```
# Import libraries
import pandas as pd
import numpy as np
from datetime import datetime
from calendar import month_name
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.feature_extraction.text import CountVectorizer
import matplotlib.pyplot as plt
import seaborn as sns
import nltk
from wordcloud import WordCloud, STOPWORDS

# Get dataset
tc_df = pd.read_csv('Comcast_telecom_complaints_data.csv')
tc_df.head()
```

```
  Ticket #                                  Customer Complaint
Date  \
0   250635                       Comcast Cable Internet Speeds  22-04-
15
1   223441       Payment disappear - service got disconnected  04-08-
15
2   242732                                    Speed and Service  18-04-
15
3   277946  Comcast Imposed a New Usage Cap of 300GB that ...  05-07-
15
4   307175         Comcast not working and no service to boot  26-05-
15

  Date_month_year         Time        Received Via      City     State
\
0       22-Apr-15   3:53:50 PM  Customer Care Call  Abingdon  Maryland

1       04-Aug-15  10:22:56 AM            Internet   Acworth   Georgia

2       18-Apr-15   9:55:47 AM            Internet   Acworth   Georgia

3       05-Jul-15  11:59:35 AM            Internet   Acworth   Georgia

4       26-May-15   1:25:26 PM            Internet   Acworth   Georgia


   Zip code  Status Filing on Behalf of Someone
0     21009  Closed                          No
1     30102  Closed                          No
2     30101  Closed                         Yes
3     30101    Open                         Yes
4     30101  Solved                          No
```

```
tc_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2224 entries, 0 to 2223
Data columns (total 11 columns):
 #   Column                       Non-Null Count  Dtype 
---  ------                       --------------  ----- 
 0   Ticket #                     2224 non-null   object
 1   Customer Complaint           2224 non-null   object
 2   Date                         2224 non-null   object
 3   Date_month_year              2224 non-null   object
 4   Time                         2224 non-null   object
 5   Received Via                 2224 non-null   object
 6   City                         2224 non-null   object
 7   State                        2224 non-null   object
 8   Zip code                     2224 non-null   int64 
 9   Status                       2224 non-null   object
 10  Filing on Behalf of Someone  2224 non-null   object
dtypes: int64(1), object(10)
memory usage: 191.2+ KB
```

```
tc_df.shape
```

```
(2224, 11)
```

```
# Unique values in Customer Complaint

tc_df['Customer Complaint'].nunique()
```

```
1841
```

```
# Unique values in Received Via
tc_df['Received Via'].value_counts()
```

```
Customer Care Call    1119
Internet              1105
Name: Received Via, dtype: int64
```

```
# Unique values in City
tc_df['City'].nunique()
```

```
928
```

```
# Unique values in State
tc_df['State'].nunique()
```

```
43
```

```
# Unique values in Status
tc_df['Status'].value_counts()
```

```
Solved     973
Closed     734
Open       363
```

```
Pending    154
Name: Status, dtype: int64
```

As open and pending refers to same state and also closed and solved refers to same state. So we can map them to open and closed only.

```
def setState(x):
    if x == 'Pending':
        return 'Open'
    elif x == 'Solved':
        return 'Closed'
    else:
        return x

tc_df['Status'] = tc_df['Status'].apply(setState)

tc_df['Status'].value_counts()
```

```
Closed    1707
Open       517
Name: Status, dtype: int64
```

```
# Unique values in Filing on Behalf of Someone
tc_df['Filing on Behalf of Someone'].value_counts()
```

```
No     2021
Yes     203
Name: Filing on Behalf of Someone, dtype: int64
```

To get the trend for number of complaint, we need to sort the dates and get the count for each one.

```
tc_df['Date_month_year'] = pd.to_datetime(tc_df['Date_month_year'])
tc_df['Month'] =  tc_df['Date_month_year'].apply(lambda x: x.month)
tc_df['Day'] = tc_df['Date_month_year'].apply(lambda x: x.day)
tc_df['Day of Week'] = tc_df['Date_month_year'].apply(lambda x:
x.dayofweek)

tc_df.head()
```

```
  Ticket #                                    Customer Complaint
Date  \
0   250635                      Comcast Cable Internet Speeds  22-04-
15
1   223441       Payment disappear - service got disconnected  04-08-
15
2   242732                                   Speed and Service  18-04-
15
3   277946  Comcast Imposed a New Usage Cap of 300GB that ...  05-07-
15
4   307175         Comcast not working and no service to boot  26-05-
15
```

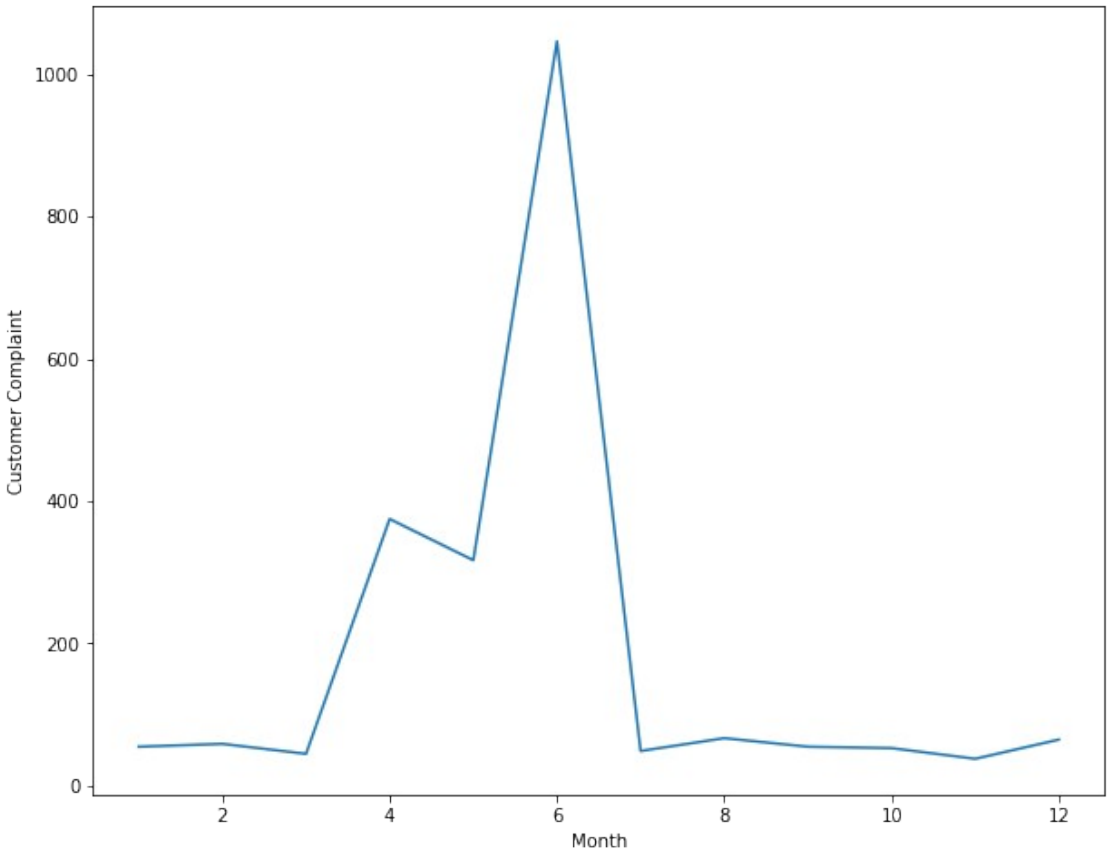
```
  Date_month_year         Time        Received Via      City     State
\
0      2015-04-22   3:53:50 PM  Customer Care Call  Abingdon  Maryland

1      2015-08-04  10:22:56 AM            Internet   Acworth   Georgia

2      2015-04-18   9:55:47 AM            Internet   Acworth   Georgia

3      2015-07-05  11:59:35 AM            Internet   Acworth   Georgia

4      2015-05-26   1:25:26 PM            Internet   Acworth   Georgia


   Zip code  Status Filing on Behalf of Someone  Month  Day  Day of
Week
0     21009  Closed                          No      4   22
2
1     30102  Closed                          No      8    4
1
2     30101  Closed                         Yes      4   18
5
3     30101    Open                         Yes      7    5
6
4     30101  Closed                          No      5   26
1
```

```
# Remove duplicate column Date as we already got Date_month_year in
same format
tc_df.drop('Date', axis=1, inplace=True)

# Get actual Day name from Day of Week

dayDict = {0:'Mon',1:'Tue',2:'Wed',3:'Thur',4:'Fri',5:'Sat',6:'Sun'}
tc_df['Day of Week']=tc_df['Day of Week'].map(dayDict)
tc_df.head(5)
```

```
  Ticket #                                  Customer Complaint
Date_month_year  \
0   250635                      Comcast Cable Internet Speeds
2015-04-22
1   223441       Payment disappear - service got disconnected
2015-08-04
2   242732                                   Speed and Service
2015-04-18
3   277946  Comcast Imposed a New Usage Cap of 300GB that ...
2015-07-05
4   307175         Comcast not working and no service to boot
2015-05-26
```

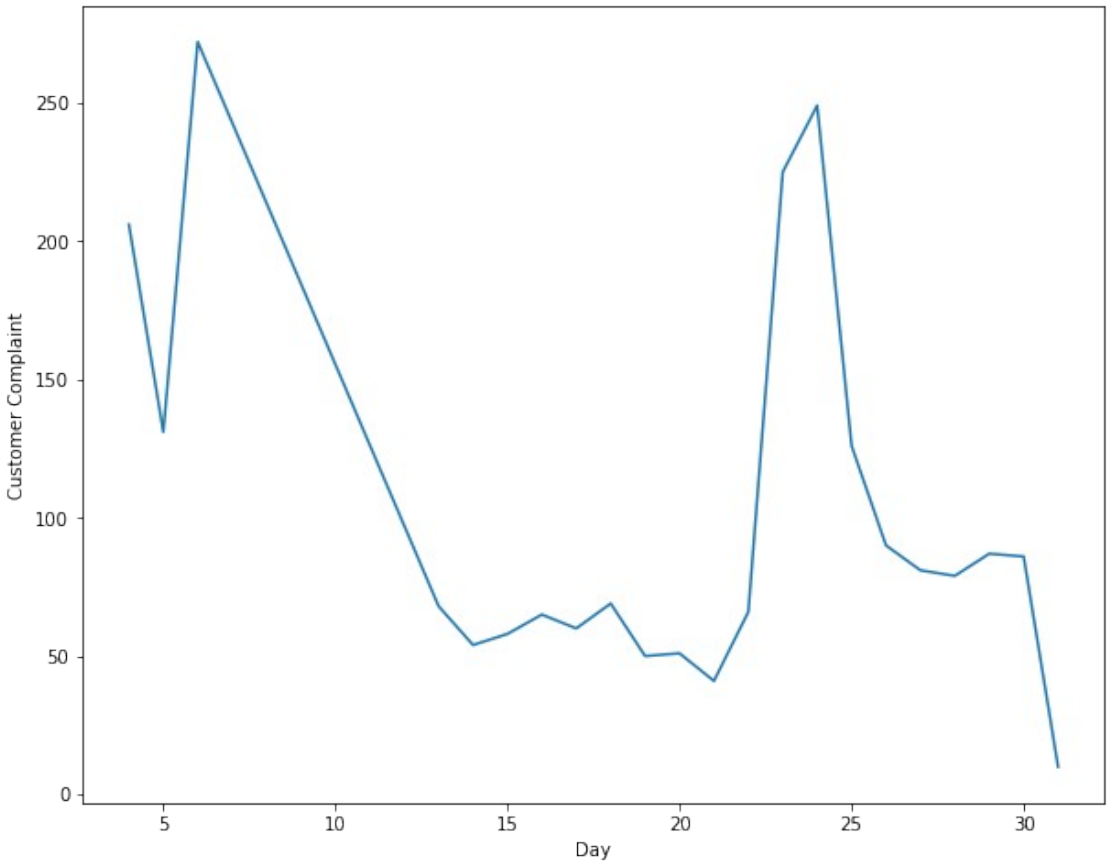
```
          Time        Received Via      City     State  Zip code
Status  \
0   3:53:50 PM  Customer Care Call  Abingdon  Maryland     21009
Closed
1  10:22:56 AM            Internet   Acworth   Georgia     30102
Closed
2   9:55:47 AM            Internet   Acworth   Georgia     30101
Closed
3  11:59:35 AM            Internet   Acworth   Georgia     30101
Open
4   1:25:26 PM            Internet   Acworth   Georgia     30101
Closed

  Filing on Behalf of Someone  Month  Day Day of Week
0                          No      4   22         Wed
1                          No      8    4         Tue
2                         Yes      4   18         Sat
3                         Yes      7    5         Sun
4                          No      5   26         Tue
```

```
# Get monthly trend of complaints

plt.figure(figsize=(10,8))
monthly_complaint = tc_df.groupby('Month').count().reset_index()
sns.lineplot(x='Month', y= 'Customer Complaint', data =
monthly_complaint)
plt.show()
```



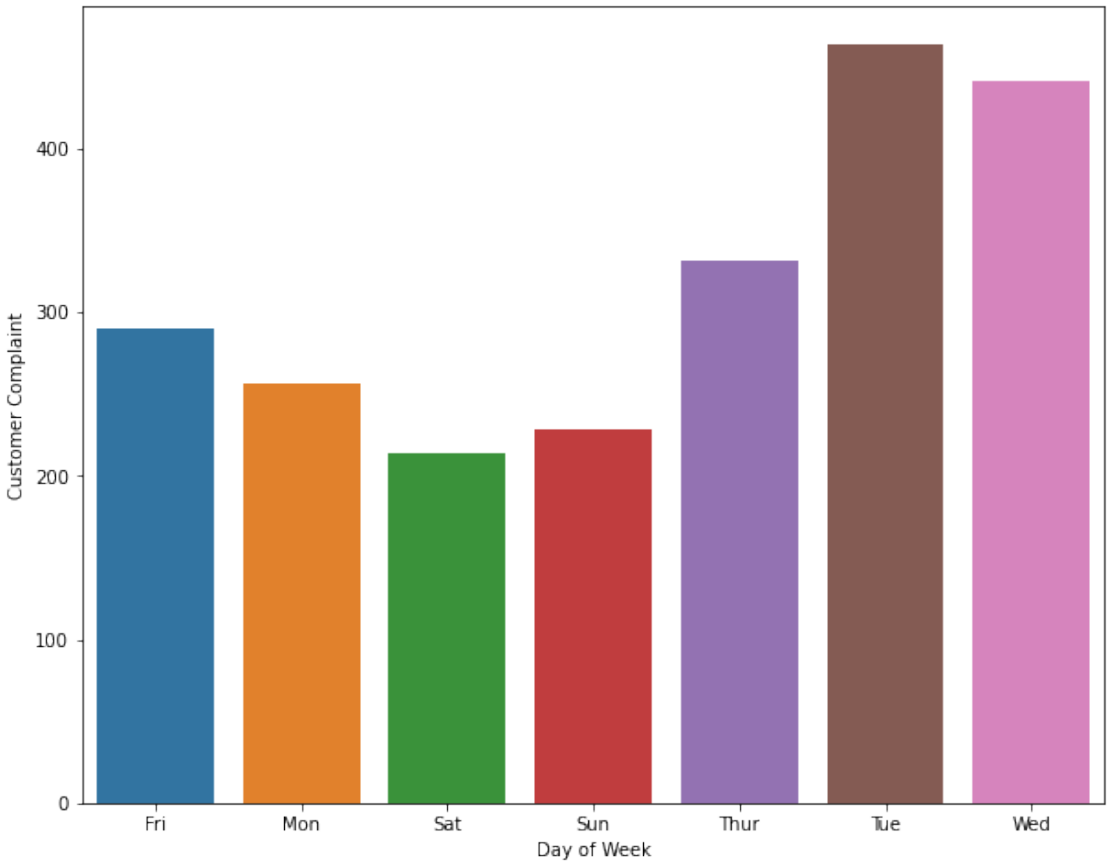
From the monthly trend, we can see, till March, the complaints are low and also after July. But during March to July, the count got a high raise and became maximum in June.

```
# Get daily trend of complaints

plt.figure(figsize=(10,8))
daily_complaint = tc_df.groupby('Day').count().reset_index()
sns.lineplot(x='Day', y= 'Customer Complaint', data = daily_complaint)
plt.show()
```



As we can see, the complaint count is very high in the beginning and in end, but it gradually decreases. Also during mid days, it comparativly low.

```
# Get week days trend of complaints

plt.figure(figsize=(10,8))
dw_complaint = tc_df.groupby('Day of Week').count().reset_index()
sns.barplot(x='Day of Week', y= 'Customer Complaint', data =
dw_complaint)
plt.show()
```



We can see, on Tuesday and Wednesday, complaint counts are high as compared to others.

Now we can extract the complaint types from the customer complaint descriptions and analyse.

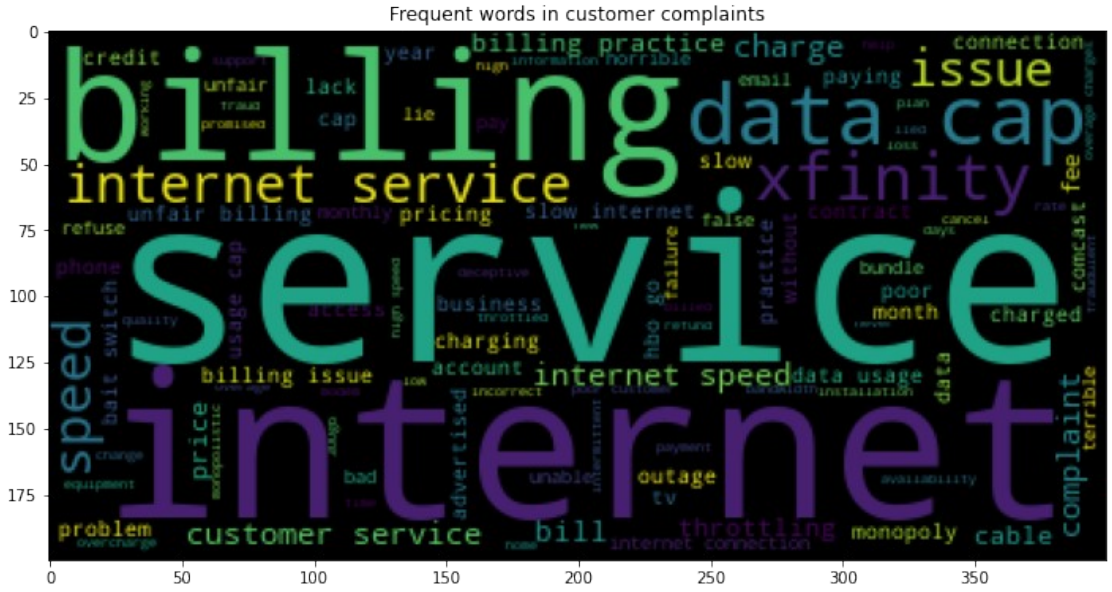
```
tc_df['Customer Complaint'] = tc_df['Customer Complaint'].str.title()
tc_df['Customer Complaint'].value_counts()
```

```
Comcast                                                          102
Comcast Data Cap                                                  30
Comcast Internet                                                  29
Comcast Data Caps                                                 21
Comcast Billing                                                   18
                                                                ...
Internet And Service                                               1
Monopolistic Behavior                                              1
Forcing Customer To Pay An Incorrect Bill To Get It Fixed          1
Comcast Data Use Caps                                              1
Assessing Unjustified Late Fees                                    1
Name: Customer Complaint, Length: 1740, dtype: int64
```

```
all_complaints = tc_df['Customer Complaint'].dropna().tolist()
all_complaints = ' '.join(all_complaints).lower()
```

We need to remove the commonly used words from the complaints. We can add them in stopwords.

```
complaint_stopwords =
('Comcast','Now','Company','Day','Someone','Thing','Also', 'to', 'it',
'Got','Way','Call','Called','One','Said','Tell')

STOPWORDS.update(complaint_stopwords)

# Create a word cloud to get frequent words

wordcloud = WordCloud(stopwords=STOPWORDS).generate(all_complaints)

# Plot the word cloud

plt.figure( figsize=(12,10) )
plt.imshow(wordcloud)
plt.title('Frequent words in customer complaints')
plt.show()
```



So we can see words like billing, service, internet, internet service, customer service, internet speed etc are mostly used in complaint registration.

So we can use them as complaint types and get the frequency as follows.

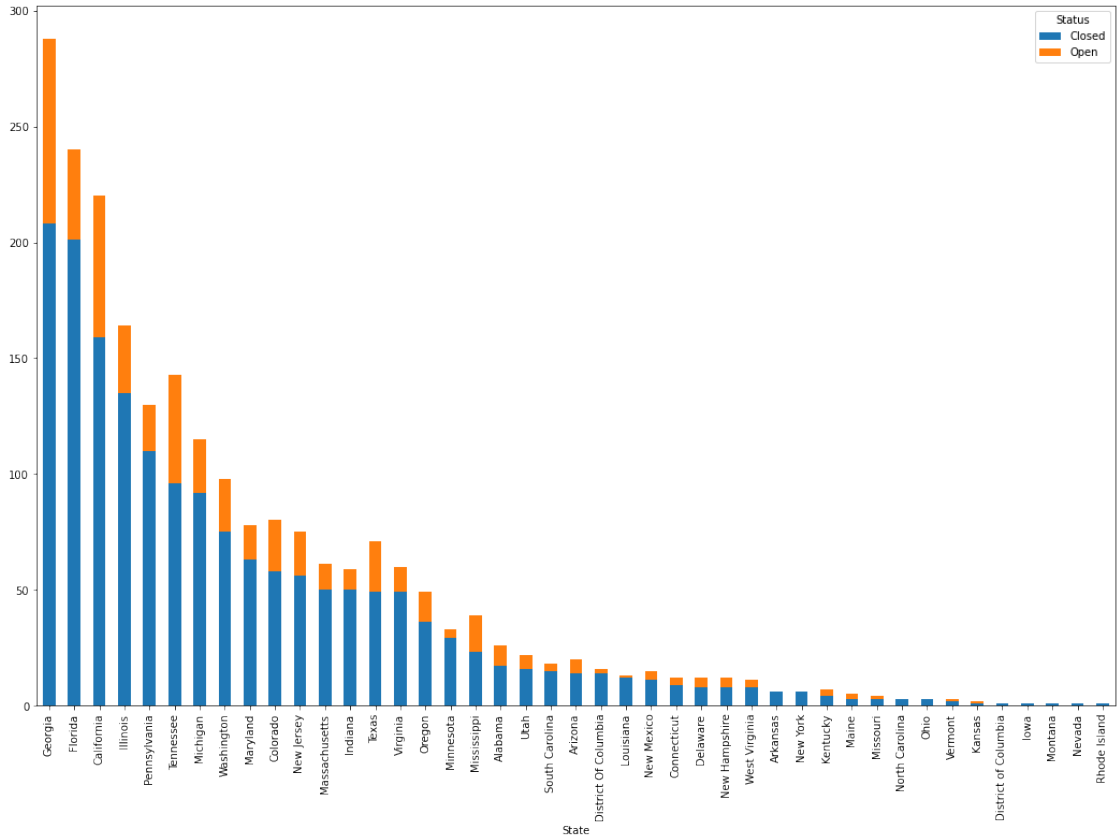
```
for k in [k for k in wordcloud.words_.keys()][:3]:
    print('Complaint type: {}, Count: {}'.format(k,
wordcloud.words_[k]*100))
```

```
Complaint type: service, Count: 100.0
Complaint type: internet, Count: 98.38187702265373
Complaint type: billing, Count: 51.1326860841424
```

```
# Get state wise complaint chart

state_status = tc_df.groupby(['State',
'Status']).size().unstack().fillna(0)
state_status.head()
```

```
Status      Closed  Open
State
Alabama       17.0   9.0
Arizona       14.0   6.0
Arkansas       6.0   0.0
California   159.0  61.0
Colorado      58.0  22.0
```

```
state_status.sort_values(['Closed', 'Open'],axis =
0,ascending=False).plot.bar(figsize=(18,12), stacked=True)
plt.show()
```

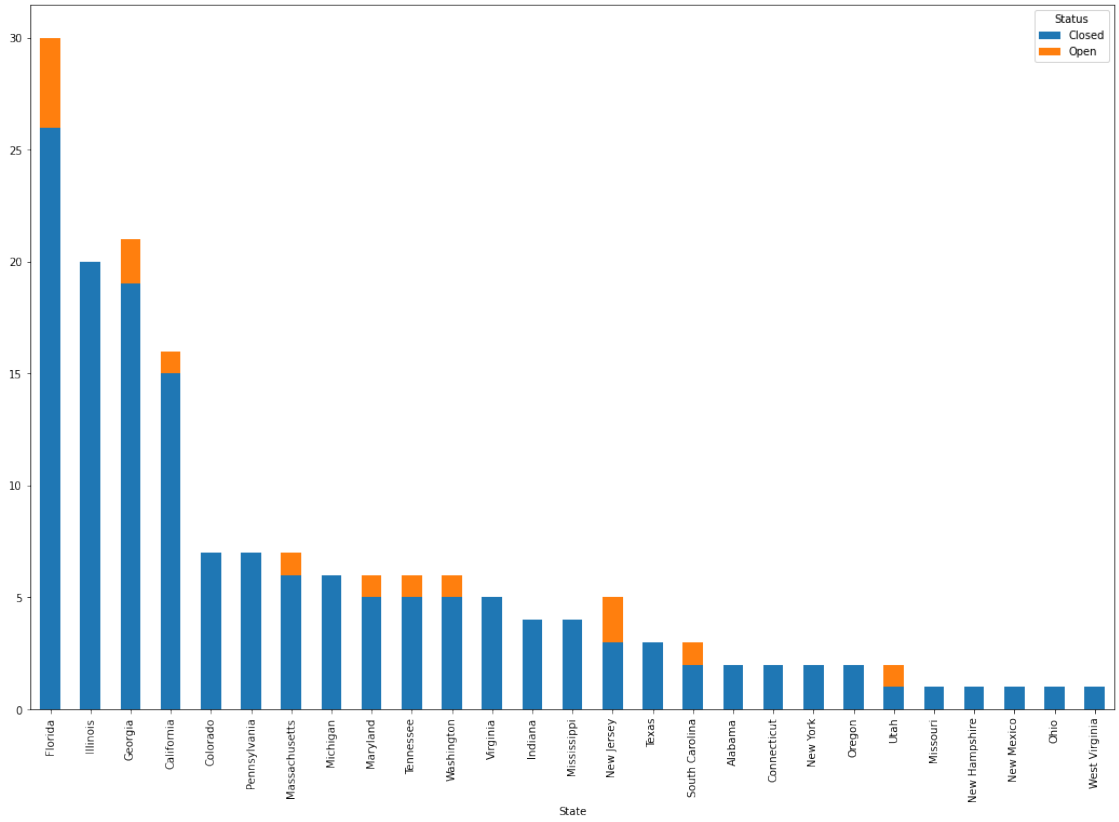


From the plot, we can say, states like Georgia, Florida and California have high number of complaints than others.

We can check the same for Q3 (Jul, Aug, Sept)

```
state_status_Q3 = tc_df[(tc_df['Month'] >=7) & (tc_df['Month']
<=9)].groupby(['State', 'Status']).size().unstack().fillna(0)
state_status_Q3.sort_values(['Closed', 'Open'],axis =
```

```
0,ascending=False).plot.bar(figsize=(18,12), stacked=True)
plt.show()
```



In 3rd quater, states like Florida, Llinois and Georgia have high complaint counts than others.

```
# State with maximum number of cases

tc_df.groupby('State').size().sort_values(ascending=False).to_frame().
rename({0: "count"}, axis=1)[:1]
```

```
         count
State
Georgia    288
```

Georgia has highest number of complaints.

Now we need to get the state having high percentage of unresolved/open cases than others.

```
state_status['% Open'] =
state_status['Open']/state_status['Open'].sum()*100
state_status['% Closed'] =
state_status['Closed']/state_status['Closed'].sum()*100
state_status.sort_values('% Open', ascending=False)[:1]
```

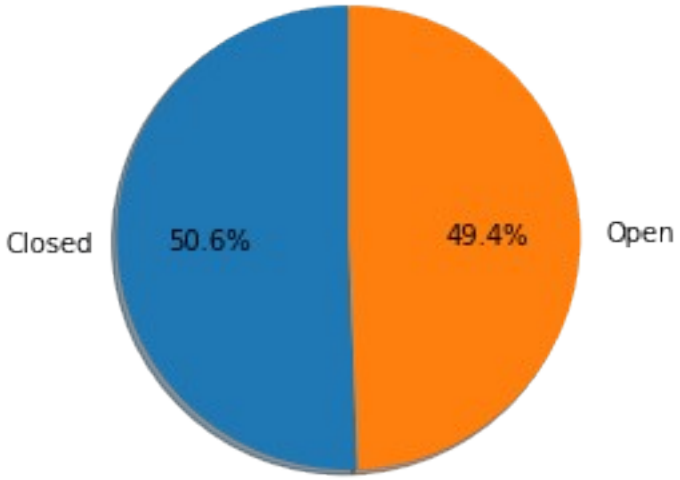
```
Status    Closed  Open     % Open  % Closed
State
Georgia    208.0  80.0  15.473888  12.18512
```

Georgia state has highest percentage of unresolved complaints than others.

```
# % of resolved cases per Received Via

received_type_status = tc_df.groupby(['Received Via',
'Status']).size().unstack().fillna(0)
received_type_status['% Open'] =
received_type_status['Open']/state_status['Open'].sum()*100
received_type_status['% Closed'] =
received_type_status['Closed']/state_status['Closed'].sum()*100
received_type_status
```

```
Status              Closed  Open     % Open   % Closed
Received Via
Customer Care Call     864   255  49.323017  50.615114
Internet               843   262  50.676983  49.384886
```

```
plt.pie(received_type_status['% Closed'], labels =
received_type_status, shadow=True, startangle=90, autopct='%1.1f%%')
plt.show()
```



Resolved cases from internet and customer care call are almost similar.