Project 02: Comcast Telecom Consumer Complaints

Submitted By Ms. Ankita Kale in September 2020

DESCRIPTION

Comcast is an American global telecommunication company. The firm has been providing terrible customer service. They continue to fall short despite repeated promises to improve. Only last month (October 2016) the authority fined them a $2.3 million, after receiving over 1000 consumer complaints.
The existing database will serve as a repository of public customer complaints filed against Comcast.
It will help to pin down what is wrong with Comcast's customer service.

Data Dictionary

Ticket #: Ticket number assigned to each complaint
Customer Complaint: Description of complaint
Date: Date of complaint
Time: Time of complaint
Received Via: Mode of communication of the complaint
City: Customer city
State: Customer state
Zipcode: Customer zip
Status: Status of complaint
Filing on behalf of someone

Analysis Task

To perform these tasks, you can use any of the different Python libraries such as NumPy, SciPy, Pandas, scikit-learn, matplotlib, and BeautifulSoup.

- Import data into Python environment.
- Provide the trend chart for the number of complaints at monthly and daily granularity levels.
- Provide a table with the frequency of complaint types.

1. Which complaint types are maximum i.e., around internet, network issues, or across any other domains.
- Create a new categorical variable with value as Open and Closed. Open & Pending is to be categorized as Open and Closed & Solved is to be categorized as Closed.
- Provide state wise status of complaints in a stacked bar chart. Use the categorized variable from Q3. Provide insights on:

2. Which state has the maximum complaints
3. Which state has the highest percentage of unresolved complaints
- Provide the percentage of complaints resolved till date, which were received through the Internet and customer care calls.

The analysis results to be provided with insights wherever applicable.

In [34]:

```python
%config IPCompleter.greedy=True
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from pandasql import sqldf
%matplotlib inline

# machine learning
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC, LinearSVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.linear_model import Perceptron
from sklearn.linear_model import SGDClassifier
from sklearn.tree import DecisionTreeClassifier
```

In [2]:

```
import warnings
warnings.filterwarnings("ignore")
```

Import data into Python environment

In [3]:

```
#Load the data
data = pd.read_csv('Comcast_telecom_complaints_data.csv')
```

In [4]:

```
data.head()
```

Out[4]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone
0	250635	Comcast Cable Internet Speeds	22-04-15	22-Apr-15	3:53:50 PM	Customer Care Call	Abingdon	Maryland	21009	Closed	No
1	223441	Payment disappear - service got disconnected	04-08-15	04-Aug-15	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed	No
2	242732	Speed and Service	18-04-15	18-Apr-15	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed	Yes
3	277946	Comcast Imposed a New Usage Cap of 300GB that ...	05-07-15	05-Jul-15	11:59:35 AM	Internet	Acworth	Georgia	30101	Open	Yes
4	307175	Comcast not working and no service to boot	26-05-15	26-May-15	1:25:26 PM	Internet	Acworth	Georgia	30101	Solved	No

In [5]:

```
data.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
```

In [6]:

```
data.describe()
```

Out[6]:

	Zip code
count	2224.000000
mean	47994.393435

	Zip code
std	28885.279427
min	1075.000000
25%	30056.500000
50%	37211.000000
75%	77058.750000
max	99223.000000

In [7]:

```python
data['City'].describe()
```

Out[7]:

```
count        2224
unique        928
top       Atlanta
freq           63
Name: City, dtype: object
```

In [8]:

```python
data['State'].describe()
```

Out[8]:

```
count        2224
unique         43
top       Georgia
freq          288
Name: State, dtype: object
```

In [9]:

```python
data['Status'].describe()
```

Out[9]:

```
count       2224
unique         4
top       Solved
freq         973
Name: Status, dtype: object
```

In [10]:

```python
data.groupby(['Status']).count()
```

Out[10]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Filing on Behalf of Someone
Status										
Closed	734	734	734	734	734	734	734	734	734	734
Open	363	363	363	363	363	363	363	363	363	363
Pending	154	154	154	154	154	154	154	154	154	154
Solved	973	973	973	973	973	973	973	973	973	973

In [11]:

```python
data.groupby(['Status','State']).count()
```

Out[11]:

Status	State	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	Zip code	Filing on Behalf of Someone
Closed	Alabama	8	8	8		8	8	8	8	8	8
	Arizona	6	6	6		6	6	6	6	6	6
	Arkansas	1	1	1		1	1	1	1	1	1
	California	72	72	72		72	72	72	72	72	72
	Colorado	23	23	23		23	23	23	23	23	23
...	...	...	...	...		...	...	...	...	...	...
Solved	Utah	9	9	9		9	9	9	9	9	9
	Vermont	2	2	2		2	2	2	2	2	2
	Virginia	28	28	28		28	28	28	28	28	28
	Washington	40	40	40		40	40	40	40	40	40
	West Virginia	2	2	2		2	2	2	2	2	2

139 rows × 9 columns

Provide the trend chart for the number of complaints at monthly and daily granularity levels.

In [12]:

```
data.head()
```

Out[12]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone
0	250635	Comcast Cable Internet Speeds	22-04-15	22-Apr-15	3:53:50 PM	Customer Care Call	Abingdon	Maryland	21009	Closed	No
1	223441	Payment disappear - service got disconnected	04-08-15	04-Aug-15	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed	No
2	242732	Speed and Service	18-04-15	18-Apr-15	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed	Yes
3	277946	Comcast Imposed a New Usage Cap of 300GB that ...	05-07-15	05-Jul-15	11:59:35 AM	Internet	Acworth	Georgia	30101	Open	Yes
4	307175	Comcast not working and no service to boot	26-05-15	26-May-15	1:25:26 PM	Internet	Acworth	Georgia	30101	Solved	No

In [13]:

```
data.Date_month_year.dtype
```

Out[13]:

```
dtype('O')
```

In [14]:

```
# Converting Date into datetime
data['Date_month_year'] = pd.to_datetime(data['Date_month_year'])
data['Month'] = data['Date_month_year'].apply(lambda x: x.month)
data['Day'] = data['Date_month_year'].apply(lambda x: x.day)
data['DayOfWeek'] = data['Date_month_year'].apply(lambda x: x.dayofweek)
```

In [15]:

```
data.head()
```

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone	Month	Day	DayO
0	250635	Comcast Cable Internet Speeds	22-04-15	2015-04-22	3:53:50 PM	Customer Care Call	Abingdon	Maryland	21009	Closed	No	4	22	
1	223441	Payment disappear - service got disconnected	04-08-15	2015-08-04	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed	No	8	4	
2	242732	Speed and Service	18-04-15	2015-04-18	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed	Yes	4	18	
3	277946	Comcast Imposed a New Usage Cap of 300GB that ...	05-07-15	2015-07-05	11:59:35 AM	Internet	Acworth	Georgia	30101	Open	Yes	7	5	
4	307175	Comcast not working and no service to boot	26-05-15	2015-05-26	1:25:26 PM	Internet	Acworth	Georgia	30101	Solved	No	5	26	

In [16]:

```
byMonth = data.groupby('Month').count().reset_index()
byMonth
```

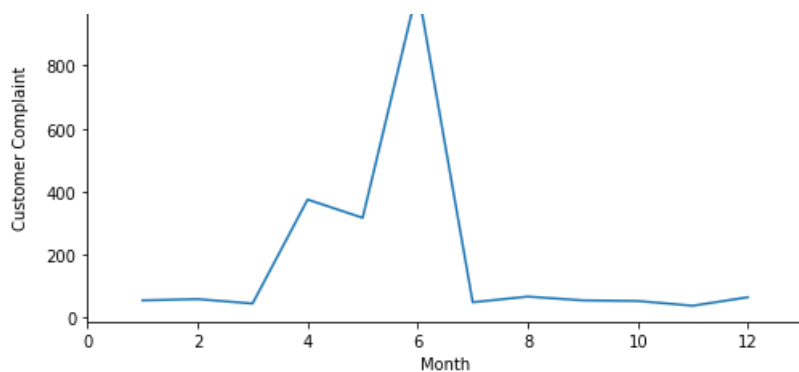		Month	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone	Day	DayOfWeek
0	1	55	55	55		55	55	55	55	55	55	55	55	55	55
1	2	59	59	59		59	59	59	59	59	59	59	59	59	59
2	3	45	45	45		45	45	45	45	45	45	45	45	45	45
3	4	375	375	375		375	375	375	375	375	375	375	375	375	375
4	5	317	317	317		317	317	317	317	317	317	317	317	317	317
5	6	1046	1046	1046		1046	1046	1046	1046	1046	1046	1046	1046	1046	1046
6	7	49	49	49		49	49	49	49	49	49	49	49	49	49
7	8	67	67	67		67	67	67	67	67	67	67	67	67	67
8	9	55	55	55		55	55	55	55	55	55	55	55	55	55
9	10	53	53	53		53	53	53	53	53	53	53	53	53	53
10	11	38	38	38		38	38	38	38	38	38	38	38	38	38
11	12	65	65	65		65	65	65	65	65	65	65	65	65	65

In [17]:

```
#data.groupby(pd.Grouper(freq="M")).size().plot() #number of complaints monthly
plt.figure(figsize=(8,4))
lp = sns.lineplot(x='Month', y= 'Customer Complaint', data = byMonth, sort=False,markers = "o")
ax = lp.axes
ax.set_xlim(0,13)
```
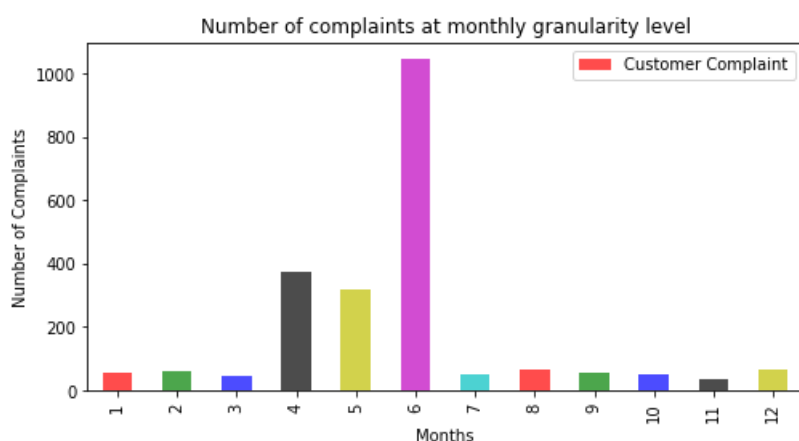
```
(0, 13)
```

```
byMonth.plot(x='Month', y= 'Customer Complaint', kind='bar', color=list('rgbkymc'), alpha=0.7, figs
ize=(8,4),stacked=False)
plt.xlabel("Months")
plt.ylabel("Number of Complaints")
plt.title("Number of complaints at monthly granularity level")
plt.show()
```


It seems the maximum complaints are registered in the month of June and minimum complaints registered in the month of November

In [19]:

```
byDay = data.groupby('Day').count().reset_index()
byDay.head()
```

Out[19]:

	Day	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone	Month	DayOfWeek
0	4	206	206	206		206	206	206	206	206	206	206	206	206	206
1	5	131	131	131		131	131	131	131	131	131	131	131	131	131
2	6	272	272	272		272	272	272	272	272	272	272	272	272	272
3	13	68	68	68		68	68	68	68	68	68	68	68	68	68
4	14	54	54	54		54	54	54	54	54	54	54	54	54	54

In [20]:

```
byDay['Day'].count()
```

Out[20]:

22

```
plt.figure(figsize=(8,4))
lp = sns.lineplot(x='Day', y= 'Customer Complaint', data = byDay, sort=False, markers = "o")
ax = lp.axes
#ax.set_xlim(0,31)
```
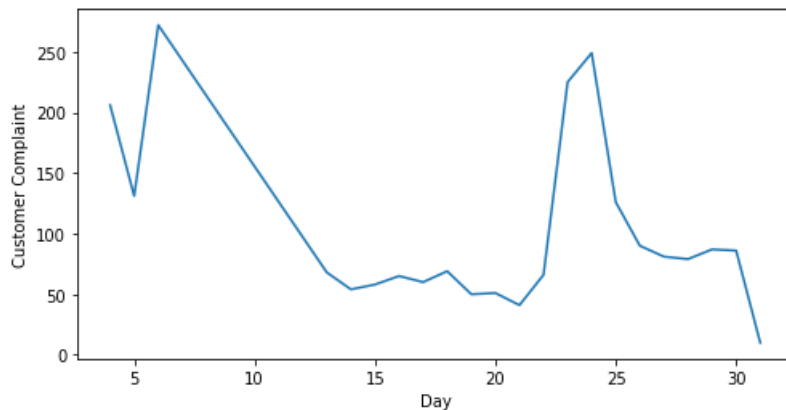
```
byDay.plot(x='Day', y= 'Customer Complaint', kind='bar', color=list('rgbkymc'), alpha=0.7, figsize=
(8,4),stacked=False)
plt.xlabel("Days")
plt.ylabel("Number of Complaints")
plt.title("Number of complaints at daily granularity level")
plt.show()
```
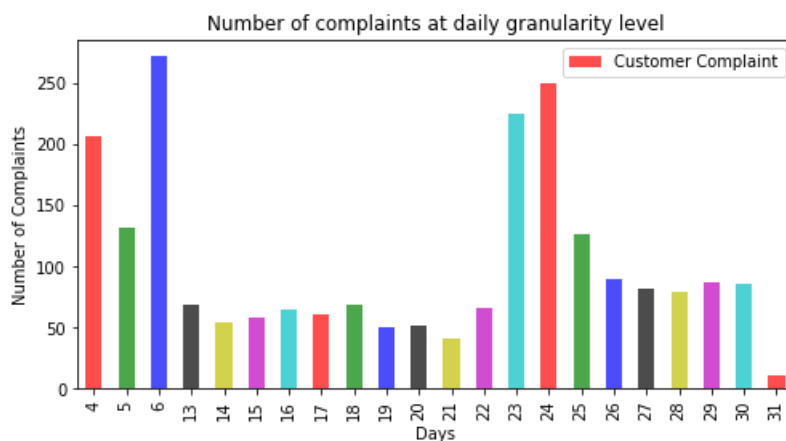

It seems the maximum complaints are registered on day 6 and minimum complaints registered on day 31.

```
data.DayOfWeek.unique()
```

```
array([2, 1, 5, 6, 4, 3, 0], dtype=int64)
```

```
daysMap = {0:'Mon',1:'Tue',2:'Wed',3:'Thur',4:'Fri',5:'Sat',6:'Sun'}
data['DayOfWeek']=data['DayOfWeek'].map(daysMap)
data.head(3)
```

Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of	Month	Day	DayO

	Ticket #	Customer Complaint	Date 22-04-15	Date_month_year	Time	Received Via	City	State	Zip code	Status	Someone Filing on Behalf of Someone	Month	Day	DayOf
0	250635	Cable Internet Speeds	22-04-15	2015-04-22	3:53:50 PM	Customer Care Call	Abingdon	Maryland	21009	Closed	No	4	22	
1	223441	Payment disappear - service got disconnected	04-08-15	2015-08-04	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed	No	8	4	
2	242732	Speed and Service	18-04-15	2015-04-18	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed	Yes	4	18	

In [25]:

```
#number of complaints based on created day of the week
sns.countplot(x='DayOfWeek', data = data, order=data['DayOfWeek'].value_counts().index, palette ="Greens_d")
```

Out[25]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x179b4c73608>
```
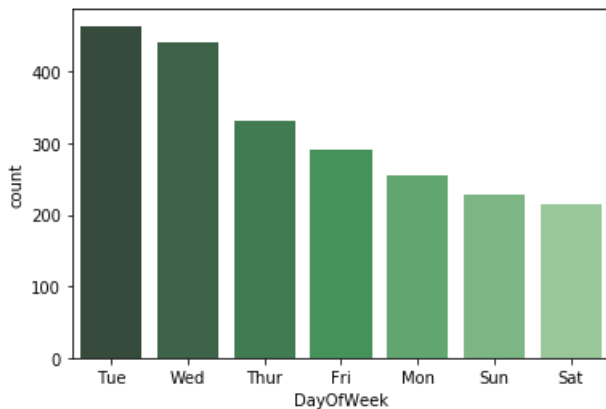

More number of complaints on Tuesday and wednesday

In [26]:

```
#number of complaints based on created year
data["Date_month_year"].value_counts().plot()
```

Out[26]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x179b4c48188>
```
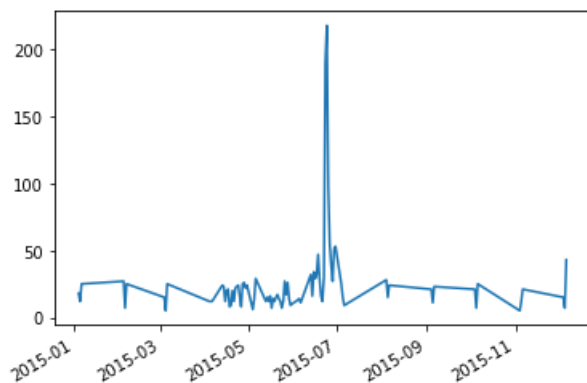

Provide a table with the frequency of complaint types

In [27]:

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

Out[27]:

```
Comcast                                                          102
Comcast Data Cap                                                  30
Comcast Internet                                                 29
Comcast Data Caps                                                21
Comcast Billing                                                 18
                                                               ...
Fake Charges                                                     1
Price Plans                                                     1
Comcast Refuses To Refund Deposit According To Initial Terms    1
Comcast Not Refunding Deposit For Cancelled Internet            1
Overpriced, Low Quality Service                                 1
Name: Customer Complaint, Length: 1740, dtype: int64
```

In [28]:

```
#Provide a table with the frequency of complaint types with plot
plt.figure(figsize=(30,6))
CT_freq.plot();
```


1. Which complaint types are maximum i.e., around internet, network issues, or across any other domains.

In [29]:

```
from wordcloud import WordCloud, STOPWORDS
common_complaints = data['Customer Complaint'].dropna().tolist()
common_complaints =''.join(common_complaints).lower()

list_stops = ('Comcast','Now','Company','Day','Someone','Thing','Also','Got','Way','Call', 'Called'
,'One','Said','Tell')

for word in list_stops: STOPWORDS.add(word)
```

In [30]:

```
wordcloud = WordCloud(stopwords=STOPWORDS,
                      background_color='white', width=1200,
                      height=1000).generate(common_complaints)
```

In [31]:

```
#Provide a table with Frequent words for customer complaint types.
plt.figure( figsize=(10,12) )
plt.imshow(wordcloud)
plt.title('Frequent words for customer complaints')
plt.axis('off')
plt.show()
```


Frequent words for customer complaints

Internet, Service, billing, speed, data complaints complaints are Maximum

Create a new categorical variable with value as Open and Closed. Open & Pending is to be categorized as Open and Closed & Solved is to be categorized as Closed.

In [32]:

```python
data.Status.unique()
```

Out[32]:

```
array(['Closed', 'Open', 'Solved', 'Pending'], dtype=object)
```

In [35]:

```python
sqldf("SELECt distinct Status FROM data order  by Status;")
```

Out[35]:

	Status
0	Closed
1	Open
2	Pending
3	Solved

In [36]:

```python
data["newStatus"] = ["Open" if Status=="Open" or Status=="Pending" else "Closed" for Status in data
["Status"]]
```

In [37]:

```python
data.head()
```

Out[37]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone	Month	Day	DayO
	250635	Comcast Cable	22-04	2015-04-22	3:53:50	Customer	Abingdon	Maryland	21009	Closed	No	4	22	

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status	Filing on Behalf of Someone	Month	Day	DayO
0	250635	Internet Speeds Payment	04-15	2015-04-22	PM	Care Call	Abingdon	Maryland	21009	Closed	No	4	22	
1	223441	Disappear - Service Got Disconnected	04-08-15	2015-08-04	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed	No	8	4	
2	242732	Speed And Service	18-04-15	2015-04-18	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed	Yes	4	18	
3	277946	Comcast Imposed A New Usage Cap Of 300Gb That ...	05-07-15	2015-07-05	11:59:35 AM	Internet	Acworth	Georgia	30101	Open	Yes	7	5	
4	307175	Comcast Not Working And No Service To Boot	26-05-15	2015-05-26	1:25:26 PM	Internet	Acworth	Georgia	30101	Solved	No	5	26	

In [38]:

```
sqldf("SELECT Status, newStatus FROM data where Status = 'Pending' LIMIT 5;",globals())
```

Out[38]:

	Status	newStatus
0	Pending	Open
1	Pending	Open
2	Pending	Open
3	Pending	Open
4	Pending	Open

In [39]:

```
sqldf("SELECT Status, newStatus FROM data where Status = 'Solved' LIMIT 5;",globals())
```

Out[39]:

	Status	newStatus
0	Solved	Closed
1	Solved	Closed
2	Solved	Closed
3	Solved	Closed
4	Solved	Closed

In [40]:

```
#complaint status
Status_complaints = data.groupby(["State","newStatus"]).size().unstack().fillna(0)
Status_complaints.sort_values('Closed',axis = 0,ascending=False)[:5]
Status_complaints["Total_Complaints"]=Status_complaints["Open"]+Status_complaints["Closed"]
Status_complaints['Resolved_cmp_prct'] =
Status_complaints['Closed']/Status_complaints['Closed'].sum()*100
Status_complaints['Unresolved_cmp_prct'] = Status_complaints['Open']/Status_complaints['Open'].sum(
)*100
```

In [41]:

```
Status_complaints.head()
```

Out[41]:

| newStatus | Closed | Open | Total_Complaints | Resolved_cmp_prct | Unresolved_cmp_prct |

newStatus State	Closed	Open	Total_Complaints	Resolved_cmp_prct	Unresolved_cmp_prct
State Alabama	17.0	9.0	26.0	0.995899	1.740812
Arizona	14.0	6.0	20.0	0.820152	1.160542
Arkansas	6.0	0.0	6.0	0.351494	0.000000
California	159.0	61.0	220.0	9.314587	11.798839
Colorado	58.0	22.0	80.0	3.397774	4.255319

Provide state wise status of complaints in a stacked bar chart. Use the categorized variable from Q3.

In [42]:

```
Status_complaints.sort_values('Closed',axis = 0,ascending=True).plot(kind="barh", figsize= (10,8),
stacked=True)
```

Out[42]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x179b5ac8388>
```
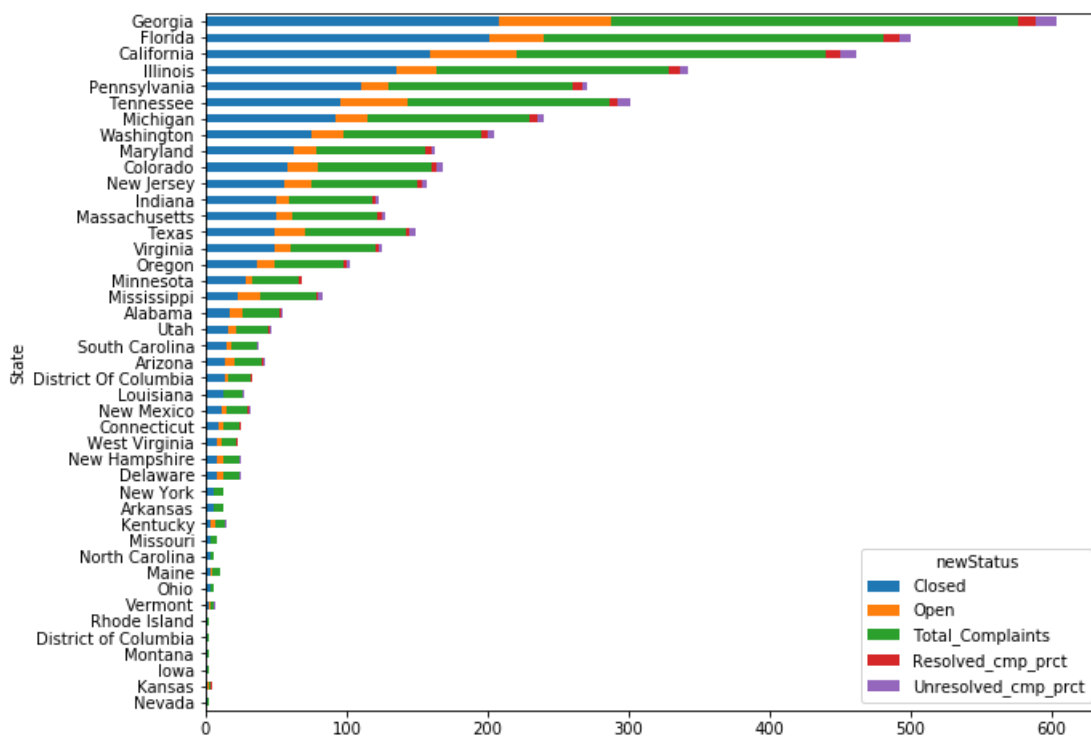

2. Which state has the maximum complaints

In [43]:

```
Status_complaints.sort_values(by=['Total_Complaints'], ascending=False)[:1]
```

Out[43]:

newStatus State	Closed	Open	Total_Complaints	Resolved_cmp_prct	Unresolved_cmp_prct
State					
Georgia	208.0	80.0	288.0	12.18512	15.473888

In [44]:

```
sqldf("SELECT * FROM Status_complaints order by Total_Complaints desc limit 1;",globals())
```

Out[44]:

	State	Closed	Open	Total_Complaints	Resolved_cmp_prct	Unresolved_cmp_prct
0	Georgia	208.0	80.0	288.0	12.18512	15.473888

State Georgia has maximum number of complaints

3. Which state has the highest percentage of unresolved complaints

In [45]:

```
Status_complaints.sort_values('Unresolved_cmp_prct',axis = 0,ascending=False)[:1]
```

Out[45]:

newStatus	Closed	Open	Total_Complaints	Resolved_cmp_prct	Unresolved_cmp_prct
State					
Georgia	208.0	80.0	288.0	12.18512	15.473888

In [46]:

```
sqldf("SELECT * FROM Status_complaints order by Unresolved_cmp_prct desc limit 1;",globals())
```

Out[46]:

	State	Closed	Open	Total_Complaints	Resolved_cmp_prct	Unresolved_cmp_prct
0	Georgia	208.0	80.0	288.0	12.18512	15.473888

Georgia state has the highest percentage of unresolved complaints

Provide the percentage of complaints resolved till date, which were received through the Internet and customer care calls.

In [47]:

```
data['Received Via'].unique()
```

Out[47]:

```
array(['Customer Care Call', 'Internet'], dtype=object)
```

In [48]:

```
cr = data.groupby(['Received Via','newStatus']).size().unstack().fillna(0)
cr['resolved'] = cr['Closed']/(cr['Closed']+cr['Open']).sum()*100
cr['resolved']
```

Out[48]:

```
Received Via
Customer Care Call    38.848921
Internet              37.904676
Name: resolved, dtype: float64
```

It seems that from total number of complaints, percentage of of resolved complains till date is, 38.848921% which were received through the Customer Care Call and 37.904676% which were received through the Internet

In [ ]:

```
cr = data.groupby(['Received Via','newStatus']).size().unstack().fillna(0)
cr['resolved'] = cr['Closed']/cr['Closed'].sum()*100
cr['resolved']
```

```
cr['resolved']
```

It seems that from resolved complaints, 50.615114% were received through the Customer Care Call and 49.384886% were received through the Internet

In [55]:

```python
import nltk
#nltk.download('stopwords')
#nltk.download('wordnet')
```

In [56]:

```python
from nltk.corpus import stopwords
from nltk.stem.wordnet import WordNetLemmatizer
import string

stop = set(stopwords.words('english'))
exclude = set(string.punctuation)
lemma = WordNetLemmatizer()
```

In [57]:

```python
def clean(doc):
    stop_free = " ".join([i for i in doc.lower().split() if i not in stop])
    punc_free = "".join([ch for ch in stop_free if ch not in exclude])
    normalised = " ".join(lemma.lemmatize(word) for word in punc_free.split())
    return normalised
```

In [76]:

```python
#nltk.download('wordnet')
```

In [61]:

```python
doc_complete = data["Customer Complaint"].tolist()
doc_clean = [clean(doc).split() for doc in doc_complete]
```

In [62]:

```python
doc_clean
```

Out[62]:

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```
#pip install gensim
```

```python
import gensim
from gensim import corpora
```

```
#pip install -U corpora
```

```python
dictionary = corpora.Dictionary(doc_clean)
print(dictionary)
```

Dictionary(1412 unique tokens: ['cable', 'comcast', 'internet', 'speed', 'disappear']...)

```python
doc_term_matrix = [dictionary.doc2bow(doc) for doc in doc_clean]
doc_term_matrix
```

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```

In [66]:

```python
# Use LDA model
from gensim.models import LdaModel
```

In [72]:

```
Num_Topic = 9
ldamodel = LdaModel(doc_term_matrix, num_topics= Num_Topic, id2word= dictionary, passes= 30)
```

```
topics = ldamodel.show_topics()
for topic in topics:
    print(topic)
print()
```

```
(0, '0.063*"internet" + 0.054*"outage" + 0.031*"please" + 0.030*"shitty" + 0.023*"broadband" + 0.0
23*"bandwidth" + 0.023*"scam" + 0.023*"provider" + 0.021*"isp" + 0.020*"misrepresentation"')
(1, '0.036*"false" + 0.028*"switch" + 0.027*"lack" + 0.025*"back" + 0.025*"show" +
0.025*"internet" + 0.021*"intermittent" + 0.021*"3" + 0.020*"day" + 0.019*"pricing"')
(2, '0.079*"comcast" + 0.066*"service" + 0.057*"bill" + 0.056*"price" + 0.034*"cable" +
0.030*"high" + 0.030*"deceptive" + 0.023*"monopoly" + 0.019*"cramming" + 0.018*"internet"')
(3, '0.284*"comcast" + 0.130*"service" + 0.121*"internet" + 0.047*"charge" + 0.037*"xfinity" + 0.0
17*"problem" + 0.015*"terrible" + 0.012*"business" + 0.011*"home" + 0.010*"charging"')
(4, '0.140*"internet" + 0.125*"speed" + 0.072*"comcast" + 0.037*"service" + 0.036*"throttling" + 0
.022*"connection" + 0.016*"pay" + 0.014*"promised" + 0.014*"customer" + 0.010*"refund"')
(5, '0.156*"comcast" + 0.132*"data" + 0.129*"billing" + 0.106*"cap" + 0.040*"practice" +
0.025*"usage" + 0.024*"unfair" + 0.019*"issue" + 0.012*"overage" + 0.010*"limit"')
(6, '0.116*"comcast" + 0.098*"service" + 0.090*"complaint" + 0.053*"internet" + 0.047*"slow" + 0.0
36*"poor" + 0.027*"pricing" + 0.023*"comcastxfinity" + 0.016*"account" + 0.015*"unfair"')
(7, '0.063*"failure" + 0.042*"email" + 0.036*"provide" + 0.036*"option" + 0.025*"improper" + 0.021
*"committing" + 0.019*"corporate" + 0.019*"cyber" + 0.019*"also" + 0.017*"tucson"')
(8, '0.074*"comcast" + 0.064*"service" + 0.062*"issue" + 0.035*"customer" + 0.028*"fee" +
0.023*"billing" + 0.021*"contract" + 0.016*"credit" + 0.015*"year" + 0.015*"month"')
```

```
word_dict = {}
for i in range(Num_Topic):
    words = ldamodel.show_topic(i, topn =20)
    word_dict["Topic # " + "{}".format(i)] = [i[0] for i in words]
```

```
pd.DataFrame(word_dict)
```

Out[75]:

	Topic # 0	Topic # 1	Topic # 2	Topic # 3	Topic # 4	Topic # 5	Topic # 6	Topic # 7	Topic # 8
0	internet	cable	data	complaint	comcast	service	internet	practice	comcast
1	comcast	service	cap	comcast	xfinity	billing	comcast	billing	bill
2	service	comcast	comcast	fee	price	comcast	service	unfair	charge
3	speed	deceptive	usage	charged	issue	issue	slow	comcast	without
4	throttling	pay	refund	failure	access	pricing	false	price	speed
5	connection	help	fraudulent	xfinitycomcast	time	customer	problem	monopoly	paying
6	charge	customer	charge	provide	several	poor	switch	monopolistic	charging
7	business	terrible	overage	12	said	comcastxfinity	speed	back	contract
8	outage	bad	limit	throttle	mb	payment	phone	bill	cramming
9	show	horrible	email	regarding	plan	month	advertising	option	monthly
10	bandwidth	please	slowing	asking	people	incorrect	installation	throttled	equipment
11	day	home	atlanta	still	300gb	billed	customer	credit	increased
12	account	hbo	agreement	day	information	refusal	misleading	comcasts	high
13	intermittent	go	device	getting	internet	request	broadband	every	fee
14	promised	provided	streaming	area	bill	improper	sale	added	rate
15	unreliable	mbps	fee	lying	scam	communication	bait	lack	year
16	low	system	home	resolution	disconnection	bundle	availability	line	change
17	unauthorized	3	u	way	awful	misrepresentation	shitty	capping	service

	Topic # 0	Topic # 1	Topic # 2	Topic # 3	Topic # 4	Topic # 5	Topic # 6	Topic # 7	Topic # 8
18	quality	blocking	fix	contract	month	ordered	contract	supervisor	notice
19	cancelling	security	last	extortion	10	refusing	lied	regular	ps4

Finally, we got the word dictionary with the help of LDAModel

----- Thank You -----