88138.50       880.5   0.000000e+00        0.0  0.000000e+00

[232 rows x 14 columns]
```

Visulization

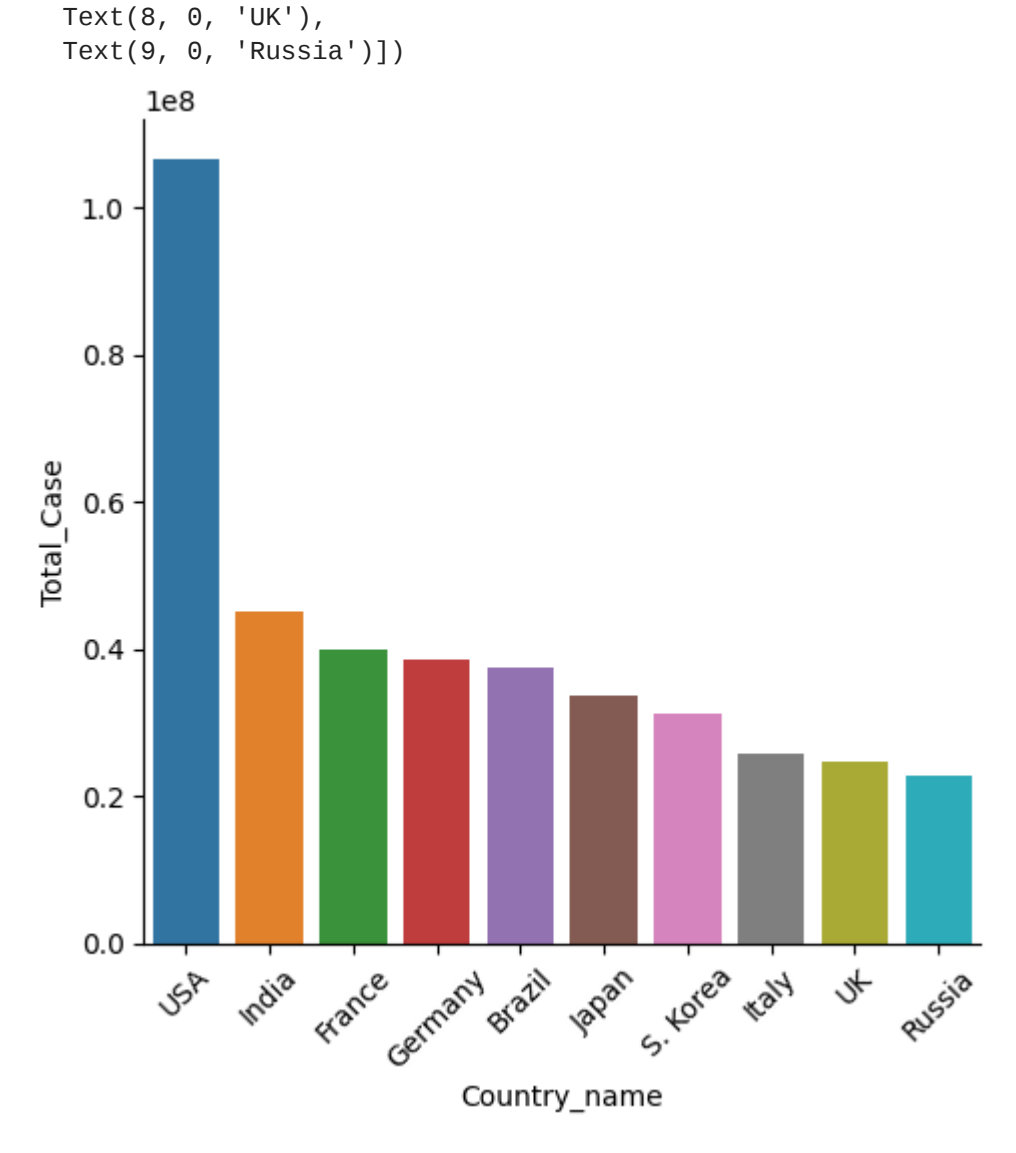
EDA- Apply Top 10 Records

In [92]:
```
cv_dataset=cv_dataset.iloc[:231 , :]
```

Total Case

In [93]:
```
cv_dataset_total_case_top_values=cv_dataset.sort_values('Total_Case' , ascending=False).head(10)
sns.catplot(data=cv_dataset_total_case_top_values , x='Country_name' , y='Total_Case' , kind='bar')
plt.xticks(rotation = 45)
```

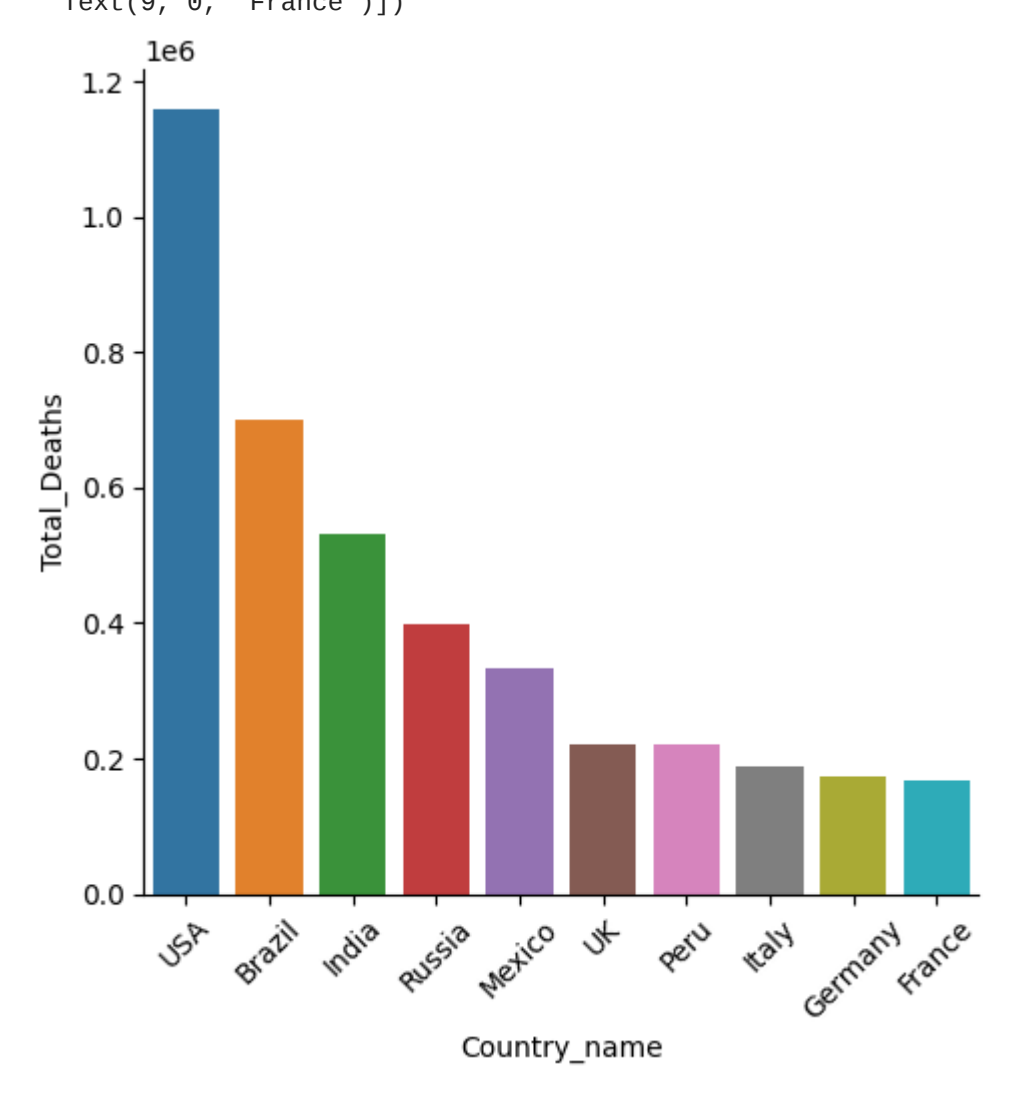
Out[93]:
```
(array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9]),
 [Text(0, 0, 'USA'),
  Text(1, 0, 'India'),
  Text(2, 0, 'France'),
  Text(3, 0, 'Germany'),
  Text(4, 0, 'Brazil'),
  Text(5, 0, 'Japan'),
  Text(6, 0, 'S. Korea'),
  Text(7, 0, 'Italy'),
  Text(8, 0, 'UK'),
  Text(9, 0, 'Russia')])
```



In [94]:
```
cv_dataset_total_top_values=cv_dataset.sort_values('Total_Deaths' , ascending=False).head(10)

sns.catplot(data=cv_dataset_total_top_values , x='Country_name' , y='Total_Deaths' , kind='bar')
plt.xticks(rotation = 45)
```

Out[94]:
```
(array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9]),
 [Text(0, 0, 'USA'),
  Text(1, 0, 'Brazil'),
  Text(2, 0, 'India'),
  Text(3, 0, 'Russia'),
  Text(4, 0, 'Mexico'),
  Text(5, 0, 'UK'),
  Text(6, 0, 'Peru'),
  Text(7, 0, 'Italy'),
  Text(8, 0, 'Germany'),
  Text(9, 0, 'France')])
```

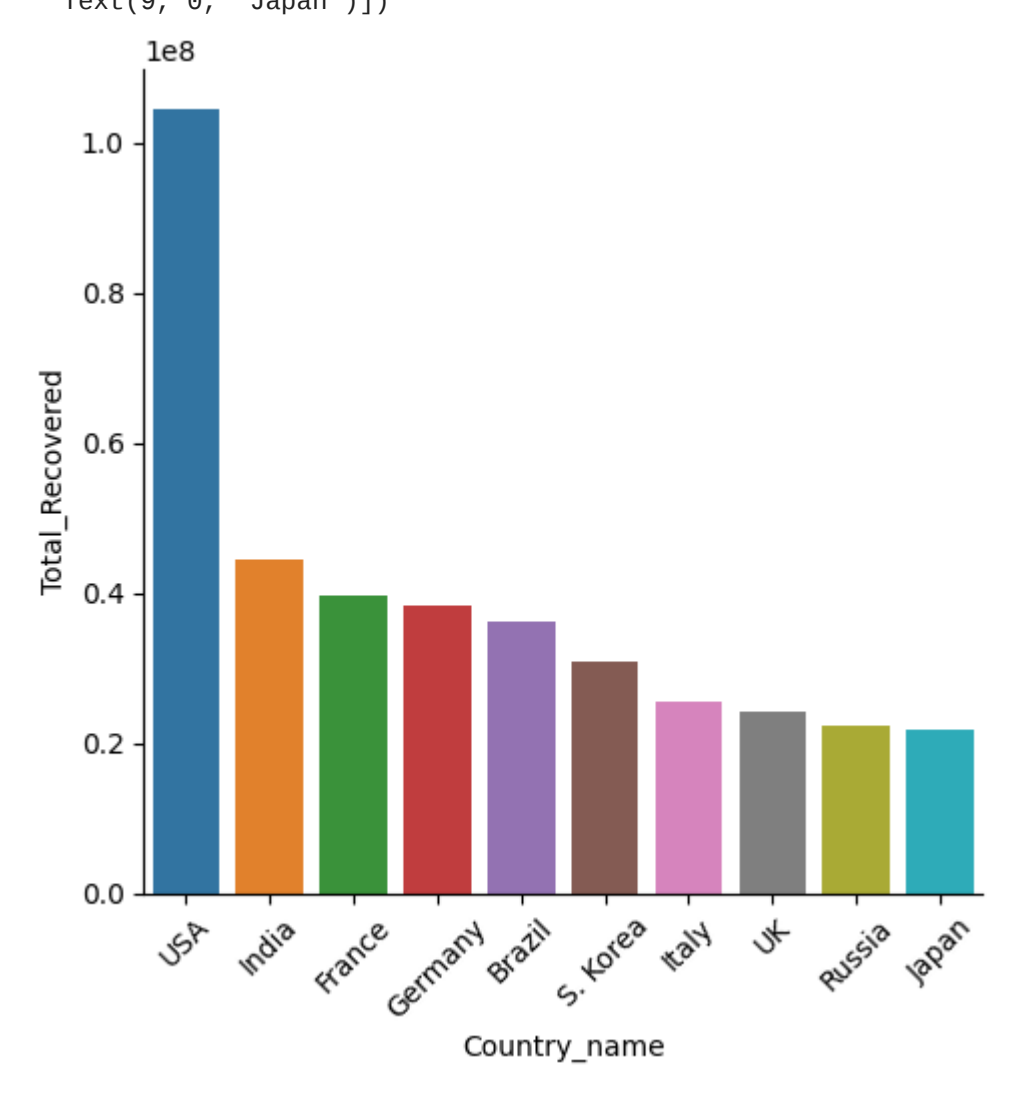


Total_Recovered

In [95]:
```
cv_dataset_total_top_values=cv_dataset.sort_values('Total_Recovered' , ascending=False).head(10)

sns.catplot(data=cv_dataset_total_top_values , x='Country_name' , y='Total_Recovered' , kind='bar')
plt.xticks(rotation = 45)
```

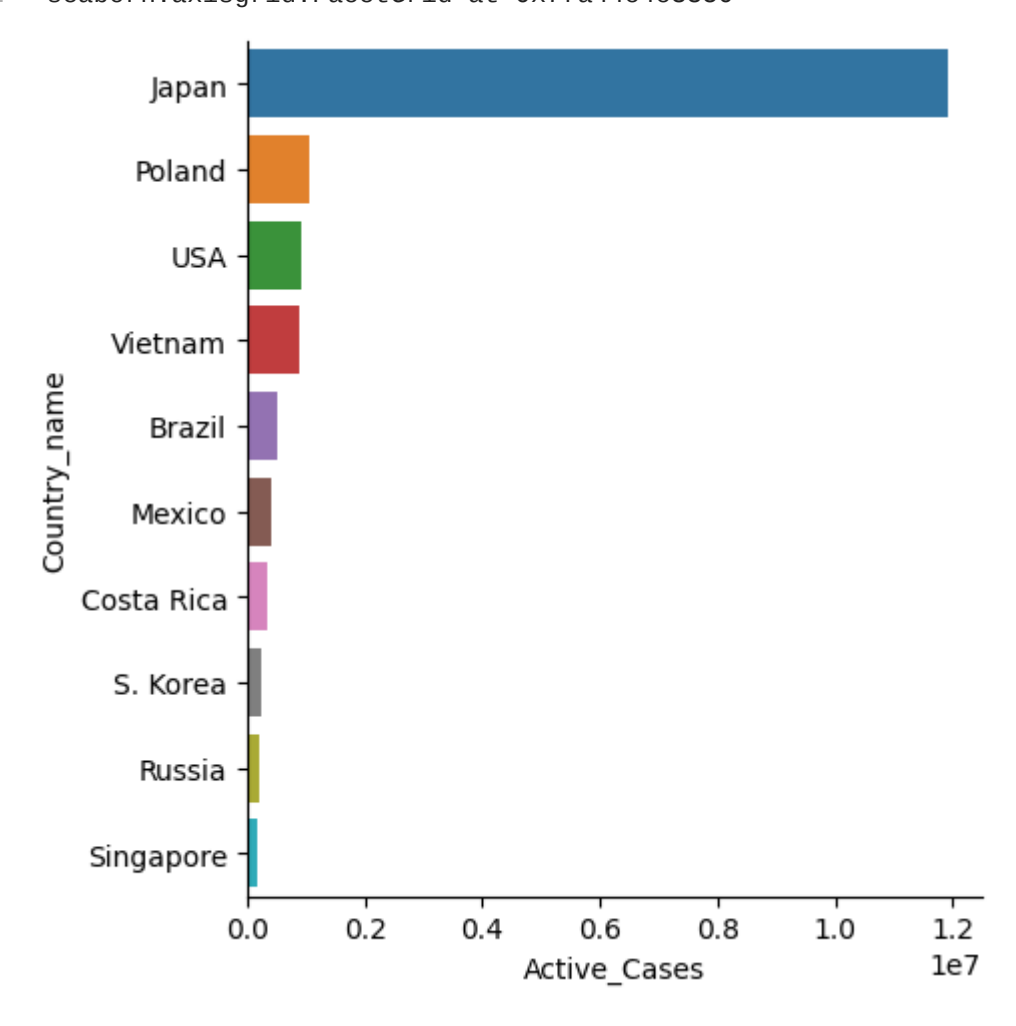
Out[95]:
```
(array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9]),
 [Text(0, 0, 'USA'),
  Text(1, 0, 'India'),
  Text(2, 0, 'France'),
  Text(3, 0, 'Germany'),
  Text(4, 0, 'Brazil'),
  Text(5, 0, 'S. Korea'),
  Text(6, 0, 'Italy'),
  Text(7, 0, 'UK'),
  Text(8, 0, 'Russia'),
  Text(9, 0, 'Japan')])
```



Active_Cases

In [96]:
```
cv_dataset_total_case=cv_dataset.sort_values('Active_Cases' , ascending=False).head(10)
sns.catplot(data=cv_dataset_total_case , x='Active_Cases' , y='Country_name' ,kind='bar')
```

Out[96]: <seaborn.axisgrid.FacetGrid at 0x7fa44c4c3850>

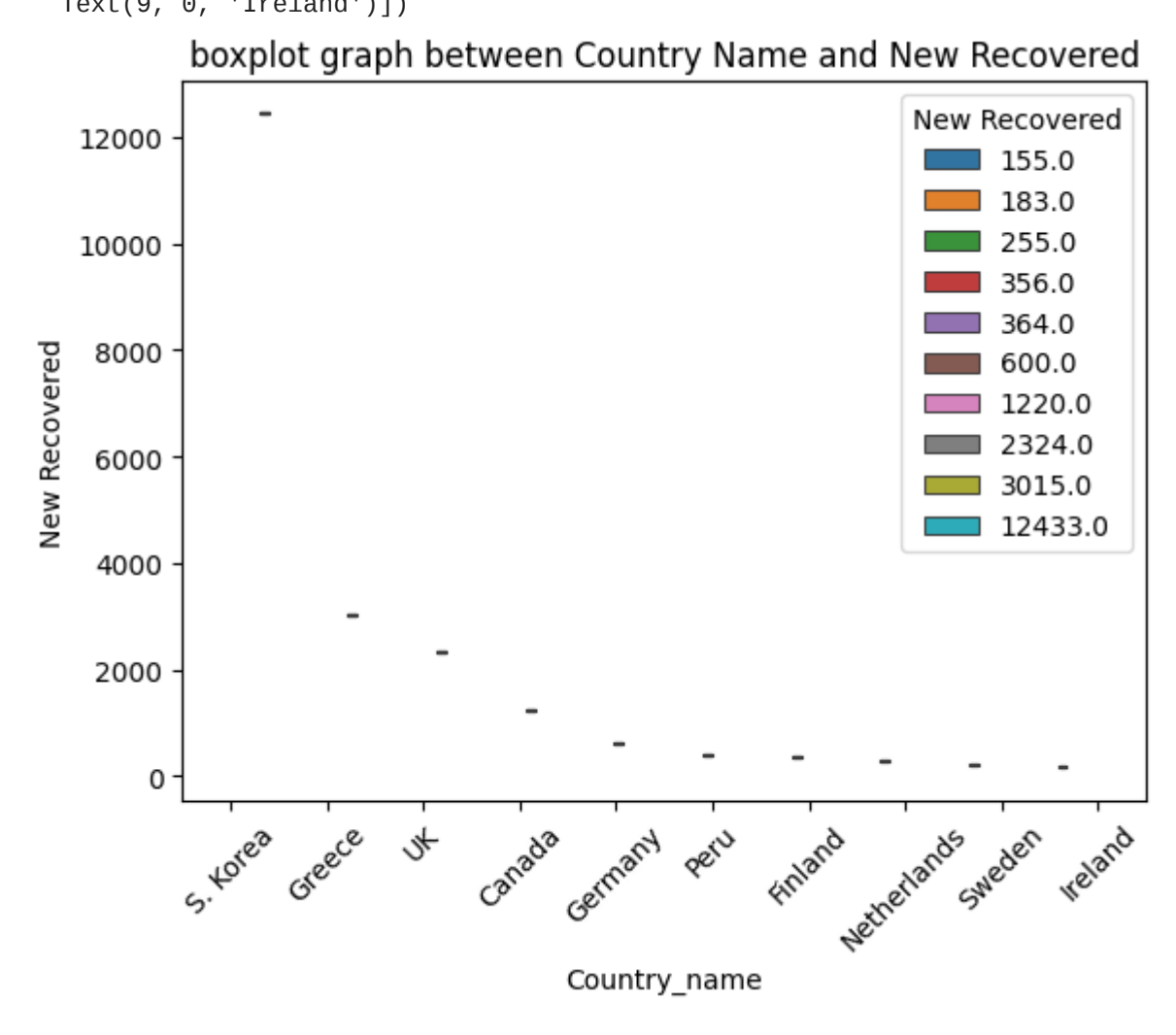


In [97]:
```
cv_dataset['New Recovered']=cv_dataset['New Recovered'].astype(np.float)
```

```
<ipython-input-97-8918137a4f3c>:1: DeprecationWarning: `np.float` is a deprecated alias for the builtin `float`. To silence this warning, use `float` by itself. Doing this will not modify an
y behavior and is safe. If you specifically wanted the numpy scalar type, use `np.float64` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  cv_dataset['New Recovered']=cv_dataset['New Recovered'].astype(np.float)
```

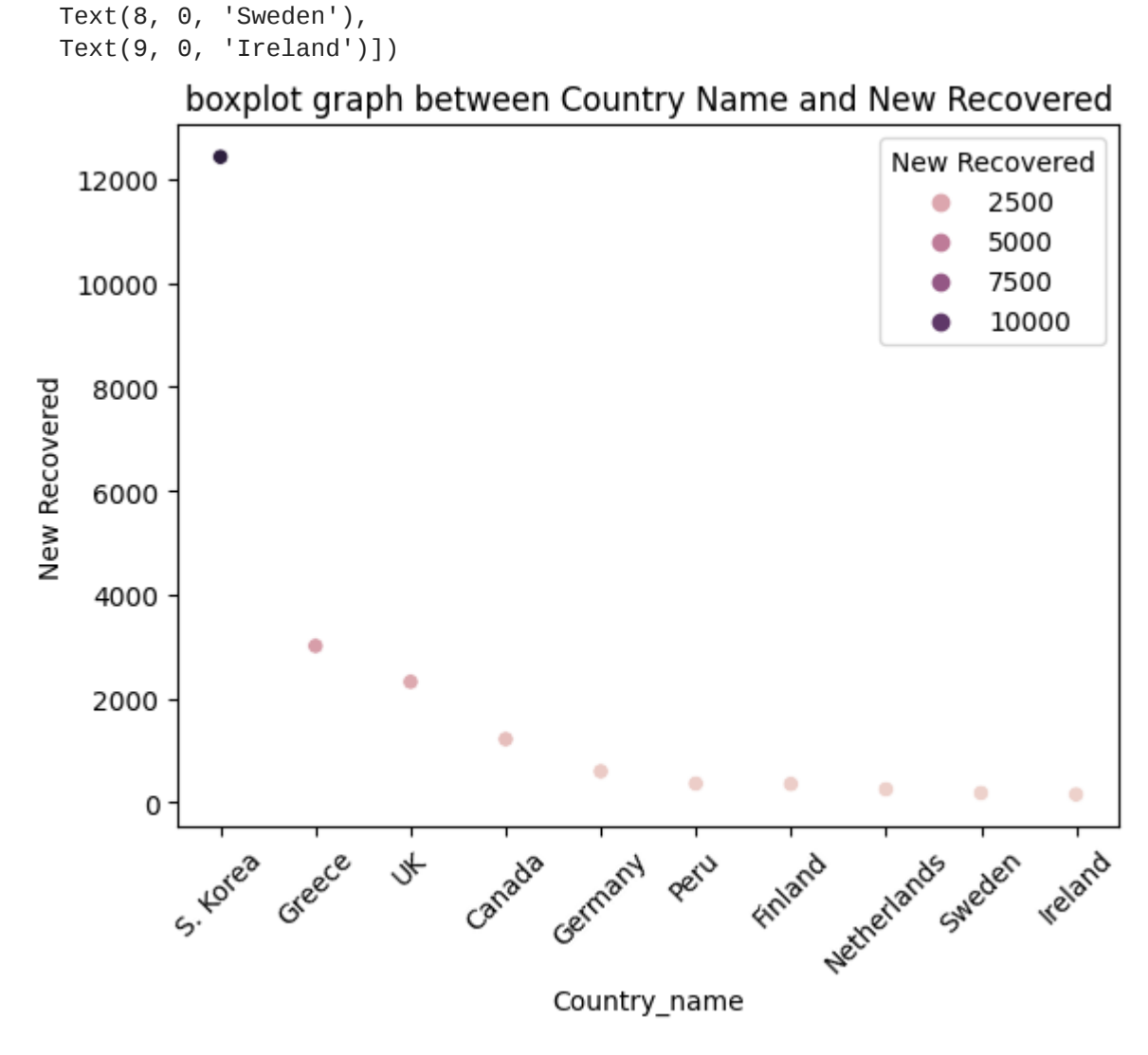
In [98]:
```
cv_dataset_reco=cv_dataset.sort_values('New Recovered' , ascending=False).head(10)
sns.boxplot(x='Country_name' , y='New Recovered', data=cv_dataset_reco , hue='New Recovered')
plt.title('boxplot graph between Country Name and New Recovered')
plt.xticks(rotation=45)
```

Out[98]:
```
(array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9]),
 [Text(0, 0, 'S. Korea'),
  Text(1, 0, 'Greece'),
  Text(2, 0, 'UK'),
  Text(3, 0, 'Canada'),
  Text(4, 0, 'Germany'),
  Text(5, 0, 'Peru'),
  Text(6, 0, 'Finland'),
  Text(7, 0, 'Netherlands'),
  Text(8, 0, 'Sweden'),
  Text(9, 0, 'Ireland')])
```



In [99]:
```
cv_dataset_reco=cv_dataset.sort_values('New Recovered' , ascending=False).head(10)
sns.scatterplot(x='Country_name' , y='New Recovered', data=cv_dataset_reco , hue='New Recovered')
plt.title('boxplot graph between Country Name and New Recovered')
plt.xticks(rotation=45)
```

Out[99]:
```
([0, 1, 2, 3, 4, 5, 6, 7, 8, 9],
 [Text(0, 0, 'S. Korea'),
  Text(1, 0, 'Greece'),
  Text(2, 0, 'UK'),
  Text(3, 0, 'Canada'),
  Text(4, 0, 'Germany'),
  Text(5, 0, 'Peru'),
  Text(6, 0, 'Finland'),
  Text(7, 0, 'Netherlands'),
  Text(8, 0, 'Sweden'),
  Text(9, 0, 'Ireland')])
```



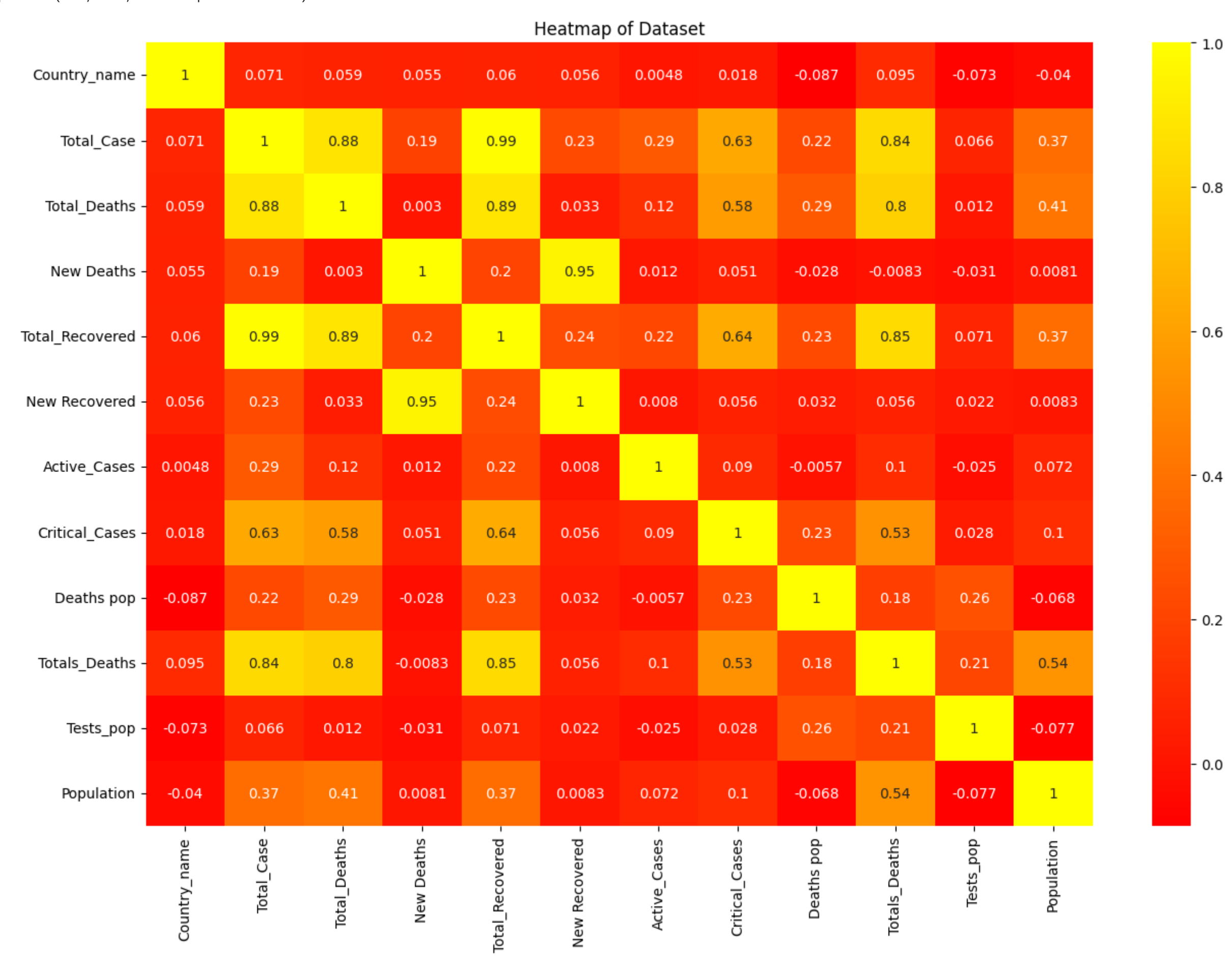
Label Encoding

In [100…
```
from sklearn import preprocessing
le=preprocessing.LabelEncoder()
cv_dataset['Country_name']=le.fit_transform(cv_dataset['Country_name'])
```

In [101…
```
plt.figure(figsize=(15,10))
sns.heatmap(cv_dataset.corr() , cmap='autumn' , annot=True)
plt.title('Heatmap of Dataset')
```

```
<ipython-input-101-1606434fd5e3>:2: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns
or specify the value of numeric_only to silence this warning.
  sns.heatmap(cv_dataset.corr() , cmap='autumn' , annot=True)
```

Out[101]: Text(0.5, 1.0, 'Heatmap of Dataset')



Feature Engineering

In [102…
```
cv_dataset.columns
```

Out[102]:
```
Index(['Country_name', 'Total_Case', 'New_Cases', 'Total_Deaths', 'New Deaths',
       'Total_Recovered', 'New Recovered', 'Active_Cases', 'Critical_Cases',
       'Tot Cases/1M pop', 'Deaths pop', 'Totals_Deaths', 'Tests_pop',
       'Population'],
      dtype='object')
```

In [103…
```
cv_dataset=cv_dataset.apply(lambda x: pd.to_numeric(x, errors='coerce'))
```

In [104…
```
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
scaled_data = scaler.fit_transform(cv_dataset)
scaled_df = pd.DataFrame(scaled_data,
                         columns=cv_dataset.columns)
scaled_df.head()
```

Out[104]:

	Country_name	Total_Case	New_Cases	Total_Deaths	New Deaths	Total_Recovered	New Recovered	Active_Cases	Critical_Cases	Tot Cases/1M pop	Deaths pop	Totals_Deaths	Tests_pop	Population
0	0.943478	1.000000	0.0	1.000000	0.0	1.000000	0.000000	0.077139	1.000000	0.451006	0.530069	1.000000	0.150844	0.231144
1	0.408696	0.421463	0.0	0.458266	0.0	0.424265	0.000000	0.004312	0.000000	0.045243	0.057842	0.787278	0.028266	0.971115
2	0.313043	0.374956	0.0	0.143605	0.0	0.379504	0.000000	0.011513	0.635234	0.863283	0.388676	0.230695	0.177647	0.045278

3	0.339130	0.360167	0.0	0.149198	0.0	0.365309	0.048259	0.003170	0.000000	0.648338	0.315685	0.103950	0.062585	0.057912
4	0.113043	0.351217	0.0	0.604828	0.0	0.346718	0.000000	0.041909	0.000000	0.246262	0.498393	0.054193	0.012709	0.148676