jupyter IT IS508 PROJECT AND ORGANIZATION CHANGE... Last Checkpoint: 2 hours ago (unsaved changes)

```
In [ ]:
#importing libraries
! pip install seaborn
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler,PolynomialFeatures
%matplotlib inline
```

```
In [2]:
file=pd.read_csv("WHO COVID-19 global table data July 10th 2021 at 1.47.08 PM.csv",sep=",")
```

```
In [3]:
#file rows
file.head()
```

Out[3]:

	Name	WHO Region	Cases - cumulative total	Cases - cumulative total per 100000 population	Cases - newly reported in last 7 days	Cases - newly reported in last 7 days per 100000 population	Cases - newly reported in last 24 hours	Deaths - cumulative total	Deaths - cumulative total per 100000 population	Deaths - newly reported in last 7 days	Deaths - newly reported in last 7 days per 100000 population	Deaths - newly reported in last 24 hours	Transmission Classification
0	Global	NaN	185291530	2377.196364	2906590	37.290076	458355	4010834	51.456966	55457	0.711485	8516	NaN
1	United States of America	Americas	33451965	10106.250000	108004	32.630000	22569	601231	181.640000	1551	0.470000	301	Community transmission
2	India	South-East Asia	30752950	2228.470000	294699	21.350000	43393	405939	29.420000	5627	0.410000	911	Clusters of cases
3	Brazil	Americas	18909037	8895.880000	351896	165.550000	54022	528540	248.660000	10474	4.930000	1648	Community transmission
4	Russian Federation	Europe	5733218	3928.630000	171858	117.760000	25766	141501	96.960000	4936	3.380000	726	Clusters of cases

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```
In [4]:
#Only Americas data
new_file=file.loc[(file["WHO Region"]=="Americas")]
```

```
In [5]:
#file rows
new_file.head()
```

Out[5]:

	Name	WHO Region	Cases - cumulative total	Cases - cumulative total per 100000 population	Cases - newly reported in last 7 days	Cases - newly reported in last 7 days per 100000 population	Cases - newly reported in last 24 hours	Deaths - cumulative total	Deaths - cumulative total per 100000 population	Deaths - newly reported in last 7 days	Deaths - newly reported in last 7 days per 100000 population	Deaths - newly reported in last 24 hours	Transmission Classification
1	United States of America	Americas	33451965	10106.25	108004	32.63	22569	601231	181.64	1551	0.47	301	Community transmission
3	Brazil	Americas	18909037	8895.88	351896	165.55	54022	528540	248.66	10474	4.93	1648	Community transmission
8	Argentina	Americas	4593763	10164.14	123389	273.01	19423	97439	215.59	3135	6.94	456	Community transmission
9	Colombia	Americas	4426811	8700.00	185829	365.21	24229	110578	217.32	4034	7.93	559	Community transmission
15	Mexico	Americas	2558369	1984.27	39100	30.33	8507	234192	181.64	1145	0.89	234	Community transmission

```
In [6]:
#load file
#Renaming some columns to make it easy to read'
new_file.rename(columns = {'Name':'Country','Cases - cumulative total':'Cases(Cum.Total)',
                           'Cases - cumulative total per 100000 population':'Cases(Cum.Total)per 100000 population',
                           'Cases - newly reported in last 7 days':'Cases(last 7 days)',
                           'Cases - newly reported in last 7 days per 100000 population':'Cases(last 7 days)per 100000 populati
                           'Cases - newly reported in last 24 hours':'Cases(last 24 hours)',
                           'Deaths - cumulative total':'Deaths(Cum.Total)','Deaths - cumulative total per 100000 population':
                           'Deaths(Cum.Total) per 100000 population', 'Deaths reported in last 7 days':
                           'Deaths(last 7 days)','Deaths - newly reported in last 7 days per 100000 population':
```

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```
/srv/conda/envs/notebook/lib/python3.6/site-packages/pandas/core/frame.py:4308: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view
-versus-a-copy
  errors=errors,
```

In [7]:

```
#data set summary
new_file.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 56 entries, 1 to 220
Data columns (total 13 columns):
 #   Column                                 Non-Null Count  Dtype
---  ------                                 --------------  -----
 0   Country                                56 non-null     object
 1   WHO Region                             56 non-null     object
 2   Cases(Cum.Total)                       56 non-null     int64
 3   Cases(Cum.Total)per 100000 population  56 non-null     float64
 4   Cases(last 7 days)                     56 non-null     int64
 5   Cases(last 7 days)per 100000 population 56 non-null    float64
 6   Cases(last 24 hours)                   56 non-null     int64
 7   Deaths(Cum.Total)                      56 non-null     int64
 8   Deaths(Cum.Total) per 100000 population 56 non-null    float64
 9   Deaths - newly reported in last 7 days 56 non-null     int64
 10  Deaths(last 7 days)per 100000 population 56 non-null   float64
 11  Deaths(last 24 hours)                  56 non-null     int64
 12  Transmission Classification            56 non-null     object
dtypes: float64(4), int64(6), object(3)
memory usage: 6.1+ KB
```

In [8]:

```
#number of countries in America's region
new_file["WHO Region"].value_counts().to_frame()
```

Out[8]:

In [8]:

```
#number of countries in America's region
new_file["WHO Region"].value_counts().to_frame()
```

Out[8]:

	WHO Region
Americas	56

In [9]:

```
#dataset description
new_file.describe()
```

Out[9]:

	Cases(Cum.Total)	Cases(Cum.Total)per 100000 population	Cases(last 7 days)	Cases(last 7 days)per 100000 population	Cases(last 24 hours)	Deaths(Cum.Total)	Deaths(Cum.Total) per 100000 population	Deaths - newly reported in last 7 days	Deaths(last 7 days)per 100000 population
count	5.600000e+01	56.000000	56.000000	56.000000	56.000000	56.000000	56.000000	56.000000	56.000000
mean	1.311608e+06	4099.591964	17272.714286	90.348393	2733.410714	34481.214286	77.229286	451.392857	1.582500
std	5.112890e+06	3312.030801	55956.745585	202.678019	8633.177160	112121.113116	95.639841	1547.820305	2.377306
min	7.000000e+00	102.940000	0.000000	0.000000	-9.000000	0.000000	0.000000	0.000000	0.000000
25%	2.086500e+03	1395.055000	10.750000	9.005000	0.000000	17.750000	11.247500	0.000000	0.000000
50%	1.556400e+04	3181.080000	310.000000	33.020000	25.000000	261.000000	53.310000	3.500000	0.445000
75%	3.425358e+05	6268.192500	7568.250000	92.862500	955.500000	5968.250000	93.797500	122.250000	1.912500
max	3.345196e+07	10785.670000	351896.000000	1465.090000	54022.000000	601231.000000	587.600000	10474.000000	10.520000

In [10]:

```
#transmission classification
new_file["Transmission Classification"].value_counts().to_frame()
```

Out[10]:

	Transmission Classification
Community transmission	42
Sporadic cases	5

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```
In [10]: #transmission classification
         new_file["Transmission Classification"].value_counts().to_frame()
```

Out[10]:

	Transmission Classification
Community transmission	42
Sporadic cases	5
Clusters of cases	5
No cases	4

```
In [11]: #country with highest number of deaths reported in the last 24hrs against transmission classification
         death_24hrs=new_file[['Country','Deaths(last 24 hours)']]
         highdeath_24hrs = death_24hrs.sort_values(by=['Deaths(last 24 hours)'], ascending= False)
         # a. check first
         highdeath_24hrs.head()
```

Out[11]:

	Country	Deaths(last 24 hours)
3	Brazil	1648
9	Colombia	559
8	Argentina	456
1	United States of America	301
15	Mexico	234

```
In [12]: #import model library
         from sklearn.linear_model import LinearRegression
```

```
In [13]: #Using Newly reported cases in last 24 hours to predict deaths in the next 24 hours
         x = new_file[['Cases(last 24 hours)']]
         y = new_file['Deaths(last 24 hours)']
         lm = LinearRegression()
```


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```
In [12]: #import model library
         from sklearn.linear_model import LinearRegression
```


```
In [13]: #Using Newly reported cases in last 24 hours to predict deaths in the next 24 hours
         x = new_file[['Cases(last 24 hours)']]
         y = new_file['Deaths(last 24 hours)']
         lm = LinearRegression()
         lm.fit(x,y)
         lm

Out[13]: LinearRegression()
```

```
In [14]: #Calculating the value of the intercept, c
         lm.intercept_

Out[14]: -4.010264462076975
```

```
In [15]: #Calculating the value of the slope, m
         lm.coef_

Out[15]: array([0.02708923])
```

Model Formular;

```
In [16]: #correlation
         new_file[['Cases(last 24 hours)','Deaths(last 24 hours)']].corr()
```

Out[16]:

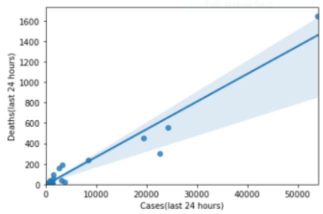
	Cases(last 24 hours)	Deaths(last 24 hours)
Cases(last 24 hours)	1.000000	0.972184
Deaths(last 24 hours)	0.972184	1.000000

```
In [17]: import matplotlib.pyplot as plt
```

In [17]:
```python
import matplotlib.pyplot as plt
```

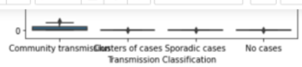
In [18]:
```python
#simple linear regression graph
sns.regplot(x="Cases(last 24 hours)", y="Deaths(last 24 hours)", data=new_file)
plt.ylim(0,)
```

Out[18]: (0.0, 1731.0038874470122)



In [19]:
```python
#plotting a box plot
sns.boxplot(x="Transmission Classification", y="Deaths(Cum.Total)", data=new_file)
```

Out[19]: <AxesSubplot:xlabel='Transmission Classification', ylabel='Deaths(Cum.Total)'>



Model performance evaluation metrics

In [20]:
```python
#Calculating R-squared
print('The R-squared is: ', lm.score(x, y))
```

The R-squared is: 0.9451426883656249

In [21]:
```python
#Let's import the function mean_squared_error % sqrt from the module metrics
from sklearn.metrics import mean_squared_error #for calculating MSE
from math import sqrt #for calculating RSME
```

In [23]:
```python
#calculating MSE
y=lm.predict(x)
mse = mean_squared_error(new_file['Deaths(last 24 hours)'], y)
print('Mean Squared Error:', mse)
```

Mean Squared Error: 3117.7858489231335

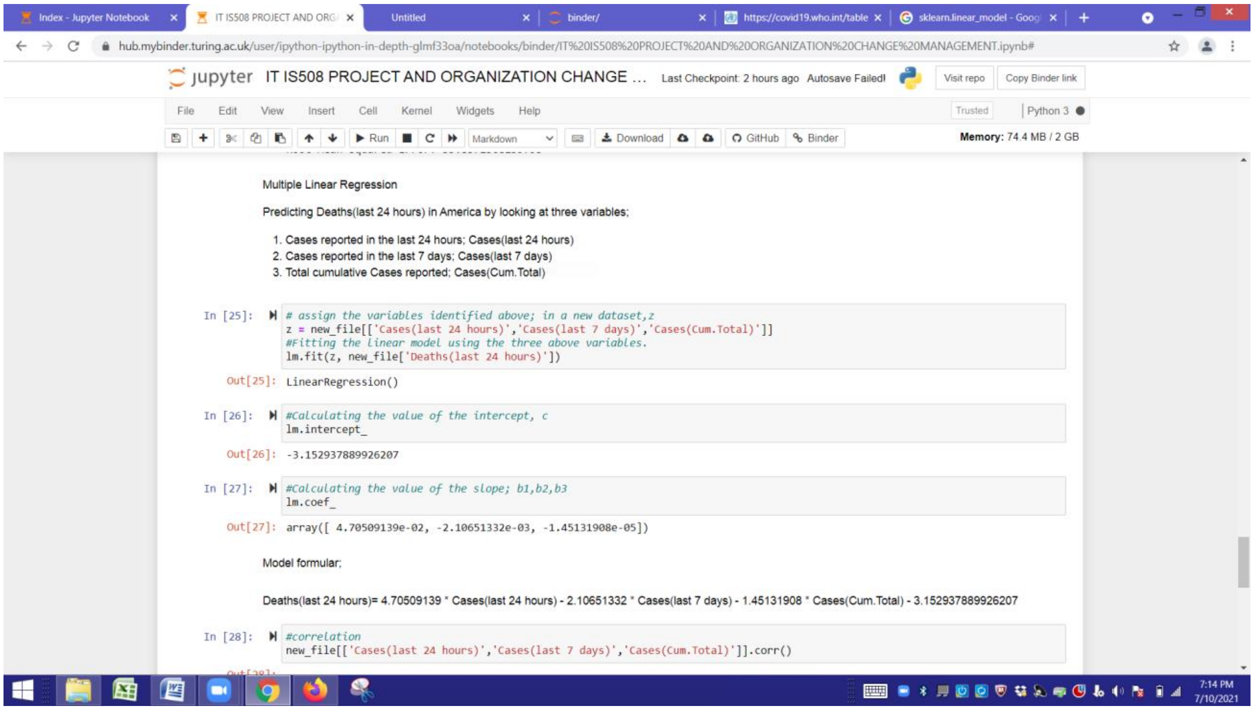
In [24]:
```python
#calculating RMSE
#since; mse=sqrt(mean_squared_error(new_file['Deaths(last 24 hours'], y))
print('Root Mean Squared Error:',sqrt(mse))
```

Root Mean Squared Error: 55.8371368259793

Multiple Linear Regression

Predicting Deaths(last 24 hours) in America by looking at three variables;

1. Cases reported in the last 24 hours; Cases(last 24 hours)
2. Cases reported in the last 7 days; Cases(last 7 days)



Multiple Linear Regression

Predicting Deaths(last 24 hours) in America by looking at three variables;

1. Cases reported in the last 24 hours; Cases(last 24 hours)
2. Cases reported in the last 7 days; Cases(last 7 days)
3. Total cumulative Cases reported; Cases(Cum.Total)

In [25]:
```
# assign the variables identified above; in a new dataset,z
z = new_file[['Cases(last 24 hours)','Cases(last 7 days)','Cases(Cum.Total)']]
#Fitting the linear model using the three above variables.
lm.fit(z, new_file['Deaths(last 24 hours)'])
```
Out[25]:
```
LinearRegression()
```

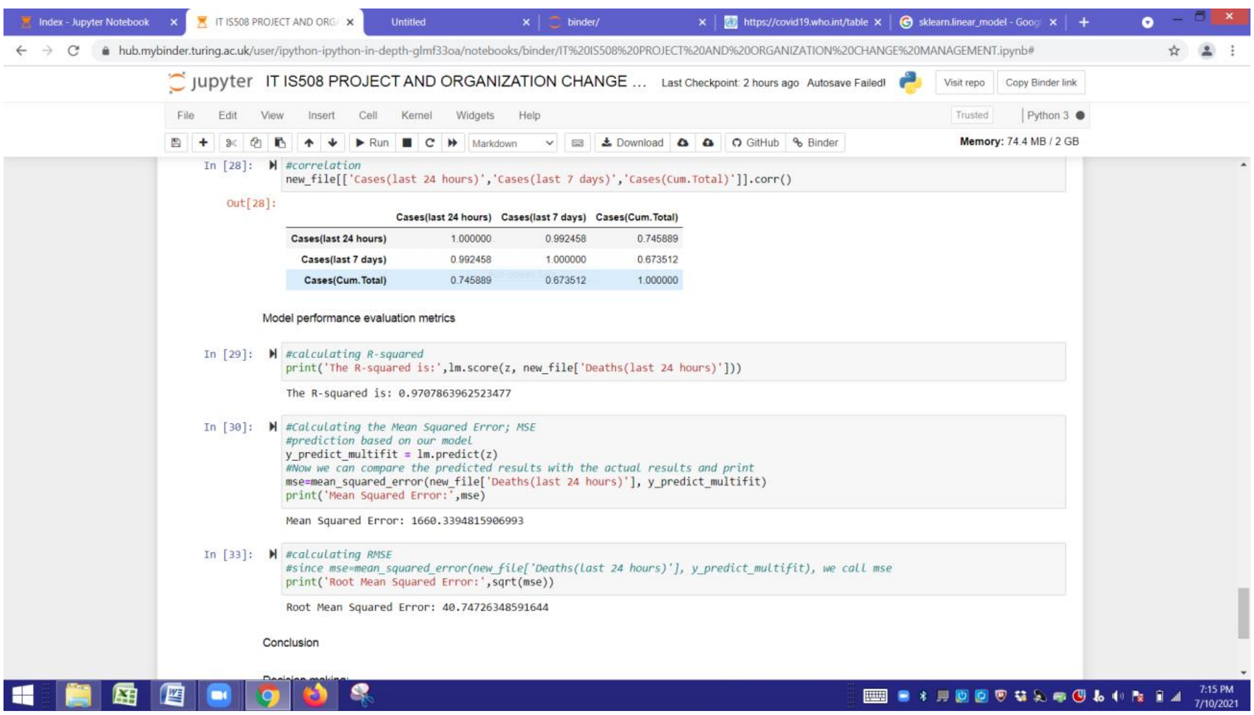
In [26]:
```
#Calculating the value of the intercept, c
lm.intercept_
```
Out[26]:
```
-3.152937889926207
```

In [27]:
```
#Calculating the value of the slope; b1,b2,b3
lm.coef_
```
Out[27]:
```
array([ 4.70509139e-02, -2.10651332e-03, -1.45131908e-05])
```

Model formular;

Deaths(last 24 hours)= 4.70509139 * Cases(last 24 hours) - 2.10651332 * Cases(last 7 days) - 1.45131908 * Cases(Cum.Total) - 3.152937889926207

In [28]:
```
#correlation
new_file[['Cases(last 24 hours)','Cases(last 7 days)','Cases(Cum.Total)']].corr()
```



In [28]:
```
#correlation
new_file[['Cases(last 24 hours)','Cases(last 7 days)','Cases(Cum.Total)']].corr()
```
Out[28]:

	Cases(last 24 hours)	Cases(last 7 days)	Cases(Cum.Total)
Cases(last 24 hours)	1.000000	0.992458	0.745889
Cases(last 7 days)	0.992458	1.000000	0.673512
Cases(Cum.Total)	0.745889	0.673512	1.000000

Model performance evaluation metrics

In [29]:
```
#calculating R-squared
print('The R-squared is:',lm.score(z, new_file['Deaths(last 24 hours)']))
```
```
The R-squared is: 0.9707863962523477
```

In [30]:
```
#Calculating the Mean Squared Error; MSE
#prediction based on our model
y_predict_multifit = lm.predict(z)
#Now we can compare the predicted results with the actual results and print
mse=mean_squared_error(new_file['Deaths(last 24 hours)'], y_predict_multifit)
print('Mean Squared Error:',mse)
```
```
Mean Squared Error: 1660.3394815906993
```

In [33]:
```
#calculating RMSE
#since mse=mean_squared_error(new_file['Deaths(last 24 hours)'], y_predict_multifit), we call mse
print('Root Mean Squared Error:',sqrt(mse))
```
```
Root Mean Squared Error: 40.74726348591644
```

Conclusion

In [30]:
```
#Calculating the Mean Squared Error; MSE
#prediction based on our model
y_predict_multifit = lm.predict(z)
#Now we can compare the predicted results with the actual results and print
mse=mean_squared_error(new_file['Deaths(last 24 hours)'], y_predict_multifit)
print('Mean Squared Error:',mse)
```

```
Mean Squared Error: 1660.3394815906993
```

In [33]:
```
#calculating RMSE
#since mse=mean_squared_error(new_file['Deaths(last 24 hours)'], y_predict_multifit), we call mse
print('Root Mean Squared Error:',sqrt(mse))
```

```
Root Mean Squared Error: 40.74726348591644
```

Conclusion

Decision making;

A model with a a high R-squared and low RMSE is the best.

From the table above, comparing the two models; Multiple Linear Regression Model is the best because it has an accuracy (R-Squared) percenatge of approximately 97.07% with a low RSME of approximately 40.7473

Therefore, The model for predicting Covid_19 daily deaths in America is; Deaths(last 24 hours)= 4.70509139 * Cases(last 24 hours) - 2.10651332 * Cases(last 7 days) - 1.45131908 * Cases(Cum.Total) - 3.152937889926207 $$

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