In [1]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```python
#import data
comcast = pd.read_csv("Comcast_telecom_complaints_data.csv")
```

In [3]:
```python
comcast.head()
```

Out[3]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code	Status
0	250635	Comcast Cable Internet Speeds	22-04-15	22-Apr-15	3:53:50 PM	Customer Care Call	Abingdon	Maryland	21009	Closed
1	223441	Payment disappear - service got disconnected	04-08-15	04-Aug-15	10:22:56 AM	Internet	Acworth	Georgia	30102	Closed
2	242732	Speed and Service	18-04-15	18-Apr-15	9:55:47 AM	Internet	Acworth	Georgia	30101	Closed
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	Oper
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

In [4]:
```python
comcast["date_index"] = comcast["Date_month_year"]+" "+comcast["Time"]
```

In [5]:
```python
comcast["date_index"] = pd.to_datetime(comcast["date_index"])
comcast["Date_month_year"] = pd.to_datetime(comcast["Date_month_year"])
```

In [6]:
```python
comcast.dtypes
```

Out[6]:
```
Ticket #                        object
Customer Complaint              object
Date                            object
Date_month_year         datetime64[ns]
Time                            object
Received Via                    object
```

```
City                               object
State                              object
Zip code                            int64
Status                             object
Filing on Behalf of Someone        object
date_index                datetime64[ns]
dtype: object
```

In [7]:
```python
comcast = comcast.set_index(comcast["date_index"])
```

In [11]:
```python
comcast.head(2)
```

Out[11]:

	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zip code
date_index									
2015-04-22 15:53:50	250635	Comcast Cable Internet Speeds	22-04-15	2015-04-22	3:53:50 PM	Customer Care Call	Abingdon	Maryland	2100
2015-08-04 10:22:56	223441	Payment disappear - service got disconnected	04-08-15	2015-08-04	10:22:56 AM	Internet	Acworth	Georgia	3010

In [14]:
```python
comcast["Date_month_year"].value_counts()[:3]
```

Out[14]:
```
2015-06-24    218
2015-06-23    190
2015-06-25     98
Name: Date_month_year, dtype: int64
```

In [15]:
```python
comcast["Date_month_year"].value_counts().plot();
```
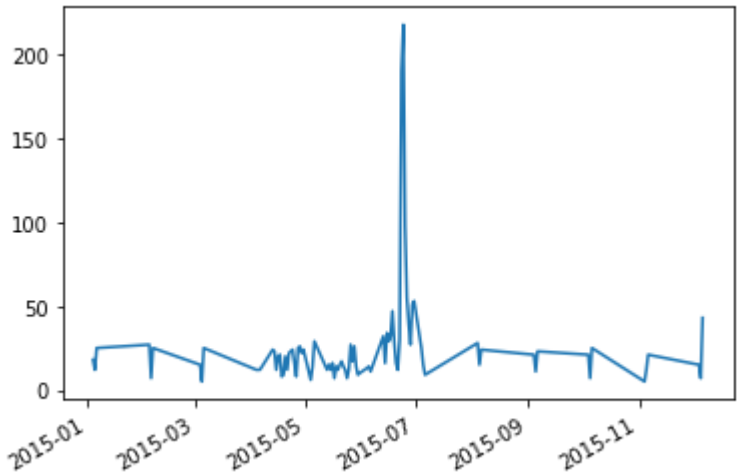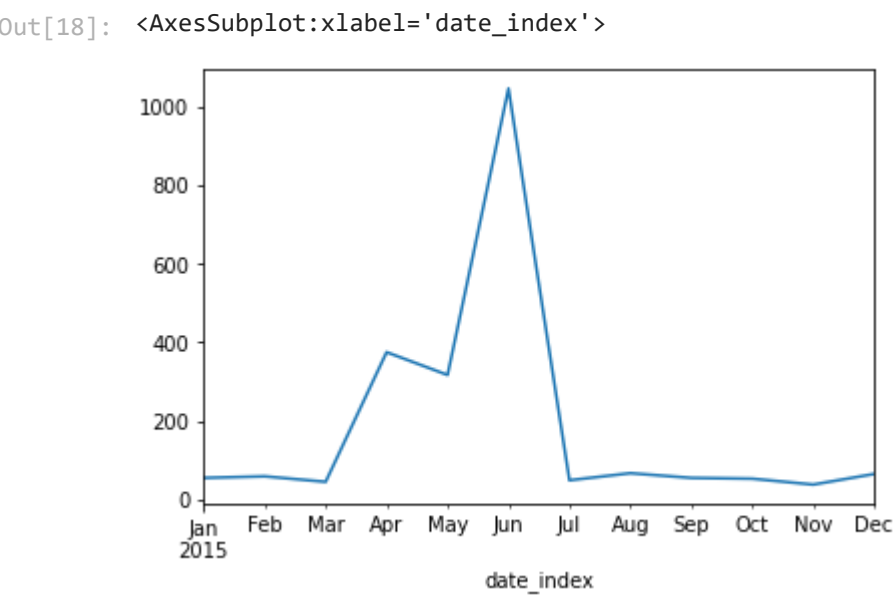

In [16]:
```python
f = comcast.groupby(pd.Grouper(freq="M")).size()
```

In [17]:
```python
f.head()
```

Out[17]:
```
date_index
2015-01-31      55
2015-02-28      59
2015-03-31      45
2015-04-30     375
2015-05-31     317
Freq: M, dtype: int64
```

In [18]:
```python
comcast.groupby(pd.Grouper(freq="M")).size().plot()
```

Out[18]: `<AxesSubplot:xlabel='date_index'>`

In [20]:
```python
comcast.Status.unique()
```

Out[20]: `array(['Closed', 'Open', 'Solved', 'Pending'], dtype=object)`

In [22]:
```python
comcast["newStatus"] = ["Open" if Status=="Open" or Status=="Pending" else "Closed" for
```

In [24]:
```python
comcast.head(2)
```

Out[24]:

date_index	Ticket #	Customer Complaint	Date	Date_month_year	Time	Received Via	City	State	Zi coc
2015-04-22 15:53:50	250635	Comcast Cable Internet Speeds	22-04-15	2015-04-22	3:53:50 PM	Customer Care Call	Abingdon	Maryland	2100
2015-08-04 10:22:56	223441	Payment disappear - service got disconnected	04-08-15	2015-08-04	10:22:56 AM	Internet	Acworth	Georgia	3010

In [25]:
```python
comcast.groupby(["State"]).size().sort_values(ascending=False).to_frame().reset_index()
```

Out[25]:

	State	Count
0	Georgia	288
1	Florida	240
2	California	220
3	Illinois	164
4	Tennessee	143

In [26]:
```python
Status_complaints = comcast.groupby(["State","newStatus"]).size().unstack().fillna(0)
Status_complaints
```

Out[26]:

newStatus State	Closed	Open
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
Connecticut	9.0	3.0
Delaware	8.0	4.0
District Of Columbia	14.0	2.0
District of Columbia	1.0	0.0
Florida	201.0	39.0
Georgia	208.0	80.0
Illinois	135.0	29.0
Indiana	50.0	9.0
Iowa	1.0	0.0
Kansas	1.0	1.0
Kentucky	4.0	3.0
Louisiana	12.0	1.0
Maine	3.0	2.0
Maryland	63.0	15.0
Massachusetts	50.0	11.0

newStatus	Closed	Open
State		
Michigan	92.0	23.0
Minnesota	29.0	4.0
Mississippi	23.0	16.0
Missouri	3.0	1.0
Montana	1.0	0.0
Nevada	1.0	0.0
New Hampshire	8.0	4.0
New Jersey	56.0	19.0
New Mexico	11.0	4.0
New York	6.0	0.0
North Carolina	3.0	0.0
Ohio	3.0	0.0
Oregon	36.0	13.0
Pennsylvania	110.0	20.0
Rhode Island	1.0	0.0
South Carolina	15.0	3.0
Tennessee	96.0	47.0
Texas	49.0	22.0
Utah	16.0	6.0
Vermont	2.0	1.0
Virginia	49.0	11.0
Washington	75.0	23.0
West Virginia	8.0	3.0

In [29]:
```python
Status_complaints.plot(kind="barh", figsize=(20,50), stacked=True)
```

Out[29]: `<AxesSubplot:ylabel='State'>`
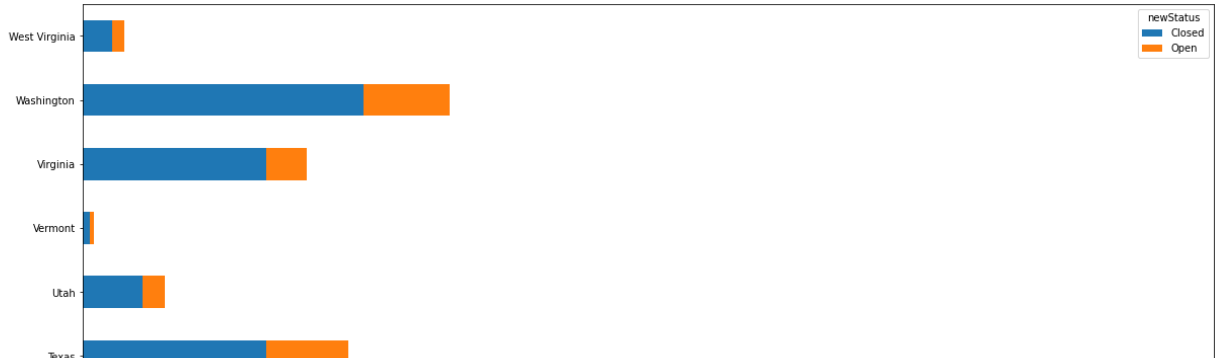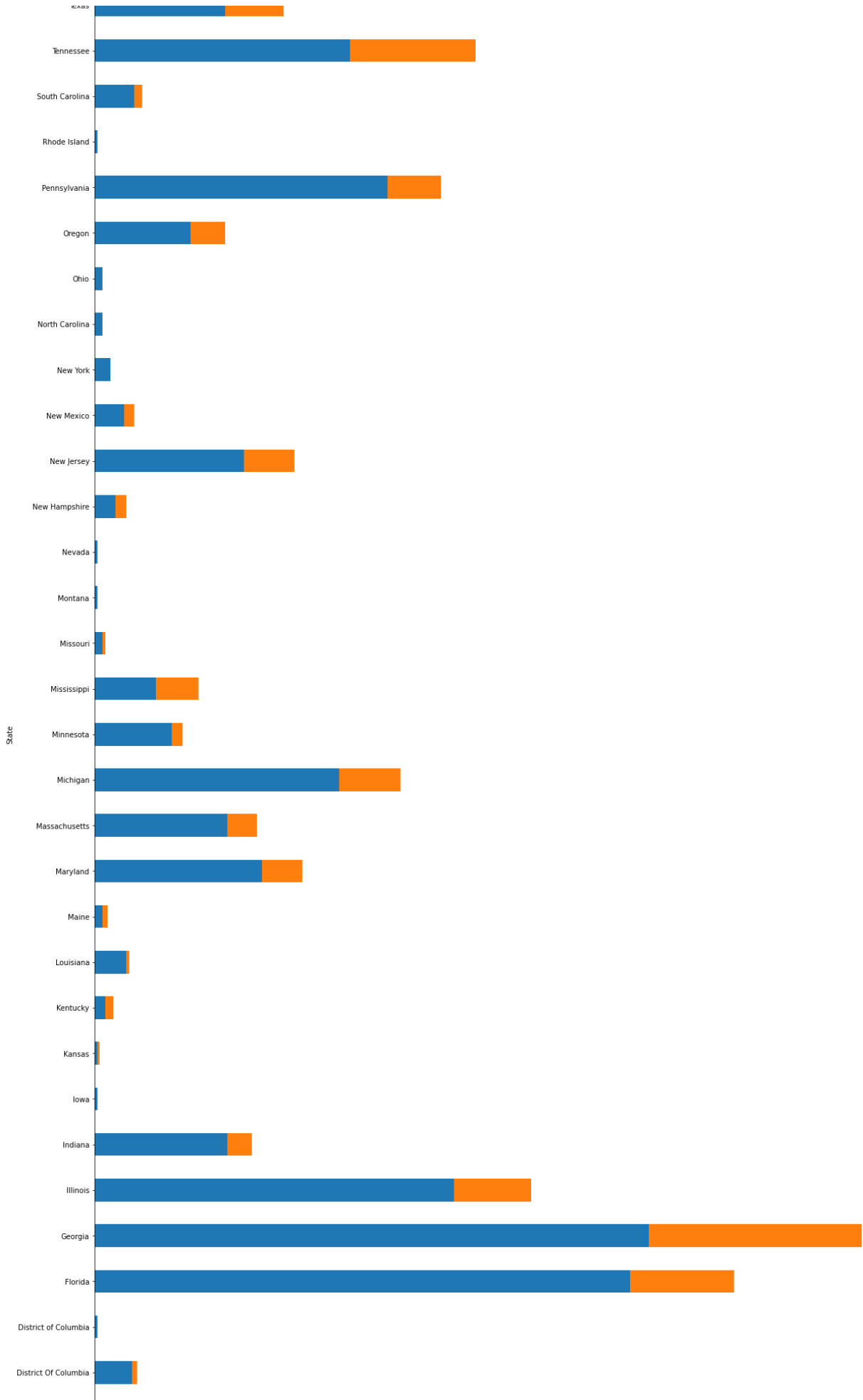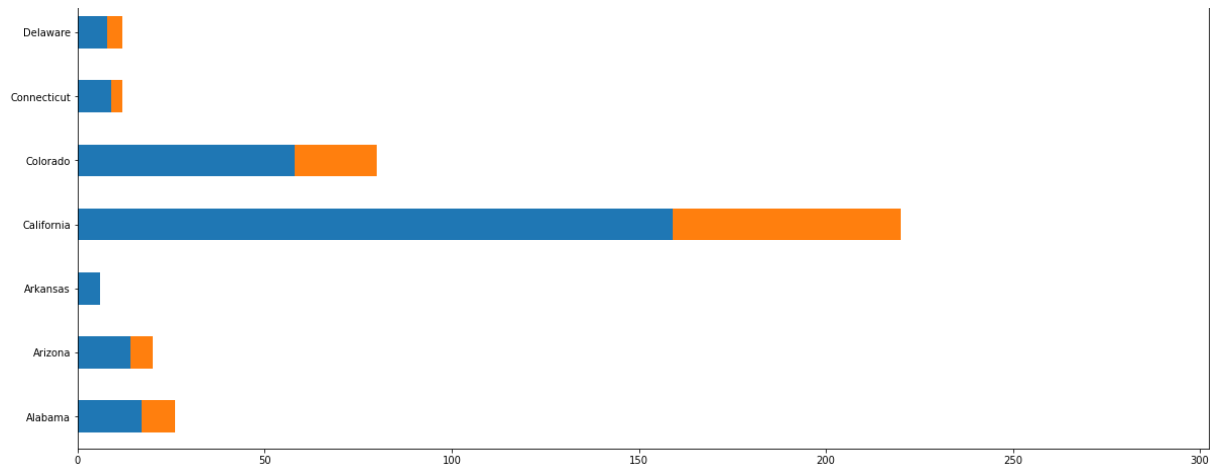
In [30]:
```python
comcast.groupby(["State"]).size().sort_values(ascending=False).to_frame().reset_index()
```

Out[30]:
```
State     West Virginia
Count               288
dtype: object
```

In [31]:
```python
comcast.groupby(["State","newStatus"]).size().unstack().fillna(0).max()
```

Out[31]:
```
newStatus
Closed     208.0
Open        80.0
dtype: float64
```

In [32]:
```python
!pip install wordcloud
```

```
Collecting wordcloud
  Downloading wordcloud-1.8.1-cp38-cp38-win_amd64.whl (155 kB)
Requirement already satisfied: numpy>=1.6.1 in c:\users\hp\appdata\local\programs\python
\python38\lib\site-packages (from wordcloud) (1.19.2)
Requirement already satisfied: pillow in c:\users\hp\appdata\local\programs\python\pytho
n38\lib\site-packages (from wordcloud) (7.2.0)
Requirement already satisfied: matplotlib in c:\users\hp\appdata\local\programs\python\p
ython38\lib\site-packages (from wordcloud) (3.3.2)
```

```
WARNING: You are using pip version 21.0.1; however, version 21.1 is available.
You should consider upgrading via the 'c:\users\hp\appdata\local\programs\python\python3
8\python.exe -m pip install --upgrade pip' command.
Requirement already satisfied: cycler>=0.10 in c:\users\hp\appdata\local\programs\python
\python38\lib\site-packages (from matplotlib->wordcloud) (0.10.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\hp\appdata\local\programs\p
ython\python38\lib\site-packages (from matplotlib->wordcloud) (1.2.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.3 in c:\users\hp\a
ppdata\local\programs\python\python38\lib\site-packages (from matplotlib->wordcloud) (2.
4.7)
Requirement already satisfied: python-dateutil>=2.1 in c:\users\hp\appdata\local\program
s\python\python38\lib\site-packages (from matplotlib->wordcloud) (2.8.1)
Requirement already satisfied: certifi>=2020.06.20 in c:\users\hp\appdata\local\programs
\python\python38\lib\site-packages (from matplotlib->wordcloud) (2020.6.20)
Requirement already satisfied: six in c:\users\hp\appdata\local\programs\python\python38
\lib\site-packages (from cycler>=0.10->matplotlib->wordcloud) (1.15.0)
Installing collected packages: wordcloud
Successfully installed wordcloud-1.8.1
```

In [40]:
```python
import nltk
nltk.download('stopwords')
```

```python
nltk.download('wordnet')
from nltk.corpus import stopwords
from nltk.stem.wordnet import WordNetLemmatizer
import string

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

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\HP\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\HP\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping corpora\wordnet.zip.
```

In [37]:
```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 [41]:
```python
doc_complete = comcast["Customer Complaint"].tolist()
doc_clean = [clean(doc).split() for doc in doc_complete]
```

In [43]:
```python
import gensim
from gensim import corpora
```

```
c:\users\hp\appdata\local\programs\python\python38\lib\site-packages\gensim\similarities
\__init__.py:15: UserWarning: The gensim.similarities.levenshtein submodule is disabled,
because the optional Levenshtein package <https://pypi.org/project/python-Levenshtein/>
is unavailable. Install Levenhstein (e.g. `pip install python-Levenshtein`) to suppress
this warning.
  warnings.warn(msg)
```

In [44]:
```python
dictionary = corpora.Dictionary(doc_clean)
print(dictionary)
```

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

In [45]:
```python
doc_term_matrix = [dictionary.doc2bow(doc) for doc in doc_clean]
doc_term_matrix
```

Out[45]:
```
[[(0, 1), (1, 1), (2, 1), (3, 1)],
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```

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[(1, 1), (19, 1), (35, 1), (715, 1)],
[(1, 1), (2, 1), (8, 1)],
[(1, 1), (2, 1), (408, 1)],
[(1, 1),
 (2, 2),
 (8, 1),
 (72, 1),
 (203, 1),
 (279, 1),
 (281, 2),
 (369, 1),
 (584, 1),
 (660, 1),
 (747, 1),
 (871, 1),
 (872, 1)],
[(8, 1),
 (38, 1),
 (72, 1),
 (82, 1),
 (271, 1),
 (572, 1),
 (873, 1),
 (874, 1),
```

```
         (875, 1),
         (876, 1)],
        [(1, 1), (38, 1), (159, 1), (877, 1)],
        [(10, 1), (20, 1), (35, 1), (289, 1)],
        [(12, 1), (193, 1), (294, 1), (393, 1), (878, 1), (879, 1)],
        [(1, 1), (880, 1)],
        [(1, 1), (8, 1), (71, 1), (72, 1), (283, 1), (411, 1), (559, 1), (881, 1)],
        [(1, 1), (8, 1), (71, 1), (72, 1), (283, 1), (411, 1), (559, 1), (881, 1)],
        [(1, 1), (8, 1), (72, 1), (197, 1), (875, 1)],
        [(38, 1), (112, 1)],
        [(0, 1), (1, 1)],
        [(258, 1), (443, 1), (539, 1), (588, 1), (882, 1)],
        [(883, 1), (884, 1)],
        [(1, 1), (8, 1)],
        [(1, 1), (102, 1)],
        ...]
```

In [46]:
```python
from gensim.models import LdaModel
```

In [47]:
```python
Num_Topic = 9
ldamodel = LdaModel(doc_term_matrix, num_topics= Num_Topic, id2word= dictionary, passes
```

In [48]:
```python
topics = ldamodel.show_topics()
for topic in topics:
    print(topic)
    print()
```

```
(0, '0.249*"internet" + 0.153*"comcast" + 0.140*"service" + 0.019*"problem" + 0.018*"bil
l" + 0.015*"outage" + 0.013*"back" + 0.012*"business" + 0.011*"phone" + 0.010*"broadban
d"')

(1, '0.124*"comcast" + 0.055*"throttling" + 0.045*"cable" + 0.030*"bill" + 0.022*"charg
e" + 0.020*"account" + 0.018*"equipment" + 0.017*"day" + 0.017*"payment" + 0.015*"monopo
ly"')

(2, '0.097*"practice" + 0.084*"unfair" + 0.074*"billing" + 0.052*"comcast" + 0.040*"pric
ing" + 0.036*"monopolistic" + 0.020*"paying" + 0.016*"lied" + 0.016*"tucson" + 0.012*"ba
ndwidth"')

(3, '0.136*"comcast" + 0.079*"charge" + 0.025*"contract" + 0.019*"cramming" + 0.017*"3"
+ 0.015*"email" + 0.015*"year" + 0.014*"appointment" + 0.014*"failure" + 0.014*"lack"')

(4, '0.090*"service" + 0.067*"xfinity" + 0.062*"comcast" + 0.032*"false" + 0.025*"decept
ive" + 0.022*"without" + 0.021*"monthly" + 0.019*"connection" + 0.019*"switch" + 0.017
*"home"')

(5, '0.118*"service" + 0.090*"comcast" + 0.067*"customer" + 0.031*"poor" + 0.021*"help"
+ 0.019*"terrible" + 0.018*"show" + 0.013*"xfinitycomcast" + 0.013*"bad" + 0.012*"horrib
le"')

(6, '0.256*"comcast" + 0.147*"billing" + 0.077*"issue" + 0.077*"complaint" + 0.074*"serv
ice" + 0.016*"comcastxfinity" + 0.013*"limit" + 0.013*"access" + 0.009*"shitty" + 0.008
*"plan"')

(7, '0.219*"data" + 0.177*"cap" + 0.126*"comcast" + 0.042*"usage" + 0.028*"fee" + 0.014
*"installation" + 0.013*"unreliable" + 0.012*"without" + 0.011*"asking" + 0.010*"300g
b"')

(8, '0.169*"speed" + 0.159*"internet" + 0.055*"slow" + 0.025*"price" + 0.021*"high" + 0.
```

019*"connectivity" + 0.016*"pay" + 0.014*"refund" + 0.014*"promised" + 0.013*"2"')

In [49]:
```python
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]
```

In [50]:
```python
pd.DataFrame(word_dict)
```

Out[50]:

	Topic # 0	Topic # 1	Topic # 2	Topic # 3	Topic # 4	Topic # 5	Topic # 6	Topi
0	internet	comcast	practice	comcast	service	service	comcast	
1	comcast	throttling	unfair	charge	xfinity	comcast	billing	
2	service	cable	billing	contract	comcast	customer	issue	cor
3	problem	bill	comcast	cramming	false	poor	complaint	u
4	bill	charge	pricing	3	deceptive	help	service	
5	outage	account	monopolistic	email	without	terrible	comcastxfinity	install
6	back	equipment	paying	year	monthly	show	limit	unre
7	business	day	lied	appointment	connection	xfinitycomcast	access	wi
8	phone	payment	tucson	failure	switch	bad	shitty	a
9	broadband	monopoly	bandwidth	lack	home	horrible	plan	3
10	availability	low	disconnection	rate	price	please	fraudulent	ove
11	quality	time	improper	option	charging	bill	incorrect	
12	pricing	credit	cable	people	advertising	throttle	atlanta	m
13	poor	unauthorized	charged	hbo	intermittent	provided	refund	
14	provider	provide	getting	one	month	billed	unable	
15	scam	mb	line	overage	sale	contract	transfer	
16	notice	12	pay	go	bait	extremely	device	extc
17	regarding	paying	predatory	fraudulent	increased	term	slowing	super
18	request	throttled	capping	call	cancelling	promotion	fix	cont
19	bundle	speed	mi	ps4	modem	price	trial	dou

In [57]:
```python
resolved = comcast.groupby(["Received Via","newStatus"]).size().unstack()
resolved['resolved_percentage'] = (resolved['Closed']/(resolved['Closed']+resolved['Ope
resolved
```

Out[57]:

newStatus	Closed	Open	resolved_percentage
Received Via			

	newStatus	Closed	Open	resolved_percentage
Received Via				
Customer Care Call		864	255	77.211796
Internet		843	262	76.289593

In [ ]: