

# COVID

November 29, 2025

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

```
[2]: data =pd.read_csv("/content/drive/MyDrive/Netflix/covid_19_clean_complete.csv")
data
```

```
[2]:
```

	Province/State	Country/Region	Lat	Long	Date \
0	NaN	Afghanistan	33.939110	67.709953	2020-01-22
1	NaN	Albania	41.153300	20.168300	2020-01-22
2	NaN	Algeria	28.033900	1.659600	2020-01-22
3	NaN	Andorra	42.506300	1.521800	2020-01-22
4	NaN	Angola	-11.202700	17.873900	2020-01-22
...	...	...	...	...	...
49063	NaN	Sao Tome and Principe	0.186400	6.613100	2020-07-27
49064	NaN	Yemen	15.552727	48.516388	2020-07-27
49065	NaN	Comoros	-11.645500	43.333300	2020-07-27
49066	NaN	Tajikistan	38.861000	71.276100	2020-07-27
49067	NaN	Lesotho	-29.610000	28.233600	2020-07-27

	Confirmed	Deaths	Recovered	Active	WHO Region
0	0	0	0	0	Eastern Mediterranean
1	0	0	0	0	Europe
2	0	0	0	0	Africa
3	0	0	0	0	Europe
4	0	0	0	0	Africa
...	...	...	...	...	...
49063	865	14	734	117	Africa
49064	1691	483	833	375	Eastern Mediterranean
49065	354	7	328	19	Africa
49066	7235	60	6028	1147	Europe
49067	505	12	128	365	Africa

[49068 rows x 10 columns]

# 1 Subtask:

Calculate daily new confirmed cases, new recovered cases, and new deaths from the cumulative data.

```
[3]: data['Date'] = pd.to_datetime(data['Date'])
data = data.sort_values(by=['Country/Region', 'Date'])
data
```

```
[3]:
```

	Province/State	Country/Region	Lat	Long	Date	\
0	NaN	Afghanistan	33.939110	67.709953	2020-01-22	
261	NaN	Afghanistan	33.939110	67.709953	2020-01-23	
522	NaN	Afghanistan	33.939110	67.709953	2020-01-24	
783	NaN	Afghanistan	33.939110	67.709953	2020-01-25	
1044	NaN	Afghanistan	33.939110	67.709953	2020-01-26	
...	...	...	...	...	...	
47991	NaN	Zimbabwe	-19.015438	29.154857	2020-07-23	
48252	NaN	Zimbabwe	-19.015438	29.154857	2020-07-24	
48513	NaN	Zimbabwe	-19.015438	29.154857	2020-07-25	
48774	NaN	Zimbabwe	-19.015438	29.154857	2020-07-26	
49035	NaN	Zimbabwe	-19.015438	29.154857	2020-07-27	

	Confirmed	Deaths	Recovered	Active	WHO Region
0	0	0	0	0	Eastern Mediterranean
261	0	0	0	0	Eastern Mediterranean
522	0	0	0	0	Eastern Mediterranean
783	0	0	0	0	Eastern Mediterranean
1044	0	0	0	0	Eastern Mediterranean
...	...	...	...	...	...
47991	2124	28	510	1586	Africa
48252	2296	32	514	1750	Africa
48513	2434	34	518	1882	Africa
48774	2512	34	518	1960	Africa
49035	2704	36	542	2126	Africa

[49068 rows x 10 columns]

```
[4]: data['Daily Confirmed'] = data.groupby('Country/Region')['Confirmed'].diff().
      ↪ fillna(0).astype(int)
data['Daily Deaths'] = data.groupby('Country/Region')['Deaths'].diff().
      ↪ fillna(0).astype(int)
data['Daily Recovered'] = data.groupby('Country/Region')['Recovered'].diff().
      ↪ fillna(0).astype(int)
data
```

```
[4]:
```

	Province/State	Country/Region	Lat	Long	Date	\
0	NaN	Afghanistan	33.939110	67.709953	2020-01-22	
261	NaN	Afghanistan	33.939110	67.709953	2020-01-23	

522	NaN	Afghanistan	33.939110	67.709953	2020-01-24
783	NaN	Afghanistan	33.939110	67.709953	2020-01-25
1044	NaN	Afghanistan	33.939110	67.709953	2020-01-26
...	...	...	...	...	...
47991	NaN	Zimbabwe	-19.015438	29.154857	2020-07-23
48252	NaN	Zimbabwe	-19.015438	29.154857	2020-07-24
48513	NaN	Zimbabwe	-19.015438	29.154857	2020-07-25
48774	NaN	Zimbabwe	-19.015438	29.154857	2020-07-26
49035	NaN	Zimbabwe	-19.015438	29.154857	2020-07-27

	Confirmed	Deaths	Recovered	Active	WHO Region \
0	0	0	0	0	Eastern Mediterranean
261	0	0	0	0	Eastern Mediterranean
522	0	0	0	0	Eastern Mediterranean
783	0	0	0	0	Eastern Mediterranean
1044	0	0	0	0	Eastern Mediterranean
...	...	...	...	...	...
47991	2124	28	510	1586	Africa
48252	2296	32	514	1750	Africa
48513	2434	34	518	1882	Africa
48774	2512	34	518	1960	Africa
49035	2704	36	542	2126	Africa

	Daily Confirmed	Daily Deaths	Daily Recovered
0	0	0	0
261	0	0	0
522	0	0	0
783	0	0	0
1044	0	0	0
...	...	...	...
47991	90	2	0
48252	172	4	4
48513	138	2	4
48774	78	0	0
49035	192	2	24

[49068 rows x 13 columns]

```
[5]: # Replace any negative values with 0
data['Daily Confirmed'] = data['Daily Confirmed'].clip(lower=0)
data['Daily Deaths'] = data['Daily Deaths'].clip(lower=0)
data['Daily Recovered'] = data['Daily Recovered'].clip(lower=0)

#Calculated daily new cases, deaths, and recoveries and handled negative values.
data.head()
```

```
[5]:
```

	Province/State	Country/Region	Lat	Long	Date	Confirmed	\
0		NaN	Afghanistan	33.93911	67.709953	2020-01-22	0
261		NaN	Afghanistan	33.93911	67.709953	2020-01-23	0
522		NaN	Afghanistan	33.93911	67.709953	2020-01-24	0
783		NaN	Afghanistan	33.93911	67.709953	2020-01-25	0
1044		NaN	Afghanistan	33.93911	67.709953	2020-01-26	0

	Deaths	Recovered	Active	WHO Region	Daily Confirmed	\
0	0	0	0	Eastern Mediterranean	0	
261	0	0	0	Eastern Mediterranean	0	
522	0	0	0	Eastern Mediterranean	0	
783	0	0	0	Eastern Mediterranean	0	
1044	0	0	0	Eastern Mediterranean	0	

	Daily Deaths	Daily Recovered
0	0	0
261	0	0
522	0	0
783	0	0
1044	0	0

## 1.1 Calculate Infection and Recovery Rates

### 1.1.1 Subtask:

Compute the daily infection rate and recovery rate based on the daily new cases and recoveries.

```
[6]: data['Previous Day Confirmed'] = data.groupby('Country/Region')['Confirmed'].
      ↪shift(1).fillna(0)

# Calculate Daily Infection Rate
# Handle division by zero: if 'Previous Day Confirmed' is 0, set 'Daily
      ↪Infection Rate' to 0
data['Daily Infection Rate'] = data.apply(lambda row: row['Daily Confirmed'] /
      ↪row['Previous Day Confirmed'] if row['Previous Day Confirmed'] != 0 else 0,
      ↪axis=1)

# Calculate Daily Recovery Rate
# Handle division by zero: if 'Previous Day Confirmed' is 0, set 'Daily
      ↪Recovery Rate' to 0
data['Daily Recovery Rate'] = data.apply(lambda row: row['Daily Recovered'] /
      ↪row['Previous Day Confirmed'] if row['Previous Day Confirmed'] != 0 else 0,
      ↪axis=1)

# Fill any remaining NaN values (e.g., for the very first day of data for a
      ↪country) with 0
data['Daily Infection Rate'] = data['Daily Infection Rate'].fillna(0)
```

```
data['Daily Recovery Rate'] = data['Daily Recovery Rate'].fillna(0)

print("Calculated daily infection and recovery rates.")
data.head()
```

Calculated daily infection and recovery rates.

```
[6]:
```

	Province/State	Country/Region	Lat	Long	Date	Confirmed	\
0	NaN	Afghanistan	33.93911	67.709953	2020-01-22	0	
261	NaN	Afghanistan	33.93911	67.709953	2020-01-23	0	
522	NaN	Afghanistan	33.93911	67.709953	2020-01-24	0	
783	NaN	Afghanistan	33.93911	67.709953	2020-01-25	0	
1044	NaN	Afghanistan	33.93911	67.709953	2020-01-26	0	

	Deaths	Recovered	Active	WHO Region	Daily Confirmed	\
0	0	0	0	Eastern Mediterranean	0	
261	0	0	0	Eastern Mediterranean	0	
522	0	0	0	Eastern Mediterranean	0	
783	0	0	0	Eastern Mediterranean	0	
1044	0	0	0	Eastern Mediterranean	0	

	Daily Deaths	Daily Recovered	Previous Day Confirmed	\
0	0	0	0.0	
261	0	0	0.0	
522	0	0	0.0	
783	0	0	0.0	
1044	0	0	0.0	

	Daily Infection Rate	Daily Recovery Rate
0	0.0	0.0
261	0.0	0.0
522	0.0	0.0
783	0.0	0.0
1044	0.0	0.0

## 1.2 Visualize Daily Trends

### 2 Subtask:

Generate line plots to visualize the daily new confirmed cases, new recovered cases, and new deaths over time. Ensure proper legends are provided.

```
[7]: daily_trends = data.groupby('Date')[['Daily Confirmed', 'Daily Deaths', 'Daily Recovered']].sum().reset_index()

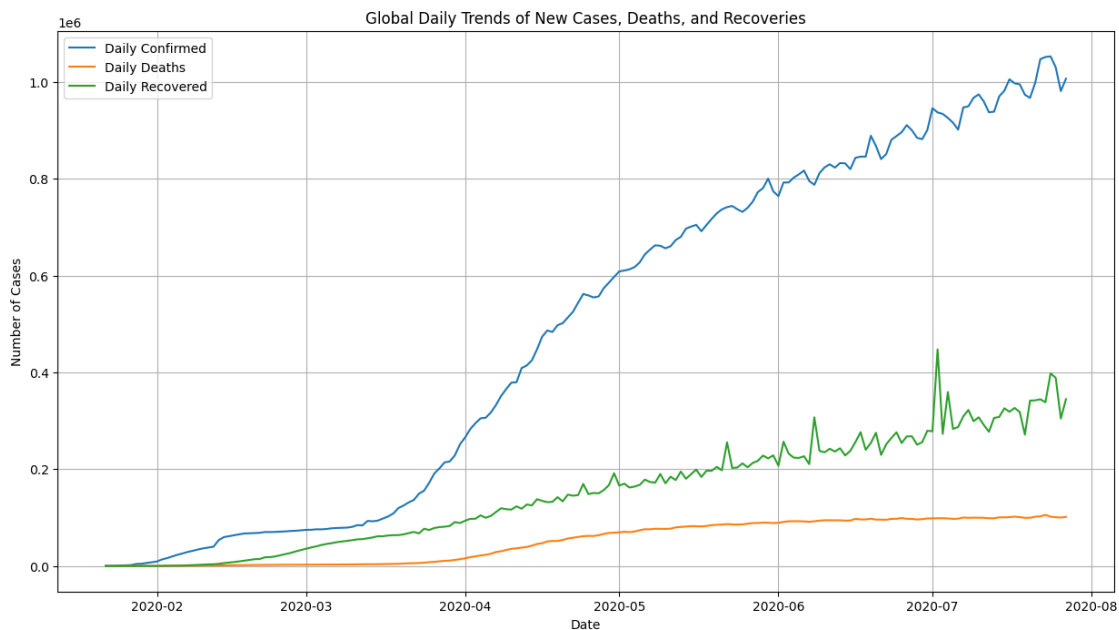
plt.figure(figsize=(15, 8))
```

```

plt.plot(daily_trends['Date'], daily_trends['Daily Confirmed'], label='Daily_
↪Confirmed')
plt.plot(daily_trends['Date'], daily_trends['Daily Deaths'], label='Daily_
↪Deaths')
plt.plot(daily_trends['Date'], daily_trends['Daily Recovered'], label='Daily_
↪Recovered')

plt.xlabel('Date')
plt.ylabel('Number of Cases')
plt.title('Global Daily Trends of New Cases, Deaths, and Recoveries')
plt.legend()
plt.grid(True)
plt.show()
print("Generated line plots for global daily trends of new cases, deaths, and_
↪recoveries.")

```



Generated line plots for global daily trends of new cases, deaths, and recoveries.

## 2.1 Visualize Rate Trends

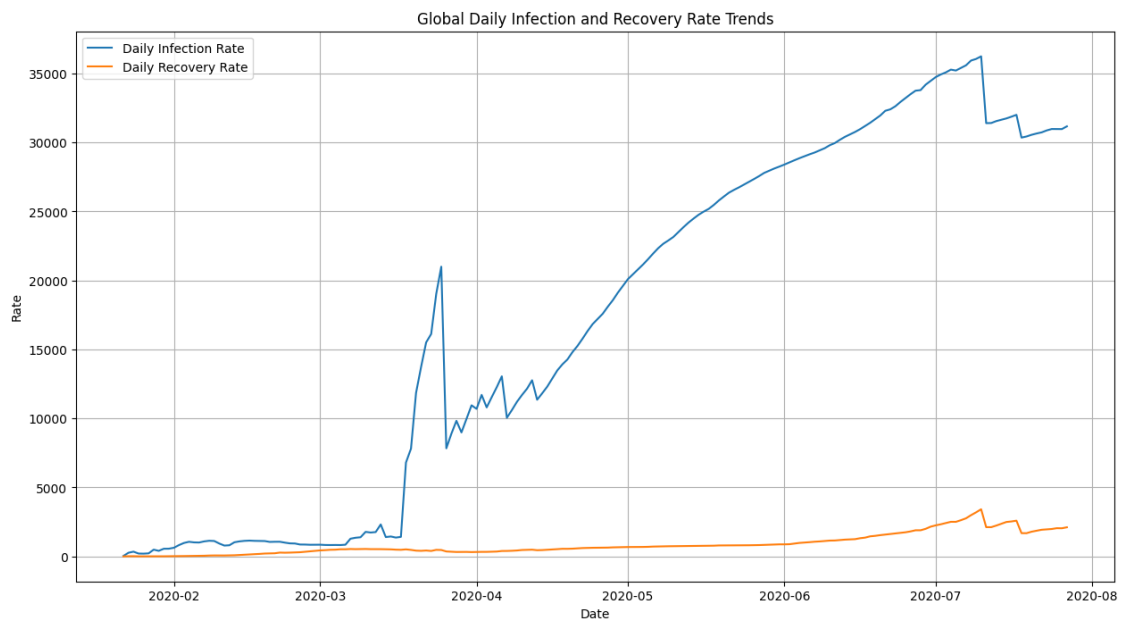
### 2.1.1 Subtask:

Generate line plots to visualize the calculated daily infection and recovery rates over time. Ensure proper legends are provided.

```
[8]: daily_rates_trends = data.groupby('Date')[['Daily Infection Rate', 'Daily Recovery Rate']].sum().reset_index()

plt.figure(figsize=(15, 8))
plt.plot(daily_rates_trends['Date'], daily_rates_trends['Daily Infection Rate'], label='Daily Infection Rate')
plt.plot(daily_rates_trends['Date'], daily_rates_trends['Daily Recovery Rate'], label='Daily Recovery Rate')

plt.xlabel('Date')
plt.ylabel('Rate')
plt.title('Global Daily Infection and Recovery Rate Trends')
plt.legend()
plt.grid(True)
plt.show()
print("Generated line plots for global daily infection and recovery rate trends.")
```



Generated line plots for global daily infection and recovery rate trends.

##FORCASTING

```
[9]: data
```

```
[9]: Province/State Country/Region Lat Long Date \
0 NaN Afghanistan 33.939110 67.709953 2020-01-22
261 NaN Afghanistan 33.939110 67.709953 2020-01-23
```

522	NaN	Afghanistan	33.939110	67.709953	2020-01-24
783	NaN	Afghanistan	33.939110	67.709953	2020-01-25
1044	NaN	Afghanistan	33.939110	67.709953	2020-01-26
...	...	...	...	...	...
47991	NaN	Zimbabwe	-19.015438	29.154857	2020-07-23
48252	NaN	Zimbabwe	-19.015438	29.154857	2020-07-24
48513	NaN	Zimbabwe	-19.015438	29.154857	2020-07-25
48774	NaN	Zimbabwe	-19.015438	29.154857	2020-07-26
49035	NaN	Zimbabwe	-19.015438	29.154857	2020-07-27

	Confirmed	Deaths	Recovered	Active	WHO Region \
0	0	0	0	0	Eastern Mediterranean
261	0	0	0	0	Eastern Mediterranean
522	0	0	0	0	Eastern Mediterranean
783	0	0	0	0	Eastern Mediterranean
1044	0	0	0	0	Eastern Mediterranean
...	...	...	...	...	...
47991	2124	28	510	1586	Africa
48252	2296	32	514	1750	Africa
48513	2434	34	518	1882	Africa
48774	2512	34	518	1960	Africa
49035	2704	36	542	2126	Africa

	Daily Confirmed	Daily Deaths	Daily Recovered	Previous Day Confirmed \
0	0	0	0	0.0
261	0	0	0	0.0
522	0	0	0	0.0
783	0	0	0	0.0
1044	0	0	0	0.0
...	...	...	...	...
47991	90	2	0	2034.0
48252	172	4	4	2124.0
48513	138	2	4	2296.0
48774	78	0	0	2434.0
49035	192	2	24	2512.0

	Daily Infection Rate	Daily Recovery Rate
0	0.000000	0.000000
261	0.000000	0.000000
522	0.000000	0.000000
783	0.000000	0.000000
1044	0.000000	0.000000
...	...	...
47991	0.044248	0.000000
48252	0.080979	0.001883
48513	0.060105	0.001742
48774	0.032046	0.000000



49035                      0.076433                      0.009554

[49068 rows x 16 columns]

```
[10]: data.isnull().sum()
```

```
[10]: Province/State      34404
      Country/Region      0
      Lat                 0
      Long                0
      Date                0
      Confirmed           0
      Deaths             0
      Recovered           0
      Active              0
      WHO Region          0
      Daily Confirmed     0
      Daily Deaths       0
      Daily Recovered     0
      Previous Day Confirmed 0
      Daily Infection Rate 0
      Daily Recovery Rate 0
      dtype: int64
```

```
[11]: col=list(data.columns)
```

```
[12]: for col_name in col:
      if data[col_name].dtypes=='object':
          data[col_name]=data[col_name].fillna(data[col_name].mode()[0])
      else:
          data[col_name]=data[col_name].fillna(data[col_name].mean())
```

```
[13]: data.duplicated().sum()
```

```
[13]: np.int64(0)
```

```
[14]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 49068 entries, 0 to 49035
Data columns (total 16 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Province/State        49068 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
10  Daily Confirmed     49068 non-null int64
11  Daily Deaths        49068 non-null int64
12  Daily Recovered     49068 non-null int64
13  Previous Day Confirmed 49068 non-null float64
14  Daily Infection Rate 49068 non-null float64
15  Daily Recovery Rate  49068 non-null float64
dtypes: datetime64[ns](1), float64(5), int64(7), object(3)
memory usage: 6.4+ MB

```

```
[15]: data["Date"] = pd.to_datetime(data["Date"], format="%Y-%m-%d")
```

```
[16]: data=data.sort_values(by='Date', ascending=True)
```

```
[17]: Df = pd.DataFrame({'Date': data['Date'], 'Confirmed': data['Confirmed']})
```

```
[18]: Df = Df.groupby('Date').sum()
```

```
[19]: Df
```

```

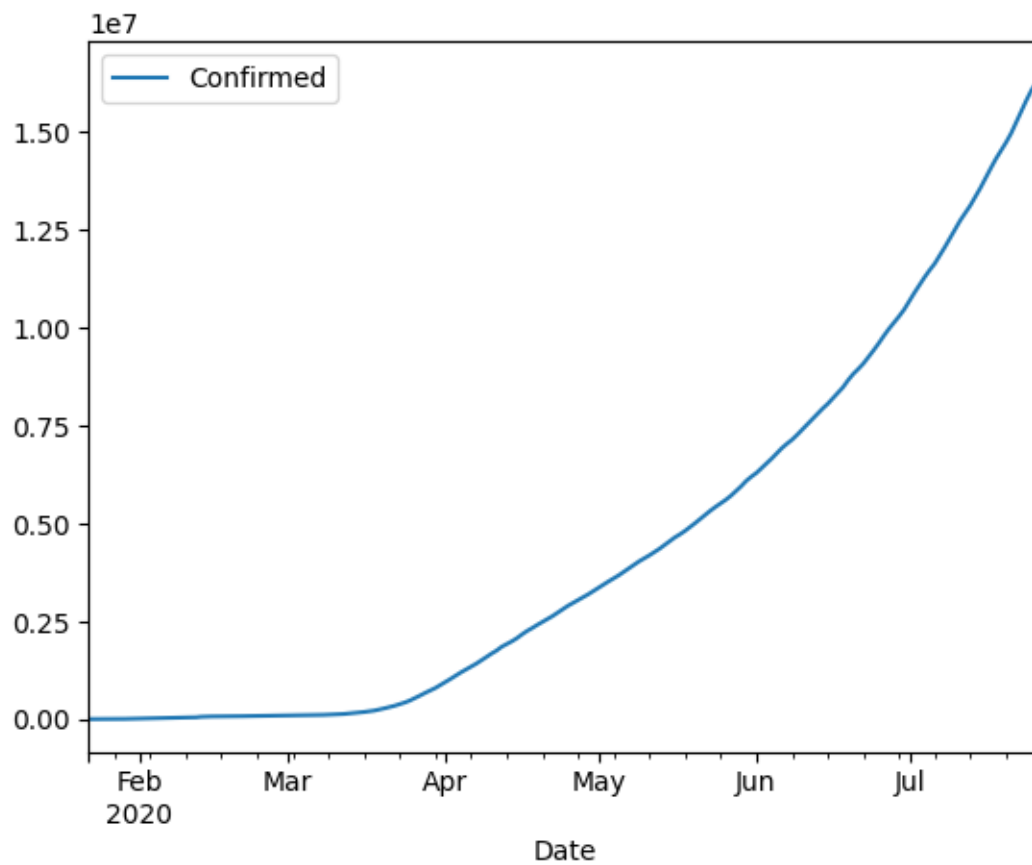
[19]:           Confirmed
Date
2020-01-22           555
2020-01-23           654
2020-01-24           941
2020-01-25          1434
2020-01-26          2118
...
2020-07-23      15510481
2020-07-24      15791645
2020-07-25      16047190
2020-07-26      16251796
2020-07-27      16480485

```

```
[188 rows x 1 columns]
```

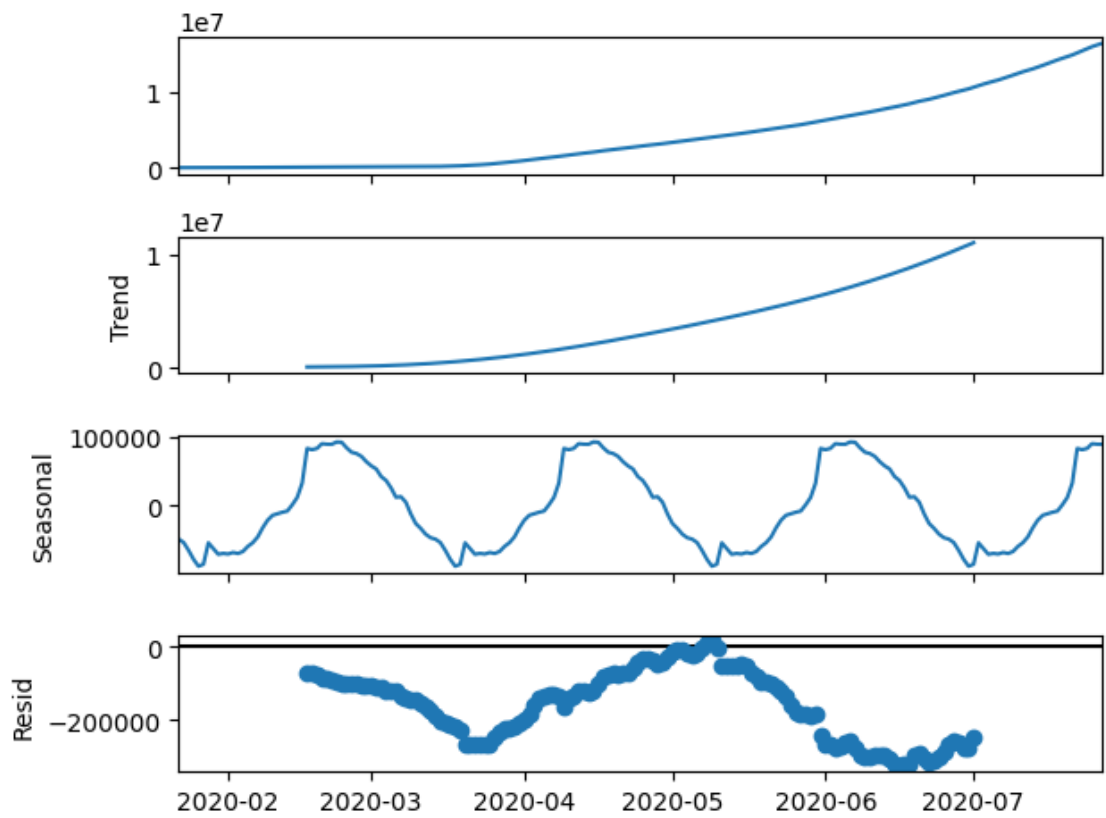
```
[20]: Df.plot()
```

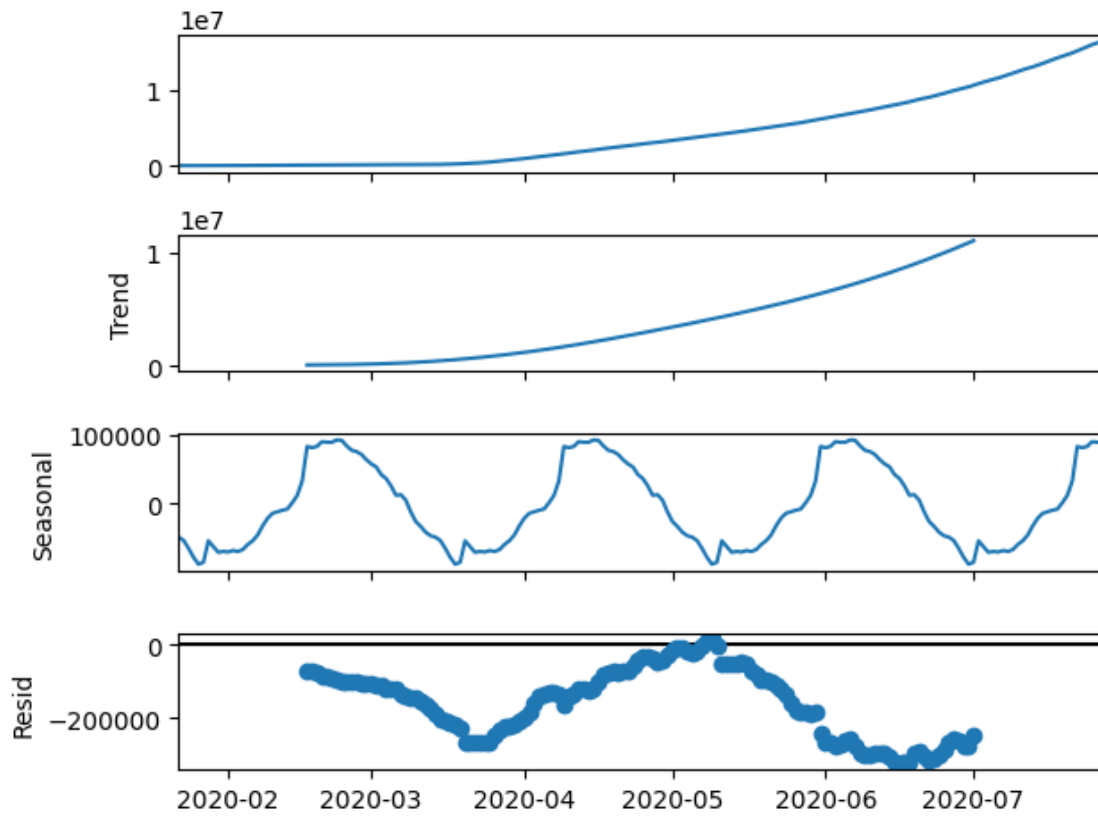
```
[20]: <Axes: xlabel='Date'>
```



```
[21]: from statsmodels.tsa.seasonal import seasonal_decompose  
decomposed = seasonal_decompose(Df, period=52)  
decomposed.plot()
```

[21]:



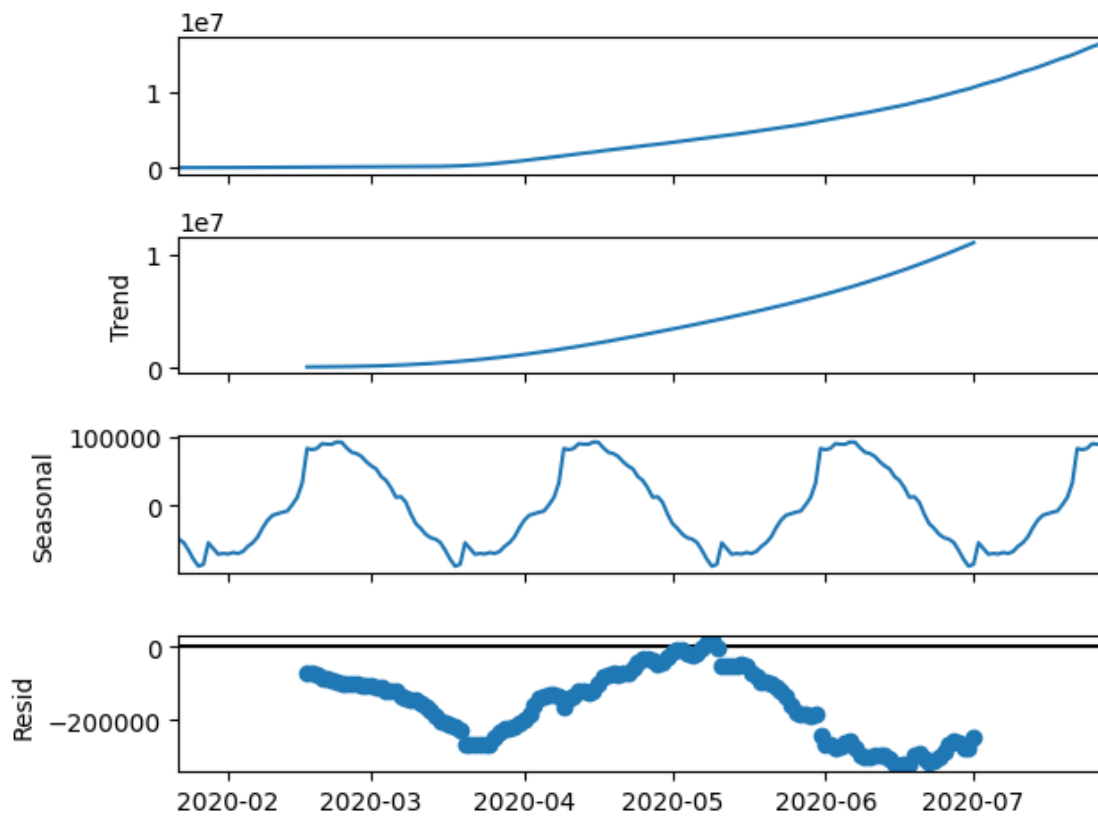


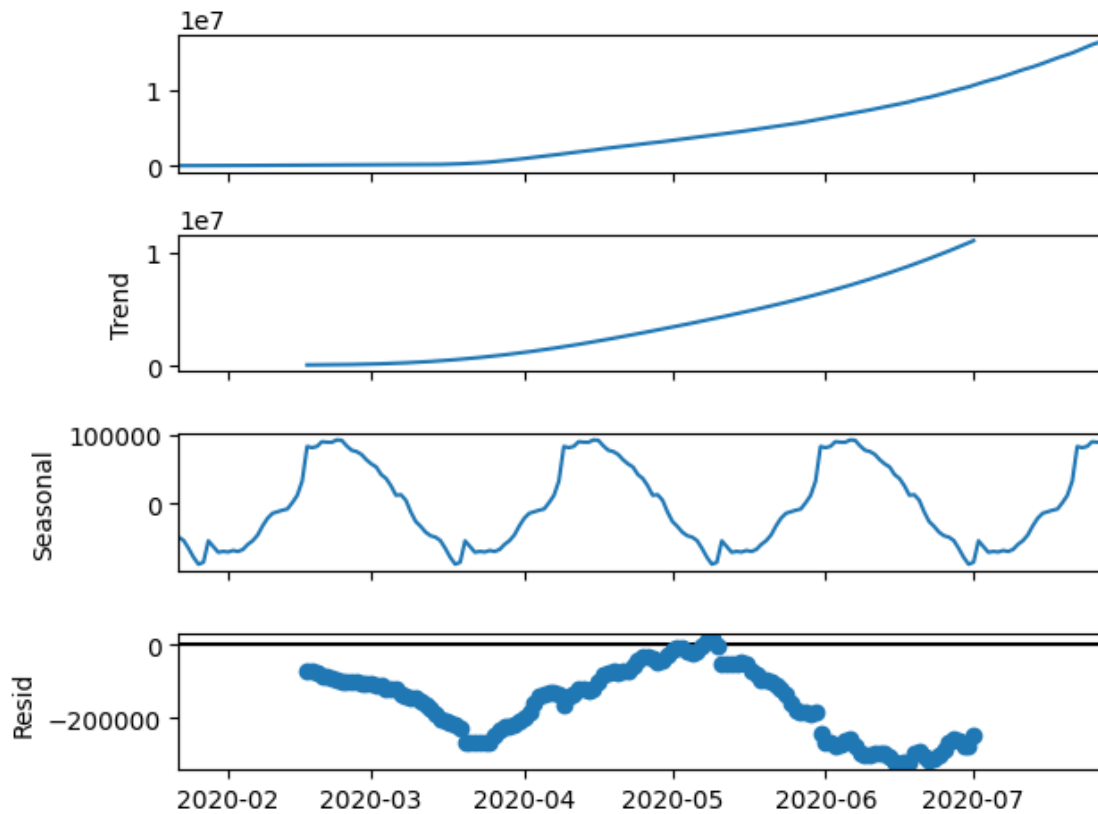
```
[22]: decomposed = seasonal_decompose(Df, period=52)
```

```
[23]: from statsmodels.tsa.seasonal import seasonal_decompose
```

```
[24]: decomposed.plot()
```

```
[24]:
```





```
[25]: first_log = np.log(Df)
first_log = first_log.dropna()
first_log
```

```
[25]:
```

Date	Confirmed
2020-01-22	6.318968
2020-01-23	6.483107
2020-01-24	6.846943
2020-01-25	7.268223
2020-01-26	7.658228
...	...
2020-07-23	16.557027
2020-07-24	16.574992
2020-07-25	16.591044
2020-07-26	16.603714
2020-07-27	16.617688

[188 rows x 1 columns]

```
[26]: mean_log = first_log.rolling(window =7).mean()
```

```
[27]: mean_log.head(15)
```

```
[27]:
```

	Confirmed
Date	
2020-01-22	NaN
2020-01-23	NaN
2020-01-24	NaN
2020-01-25	NaN
2020-01-26	NaN
2020-01-27	NaN
2020-01-28	7.311970
2020-01-29	7.655947
2020-01-30	8.017792
2020-01-31	8.354374
2020-02-01	8.658317
2020-02-02	8.954050
2020-02-03	9.227777
2020-02-04	9.435629
2020-02-05	9.649961

```
[28]: new_data = first_log - mean_log
new_data = new_data.dropna()
new_data
```

```
[28]:
```

	Confirmed
Date	
2020-01-28	1.314616
2020-01-29	1.070859
2020-01-30	0.998235
2020-01-31	0.848640
2020-02-01	0.737507
...	...
2020-07-23	0.050772
2020-07-24	0.052090
2020-07-25	0.051597
2020-07-26	0.048040
2020-07-27	0.045813

[182 rows x 1 columns]

```
[29]: from statsmodels.tsa.stattools import adfuller
```

```
[30]: test_result = adfuller(new_data)
```

```
[31]: p_value = test_result[1]
p_value
```



```
[31]: np.float64(0.20998216418983862)
```

```
[32]: new_data_diff = new_data.diff().dropna()
```

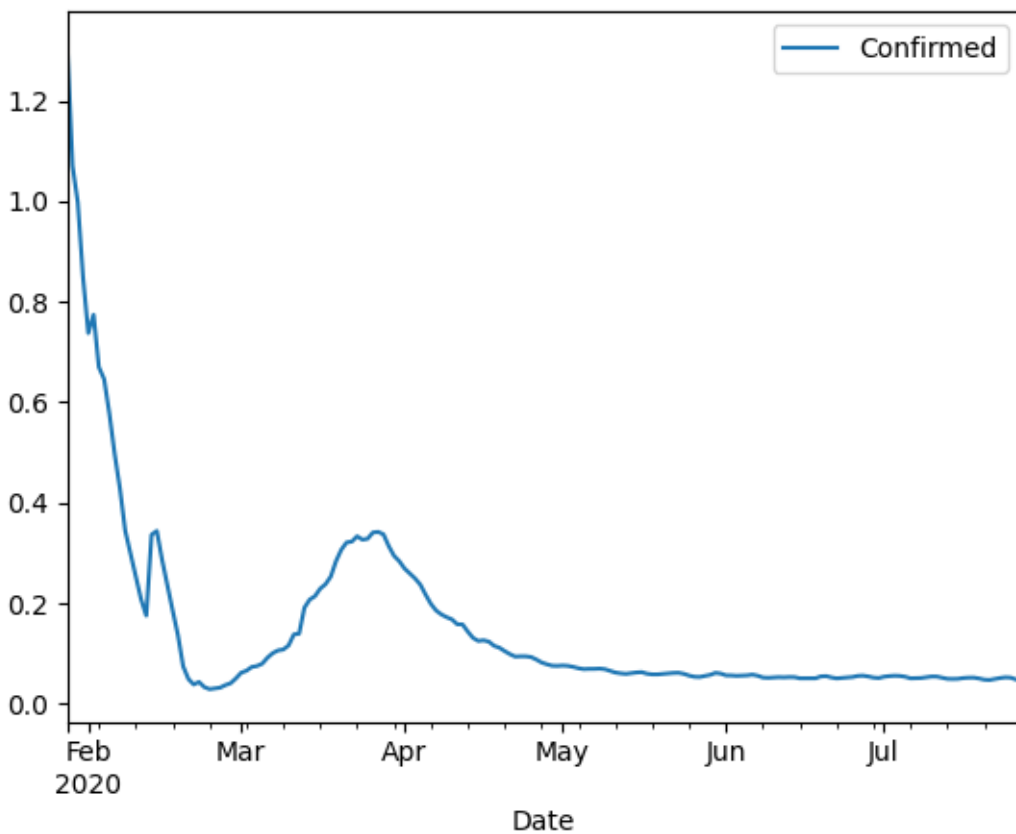
```
[33]: from statsmodels.tsa.stattools import adfuller

test_result = adfuller(new_data_diff)
p_value = test_result[1]
p_value
```

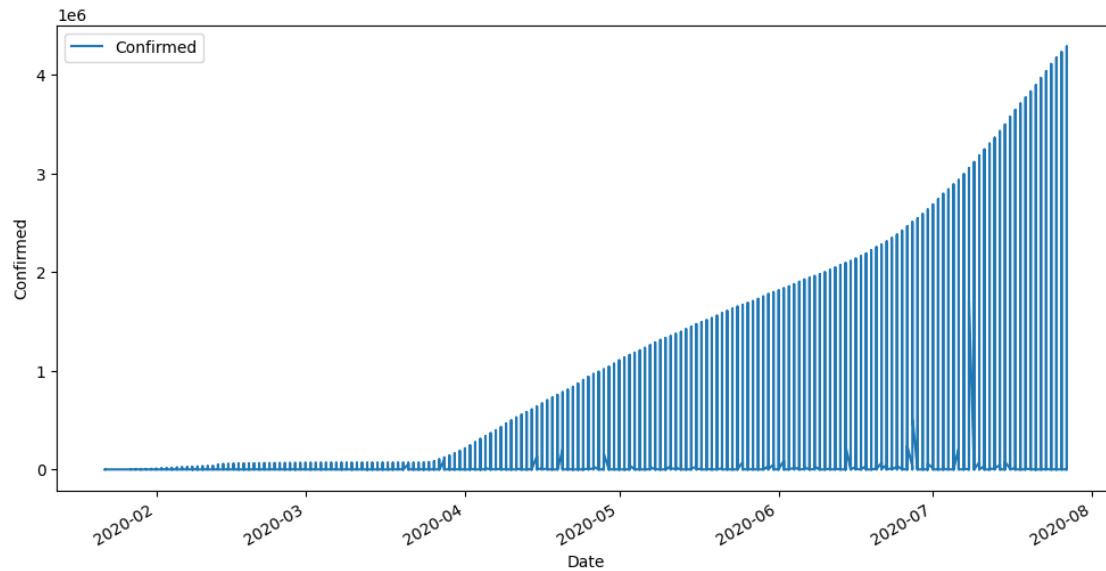
```
[33]: np.float64(0.005488213142700435)
```

```
[34]: new_data.plot()
```

```
[34]: <Axes: xlabel='Date'>
```



```
[35]: data.plot(x='Date', y='Confirmed', figsize=(12, 6))
plt.xlabel('Date')
plt.ylabel('Confirmed')
plt.show()
```



#Model building

```
[36]: new_data
```

```
[36]:
```

Date	Confirmed
2020-01-28	1.314616
2020-01-29	1.070859
2020-01-30	0.998235
2020-01-31	0.848640
2020-02-01	0.737507
...	...
2020-07-23	0.050772
2020-07-24	0.052090
2020-07-25	0.051597
2020-07-26	0.048040
2020-07-27	0.045813

[182 rows x 1 columns]

```
[37]: new_data.iloc[144]
```

```
[37]: Confirmed    0.054574
Name: 2020-06-20 00:00:00, dtype: float64
```

```
[38]: train = new_data.iloc[:144]["Confirmed"]
test = new_data.iloc[144:]["Confirmed"]
```

```
[39]: train
```

```
[39]: Date
      2020-01-28    1.314616
      2020-01-29    1.070859
      2020-01-30    0.998235
      2020-01-31    0.848640
      2020-02-01    0.737507
      ...
      2020-06-15    0.050235
      2020-06-16    0.050397
      2020-06-17    0.050477
      2020-06-18    0.050304
      2020-06-19    0.054008
      Name: Confirmed, Length: 144, dtype: float64
```

```
[40]: test
```

```
[40]: Date
      2020-06-20    0.054574
      2020-06-21    0.051933
      2020-06-22    0.050065
      2020-06-23    0.050856
      2020-06-24    0.051779
      2020-06-25    0.052775
      2020-06-26    0.054999
      2020-06-27    0.055512
      2020-06-28    0.053847
      2020-06-29    0.051594
      2020-06-30    0.050755
      2020-07-01    0.053429
      2020-07-02    0.054691
      2020-07-03    0.055383
      2020-07-04    0.054961
      2020-07-05    0.053300
      2020-07-06    0.050214
      2020-07-07    0.050432
      2020-07-08    0.050824
      2020-07-09    0.052319
      2020-07-10    0.053782
      2020-07-11    0.053648
      2020-07-12    0.051543
      2020-07-13    0.049180
      2020-07-14    0.048929
      2020-07-15    0.049193
      2020-07-16    0.050764
      2020-07-17    0.051455
```

```

2020-07-18    0.051595
2020-07-19    0.049893
2020-07-20    0.047533
2020-07-21    0.046906
2020-07-22    0.048937
2020-07-23    0.050772
2020-07-24    0.052090
2020-07-25    0.051597
2020-07-26    0.048040
2020-07-27    0.045813
Name: Confirmed, dtype: float64

```

```
[41]: from statsmodels.tsa.arima.model import ARIMA
```

```
[42]: model1=ARIMA(train,order=(1,2,1))

# Train the Model

model1=model1.fit()

# Make Prediction

new_data["ARIMA Prediction"] = model1.predict(start = len(train),
↪end=len(train)+len(test)-1)

```

```

/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
    self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
    self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
    self._init_dates(dates, freq)

```

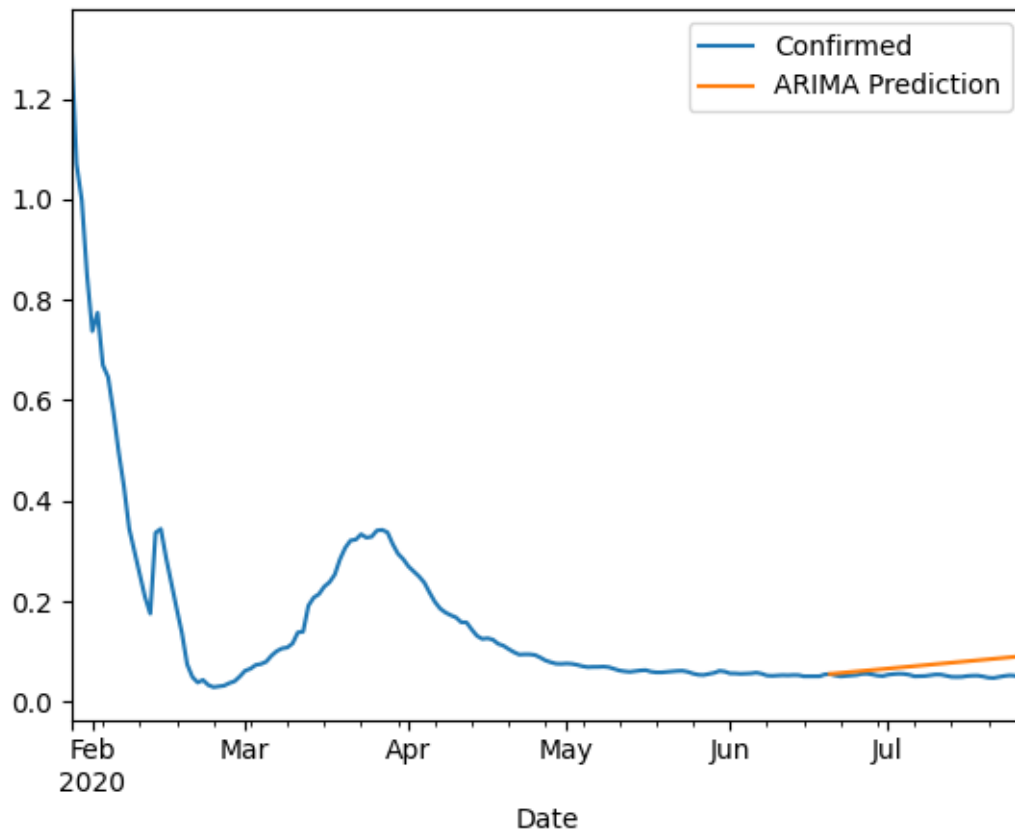
```
[43]: new_data.tail()
```

```
[43]:
```

	Confirmed	ARIMA Prediction
Date		
2020-07-23	0.050772	0.087003
2020-07-24	0.052090	0.087974
2020-07-25	0.051597	0.088944
2020-07-26	0.048040	0.089915
2020-07-27	0.045813	0.090886

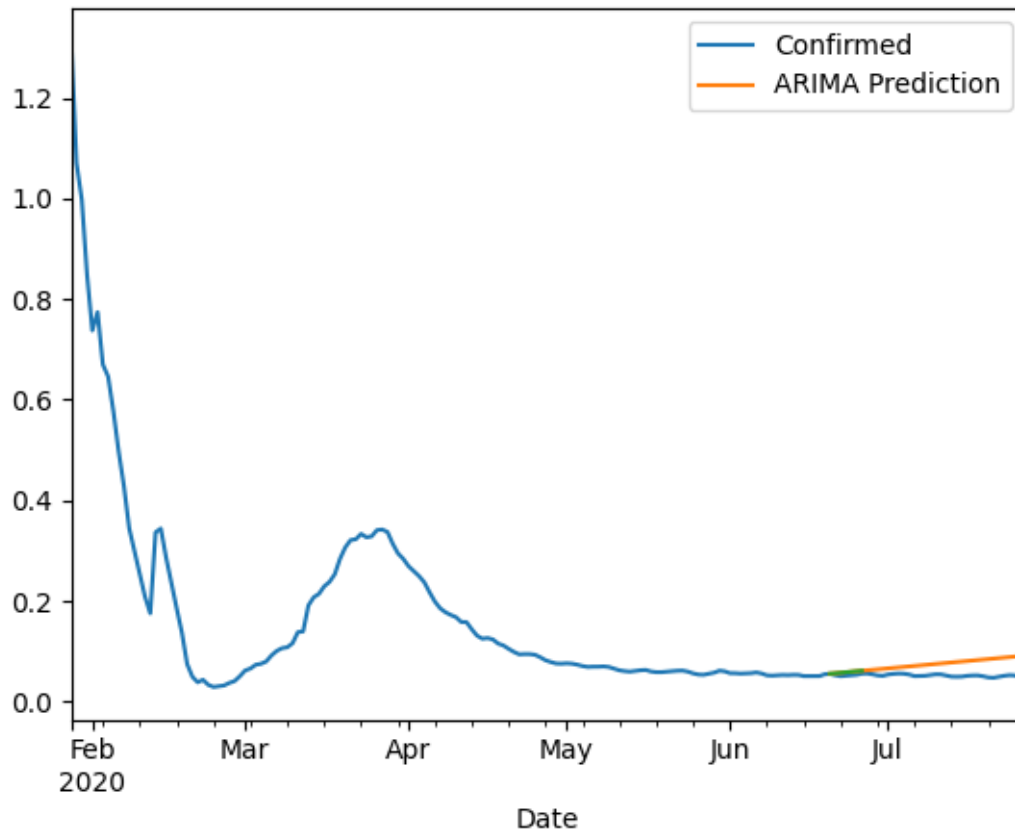
```
[44]: new_data[["Confirmed", "ARIMA Prediction"]].plot()
```

```
[44]: <Axes: xlabel='Date'>
```



```
[45]: future_data = model1.forecast(steps = 7)
new_data.plot()
future_data.plot()
```

```
[45]: <Axes: xlabel='Date'>
```



```
[46]: future_data
```

```
[46]: 2020-06-20    0.054971
      2020-06-21    0.055942
      2020-06-22    0.056913
      2020-06-23    0.057883
      2020-06-24    0.058854
      2020-06-25    0.059825
      2020-06-26    0.060795
      Freq: D, Name: predicted_mean, dtype: float64
```

```
[47]: model2= ARIMA(new_data['Confirmed'], order=(1,2,1))
      model2_fit = model2.fit()

      # Forecast the next 1 week after the end of the new_data series
      forecast= model2_fit.forecast(steps=7)
```

```
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
```

```

    self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
    self._init_dates(dates, freq)
/usr/local/lib/python3.12/dist-packages/statsmodels/tsa/base/tsa_model.py:473:
ValueWarning: No frequency information was provided, so inferred frequency D
will be used.
    self._init_dates(dates, freq)

```

[48]: forecast

```

[48]: 2020-07-28    0.044558
      2020-07-29    0.043295
      2020-07-30    0.042032
      2020-07-31    0.040769
      2020-08-01    0.039506
      2020-08-02    0.038243
      2020-08-03    0.036980
      Freq: D, Name: predicted_mean, dtype: float64

```

[49]: `!apt-get install texlive-xetex texlive-fonts-recommended texlive-plain-generic`

```

Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono
  fonts-texgyre fonts-urw-base35 libapache-pom-java libcommons-logging-java
  libcommons-parent-java libfontbox-java libgs9 libgs9-common libidn12
  libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1 libruby3.0
  libsynchronet2 libteckit0 libtexlua53 libtexluajit2 libwoff1 libzzip-0-13
  lmodern poppler-data preview-latex-style rake ruby ruby-net-telnet
  ruby-rubygems ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration tiutils
  teckit tex-common tex-gyre texlive-base texlive-binaries texlive-latex-base
  texlive-latex-extra texlive-latex-recommended texlive-pictures tipa
  xfonts-encodings xfonts-utils
Suggested packages:
  fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java
  libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java
  poppler-utils ghostscript fonts-japanese-mincho | fonts-ipafont-mincho
  fonts-japanese-gothic | fonts-ipafont-gothic fonts-arphic-ukai
  fonts-arphic-uming fonts-nanum ri ruby-dev bundler debhelper gv
  | postscript-viewer perl-tk xpdf | pdf-viewer xzdec
  texlive-fonts-recommended-doc texlive-latex-base-doc python3-pygments
  icc-profiles libfile-which-perl libspreadsheet-parseexcel-perl
  texlive-latex-extra-doc texlive-latex-recommended-doc texlive-luatex
  texlive-pstricks dot2tex prerex texlive-pictures-doc vprerex

```

default-jre-headless tipa-doc

The following NEW packages will be installed:

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono  
fonts-texgyre fonts-urw-base35 libapache-pom-java libcommons-logging-java  
libcommons-parent-java libfontbox-java libgs9 libgs9-common libidn12  
libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1 libruby3.0  
libsyntax2 libteckit0 libtexlua53 libtexluajit2 libwoff1 libzip-0-13  
lmodern poppler-data preview-latex-style rake ruby ruby-net-telnet  
ruby-rubygems ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration tiutils  
teckit tex-common tex-gyre texlive-base texlive-binaries  
texlive-fonts-recommended texlive-latex-base texlive-latex-extra  
texlive-latex-recommended texlive-pictures texlive-plain-generic  
texlive-xetex tipa xfonts-encodings xfonts-utils

0 upgraded, 53 newly installed, 0 to remove and 41 not upgraded.

Need to get 182 MB of archives.

After this operation, 571 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-droid-fallback all 1:6.0.1r16-1.1build1 [1,805 kB]

Get:2 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-lato all 2.0-2.1 [2,696 kB]

Get:3 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 poppler-data all 0.4.11-1 [2,171 kB]

Get:4 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-common all 6.17 [33.7 kB]

Get:5 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-urw-base35 all 20200910-1 [6,367 kB]

Get:6 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9-common all 9.55.0~dfsg1-0ubuntu5.13 [753 kB]

Get:7 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libidn12 amd64 1.38-4ubuntu1 [60.0 kB]

Get:8 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libijs-0.35 amd64 0.35-15build2 [16.5 kB]

Get:9 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libjbig2dec0 amd64 0.19-3build2 [64.7 kB]

Get:10 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9 amd64 9.55.0~dfsg1-0ubuntu5.13 [5,032 kB]

Get:11 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libkpathsea6 amd64 2021.20210626.59705-1ubuntu0.2 [60.4 kB]

Get:12 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libwoff1 amd64 1.0.2-1build4 [45.2 kB]

Get:13 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 dvisvgm amd64 2.13.1-1 [1,221 kB]

Get:14 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-lmodern all 2.004.5-6.1 [4,532 kB]

Get:15 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-noto-mono all 20201225-1build1 [397 kB]

Get:16 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-texgyre all 20180621-3.1 [10.2 MB]



Get:17 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libapache-pom-java  
 all 18-1 [4,720 B]  
 Get:18 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-parent-  
 java all 43-1 [10.8 kB]  
 Get:19 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-logging-  
 java all 1.2-2 [60.3 kB]  
 Get:20 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libptexenc1  
 amd64 2021.20210626.59705-1ubuntu0.2 [39.1 kB]  
 Get:21 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rubygems-integration  
 all 1.18 [5,336 B]  
 Get:22 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby3.0 amd64  
 3.0.2-7ubuntu2.11 [50.1 kB]  
 Get:23 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby-rubygems  
 all 3.3.5-2ubuntu1.2 [228 kB]  
 Get:24 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby amd64 1:3.0~exp1  
 [5,100 B]  
 Get:25 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rake all 13.0.6-2 [61.7  
 kB]  
 Get:26 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby-net-telnet all  
 0.1.1-2 [12.6 kB]  
 Get:27 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby-webrick  
 all 1.7.0-3ubuntu0.2 [52.5 kB]  
 Get:28 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby-xmlrpc all  
 0.3.2-1ubuntu0.1 [24.9 kB]  
 Get:29 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libruby3.0  
 amd64 3.0.2-7ubuntu2.11 [5,114 kB]  
 Get:30 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libsynchronet2  
 amd64 2021.20210626.59705-1ubuntu0.2 [55.6 kB]  
 Get:31 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libteckit0 amd64  
 2.5.11+ds1-1 [421 kB]  
 Get:32 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexlua53  
 amd64 2021.20210626.59705-1ubuntu0.2 [120 kB]  
 Get:33 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexluajit2  
 amd64 2021.20210626.59705-1ubuntu0.2 [267 kB]  
 Get:34 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libzip-0-13 amd64  
 0.13.72+dfsg.1-1.1 [27.0 kB]  
 Get:35 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-encodings all  
 1:1.0.5-0ubuntu2 [578 kB]  
 Get:36 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-utils amd64  
 1:7.7+6build2 [94.6 kB]  
 Get:37 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 lmodern all  
 2.004.5-6.1 [9,471 kB]  
 Get:38 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 preview-latex-style  
 all 12.2-1ubuntu1 [185 kB]  
 Get:39 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 t1utils amd64  
 1.41-4build2 [61.3 kB]  
 Get:40 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 teckit amd64  
 2.5.11+ds1-1 [699 kB]

```

Get:41 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tex-gyre all
20180621-3.1 [6,209 kB]
Get:42 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 texlive-
binaries amd64 2021.20210626.59705-1ubuntu0.2 [9,860 kB]
Get:43 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-base all
2021.20220204-1 [21.0 MB]
Get:44 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-fonts-
recommended all 2021.20220204-1 [4,972 kB]
Get:45 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-base
all 2021.20220204-1 [1,128 kB]
Get:46 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libfontbox-java all
1:1.8.16-2 [207 kB]
Get:47 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:48 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-
recommended all 2021.20220204-1 [14.4 MB]
Get:49 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
Get:50 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-extra
all 2021.20220204-1 [13.9 MB]
Get:51 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:52 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
Fetched 182 MB in 2s (72.7 MB/s)
Extracting templates from packages: 100%
Preconfiguring packages ...
Selecting previously unselected package fonts-droid-fallback.
(Reading database ... 121713 files and directories currently installed.)
Preparing to unpack .../00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
...
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Selecting previously unselected package fonts-lato.
Preparing to unpack .../01-fonts-lato_2.0-2.1_all.deb ...
Unpacking fonts-lato (2.0-2.1) ...
Selecting previously unselected package poppler-data.
Preparing to unpack .../02-poppler-data_0.4.11-1_all.deb ...
Unpacking poppler-data (0.4.11-1) ...
Selecting previously unselected package tex-common.
Preparing to unpack .../03-tex-common_6.17_all.deb ...
Unpacking tex-common (6.17) ...
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack .../04-fonts-urw-base35_20200910-1_all.deb ...
Unpacking fonts-urw-base35 (20200910-1) ...
Selecting previously unselected package libgs9-common.
Preparing to unpack .../05-libgs9-common_9.55.0~dfsg1-0ubuntu5.13_all.deb ...

```

```

Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.13) ...
Selecting previously unselected package libidn12:amd64.
Preparing to unpack .../06-libidn12_1.38-4ubuntu1_amd64.deb ...
Unpacking libidn12:amd64 (1.38-4ubuntu1) ...
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack .../07-libijs-0.35_0.35-15build2_amd64.deb ...
Unpacking libijs-0.35:amd64 (0.35-15build2) ...
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack .../08-libjbig2dec0_0.19-3build2_amd64.deb ...
Unpacking libjbig2dec0:amd64 (0.19-3build2) ...
Selecting previously unselected package libgs9:amd64.
Preparing to unpack .../09-libgs9_9.55.0~dfsg1-0ubuntu5.13_amd64.deb ...
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.13) ...
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack .../10-libkpathsea6_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack .../11-libwoff1_1.0.2-1build4_amd64.deb ...
Unpacking libwoff1:amd64 (1.0.2-1build4) ...
Selecting previously unselected package dvisvgm.
Preparing to unpack .../12-dvisvgm_2.13.1-1_amd64.deb ...
Unpacking dvisvgm (2.13.1-1) ...
Selecting previously unselected package fonts-lmodern.
Preparing to unpack .../13-fonts-lmodern_2.004.5-6.1_all.deb ...
Unpacking fonts-lmodern (2.004.5-6.1) ...
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack .../14-fonts-noto-mono_20201225-1build1_all.deb ...
Unpacking fonts-noto-mono (20201225-1build1) ...
Selecting previously unselected package fonts-texgyre.
Preparing to unpack .../15-fonts-texgyre_20180621-3.1_all.deb ...
Unpacking fonts-texgyre (20180621-3.1) ...
Selecting previously unselected package libapache-pom-java.
Preparing to unpack .../16-libapache-pom-java_18-1_all.deb ...
Unpacking libapache-pom-java (18-1) ...
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack .../17-libcommons-parent-java_43-1_all.deb ...
Unpacking libcommons-parent-java (43-1) ...
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack .../18-libcommons-logging-java_1.2-2_all.deb ...
Unpacking libcommons-logging-java (1.2-2) ...
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack .../19-libptexenc1_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package rubygems-integration.
Preparing to unpack .../20-rubygems-integration_1.18_all.deb ...
Unpacking rubygems-integration (1.18) ...

```

```

Selecting previously unselected package ruby3.0.
Preparing to unpack .../21-ruby3.0_3.0.2-7ubuntu2.11_amd64.deb ...
Unpacking ruby3.0 (3.0.2-7ubuntu2.11) ...
Selecting previously unselected package ruby-rubygems.
Preparing to unpack .../22-ruby-rubygems_3.3.5-2ubuntu1.2_all.deb ...
Unpacking ruby-rubygems (3.3.5-2ubuntu1.2) ...
Selecting previously unselected package ruby.
Preparing to unpack .../23-ruby_1%3a3.0~exp1_amd64.deb ...
Unpacking ruby (1:3.0~exp1) ...
Selecting previously unselected package rake.
Preparing to unpack .../24-rake_13.0.6-2_all.deb ...
Unpacking rake (13.0.6-2) ...
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack .../25-ruby-net-telnet_0.1.1-2_all.deb ...
Unpacking ruby-net-telnet (0.1.1-2) ...
Selecting previously unselected package ruby-webrick.
Preparing to unpack .../26-ruby-webrick_1.7.0-3ubuntu0.2_all.deb ...
Unpacking ruby-webrick (1.7.0-3ubuntu0.2) ...
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack .../27-ruby-xmlrpc_0.3.2-1ubuntu0.1_all.deb ...
Unpacking ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack .../28-libruby3.0_3.0.2-7ubuntu2.11_amd64.deb ...
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.11) ...
Selecting previously unselected package libsyntax2:amd64.
Preparing to unpack .../29-libsyntax2_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libsyntax2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack .../30-libteckit0_2.5.11+ds1-1_amd64.deb ...
Unpacking libteckit0:amd64 (2.5.11+ds1-1) ...
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack .../31-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
.../32-libtexluajit2_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libzip-0-13:amd64.
Preparing to unpack .../33-libzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb ...
Unpacking libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Selecting previously unselected package xfonts-encodings.
Preparing to unpack .../34-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb ...
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) ...
Selecting previously unselected package xfonts-utils.
Preparing to unpack .../35-xfonts-utils_1%3a7.7+6build2_amd64.deb ...
Unpacking xfonts-utils (1:7.7+6build2) ...

```

Selecting previously unselected package lmodern.  
 Preparing to unpack .../36-lmodern\_2.004.5-6.1\_all.deb ...  
 Unpacking lmodern (2.004.5-6.1) ...  
 Selecting previously unselected package preview-latex-style.  
 Preparing to unpack .../37-preview-latex-style\_12.2-1ubuntu1\_all.deb ...  
 Unpacking preview-latex-style (12.2-1ubuntu1) ...  
 Selecting previously unselected package t1utils.  
 Preparing to unpack .../38-t1utils\_1.41-4build2\_amd64.deb ...  
 Unpacking t1utils (1.41-4build2) ...  
 Selecting previously unselected package teckit.  
 Preparing to unpack .../39-teckit\_2.5.11+ds1-1\_amd64.deb ...  
 Unpacking teckit (2.5.11+ds1-1) ...  
 Selecting previously unselected package tex-gyre.  
 Preparing to unpack .../40-tex-gyre\_20180621-3.1\_all.deb ...  
 Unpacking tex-gyre (20180621-3.1) ...  
 Selecting previously unselected package texlive-binaries.  
 Preparing to unpack .../41-texlive-binaries\_2021.20210626.59705-1ubuntu0.2\_amd64.deb ...  
 Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...  
 Selecting previously unselected package texlive-base.  
 Preparing to unpack .../42-texlive-base\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-base (2021.20220204-1) ...  
 Selecting previously unselected package texlive-fonts-recommended.  
 Preparing to unpack .../43-texlive-fonts-recommended\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-fonts-recommended (2021.20220204-1) ...  
 Selecting previously unselected package texlive-latex-base.  
 Preparing to unpack .../44-texlive-latex-base\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-latex-base (2021.20220204-1) ...  
 Selecting previously unselected package libfontbox-java.  
 Preparing to unpack .../45-libfontbox-java\_1%3a1.8.16-2\_all.deb ...  
 Unpacking libfontbox-java (1:1.8.16-2) ...  
 Selecting previously unselected package libpdfbox-java.  
 Preparing to unpack .../46-libpdfbox-java\_1%3a1.8.16-2\_all.deb ...  
 Unpacking libpdfbox-java (1:1.8.16-2) ...  
 Selecting previously unselected package texlive-latex-recommended.  
 Preparing to unpack .../47-texlive-latex-recommended\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-latex-recommended (2021.20220204-1) ...  
 Selecting previously unselected package texlive-pictures.  
 Preparing to unpack .../48-texlive-pictures\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-pictures (2021.20220204-1) ...  
 Selecting previously unselected package texlive-latex-extra.  
 Preparing to unpack .../49-texlive-latex-extra\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-latex-extra (2021.20220204-1) ...  
 Selecting previously unselected package texlive-plain-generic.  
 Preparing to unpack .../50-texlive-plain-generic\_2021.20220204-1\_all.deb ...  
 Unpacking texlive-plain-generic (2021.20220204-1) ...  
 Selecting previously unselected package tipa.  
 Preparing to unpack .../51-tipa\_2%3a1.3-21\_all.deb ...

```

Unpacking tipa (2:1.3-21) ...
Selecting previously unselected package texlive-xetex.
Preparing to unpack .../52-texlive-xetex_2021.20220204-1_all.deb ...
Unpacking texlive-xetex (2021.20220204-1) ...
Setting up fonts-lato (2.0-2.1) ...
Setting up fonts-noto-mono (20201225-1build1) ...
Setting up libwoff1:amd64 (1.0.2-1build4) ...
Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libijs-0.35:amd64 (0.35-15build2) ...
Setting up libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libfontbox-java (1:1.8.16-2) ...
Setting up rubygems-integration (1.18) ...
Setting up libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Setting up fonts-urw-base35 (20200910-1) ...
Setting up poppler-data (0.4.11-1) ...
Setting up tex-common (6.17) ...
update-language: texlive-base not installed and configured, doing nothing!
Setting up libjbig2dec0:amd64 (0.19-3build2) ...
Setting up libteckit0:amd64 (2.5.11+ds1-1) ...
Setting up libapache-pom-java (18-1) ...
Setting up ruby-net-telnet (0.1.1-2) ...
Setting up xfonts-encodings (1:1.0.5-0ubuntu2) ...
Setting up t1utils (1.41-4build2) ...
Setting up libidn12:amd64 (1.38-4ubuntu1) ...
Setting up fonts-texgyre (20180621-3.1) ...
Setting up libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up ruby-webrick (1.7.0-3ubuntu0.2) ...
Setting up fonts-lmodern (2.004.5-6.1) ...
Setting up fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Setting up ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Setting up libsynchronet2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libgs9-common (9.55.0~dfsg1-0ubuntu5.13) ...
Setting up teckit (2.5.11+ds1-1) ...
Setting up libpdfbox-java (1:1.8.16-2) ...
Setting up libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.13) ...
Setting up preview-latex-style (12.2-1ubuntu1) ...
Setting up libcommons-parent-java (43-1) ...
Setting up dvisvgm (2.13.1-1) ...
Setting up libcommons-logging-java (1.2-2) ...
Setting up xfonts-utils (1:7.7+6build2) ...
Setting up libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6.1) ...
Setting up texlive-base (2021.20220204-1) ...

```

```

/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN...
mktexlsr: Updating /var/lib/texmf/ls-R...
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4: /var/lib/texmf/tex/generic/tex-
ini-files/pdftexconfig.tex
Setting up tex-gyre (20180621-3.1) ...
Setting up texlive-plain-generic (2021.20220204-1) ...
Setting up texlive-latex-base (2021.20220204-1) ...
Setting up texlive-latex-recommended (2021.20220204-1) ...
Setting up texlive-pictures (2021.20220204-1) ...
Setting up texlive-fonts-recommended (2021.20220204-1) ...
Setting up tipa (2:1.3-21) ...
Setting up texlive-latex-extra (2021.20220204-1) ...
Setting up texlive-xetex (2021.20220204-1) ...
Setting up rake (13.0.6-2) ...
Setting up libruby3.0:amd64 (3.0.2-7ubuntu2.11) ...
Setting up ruby3.0 (3.0.2-7ubuntu2.11) ...
Setting up ruby (1:3.0~exp1) ...
Setting up ruby-rubygems (3.3.5-2ubuntu1.2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for mailcap (3.70+nmu1ubuntu1) ...
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) ...
Processing triggers for libc-bin (2.35-0ubuntu3.8) ...
/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opencl.so.0 is not a symbolic
link

```

```

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a
symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero_v2.so.0 is not a
symbolic link

```

```

Processing triggers for tex-common (6.17) ...
Running updmap-sys. This may take some time... done.
Running mktexlsr /var/lib/texmf ... done.
Building format(s) --all.
    This may take some time... done.

```

```

[50]: from google.colab import drive
      drive.mount('/content/gdrive')

```

Mounted at /content/gdrive

```

[54]: !jupyter nbconvert --to pdf '/content/gdrive/MyDrive/Colab Notebooks/COVID.
      ↪ipynb'

```

```

[NbConvertApp] WARNING | pattern '/content/gdrive/MyDrive/Colab
Notebooks/COVID.ipynb' matched no files
This application is used to convert notebook files (*.ipynb)
to various other formats.

```

WARNING: THE COMMANDLINE INTERFACE MAY CHANGE IN FUTURE RELEASES.

Options  
=====

The options below are convenience aliases to configurable class-options,  
as listed in the "Equivalent to" description-line of the aliases.  
To see all configurable class-options for some <cmd>, use:  
    <cmd> --help-all

--debug  
    set log level to logging.DEBUG (maximize logging output)  
    Equivalent to: [--Application.log\_level=10]



```

--show-config
    Show the application's configuration (human-readable format)
    Equivalent to: [--Application.show_config=True]
--show-config-json
    Show the application's configuration (json format)
    Equivalent to: [--Application.show_config_json=True]
--generate-config
    generate default config file
    Equivalent to: [--JupyterApp.generate_config=True]
-y
    Answer yes to any questions instead of prompting.
    Equivalent to: [--JupyterApp.answer_yes=True]
--execute
    Execute the notebook prior to export.
    Equivalent to: [--ExecutePreprocessor.enabled=True]
--allow-errors
    Continue notebook execution even if one of the cells throws an error and
    include the error message in the cell output (the default behaviour is to abort
    conversion). This flag is only relevant if '--execute' was specified, too.
    Equivalent to: [--ExecutePreprocessor.allow_errors=True]
--stdin
    read a single notebook file from stdin. Write the resulting notebook with
    default basename 'notebook.*'
    Equivalent to: [--NbConvertApp.from_stdin=True]
--stdout
    Write notebook output to stdout instead of files.
    Equivalent to: [--NbConvertApp.writer_class=StdoutWriter]
--inplace
    Run nbconvert in place, overwriting the existing notebook (only
    relevant when converting to notebook format)
    Equivalent to: [--NbConvertApp.use_output_suffix=False
--NbConvertApp.export_format=notebook --FilesWriter.build_directory=]
--clear-output
    Clear output of current file and save in place,
    overwriting the existing notebook.
    Equivalent to: [--NbConvertApp.use_output_suffix=False
--NbConvertApp.export_format=notebook --FilesWriter.build_directory=
--ClearOutputPreprocessor.enabled=True]
--coalesce-streams
    Coalesce consecutive stdout and stderr outputs into one stream (within each
    cell).
    Equivalent to: [--NbConvertApp.use_output_suffix=False
--NbConvertApp.export_format=notebook --FilesWriter.build_directory=
--CoalesceStreamsPreprocessor.enabled=True]
--no-prompt
    Exclude input and output prompts from converted document.
    Equivalent to: [--TemplateExporter.exclude_input_prompt=True
--TemplateExporter.exclude_output_prompt=True]

```

```

--no-input
    Exclude input cells and output prompts from converted document.
    This mode is ideal for generating code-free reports.
    Equivalent to: [--TemplateExporter.exclude_output_prompt=True]
--TemplateExporter.exclude_input=True
--TemplateExporter.exclude_input_prompt=True]
--allow-chromium-download
    Whether to allow downloading chromium if no suitable version is found on the
    system.
    Equivalent to: [--WebPDFExporter.allow_chromium_download=True]
--disable-chromium-sandbox
    Disable chromium security sandbox when converting to PDF..
    Equivalent to: [--WebPDFExporter.disable_sandbox=True]
--show-input
    Shows code input. This flag is only useful for dejavu users.
    Equivalent to: [--TemplateExporter.exclude_input=False]
--embed-images
    Embed the images as base64 dataurls in the output. This flag is only useful
    for the HTML/WebPDF/Slides exports.
    Equivalent to: [--HTMLExporter.embed_images=True]
--sanitize-html
    Whether the HTML in Markdown cells and cell outputs should be sanitized..
    Equivalent to: [--HTMLExporter.sanitize_html=True]
--log-level=<Enum>
    Set the log level by value or name.
    Choices: any of [0, 10, 20, 30, 40, 50, 'DEBUG', 'INFO', 'WARN', 'ERROR',
    'CRITICAL']
    Default: 30
    Equivalent to: [--Application.log_level]
--config=<Unicode>
    Full path of a config file.
    Default: ''
    Equivalent to: [--JupyterApp.config_file]
--to=<Unicode>
    The export format to be used, either one of the built-in formats
    ['asciidoc', 'custom', 'html', 'latex', 'markdown', 'notebook',
    'pdf', 'python', 'qtpdf', 'qtpng', 'rst', 'script', 'slides', 'webpdf']
    or a dotted object name that represents the import path for an
    ``Exporter`` class
    Default: ''
    Equivalent to: [--NbConvertApp.export_format]
--template=<Unicode>
    Name of the template to use
    Default: ''
    Equivalent to: [--TemplateExporter.template_name]
--template-file=<Unicode>
    Name of the template file to use
    Default: None

```

Equivalent to: [--TemplateExporter.template\_file]

--theme=<Unicode>  
 Template specific theme(e.g. the name of a JupyterLab CSS theme distributed as prebuilt extension for the lab template)  
 Default: 'light'  
 Equivalent to: [--HTMLExporter.theme]

--sanitize\_html=<Bool>  
 Whether the HTML in Markdown cells and cell outputs should be sanitized. This should be set to True by nbviewer or similar tools.  
 Default: False  
 Equivalent to: [--HTMLExporter.sanitize\_html]

--writer=<DottedObjectName>  
 Writer class used to write the  
 results of the conversion  
 Default: 'FilesWriter'  
 Equivalent to: [--NbConvertApp.writer\_class]

--post=<DottedOrNone>  
 PostProcessor class used to write the  
 results of the conversion  
 Default: ''  
 Equivalent to: [--NbConvertApp.postprocessor\_class]

--output=<Unicode>  
 Overwrite base name use for output files.  
 Supports pattern replacements '{notebook\_name}'.  
 Default: '{notebook\_name}'  
 Equivalent to: [--NbConvertApp.output\_base]

--output-dir=<Unicode>  
 Directory to write output(s) to. Defaults  
 to output to the directory of each notebook.  
 To recover  
 previous default behaviour (outputting to the  
 current  
 working directory) use . as the flag value.  
 Default: ''  
 Equivalent to: [--FilesWriter.build\_directory]

--reveal-prefix=<Unicode>  
 The URL prefix for reveal.js (version 3.x).  
 This defaults to the reveal CDN, but can be any url pointing to a  
 copy  
 of reveal.js.  
 For speaker notes to work, this must be a relative path to a local  
 copy of reveal.js: e.g., "reveal.js".  
 If a relative path is given, it must be a subdirectory of the  
 current directory (from which the server is run).  
 See the usage documentation  
 ([https://nbconvert.readthedocs.io/en/latest/usage.html#reveal-js-  
 html-slideshow](https://nbconvert.readthedocs.io/en/latest/usage.html#reveal-js-html-slideshow))  
 for more details.

Default: ''  
Equivalent to: [--SlidesExporter.reveal\_url\_prefix]  
--nbformat=<Enum>  
The nbformat version to write.  
Use this to downgrade notebooks.  
Choices: any of [1, 2, 3, 4]  
Default: 4  
Equivalent to: [--NotebookExporter.nbformat\_version]

## Examples

-----

The simplest way to use nbconvert is

```
> jupyter nbconvert mynotebook.ipynb --to html
```

Options include ['asciidoc', 'custom', 'html', 'latex', 'markdown', 'notebook', 'pdf', 'python', 'qtpdf', 'qtpng', 'rst', 'script', 'slides', 'webpdf'].

```
> jupyter nbconvert --to latex mynotebook.ipynb
```

Both HTML and LaTeX support multiple output templates. LaTeX includes

'base', 'article' and 'report'. HTML includes 'basic', 'lab' and 'classic'. You can specify the flavor of the format used.

```
> jupyter nbconvert --to html --template lab mynotebook.ipynb
```

You can also pipe the output to stdout, rather than a file

```
> jupyter nbconvert mynotebook.ipynb --stdout
```

PDF is generated via latex

```
> jupyter nbconvert mynotebook.ipynb --to pdf
```

You can get (and serve) a Reveal.js-powered slideshow

```
> jupyter nbconvert myslides.ipynb --to slides --post serve
```

Multiple notebooks can be given at the command line in a couple of different ways:

```
> jupyter nbconvert notebook*.ipynb  
> jupyter nbconvert notebook1.ipynb notebook2.ipynb
```

or you can specify the notebooks list in a config file, containing::

```
c.NbConvertApp.notebooks = ["my_notebook.ipynb"]
```

```
> jupyter nbconvert --config mycfg.py
```

To see all available configurables, use `--help-all`.

```
[55]: from google.colab import files
files.download('/content/gdrive/MyDrive/Colab Notebooks/COVID.pdf')
```

```
-----
FileNotFoundError                                Traceback (most recent call last)
/tmp/ipython-input-2986145528.py in <cell line: 0>()
      1 from google.colab import files
----> 2 files.download('/content/gdrive/MyDrive/Colab Notebooks/COVID.pdf')

/usr/local/lib/python3.12/dist-packages/google/colab/files.py in _
    ↪download(filename)
      231 if not _os.path.exists(filename):
      232     msg = 'Cannot find file: {}'.format(filename)
--> 233     raise FileNotFoundError(msg) # pylint: disable=undefined-variable
      234
      235 comm_manager = _IPython.get_ipython().kernel.comm_manager

FileNotFoundError: Cannot find file: /content/gdrive/MyDrive/Colab Notebooks/
    ↪COVID.pdf
```