Readme File

Assumption:

States List :

Andhra Pradesh - ap, Arunachal Pradesh - ar, Assam- as, Bihar - br, Chhattisgarh-ct, Goa - ga, Gujarat - gj, Haryana - hr, Himachal Pradesh- hp, Jharkhand - jr, Karnataka - ka, Kerala - kl, Madhya Pradesh - mp, Maharashtra - mh, Manipur - mn, Meghalaya - ml, Mizoram - mz, Nagaland - nl, Odisha - or, Punjab - pb, Rajasthan - rj, Sikkim - sk, Tamil Nadu - tn, Telangana - tg, Tripura - tr, Uttar Pradesh - up, Uttarakhand -ut, West Bengal -wb

Union Territories List :

Andaman and Nicobar - an, Chandigarh - ch, Dadra Nagar Haveli - dn, Daman and Diu - dd, Delhi - dl, Jammu and Kashmir - jk, Lakshadweep- la, Ladakh - ld, Puducherry -py

Data Preprocessing :

1. Know your data:
   The JSON data is stored in a dataframe. It has the following columns:

```
:(['an', 'ap', 'ar', 'as', 'br', 'ch', 'ct', 'date', 'dateymd', 'dd', 'dl',
   'dn', 'ga', 'gj', 'hp', 'hr', 'jh', 'jk', 'ka', 'kl', 'la', 'ld', 'mh',
   'ml', 'mn', 'mp', 'mz', 'nl', 'or', 'pb', 'py', 'rj', 'sk', 'status',
   'tg', 'tn', 'tr', 'tt', 'un', 'up', 'ut', 'wb'],
```

2. Feature Selection:
   The “tt” and “un” are dropped. The “un” column is zero for all the rows. The Total count has been calculated without using the ‘tt’ column.
3. Handling Data Type:
   The numbers in the dataset are in string form and numerical operations cannot be performed, so they are converted from ‘str’ to ‘int’.

Q1. Data Manipulation

1. **Count the total number of "Confirmed," "Recovered," and "Deceased" from 14-Mar-2020 to 16-Aug-2021 and report the numbers.**

Solution :

- We created three different data frames that contain rows corresponding to 'Confirmed', 'Recovered' and 'Deceased' status namely, df_confirmed, df_recovered, df_deceased respectively.
- Then, we dropped 'tt', 'date', 'dateymd' 'status', and 'un' columns from these data frames.
- We calculated the total count of "Confirmed," "Recovered," and "Deceased" for all States and Union Territories.

Output :

```
Total number of "Confirmed" from 14-Mar-2020 to 16-Aug-2021 are :  32249047
Total number of "Recovered" from 14-Mar-2020 to 16-Aug-2021 are :  31441098
Total number of "Deceased" from 14-Mar-2020 to 16-Aug-2021 are :  432118
```

2. **Count the total number of "Confirmed," "Recovered," and "Deceased" from 14-Mar-2020 to 16-Aug-2021 for each state: Delhi, Maharashtra, West Bengal, and Tamil Nadu.**

Solution :

- The total is calculated from the above mentioned three data frames, only for 4 columns:
- We simply fetched the column name 'dl' (corresponding to Delhi), column name 'mh' (corresponding to Maharastra), column name 'wb' (corresponding to West Bengal), column name 'tn' (corresponding to Tamil Nadu) and find the sum of the entire column.

Output :

```
Total number of "Confirmed" from 14-Mar-2020 to 16-Aug-2021 in Delhi are :  1437118
Total number of "Confirmed" from 14-Mar-2020 to 16-Aug-2021 in Maharashtra are :  6396805
Total number of "Confirmed" from 14-Mar-2020 to 16-Aug-2021 in West-Bengal are :  1539065
Total number of "Confirmed" from 14-Mar-2020 to 16-Aug-2021 in Tamil Nadu are :  2590632
Total number of "Recovered" from 14-Mar-2020 to 16-Aug-2021 in Delhi are :  1411582
Total number of "Recovered" from 14-Mar-2020 to 16-Aug-2021 in Maharashtra are :  6195744
Total number of "Recovered" from 14-Mar-2020 to 16-Aug-2021 in West-Bengal are :  1510921
Total number of "Recovered" from 14-Mar-2020 to 16-Aug-2021 in Tamil Nadu are :  2535715
Total number of "Deceased" from 14-Mar-2020 to 16-Aug-2021 in Delhi are :  25069
Total number of "Deceased" from 14-Mar-2020 to 16-Aug-2021 in Maharashtra are :  135138
Total number of "Deceased" from 14-Mar-2020 to 16-Aug-2021 in West-Bengal are :  18312
Total number of "Deceased" from 14-Mar-2020 to 16-Aug-2021 in Tamil Nadu are :  34547
```

3. **Report the top 10 states with the highest recovery rate and top 10 states with the lowest recovery rate from 14-Mar-2020 to 16-Aug-2021.**

Solution :

- To calculate the recovery rate:
  $Recovery\ rate\ =\ (total\ recovery\ in\ the\ state)\ /\ (total\ confirmed\ positive\ cases\ in\ the\ state)$
- The recovery rate of each state is calculated by dividing the cumulative recovery total of the state by the total positive cases of the state from 14-Mar-2020 to 16-Aug-2021.
- The states are sorted based on the recovery rates in ascending order and top 10 and lowest 10 are printed.

Output :

```
Top 10 states with the lowest recovery rate

mz : 0.8139062243389719
sk : 0.9052920914373195
nl : 0.9122740834733701
mn : 0.9264787175234936
ml : 0.9294440669504805
kl : 0.9482732635807194
ar : 0.9594292924390954
ut : 0.9598286082887973
mh : 0.968568376155225
hp : 0.9702879954376961


Top 10 states with the highest recovery rate

rj : 0.9904240766073872
gj : 0.9875653784070694
mp : 0.9866042795602264
hr : 0.9865910356763101
up : 0.9864216140051938
br : 0.9864052002900077
ct : 0.9853688179594846
jh : 0.9846344164904558
ap : 0.9845187548223785
tg : 0.9840113694203068
```

Inference :

- Mizoram, Sikkim, Nagaland, Manipur, Meghalaya, Kerala, Arunachal Pradesh, Uttrakhand, Maharashtra and Himachal Pradesh have the lowest recovery rate in ascending order.
- Rajasthan, Gujrat, Madhya Pradesh, Haryana, Uttar Pradesh, Bihar, Chhattisgarh, Jharkhand, Andhra Pradesh and Telangana have the highest recovery rates in ascending order.

4. **Report the top 3 highest affected states in terms of "Confirmed," "Recovered," and "Deceased," with the count from 14-Mar-2020 to 16-Aug-2021.**

Solution :

- A list is made for storing the total confirmed cases for each state.
- Similarly lists are made for total recovered cases and total deceased cases for each state.
- The states are sorted based on the count of the cases in the lists.

Output :

```
Top 3 highest affected states in terms of Confirmed
mh : 6396805
kl : 3702417
ka : 2930529
Top 3 highest affected states in terms of Recovered
mh : 6195744
kl : 3510904
ka : 2871449
Top 3 highest affected states in terms of Deceased
mh : 135138
ka : 37014
tn : 34547
```

Inference :

- Maharashtra, Kerala, and Karnataka have the highest affected and recovered cases.
- Maximum people deceased in Maharashtra, Karnataka, and Tamil Nadu.

5. **Report the top 3 lowest affected states in terms of "Confirmed," "Recovered," and "Deceased," with the count from 14-Mar-2020 to 16-Aug-2021.**

Solution :

- The lowest affected states are also extracted using the same method as above.

Output :

```
Top 3 lowest affected states in terms of Confirmed
sk : 28740
nl : 29158
mz : 48711
Top 3 lowest affected states in terms of Recovered
sk : 26019
nl : 26601
mz : 39647
Top 3 lowest affected states in terms of Deceased
mz : 184
ar : 252
sk : 361
```

Inference :

- Sikkim, Nagaland and Mizoram has the lowest affected and recovered count.
- The lowest deceased count is in states Mizoram, Arunachal Pradesh and Sikkim.

6. **Find the day and count with the highest spike in a day in the number of cases for each state and UTs for "Confirmed," "Recovered" and "Deceased" between dates 14-Mar-2020 and 16-Aug-2021.**

Solution :

- For all the states, we find the index that has the maximum count of Confirmed, Recovered, Deceased data frames separately.
- Then we find the corresponding dates using the index retrieved.

Output :

	State	Highest Number of Confirmed cases	Date
0	an	149	14-Aug-20
1	ap	24171	16-May-21
2	ar	566	12-Jul-21
3	as	6573	20-May-21
4	br	15853	30-Apr-21
5	ch	895	09-May-21
6	ct	17397	23-Apr-21
7	dd	0	14-Mar-20
8	dl	28395	20-Apr-21
9	dn	359	22-Apr-21
10	ga	4195	07-May-21
11	gj	14605	30-Apr-21
12	hp	5424	08-May-21
13	hr	15786	04-May-21
14	jh	8075	28-Apr-21
15	jk	5443	07-May-21
16	ka	50112	05-May-21
17	kl	43529	12-May-21
18	la	362	17-Apr-21
19	ld	345	21-May-21
20	mh	68631	18-Apr-21
21	ml	1183	20-May-21
22	mn	1327	21-Jul-21
23	mp	13601	25-Apr-21
24	mz	1369	26-Jul-21
25	nl	366	13-May-21
26	or	12852	23-May-21
27	pb	9042	08-May-21
28	py	2049	11-May-21
29	rj	18298	02-May-21
30	sk	420	28-May-21
31	tg	11451	07-May-21
32	tn	36184	21-May-21
33	tr	879	19-May-21
34	up	37944	24-Apr-21
35	ut	9642	07-May-21
36	wb	20846	14-May-21

	State	Highest Number of Recovered cases	Date
0	an	149	14-Aug-20
1	ap	24171	16-May-21
2	ar	566	12-Jul-21
3	as	6573	20-May-21
4	br	15853	30-Apr-21
5	ch	895	09-May-21
6	ct	17397	23-Apr-21
7	dd	0	14-Mar-20
8	dl	28395	20-Apr-21
9	dn	359	22-Apr-21
10	ga	4195	07-May-21
11	gj	14605	30-Apr-21
12	hp	5424	08-May-21
13	hr	15786	04-May-21
14	jh	8075	28-Apr-21
15	jk	5443	07-May-21
16	ka	50112	05-May-21
17	kl	43529	12-May-21
18	la	362	17-Apr-21
19	ld	345	21-May-21
20	mh	68631	18-Apr-21
21	ml	1183	20-May-21
22	mn	1327	21-Jul-21
23	mp	13601	25-Apr-21
24	mz	1369	26-Jul-21
25	nl	366	13-May-21
26	or	12852	23-May-21
27	pb	9042	08-May-21
28	py	2049	11-May-21
29	rj	18298	02-May-21
30	sk	420	28-May-21
31	tg	11451	07-May-21
32	tn	36184	21-May-21
33	tr	879	19-May-21
34	up	37944	24-Apr-21
35	ut	9642	07-May-21
36	wb	20846	14-May-21

	State	Highest Number of Deceased cases	Date
0	an	149	14-Aug-20
1	ap	24171	16-May-21
2	ar	566	12-Jul-21
3	as	6573	20-May-21
4	br	15853	30-Apr-21
5	ch	895	09-May-21
6	ct	17397	23-Apr-21
7	dd	0	14-Mar-20
8	dl	28395	20-Apr-21
9	dn	359	22-Apr-21
10	ga	4195	07-May-21
11	gj	14605	30-Apr-21
12	hp	5424	08-May-21
13	hr	15786	04-May-21
14	jh	8075	28-Apr-21
15	jk	5443	07-May-21
16	ka	50112	05-May-21
17	kl	43529	12-May-21
18	la	362	17-Apr-21
19	ld	345	21-May-21
20	mh	68631	18-Apr-21
21	ml	1183	20-May-21
22	mn	1327	21-Jul-21
23	mp	13601	25-Apr-21
24	mz	1369	26-Jul-21
25	nl	366	13-May-21
26	or	12852	23-May-21
27	pb	9042	08-May-21
28	py	2049	11-May-21
29	rj	18298	02-May-21
30	sk	420	28-May-21
31	tg	11451	07-May-21
32	tn	36184	21-May-21
33	tr	879	19-May-21
34	up	37944	24-Apr-21
35	ut	9642	07-May-21
36	wb	20846	14-May-21

7. **Report active cases (Assume active = Confirmed - (Recovered + Deceased)) state-wise for all individual states and UTs on date 15-Aug-2021 (This date only) starting from 14-March-2020.**

Solution :

- Formula Used :

$$active\ cases\ [state]\ =\ Confirmed\ [state]\ -\ (Recovered\ [state]\ +\ Deceased\ [state])$$

Output :

```
an : 6
ap : 17218
ar : 1837
as : 8947
br : 213
ch : 43
ct : 1138
dd : 0
dl : 467
dn : -18
ga : 873
gj : 183
hp : 2716
hr : 667
jh : 209
jk : 1229
ka : 22066
kl : 172769
la : 13
ld : 79
mh : 65923
ml : 3852
mn : 6263
mp : 93
mz : 8880
nl : 1958
or : 9020
pb : 557
py : 894
rj : 180
sk : 2360
tg : 6583
tn : 20370
tr : 1601
up : 419
ut : 6391
wb : 9832
```

Inference :

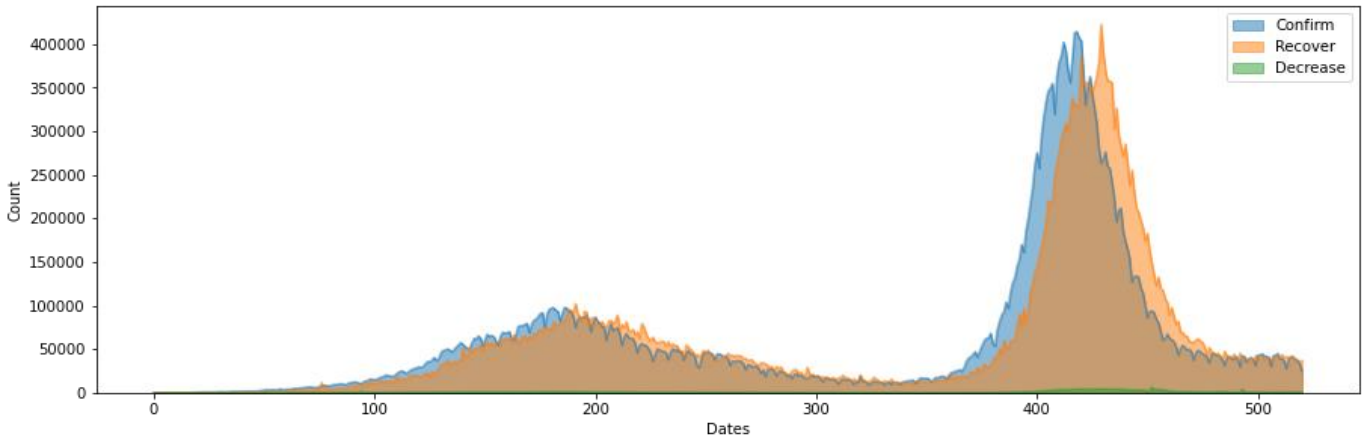
- "Dadar and Nagar Haveli - dn" has more (Recovered + deceased) cases than confirmed cases so the count is negative.
- "Daman and Diu - dn" has 0 confirmed, recovered and deceased cases.

Q2. Plotting

- We used matplotlib.pyplot library to plot the area trend line. We have set "stacked" to false. The legends are used to clearly demonstrate the colour code.

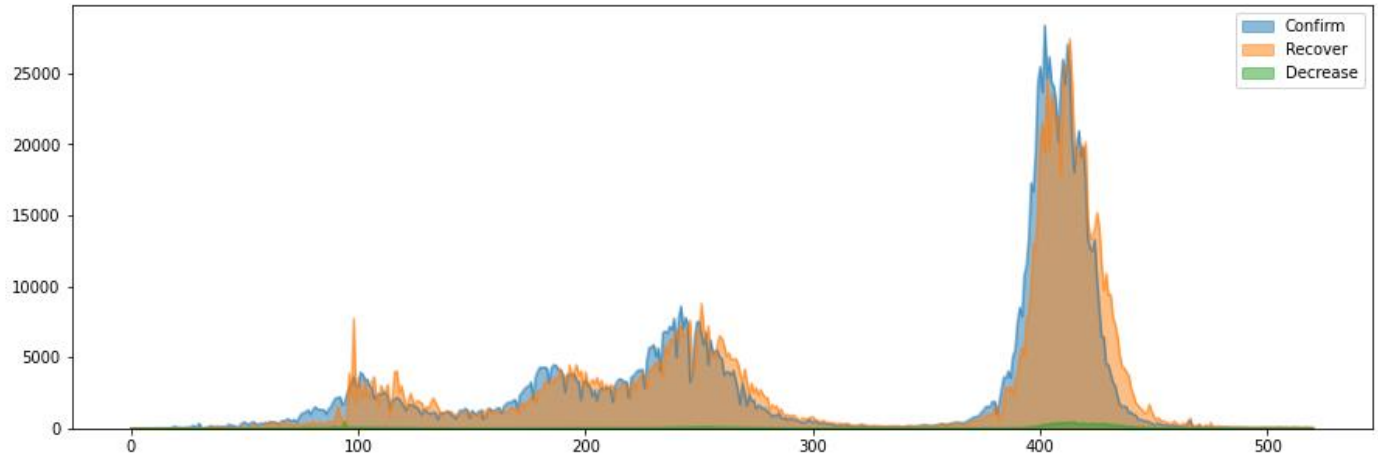
1. **Plot the area trend line for total "Confirmed," "Recovered," and "Deceased" cases from 14-Mar-2020 to 16-Aug-2021**.

Output :



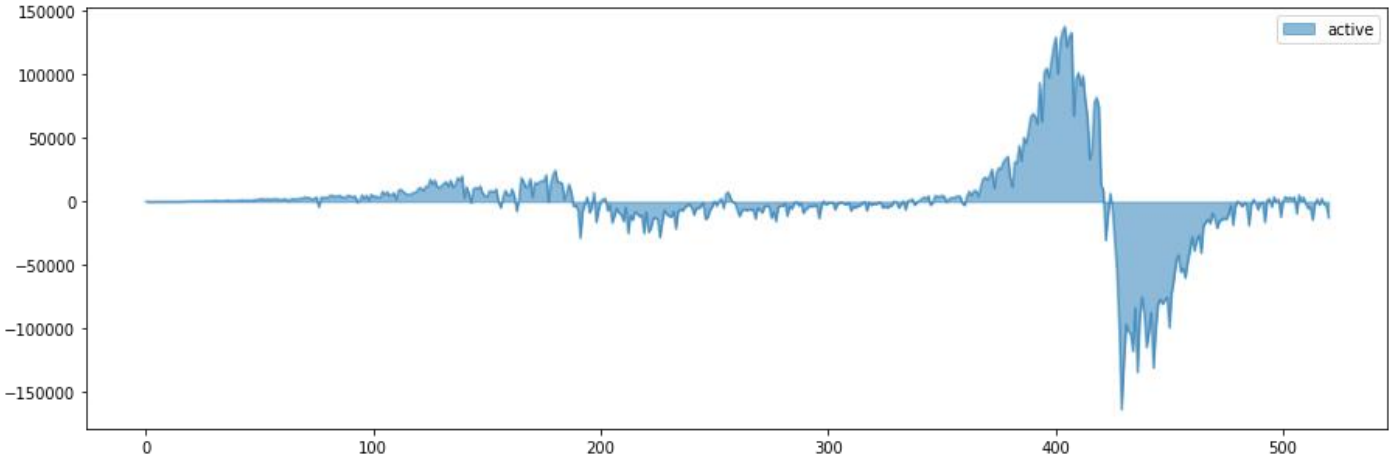
2. **Plot the area trend line for total "Confirmed," "Recovered," and "Deceased" cases for Delhi (dl) from 14-Mar-2020 to 16-Aug-2021.**

Output :



3. **Plot the area trend line for active cases. Assume active = Confirmed - (Recovered + Deceased) from 14-Mar-2020 to 16-Aug-2021.**

Solution :



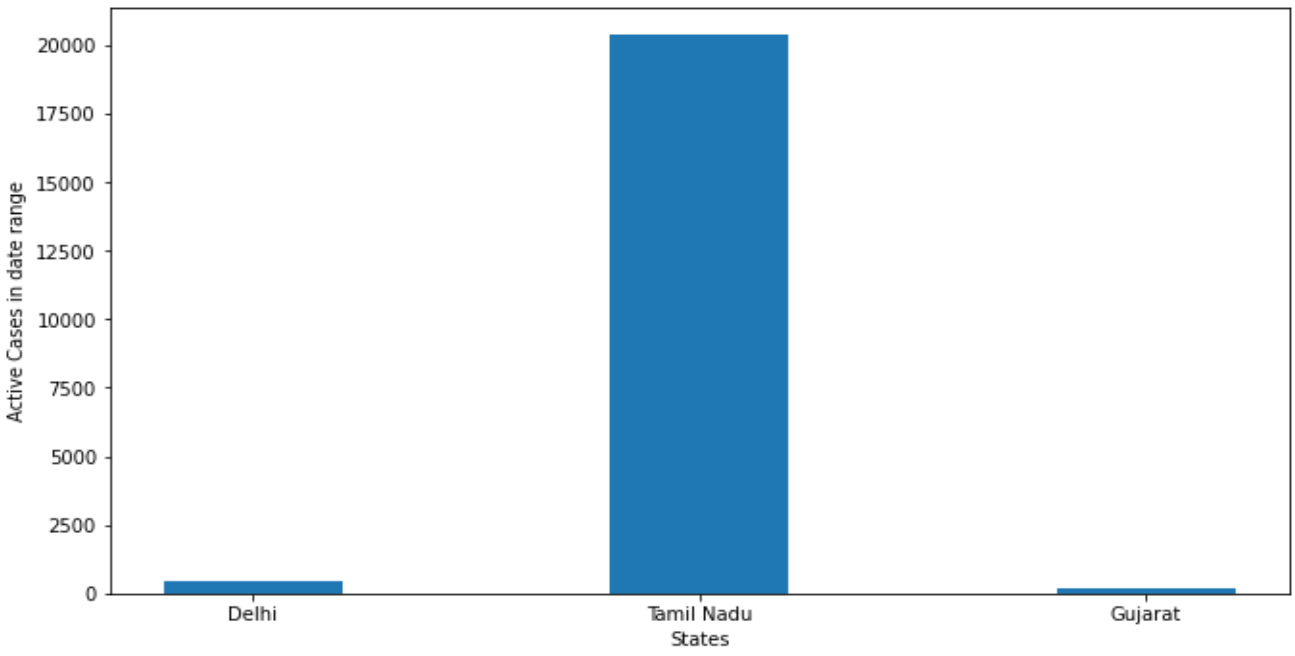
4. **Plot a bar plot of the number of active cases in Delhi, Tamil Nadu, and Gujarat for any date range of your choice.**

Solution :

Input of Date Format : Year-Month-Day

Start_Date: 2020-03-14

End_Date: 2021-08-16



Input of Date Format : Year-Month-Day

Start_Date: 2020-03-14

End_Date: 2020-05-16