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COVID-19 CASES ANALYSIS

DATA ANALYTICS WITH COGNOS:GROUP2

PHASE:3

This phase involves designing of the steps that define in each phase of the previous documentation this involves importing necessary functions, data processing and so on. In this phase we have to begin our project by loading and preprocessing the dataset.

The IBM suggests using the jupyter notebook for loading and preprocess the dataset:

Here for this project title we need to define the loading of the libraries, understand the data and visualize the missing values.

For this certain inputs are defined for this project.in this phase each of the input lines of the project is given as follows:

phase3

October 17, 2023

Welcome to Covid19 Data Analysis Notebook

Let's Import the modules

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
print('Modules are imported.')
```

```
Modules are imported.
```

Task 2

Task 2.1: importing covid19 dataset

importing "Covid19_Confirmed_dataset.csv" from "./Dataset" folder.

```
corona_dataset_csv =
pd.read_csv('Covid19_Confirmed_dataset.csv')
corona_dataset_csv.head(10)
#We will notice data is from 22 January 2020 to 30 April 2020
```



```
 Province/State Country/Region Lat Long \ 0 NaN Afghanistan 33.0000
65.0000  1 NaN Albania 41.1533 20.1683  2 NaN Algeria 28.0339 1.6596  3
NaN Andorra 42.5063 1.5218  4 NaN Angola -11.2027 17.8739  5 NaN Antigua
and Barbuda 17.0608 -61.7964  6 NaN Argentina -38.4161 -63.6167  7 NaN
Armenia 40.0691 45.0382  8 Australian Capital Territory Australia
-35.4735 149.0124  9 New South Wales Australia -33.8688 151.2093

 1/22/20 1/23/20 1/24/20 1/25/20 1/26/20 1/27/20 ... 4/21/20 \ 0 0 0 0
0 0 0 ... 1092  1 0 0 0 0 0 0 ... 609  2 0 0 0 0 0 0 ... 2811  3 0 0 0
0 0 0 ... 717  4 0 0 0 0 0 0 ... 24  5 0 0 0 0 0 0 ... 23  6 0 0 0 0 0
0 ... 3031  7 0 0 0 0 0 0 ... 1401  8 0 0 0 0 0 0 ... 104  9 0 0 0 0 3
4 ... 2969
```



```
 4/22/20 4/23/20 4/24/20 4/25/20 4/26/20 4/27/20 4/28/20 4/29/20 \ 0 1176
1279 1351 1463 1531 1703 1828 1939  1 634 663 678 712 726 736 750 766  2
2910 3007 3127 3256 3382 3517 3649 3848  3 723 723 731 738 738 743 743 743
4 25 25 25 25 26 27 27 27  5 24 24 24 24 24 24 24 24  6 3144 3435 3607 3780
3892 4003 4127 4285  7 1473 1523 1596 1677 1746 1808 1867 1932  8 104 104
105 106 106 106 106 106  9 2971 2976 2982 2994 3002 3004 3016 3016

 4/30/20
0 2171
1 773
2 4006
```

```
3 745
4 27
5 24
6 4428
7 2066
8 106
9 3025

[10 rows x 104 columns]
```

Let's check the shape of the dataframe

```
corona_dataset_csv.shape #Tuple with 266 rows and 104 columns
```

```
(266, 104)
```

```
columns = corona_dataset_csv.columns
columns
```

```
Index(['Province/State', 'Country/Region', 'Lat', 'Long', '1/22/20',
'1/23/20',  '1/24/20', '1/25/20', '1/26/20', '1/27/20',
 ...
 '4/21/20', '4/22/20', '4/23/20', '4/24/20', '4/25/20', '4/26/20',
'4/27/20', '4/28/20', '4/29/20', '4/30/20'],
 dtype='object', length=104)
```

Task 2.2: Delete the useless columns

```
#Latitude and Longitude are not important features for us
here corona_dataset_csv.drop(["Lat",
"Long"],
                             axis=1,
 #default value, annotation axis=0 which is equal to rows inplace = True #will
                             change the corona dataset too
 )
```



```
corona_dataset_csv.head(10)
```

```
 Province/State Country/Region 1/22/20 1/23/20 \ 0 NaN Afghanistan 0 0
1 NaN Albania 0 0  2 NaN Algeria 0 0  3 NaN Andorra 0 0  4 NaN Angola 0
0  5 NaN Antigua and Barbuda 0 0  6 NaN Argentina 0 0  7 NaN Armenia 0 0
8 Australian Capital Territory Australia 0 0  9 New South Wales
Australia 0 0

 1/24/20 1/25/20 1/26/20 1/27/20 1/28/20 1/29/20 ... 4/21/20 \ 0 0 0 0
0 0 0 ... 1092  1 0 0 0 0 0 0 ... 609  2 0 0 0 0 0 0 ... 2811  3 0 0 0
0 0 0 ... 717  4 0 0 0 0 0 0 ... 24  5 0 0 0 0 0 0 ... 23  6 0 0 0 0 0
0 ... 3031  7 0 0 0 0 0 0 ... 1401  8 0 0 0 0 0 0 ... 104  9 0 0 3 4 4
4 ... 2969

 4/22/20 4/23/20 4/24/20 4/25/20 4/26/20 4/27/20 4/28/20 4/29/20 \ 0 1176
1279 1351 1463 1531 1703 1828 1939  1 634 663 678 712 726 736 750 766  2
2910 3007 3127 3256 3382 3517 3649 3848  3 723 723 731 738 738 743 743 743
4 25 25 25 25 26 27 27 27  5 24 24 24 24 24 24 24 24  6 3144 3435 3607 3780
```

```
3892 4003 4127 4285  7 1473 1523 1596 1677 1746 1808 1867 1932  8 104 104
105 106 106 106 106 106  9 2971 2976 2982 2994 3002 3004 3016 3016
```

```
 4/30/20
0 2171
1 773
2 4006
3 745
4 27
5 24
6 4428
7 2066
8 106
9 3025
```



```
[10 rows x 102 columns]
```

Task 2.3: Aggregating the rows by the country

```
corona_dataset_aggregated = corona_dataset_csv.groupby("Country/Region").sum()

corona_dataset_aggregated.head()
#After aggregation, the index of the df is the column at which we aggregated
```

```
 1/22/20 1/23/20 1/24/20 1/25/20 1/26/20 1/27/20 1/28/20 \ Country/Region
Afghanistan 0 0 0 0 0 0 0  Albania 0 0 0 0 0 0 0  Algeria 0 0 0 0 0 0 0
Andorra 0 0 0 0 0 0 0  Angola 0 0 0 0 0 0 0
```



```
 1/29/20 1/30/20 1/31/20 ... 4/21/20 4/22/20 4/23/20 \ Country/Region ...
Afghanistan  0  0  0  ...  1092  1176  1279   Albania  0  0  0  ...  609  634  663
Algeria 0 0 0 ... 2811 2910 3007  Andorra 0 0 0 ... 717 723 723  Angola 0
0 0 ... 24 25 25

 4/24/20 4/25/20 4/26/20 4/27/20 4/28/20 4/29/20 4/30/20  Country/Region
Afghanistan 1351 1463 1531 1703 1828 1939 2171  Albania 678 712 726 736 750
766 773  Algeria 3127 3256 3382 3517 3649 3848 4006  Andorra 731 738 738 743
743 743 745  Angola 25 25 26 27 27 27 27

[5 rows x 100 columns]

corona_dataset_aggregated.shape
#we have 187 countries, 100 dates

(187, 100)
```

Task 2.4: Visualizing data related to a country for example China

visualization always helps for better understanding of our data.

```
corona_dataset_aggregated.loc["China"]
#will return pandas series

1/22/20 548
1/23/20 643
```

1/24/20 920
1/25/20 1406

1/26/20 2075
1/27/20 2877
1/28/20 5509
1/29/20 6087
1/30/20 8141
1/31/20 9802
2/1/20 11891
2/2/20 16630
2/3/20 19716
2/4/20 23707
2/5/20 27440
2/6/20 30587
2/7/20 34110
2/8/20 36814
2/9/20 39829
2/10/20 42354
2/11/20 44386
2/12/20 44759
2/13/20 59895
2/14/20 66358
2/15/20 68413
2/16/20 70513
2/17/20 72434
2/18/20 74211
2/19/20 74619
2/20/20 75077
...
4/1/20 82361
4/2/20 82432
4/3/20 82511
4/4/20 82543
4/5/20 82602
4/6/20 82665
4/7/20 82718
4/8/20 82809
4/9/20 82883
4/10/20 82941
4/11/20 83014
4/12/20 83134
4/13/20 83213
4/14/20 83306
4/15/20 83356
4/16/20 83403
4/17/20 83760
4/18/20 83787
4/19/20 83805
4/20/20 83817
4/21/20 83853

```
4/22/20    83868
4/23/20 83884
```



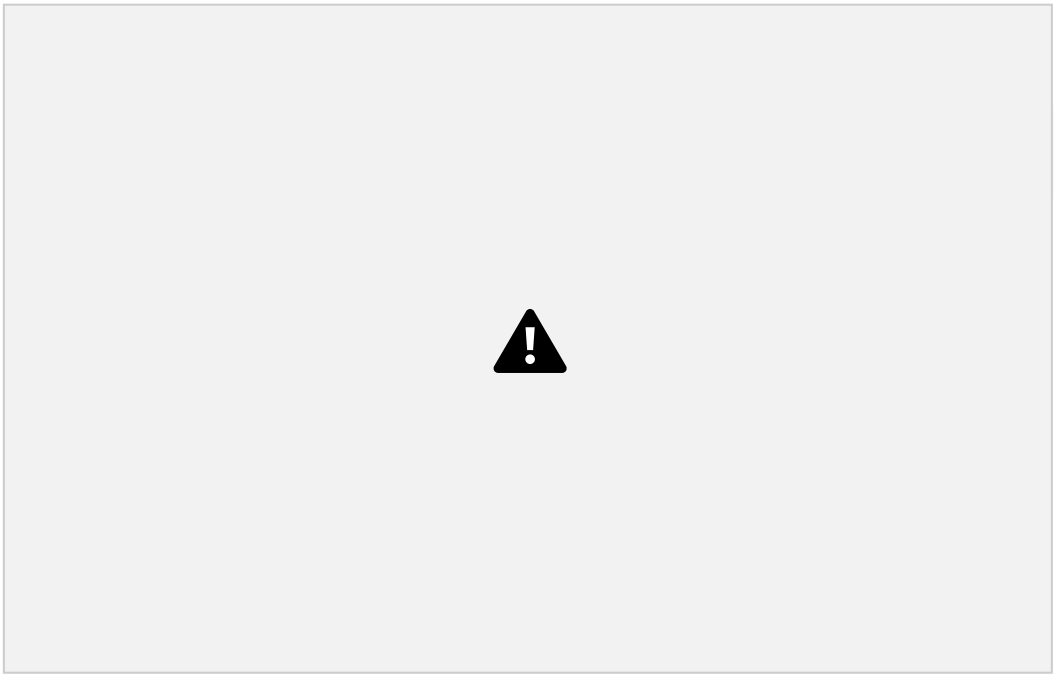
```
4/24/20 83899
4/25/20 83909
4/26/20 83912
4/27/20 83918
4/28/20 83940
4/29/20 83944
4/30/20 83956
Name: China, Length: 100, dtype: int64
```

Task3: Calculating a good measure

we need to find a good measure reperestend as a number, describing the spread of the virus in a country.

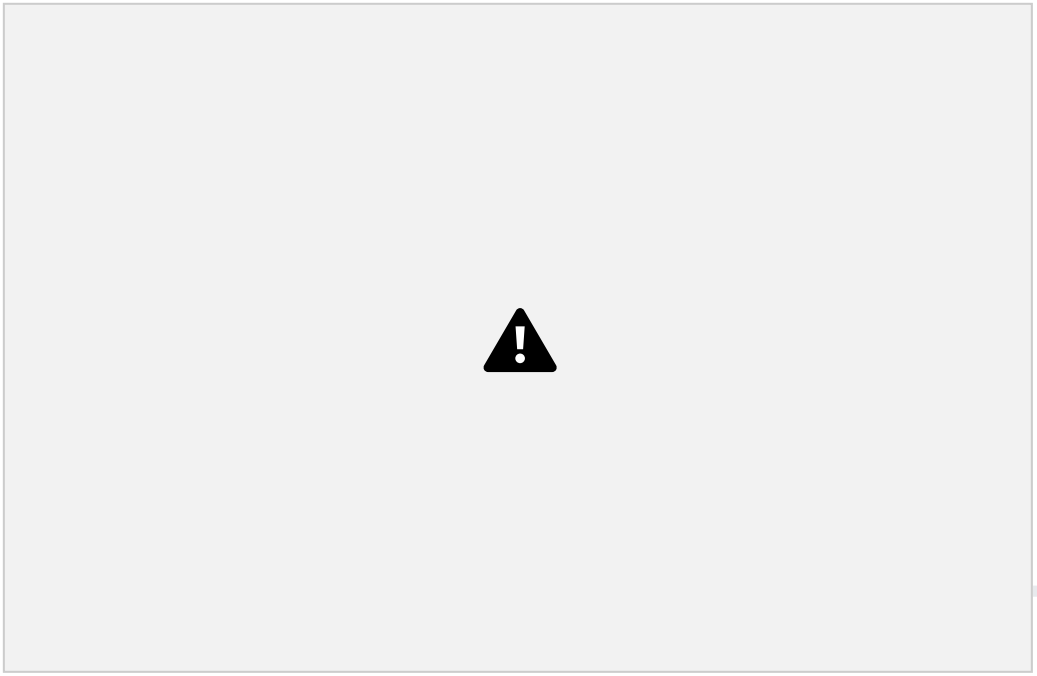
```
corona_dataset_aggregated.loc['China'].plot()
#will plot the values on different date
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4c9fc828>
```



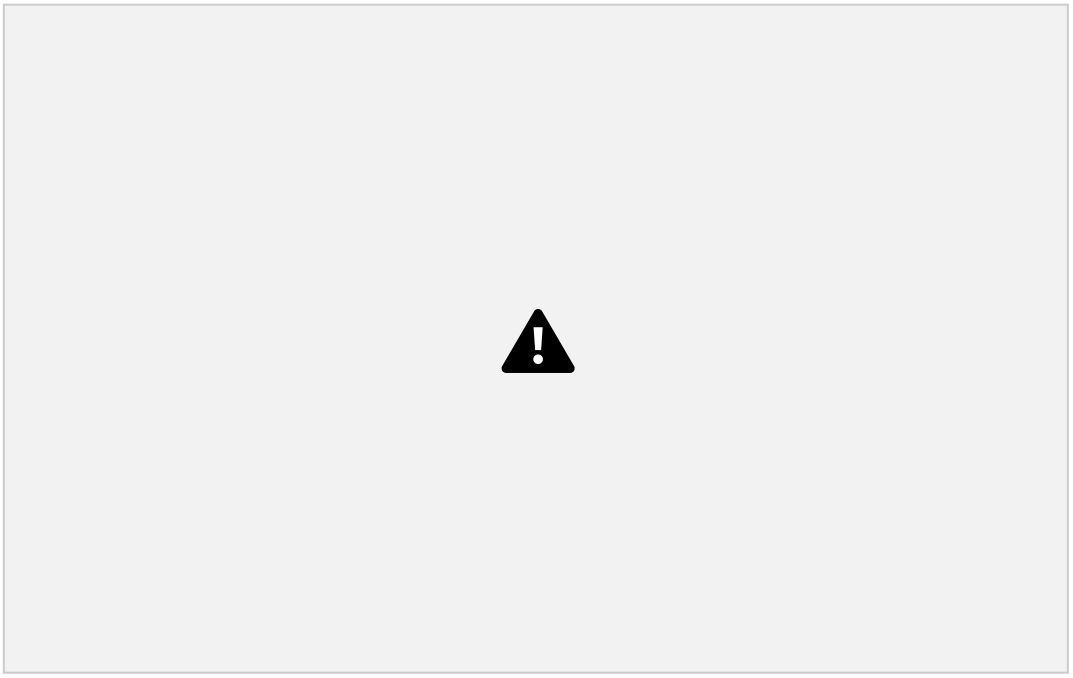

```
corona_dataset_aggregated.loc['Egypt'].plot()
plt.legend()
```

```
<matplotlib.legend.Legend at 0x20d4cd43ba8>
```




```
corona_dataset_aggregated.loc['China'].plot()
corona_dataset_aggregated.loc['Italy'].plot()
corona_dataset_aggregated.loc['Spain'].plot()
plt.legend()
```

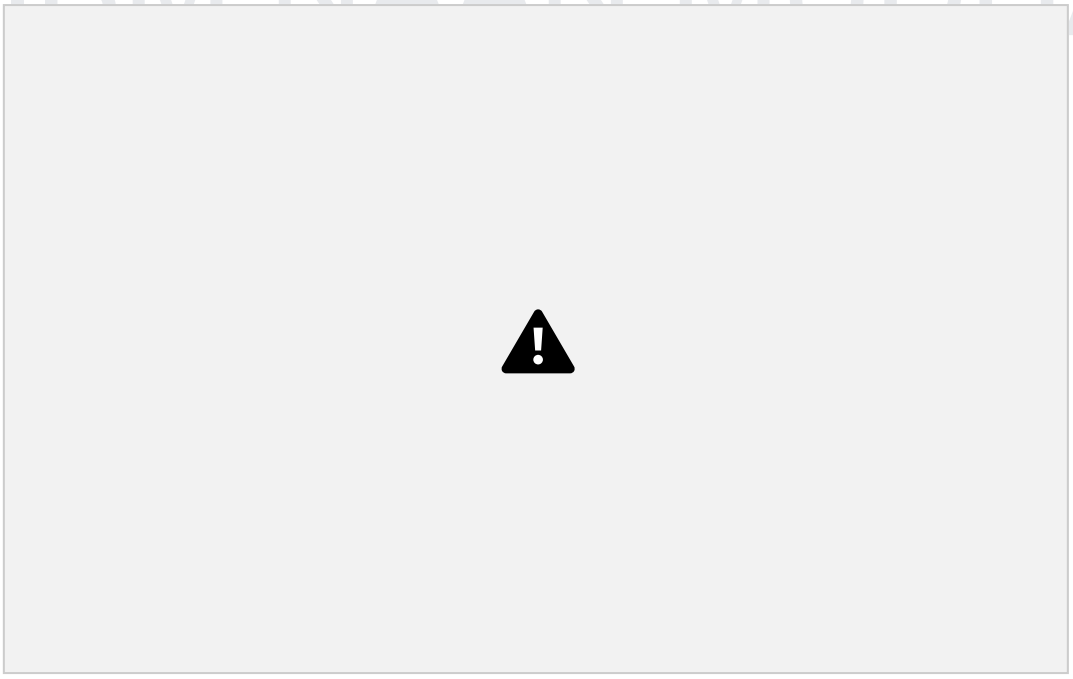
```
<matplotlib.legend.Legend at 0x20d4cd9fa58>
```



```
#Spread of the virus in China for the first 3 dates
only corona_dataset_aggregated.loc['China'][:3].plot()
```



```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4ce2fdd8>
```

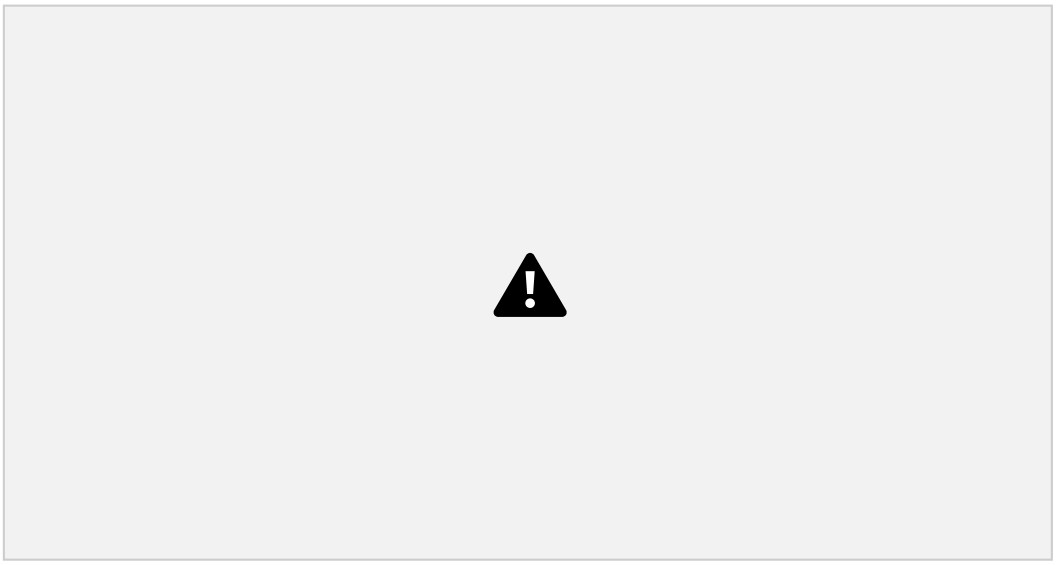
In the 1st 24 hrs, an increase in case (550 to 650) by 100
In the 2nd 24 hrs, an increase (650 to 900) by 250

We want to find a measure for new cases, so either say average or maximum number of new cases.

task 3.1: caculating the first derivative of the curve

```
corona_dataset_aggregated.loc["China"].diff().plot()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4ce9fda0>
```



This plot shows us the change in infection rate day by day and what we are looking for is the maximum number.

task 3.2: find maxmimum infection rate for China

```
corona_dataset_aggregated.loc["China"].diff().max()
#In only 24 hrs, the difference was 15136
```



```
15136.0
```

```
corona_dataset_aggregated.loc["Italy"].diff().max()
#In only 24 hrs, the difference was 6557
```

```
6557.0
```

```
corona_dataset_aggregated.loc["Spain"].diff().max()
#In only 24 hrs, the difference was 9630
```

```
9630.0
```

Task 3.3: find maximum infection rate for all of the countries.

```
countries = list(corona_dataset_aggregated.index)
max_infection_rates = []
for c in countries :
 max_infection_rates.append(corona_dataset_aggregated.loc[c].diff().max())
max_infection_rates
```

```
[232.0,
 34.0,
 199.0,
 43.0,
 5.0,
 6.0,
 291.0,
 134.0,
 497.0,
```

```
1321.0,
105.0,
7.0,
301.0,
641.0,
12.0,
1485.0,
2454.0,
4.0,
19.0,
1.0,
104.0,
92.0,
7.0,
7502.0,
26.0,
```



```
137.0,
41.0,
21.0,
6.0,
45.0,
31.0,
203.0,
2778.0
,
31.0,
21.0,
1138.0,
15136.0
,
353.0,
1.0,
57.0,
81.0,
37.0,
113.0,
96.0,
63.0,
58.0,
381.0,
391.0,
99.0,
156.0,
5.0,
371.0,
11536.0
,
269.0,
32.0,
130.0,
```

```
7.0,
134.0,
20.0,
9.0,
5.0,
267.0,
26849.0
, 38.0,
5.0,
42.0,
6933.0
,
403.0,
156.0,
6.0,
68.0,
167.0,
132.0,
12.0,
10.0,
```



```
3.0,
72.0,
210.0
,
99.0,
1893.0
,
436.0,
3186.0
,
91.0,
1515.0
,
1131.0
,
6557.0
,
52.0,
1161.0
,
40.0,
264.0
,
29.0,
851.0
,
289.0
,
300.0
,
```

```
69.0,
3.0,
48.0,
61.0,
17.0,
13.0,
21.0,
90.0,
234.0
,
7.0,
14.0,
10.0,
235.0
,
190.0
,
58.0,
52.0,
2.0,
41.0,
1425.0
,
222.0,
12.0,
13.0,
30.0,
281.0
,
19.0,
3.0,
14.0,
1346.0
,
89.0,
2.0,
69.0,
```



```
208.0,
107.0,
386.0,
144.0,
1292.0
,
357.0,
5.0,
27.0,
3683.0
,
538.0,
545.0,
```

1516.0
,
957.0,
523.0,
7099.0
,
22.0,
5.0,
6.0,
4.0,
54.0,
6.0,
1351.0
,
87.0,
2379.0
, 2.0,
20.0,
1426.0
,
114.0,
70.0,
73.0,
354.0,
28.0,
9630.0
,
65.0,
67.0,
3.0,
812.0,
1321.0
, 6.0,
27.0,
15.0,
181.0,
188.0,
10.0,
14.0,
40.0,
82.0,
5138.0,
36188.0
, 11.0,

578.0,
552.0,
8733.0,
48.0,
167.0,
29.0,

```
 19.0,
 66.0,
 4.0,
 5.0,
 9.0,
 8.0]

corona_dataset_aggregated["max_infection_rates"] =

max_infection_rates corona_dataset_aggregated.head()

 1/22/20 1/23/20 1/24/20 1/25/20 1/26/20 1/27/20 1/28/20 \ Country/Region
Afghanistan  0  0  0  0  0  0  0   Albania  0  0  0  0  0  0  0   Algeria  0  0  0  0  0  0  0
Andorra 0 0 0 0 0 0 0  Angola 0 0 0 0 0 0 0

 1/29/20 1/30/20 1/31/20 ... 4/22/20 4/23/20 4/24/20 \ Country/Region ...
Afghanistan  0  0  0  ...  1176  1279  1351   Albania  0  0  0  ...  634  663  678
Algeria 0 0 0 ... 2910 3007 3127  Andorra 0 0 0 ... 723 723 731  Angola 0
0 0 ... 25 25 25

 4/25/20 4/26/20 4/27/20 4/28/20 4/29/20 4/30/20 \ Country/Region
Afghanistan 1463 1531 1703 1828 1939 2171  Albania 712 726 736 750
766 773  Algeria 3256 3382 3517 3649 3848 4006  Andorra 738 738 743
743 743 745  Angola 25 26 27 27 27 27

 max_infection_rates
Country/Region
Afghanistan 232.0
Albania 34.0
Algeria 199.0
Andorra 43.0
Angola 5.0

[5 rows x 101 columns]
```


Task 3.4: create a new dataframe with only needed column

```
corona_data =

pd.DataFrame(corona_dataset_aggregated["max_infection_rates"])

corona_data.head()

 max_infection_rates
Country/Region
Afghanistan 232.0
Albania 34.0
Algeria 199.0
Andorra 43.0
Angola 5.0
```

Task4:

- Importing the WorldHappinessReport.csv dataset

- selecting needed columns for our analysis
- join the datasets
- calculate the correlations as the result of our analysis

Task 4.1 : importing the dataset

```
happiness_report_csv =

pd.read_csv("worldwide_happiness_report.csv")

happiness_report_csv.head()
```

```
 Overall rank Country or region Score GDP per capita Social support \ 0 1
Finland 7.769 1.340 1.587  1 2 Denmark 7.600 1.383 1.573  2 3 Norway 7.554
1.488 1.582  3 4 Iceland 7.494 1.380 1.624  4 5 Netherlands 7.488 1.396
1.522

 Healthy life expectancy Freedom to make life choices Generosity \ 0
0.986 0.596 0.153  1 0.996 0.592 0.252  2 1.028 0.603 0.271  3 1.026
0.591 0.354  4 0.999 0.557 0.322

 Perceptions of corruption
0 0.393
1 0.410
2 0.341
3 0.118
4 0.298
```


Task 4.2: let's drop the useless columns

```
useless_cols = ["Overall rank", "Score", "Generosity", "Perceptions of
corruption"]
```



```
happiness_report_csv.drop(useless_cols, axis=1,
inplace=True) happiness_report_csv.head()
```

```
 Country or region GDP per capita Social support Healthy life expectancy \ 0
Finland 1.340 1.587 0.986  1 Denmark 1.383 1.573 0.996  2 Norway 1.488 1.582
1.028  3 Iceland 1.380 1.624 1.026  4 Netherlands 1.396 1.522 0.999

 Freedom to make life choices
0 0.596
1 0.592
2 0.603
3 0.591
4 0.557
```

Task 4.3: changing the indices of the dataframe

```
happiness_report_csv.set_index("Country or region",

inplace=True) happiness_report_csv.head()

 GDP per capita Social support Healthy life expectancy \ Country or region
```

```
Finland 1.340 1.587 0.986  Denmark 1.383 1.573 0.996  Norway 1.488 1.582
1.028  Iceland 1.380 1.624 1.026  Netherlands 1.396 1.522 0.999

 Freedom to make life choices
Country or region
Finland 0.596
Denmark 0.592
Norway 0.603
Iceland 0.591
Netherlands 0.557
```

Task4.4: now let's join two dataset we have prepared

Corona Dataset :

```
corona_data.head()
```

```
 max_infection_rates
Country/Region
Afghanistan 232.0
Albania 34.0
Algeria 199.0
Andorra 43.0
Angola 5.0
```



```
corona_data.shape #Tuple with 187 countries
```

```
(187, 1)
```

wolrd happiness report Dataset :

```
happiness_report_csv.head()
```

```
 GDP per capita Social support Healthy life expectancy \ Country or region
Finland 1.340 1.587 0.986  Denmark 1.383 1.573 0.996  Norway 1.488 1.582
1.028  Iceland 1.380 1.624 1.026  Netherlands 1.396 1.522 0.999

 Freedom to make life choices
Country or region
Finland 0.596
Denmark 0.592
Norway 0.603
Iceland 0.591
Netherlands 0.557
```

```
happiness_report_csv.shape #156 countries, less than corona data
```

```
(156, 4)
```

```
#Inner join
data = corona_data.join(happiness_report_csv,
 how = "inner" #method/type of join
 )
data.head()
```

```
  max_infection_rates GDP per capita Social support \ Afghanistan
232.0 0.350 0.517  Albania 34.0 0.947 0.848  Algeria 199.0 1.002
1.160  Argentina 291.0 1.092 1.432  Armenia 134.0 0.850 1.055

 Healthy life expectancy Freedom to make life choices  Afghanistan
0.361 0.000  Albania 0.874 0.383  Algeria 0.785 0.086  Argentina
0.881 0.471  Armenia 0.815 0.283
```

Task 4.5: correlation matrix

```
data.corr()
```



```
 max_infection_rates GDP per capita \ max_infection_rates 1.000000
0.250118  GDP per capita 0.250118 1.000000  Social support 0.191958
0.759468  Healthy life expectancy 0.289263 0.863062  Freedom to
make life choices 0.078196 0.394603

 Social support Healthy life expectancy \ max_infection_rates 0.191958
0.289263  GDP per capita 0.759468 0.863062  Social support 1.000000
0.765286  Healthy life expectancy 0.765286 1.000000  Freedom to make
life choices 0.456246 0.427892

 Freedom to make life choices
max_infection_rates 0.078196
GDP per capita 0.394603
Social support 0.456246
Healthy life expectancy 0.427892
Freedom to make life choices 1.000000
```


There is +ve correlation between max_infection-rate and all other features

Task 5: Visualization of the results

our Analysis is not finished unless we visualize the results in terms figures and graphs so that everyone can understand what you get out of our analysis

```
data.head()
```

```
 max_infection_rates GDP per capita Social support \ Afghanistan
232.0 0.350 0.517  Albania 34.0 0.947 0.848  Algeria 199.0 1.002
1.160  Argentina 291.0 1.092 1.432  Armenia 134.0 0.850 1.055

 Healthy life expectancy Freedom to make life choices  Afghanistan
0.361 0.000  Albania 0.874 0.383  Algeria 0.785 0.086  Argentina
0.881 0.471  Armenia 0.815 0.283
```

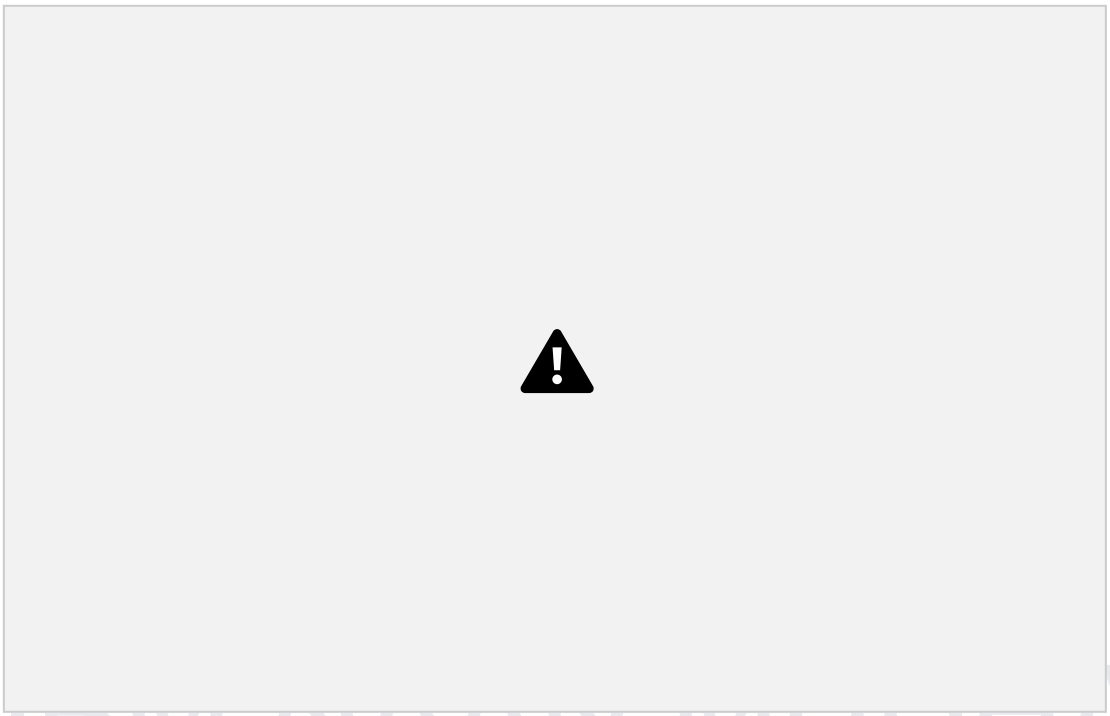
Task 5.1: Plotting GDP vs maximum Infection rate

```
x = data["GDP per capita"]
y = data["max_infection_rates"]
sns.scatterplot(x,y)
```

```
#We can see the values need different scaling
```



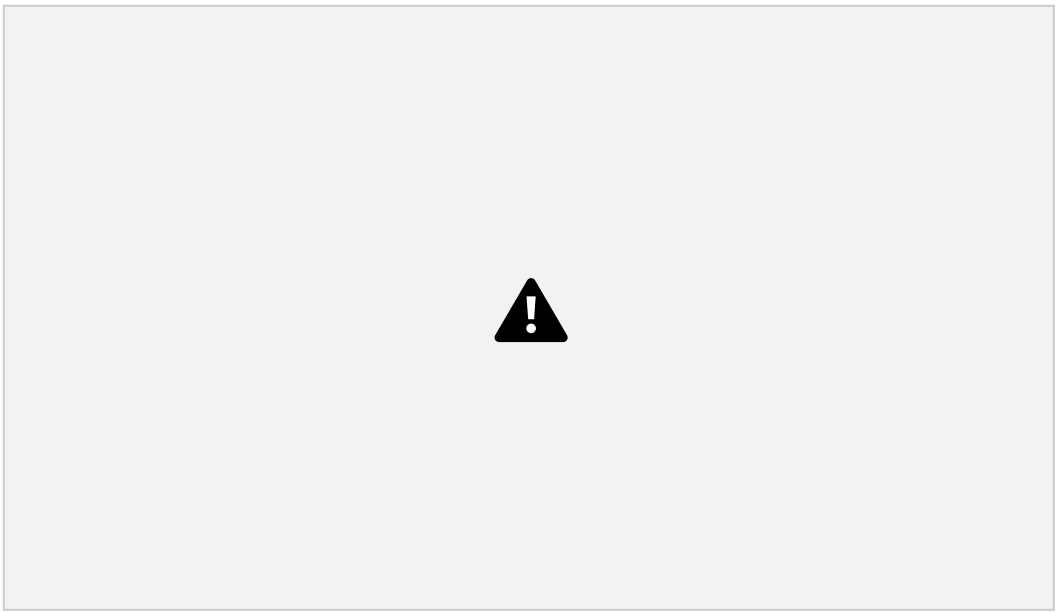
```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4cf22828>
```




```
#Will apply log scaling to y
x = data["GDP per capita"]
y = data["max_infection_rates"]
sns.scatterplot(x,np.log(y))

#Now we can see +ve correlation
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4cf8fd30>
```

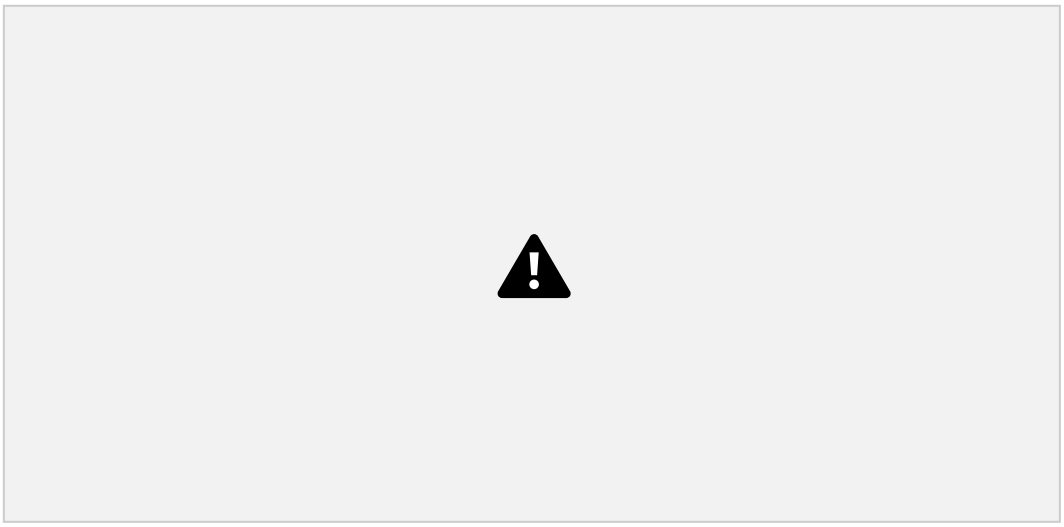


```
#RegPlot
x = data["GDP per capita"]
y = data["max_infection_rates"]

sns.regplot(x,np.log(y))

#Line fitted, +ve slope seen
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4cffcdd8>
```

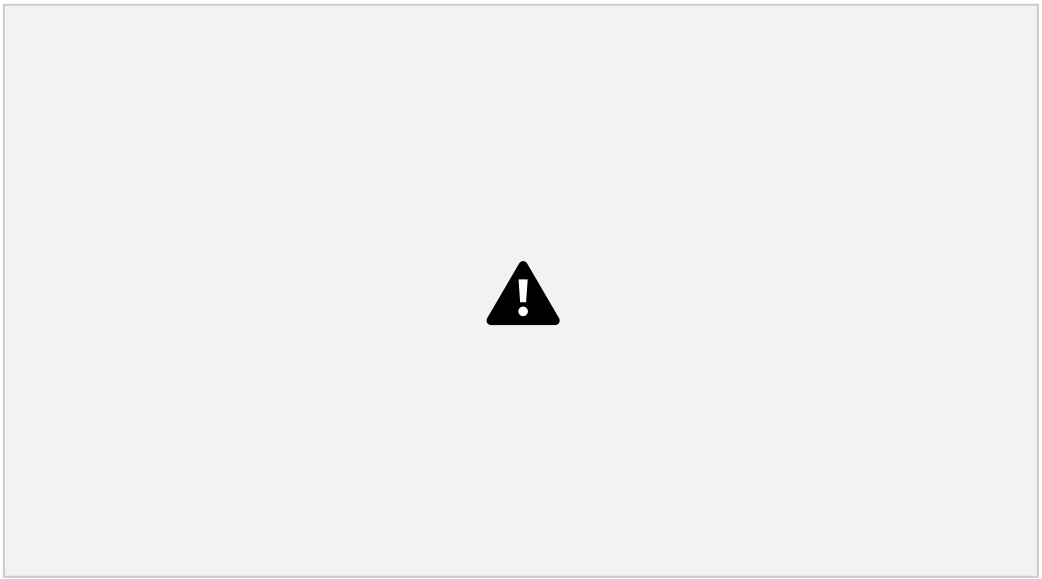


Task 5.2: Plotting Social support vs maximum Infection rate

```
x = data["Social support"]
y = data["max_infection_rates"]

sns.scatterplot(x,np.log(y))
```

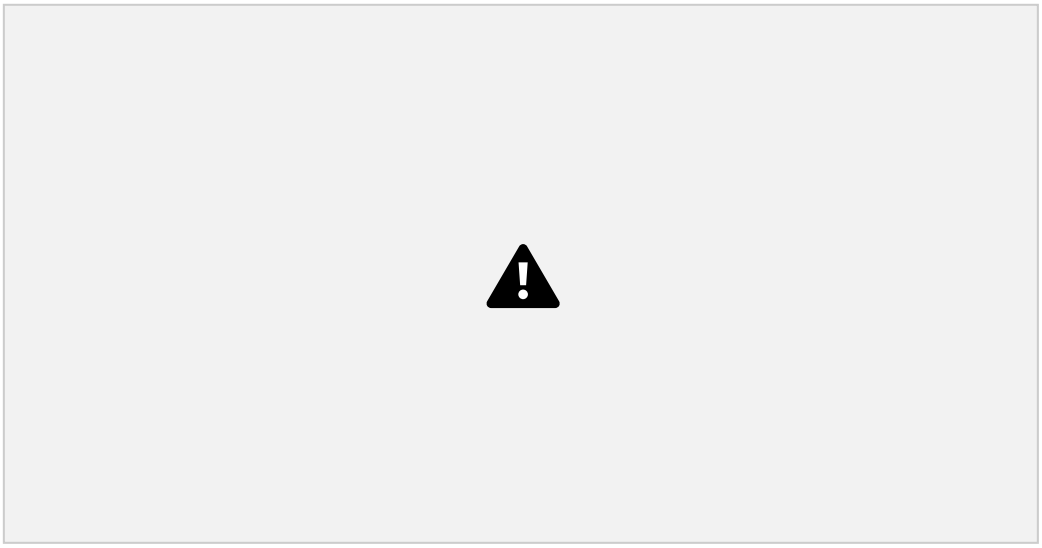
```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d0689b0>
```




```
x = data["Social support"]
y = data["max_infection_rates"]
```

```
sns.regplot(x,np.log(y))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d0c70b8>
```

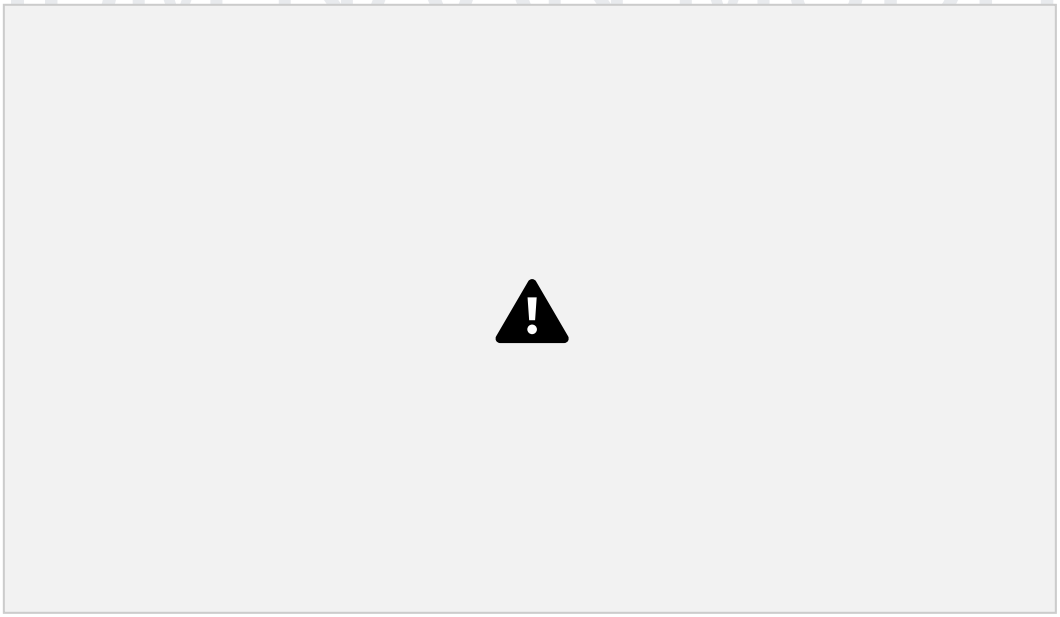


Task 5.3: Plotting Healthy life expectancy vs maximum Infection rate

```
x = data["Healthy life expectancy"]
y = data["max_infection_rates"]

sns.scatterplot(x,np.log(y))
```

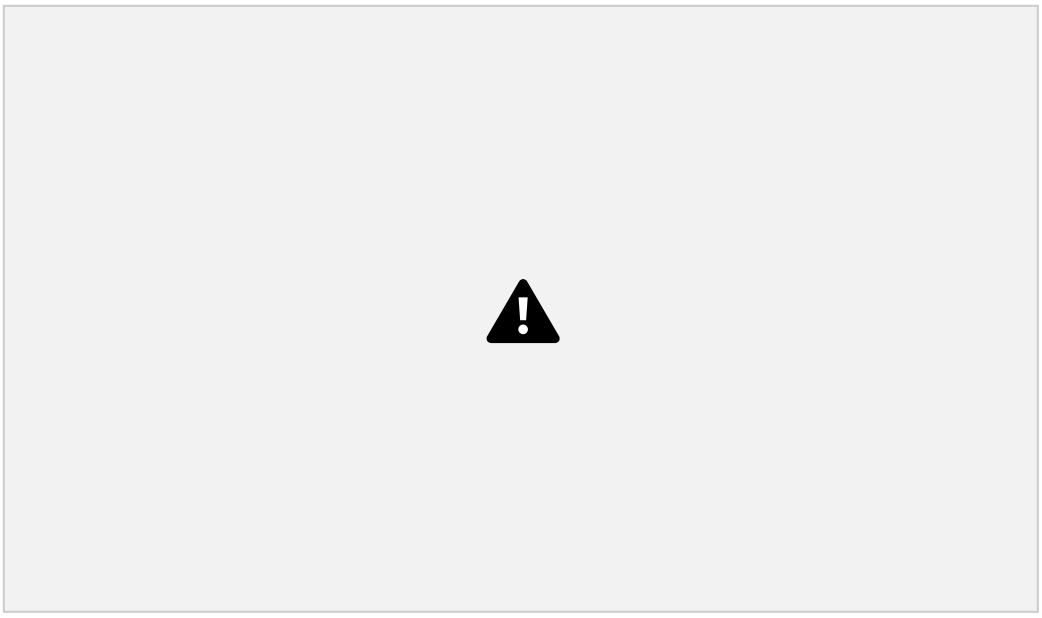
```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d1397b8>
```




```
x = data["Healthy life expectancy"]
y = data["max_infection_rates"]

sns.regplot(x,np.log(y))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d1829e8>
```

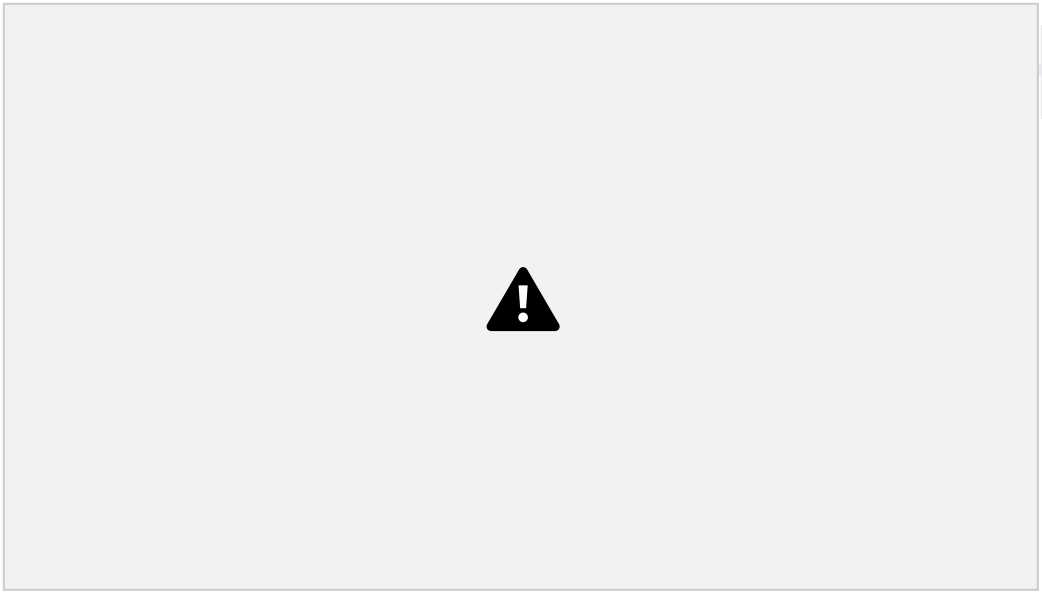


Task 5.4: Plotting Freedom to make life choices vs maximum Infection rate

```
x = data["Freedom to make life choices"]
y = data["max_infection_rates"]

sns.scatterplot(x,np.log(y))
```

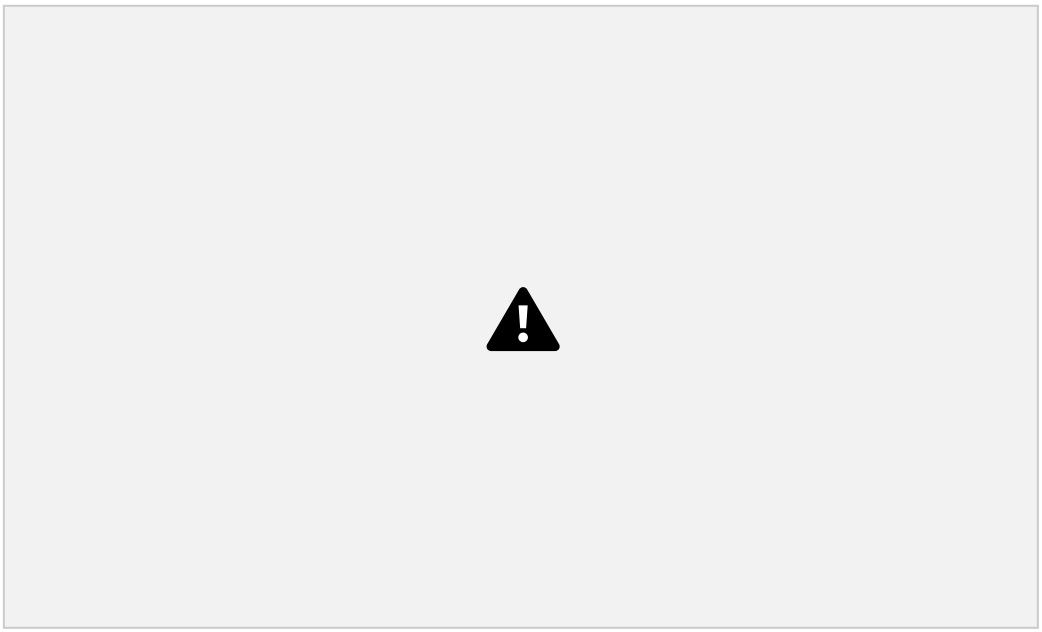
```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d1e0c88>
```




```
x = data["Freedom to make life choices"]
y = data["max_infection_rates"]

sns.regplot(x,np.log(y))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d1e0c88>
```



```
x = data["Freedom to make life choices"]
y = data["max_infection_rates"]

sns.regplot(x,np.log(y))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20d4d246940>
```