```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

df=pd.read_csv("/Users/shraddhalipane/Downloads/
Comcast_telecom_complaints_data.csv")    #load csv dataset

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
```

```
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
```

```
df['Date']=pd.to_datetime(df['Date'])        # number of complaints on
daily basis
```

```
df.head()
```

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

  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
```

```
df['month']=df['Date'].dt.month_name()      # created column 'month'
```

```
df
```

```
     Ticket #                                  Customer Complaint
Date  \
0      250635                     Comcast Cable Internet Speeds 2015-
04-22
1      223441       Payment disappear - service got disconnected 2015-
04-08
2      242732                                    Speed and Service 2015-
04-18
3      277946  Comcast Imposed a New Usage Cap of 300GB that ... 2015-
05-07
4      307175         Comcast not working and no service to boot 2015-
05-26
...       ...                                                   ...
...
2219   213550                                Service Availability 2015-
04-02
2220   318775         Comcast Monthly Billing for Returned Modem 2015-
06-02
2221   331188                              complaint about comcast 2015-
06-09
2222   360489             Extremely unsatisfied Comcast customer 2015-
06-23
2223   363614               Comcast, Ypsilanti MI Internet Speed 2015-
06-24

     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
...              ...         ...                 ...         ...
...
2219       04-Feb-15   9:13:18 AM  Customer Care Call  Youngstown
Florida
2220       06-Feb-15   1:24:39 PM  Customer Care Call   Ypsilanti
Michigan
2221       06-Sep-15   5:28:41 PM            Internet   Ypsilanti
```

```
Michigan
2222       23-Jun-15  11:13:30 PM  Customer Care Call   Ypsilanti
Michigan
2223       24-Jun-15  10:28:33 PM  Customer Care Call   Ypsilanti
Michigan
```

	Zip code	Status	Filing on Behalf of Someone	month
0	21009	Closed	No	April
1	30102	Closed	No	April
2	30101	Closed	Yes	April
3	30101	Open	Yes	May
4	30101	Solved	No	May
...	...	...	...	...
2219	32466	Closed	No	April
2220	48197	Solved	No	June
2221	48197	Solved	No	June
2222	48197	Solved	No	June
2223	48198	Open	Yes	June

```
[2224 rows x 12 columns]
```

```
df.groupby('month').size()
```

```
month
April     545
June     1280
May       399
dtype: int64
```

```
month=df.groupby('month').size()
```

```
df.groupby('month').size()
```

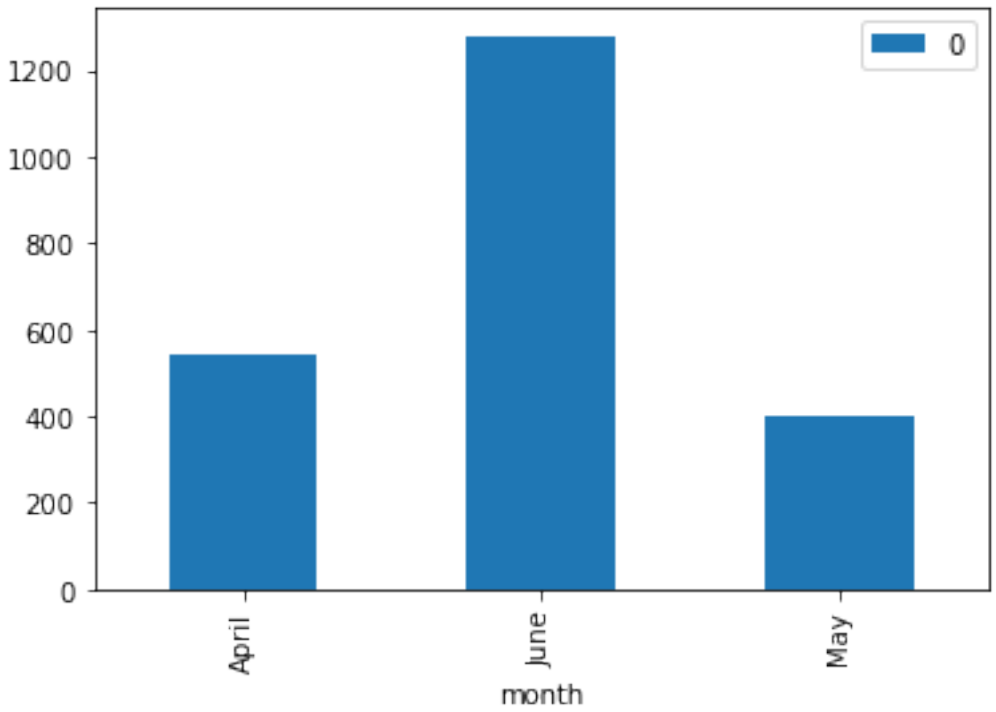
```
month
April     545
June     1280
May       399
dtype: int64
```

```
month_df=pd.DataFrame(month).reset_index()
```

```
month_df                                    # number of complaints on
Monthly basis
```

	month	0
0	April	545
1	June	1280
2	May	399

```
month_df.plot(x='month',y=0,kind='bar')
plt.show()
```



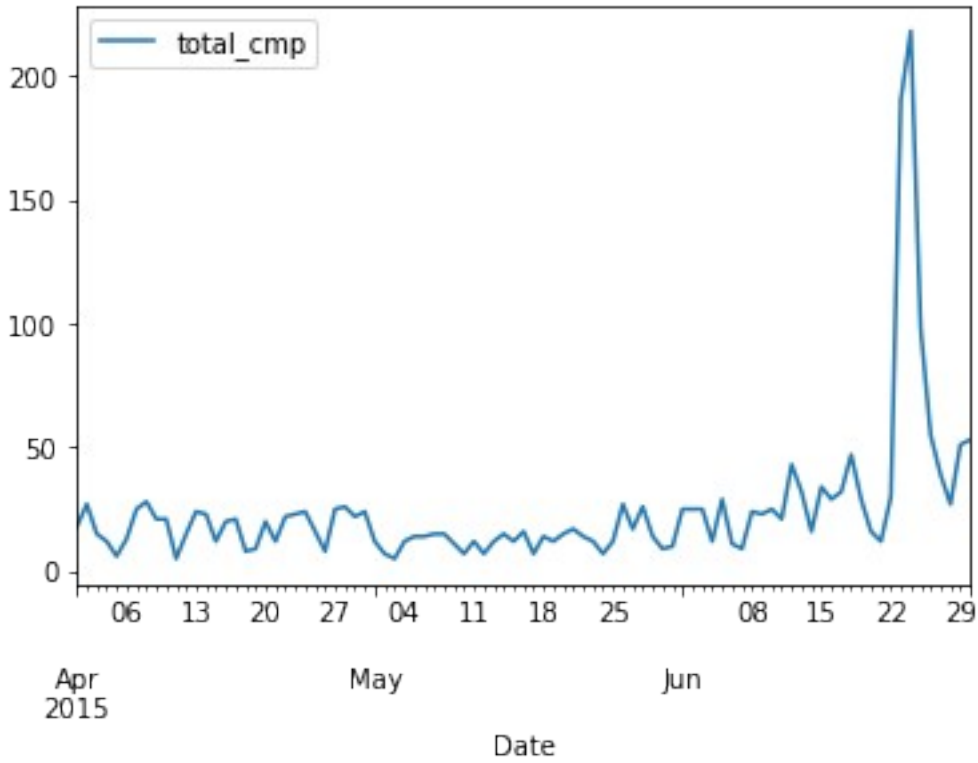

```
by_date=df.groupby('Date').size()

daily_df=pd.DataFrame(by_date).reset_index()

daily_df.rename(columns={0:'total_cmp'},inplace=True)

daily_df.plot(x='Date',y='total_cmp')                              # number
of complaints on daily basis using plot
```

```
<AxesSubplot:xlabel='Date'>
```




```
daily_df.sort_values(by='total_cmp', ascending=False)
```

```
         Date  total_cmp
84 2015-06-24        218
83 2015-06-23        190
85 2015-06-25         98
86 2015-06-26         55
90 2015-06-30         53
..        ...        ...
46 2015-05-17          7
41 2015-05-12          7
4  2015-04-05          6
10 2015-04-11          5
32 2015-05-03          5

[91 rows x 2 columns]
```

```
df['Customer Complaint'] = df['Customer Complaint'].str.title()
frequency = df['Customer Complaint'].value_counts()
#Provide a table with the frequency of complaint types

frequency
```

```
Comcast                                                                 102
Comcast Data Cap                                                         30
Comcast Internet                                                         29
Comcast Data Caps                                                        21
```

```
Comcast Billing                                                    18
                                                                  ...
Monthly Data Caps                                                   1
Comcast/Xfinity Poor Service, Fraudulent Billing And Collection     1
Lost Emails/Billing                                                 1
Improper Billing And Non Resolution Of Issues                       1
Comcast, Ypsilanti Mi Internet Speed                                1
Name: Customer Complaint, Length: 1740, dtype: int64
```

```
import nltk
```

```
nltk.download ()
```

```
showing info https://raw.githubusercontent.com/nltk/nltk_data/gh-
pages/index.xml
```

```
True
```

```
!pip install wordcloud
```

```
Requirement already satisfied: wordcloud in
./opt/anaconda3/lib/python3.9/site-packages (1.8.1)
Requirement already satisfied: numpy>=1.6.1 in
./opt/anaconda3/lib/python3.9/site-packages (from wordcloud) (1.20.3)
Requirement already satisfied: matplotlib in
./opt/anaconda3/lib/python3.9/site-packages (from wordcloud) (3.4.3)
Requirement already satisfied: pillow in
./opt/anaconda3/lib/python3.9/site-packages (from wordcloud) (8.4.0)
Requirement already satisfied: cycler>=0.10 in
./opt/anaconda3/lib/python3.9/site-packages (from matplotlib-
>wordcloud) (0.10.0)
Requirement already satisfied: pyparsing>=2.2.1 in
./opt/anaconda3/lib/python3.9/site-packages (from matplotlib-
>wordcloud) (3.0.4)
Requirement already satisfied: python-dateutil>=2.7 in
./opt/anaconda3/lib/python3.9/site-packages (from matplotlib-
>wordcloud) (2.8.2)
Requirement already satisfied: kiwisolver>=1.0.1 in
./opt/anaconda3/lib/python3.9/site-packages (from matplotlib-
>wordcloud) (1.3.1)
Requirement already satisfied: six in
./opt/anaconda3/lib/python3.9/site-packages (from cycler>=0.10-
>matplotlib->wordcloud) (1.16.0)
```

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

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

```
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

doc_complete = df["Customer Complaint"].tolist()
frequency= [clean(doc).split() for doc in doc_complete]

conda install -c conda-forge gensim

Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /Users/shraddhalipane/opt/anaconda3

  added / updated specs:
    - gensim


The following packages will be SUPERSEDED by a higher-priority
channel:

  conda              pkgs/main::conda-4.11.0-py39hecd8cb5_0 --> conda-
forge::conda-4.11.0-py39h6e9494a_0


Preparing transaction: done
Verifying transaction: done
Executing transaction: done

Note: you may need to restart the kernel to use updated packages.

conda install jupyter

Collecting package metadata (current_repodata.json): done
Solving environment: done

# All requested packages already installed.


Note: you may need to restart the kernel to use updated packages.

import gensim
from gensim import corpora
```

```
dictionary = corpora.Dictionary(frequency)
print(dictionary)
```

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

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

```
[[(0, 1), (1, 1), (2, 1), (3, 1)],
 [(4, 1), (5, 1), (6, 1), (7, 1), (8, 1)],
 [(3, 1), (8, 1)],
 [(1, 1), (9, 1), (10, 1), (11, 1), (12, 1), (13, 1), (14, 1), (15,
1)],
 [(1, 1), (8, 1), (16, 1), (17, 1)],
 [(18, 1), (19, 1), (20, 1), (21, 1), (22, 1), (23, 1), (24, 1)],
 [(8, 1), (10, 1), (20, 1), (25, 1), (26, 1)],
 [(1, 1), (8, 1), (27, 1), (28, 1), (29, 1), (30, 1)],
 [(1, 1), (31, 1), (32, 1)],
 [(1, 1), (33, 1), (34, 1), (35, 1), (36, 1)],
 [(5, 1), (8, 1), (37, 1), (38, 1)],
 [(39, 1), (40, 1), (41, 1), (42, 1), (43, 1), (44, 1)],
 [(1, 1),
  (2, 1),
  (45, 1),
  (46, 1),
  (47, 1),
  (48, 1),
  (49, 1),
  (50, 1),
  (51, 1),
  (52, 1),
  (53, 1)],
 [(2, 1), (3, 1)],
 [(2, 1), (54, 1), (55, 1), (56, 1)],
 [(2, 1), (57, 1)],
 [(2, 1), (3, 1), (58, 1)],
 [(1, 1), (59, 1), (60, 1), (61, 1), (62, 1), (63, 1), (64, 1), (65,
1)],
 [(2, 1), (8, 1), (66, 1)],
 [(8, 1), (40, 1), (67, 1), (68, 1), (69, 1)],
 [(2, 1), (70, 1), (71, 1)],
 [(0, 1), (8, 2), (66, 1), (72, 1)],
 [(3, 1)],
 [(1, 1), (70, 1), (73, 1), (74, 1)],
 [(1, 1)],
 [(75, 1), (76, 1)],
 [(1, 1), (8, 1), (72, 1)],
 [(1, 1), (77, 1), (78, 1), (79, 1), (80, 1)],
 [(1, 1), (2, 1), (38, 1), (81, 1), (82, 1), (83, 1), (84, 1)],
 [(2, 1), (17, 1), (85, 1), (86, 1)],
```

```
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (2, 1), (10, 1), (20, 1)],
 [(87, 1), (88, 1), (89, 1), (90, 1)],
 [(1, 1), (2, 1), (15, 1), (20, 1)],
 [(1, 1), (91, 1), (92, 1)],
 [(1, 1)],
 [(8, 1)],
 [(1, 1)],
 [(2, 1), (38, 1), (82, 1), (93, 1)],
 [(1, 1), (46, 1), (94, 1), (95, 1)],
 [(96, 1)],
 [(2, 1), (3, 1), (97, 1)],
 [(2, 1), (98, 1), (99, 1)],
 [(1, 1), (55, 1), (100, 1), (101, 1), (102, 1), (103, 1), (104, 1),
(105, 1)],
 [(3, 1), (22, 1), (106, 1)],
 [(38, 1), (107, 1), (108, 1), (109, 1), (110, 1), (111, 1)],
 [(1, 1), (38, 1), (112, 1)],
 [(1, 1)],
 [(1, 1), (8, 1), (38, 1), (82, 1)],
 [(0, 1), (35, 1), (113, 1)],
 [(8, 1), (82, 1)],
 [(48, 1), (49, 1), (114, 1), (115, 1)],
 [(2, 1), (116, 1)],
 [(39, 1), (82, 1)],
 [(70, 1)],
 [(57, 1), (117, 1)],
 [(1, 1), (91, 1), (118, 1), (119, 1), (120, 1)],
 [(1, 1), (121, 1), (122, 1)],
 [(1, 1), (46, 1), (123, 1), (124, 1), (125, 1)],
 [(1, 1), (82, 1)],
 [(1, 1), (8, 1), (29, 1), (126, 1), (127, 1), (128, 1)],
 [(1, 1)],
 [(129, 1)],
 [(1, 1), (8, 1), (40, 1), (69, 1), (78, 1), (130, 1), (131, 1)],
 [(1, 1), (8, 1), (132, 1)],
 [(8, 1), (133, 1), (134, 1), (135, 1), (136, 1)],
 [(82, 1), (117, 1)],
 [(0, 1), (2, 1), (45, 1), (137, 1), (138, 1)],
 [(139, 1)],
 [(3, 1), (82, 1)],
 [(140, 1)],
 [(60, 1), (141, 1), (142, 1), (143, 1), (144, 1)],
 [(1, 1),
  (10, 1),
  (20, 1),
  (145, 1),
  (146, 1),
  (147, 1),
  (148, 1),
```

```
  (149, 1),
  (150, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(3, 1), (8, 1)],
 [(20, 1), (74, 1), (151, 1), (152, 1), (153, 1)],
 [(1, 1), (10, 1), (20, 1), (154, 1)],
 [(1, 1), (38, 1), (155, 1)],
 [(1, 1), (62, 1), (156, 1)],
 [(1, 1), (82, 1), (157, 1)],
 [(158, 1), (159, 1)],
 [(10, 1), (20, 1), (160, 1)],
 [(10, 1), (20, 1)],
 [(1, 1), (8, 1), (161, 1), (162, 1)],
 [(1, 1), (24, 1), (163, 1), (164, 1)],
 [(0, 1), (8, 1), (165, 1), (166, 1), (167, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (8, 1), (168, 1)],
 [(10, 1), (20, 1)],
 [(1, 1), (8, 1), (169, 1), (170, 1), (171, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1)],
 [(172, 1), (173, 1)],
 [(1, 1), (2, 1), (8, 1), (74, 1), (102, 1), (174, 1), (175, 1), (176,
1)],
 [(8, 1), (102, 1), (152, 1), (177, 1), (178, 1)],
 [(8, 1),
  (146, 1),
  (179, 1),
  (180, 1),
  (181, 1),
  (182, 1),
  (183, 1),
  (184, 1),
  (185, 1),
  (186, 1),
  (187, 1),
  (188, 1),
  (189, 1),
  (190, 1)],
 [(1, 1), (8, 1), (82, 1), (191, 1)],
 [(1, 1), (8, 1), (72, 1)],
 [(1, 1)],
 [(1, 1), (10, 1), (20, 1), (101, 1), (192, 1), (193, 1)],
 [(1, 1), (19, 1), (137, 1), (194, 1), (195, 1)],
 [(1, 1), (10, 1), (196, 1)],
 [(1, 1), (8, 1), (66, 1), (72, 1)],
 [(10, 1), (20, 1)],
 [(8, 1), (72, 1), (197, 1)],
 [(8, 1), (198, 1)],
 [(1, 1), (15, 1), (20, 1), (199, 1)],
```

```
[(1, 1), (8, 1), (29, 1), (200, 1)],
[(1, 1), (8, 1), (158, 1), (201, 1), (202, 1), (203, 1)],
[(1, 1), (38, 1), (204, 1)],
[(1, 1), (205, 1), (206, 1)],
[(8, 1), (207, 1), (208, 1)],
[(1, 1), (38, 1)],
[(1, 1), (2, 1)],
[(1, 1), (3, 1), (209, 1)],
[(10, 1), (20, 1)],
[(1, 1), (10, 1), (20, 1), (192, 1)],
[(1, 1), (10, 1), (20, 1), (192, 1)],
[(1, 1), (8, 1), (72, 1), (210, 1)],
[(1, 1), (9, 1), (20, 1), (24, 1), (211, 1)],
[(1, 1), (158, 1)],
[(1, 1), (10, 1), (20, 1)],
[(38, 1), (74, 1), (212, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (2, 1), (213, 1), (214, 1), (215, 1)],
[(3, 1)],
[(2, 1), (199, 1), (216, 1), (217, 1)],
[(0, 1), (1, 1), (2, 1), (8, 1)],
[(1, 1), (24, 1), (109, 1), (199, 1), (218, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (90, 1), (219, 1)],
[(1, 1), (69, 1), (84, 1), (187, 1), (220, 1), (221, 1)],
[(1, 1), (15, 1), (20, 1), (23, 1)],
[(137, 1), (195, 1), (199, 1), (222, 1), (223, 1)],
[(90, 1), (224, 1)],
[(1, 1), (70, 1)],
[(2, 1), (3, 1), (196, 1), (225, 1), (226, 1)],
[(2, 1), (58, 1)],
[(1, 1), (3, 1), (25, 1), (227, 1), (228, 1)],
[(1, 1), (57, 1)],
[(1, 1)],
[(1, 1), (38, 1), (74, 1), (90, 1), (153, 1)],
[(2, 1), (25, 1)],
[(15, 1), (20, 1), (24, 1)],
[(8, 1), (38, 1), (108, 1), (229, 1)],
[(10, 1), (101, 1), (230, 1), (231, 1)],
[(1, 1), (20, 1), (23, 1)],
[(84, 1), (90, 1), (168, 1), (232, 1), (233, 1)],
[(1, 1), (234, 1), (235, 1), (236, 1), (237, 1)],
[(71, 1), (178, 1), (238, 1)],
[(12, 1), (35, 1), (72, 1), (159, 1)],
[(1, 1), (2, 1), (25, 1)],
[(2, 1), (224, 1)],
[(199, 1), (239, 1)],
[(10, 1), (20, 1), (240, 1)],
[(1, 1), (2, 1), (241, 1)],
[(25, 1)],
```

```
[(2, 1), (8, 1), (73, 1), (242, 1), (243, 1)],
[(1, 1), (2, 1)],
[(8, 1), (40, 1), (244, 1)],
[(1, 1), (48, 1), (49, 1), (245, 1), (246, 1)],
[(8, 1), (130, 1), (152, 1), (247, 1), (248, 1), (249, 1), (250, 1)],
[(214, 1)],
[(21, 1), (249, 1)],
[(1, 1), (251, 1)],
[(0, 1), (158, 1), (199, 1), (229, 1)],
[(1, 1), (38, 1), (82, 1), (223, 1)],
[(1, 1), (235, 1), (252, 1), (253, 1)],
[(8, 1), (57, 1), (254, 1), (255, 1)],
[(1, 1),
 (2, 1),
 (3, 1),
 (99, 1),
 (158, 1),
 (256, 1),
 (257, 1),
 (258, 1),
 (259, 1)],
[(2, 1), (3, 1), (158, 1), (260, 1)],
[(2, 1), (3, 1), (261, 1)],
[(8, 1), (262, 1)],
[(1, 1), (38, 1), (74, 1)],
[(70, 1)],
[(2, 1), (3, 1), (97, 1), (263, 1), (264, 1)],
[(1, 1),
 (2, 1),
 (3, 1),
 (8, 1),
 (97, 1),
 (98, 1),
 (99, 1),
 (263, 1),
 (265, 1)],
[(1, 1), (8, 1), (70, 1), (147, 1), (266, 1), (267, 1)],
[(2, 1), (21, 1), (225, 1), (268, 1), (269, 1)],
[(1, 1), (2, 1), (3, 1), (70, 1), (265, 1)],
[(0, 1), (1, 1), (270, 1)],
[(8, 1), (38, 1), (72, 1), (112, 1), (210, 1)],
[(1, 1), (78, 1), (108, 1)],
[(1, 1), (241, 1)],
[(45, 1), (86, 1), (90, 1)],
[(0, 1), (2, 1)],
[(2, 1), (8, 1), (97, 1), (262, 1)],
[(1, 1), (179, 1)],
[(1, 1), (3, 1), (28, 1), (82, 1), (271, 1), (272, 1)],
[(10, 1), (15, 1), (20, 1), (273, 1)],
[(74, 1), (102, 1), (152, 1), (274, 1)],
```

```
 [(0, 1), (1, 1)],
 [(1, 1), (224, 1)],
 [(1, 1), (57, 1)],
 [(0, 1)],
 [(1, 1), (199, 1)],
 [(1, 1)],
 [(2, 1), (275, 1)],
 [(74, 1), (109, 1)],
 [(1, 1), (204, 1)],
 [(1, 1), (17, 1), (57, 1), (155, 1), (176, 1), (208, 1), (276, 1),
(277, 1)],
 [(1, 1)],
 [(278, 1)],
 [(3, 1), (99, 1), (196, 1), (279, 1), (280, 1), (281, 1), (282, 1)],
 [(1, 1), (38, 1), (283, 1)],
 [(1, 1), (2, 1), (221, 1), (284, 1)],
 [(1, 1), (46, 1), (246, 1), (285, 1)],
 [(10, 1), (20, 1), (286, 1), (287, 1)],
 [(1, 1)],
 [(136, 1), (199, 1), (247, 1), (288, 1), (289, 1)],
 [(1, 1), (2, 1), (290, 1), (291, 1), (292, 1)],
 [(1, 1), (2, 1), (290, 1), (291, 1), (292, 1)],
 [(1, 1), (8, 2), (72, 1), (203, 1)],
 [(2, 1), (12, 1), (137, 1), (210, 1), (225, 1), (293, 1), (294, 1),
(295, 1)],
 [(1, 1), (38, 1)],
 [(21, 1), (181, 1), (296, 1), (297, 1)],
 [(1, 1), (199, 1), (212, 1)],
 [(38, 1), (298, 1)],
 [(38, 1), (155, 1)],
 [(3, 1), (8, 1), (130, 1), (299, 1), (300, 1)],
 [(1, 1),
  (57, 1),
  (71, 1),
  (72, 1),
  (82, 1),
  (301, 1),
  (302, 1),
  (303, 1),
  (304, 1)],
 [(8, 1), (305, 1)],
 [(199, 1), (306, 1)],
 [(1, 1),
  (12, 1),
  (55, 1),
  (71, 1),
  (158, 1),
  (188, 1),
  (307, 1),
  (308, 1),
```

```
 (309, 1)],
[(310, 1), (311, 1), (312, 1), (313, 1), (314, 1), (315, 1)],
[(1, 1), (2, 1)],
[(1, 1), (8, 1), (38, 1), (191, 1)],
[(1, 1), (57, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (82, 1)],
[(1, 1), (19, 1), (21, 1), (136, 1), (316, 1)],
[(158, 1), (288, 1)],
[(159, 1), (199, 1), (317, 1), (318, 1)],
[(25, 1), (319, 1)],
[(2, 1), (8, 1), (320, 1), (321, 1)],
[(1, 1), (38, 1), (74, 1), (212, 1)],
[(1, 1), (8, 1), (38, 1), (159, 1)],
[(1, 1), (2, 1), (3, 1), (322, 1)],
[(21, 1), (98, 1), (137, 1), (195, 1), (309, 1), (323, 1), (324, 1)],
[(139, 1), (325, 1)],
[(38, 1)],
[(38, 1)],
[(8, 1), (326, 1)],
[(1, 1), (74, 1), (197, 1)],
[(38, 1), (61, 1), (327, 1)],
[(1, 1), (3, 1), (82, 1)],
[(221, 1), (284, 1)],
[(2, 1), (8, 1), (40, 1), (328, 1), (329, 1)],
[(1, 1), (5, 1), (136, 1), (179, 1), (188, 1), (247, 1)],
[(197, 1), (221, 1), (330, 1), (331, 1)],
[(21, 1), (137, 1), (195, 1)],
[(1, 1), (82, 1), (332, 1)],
[(153, 1), (333, 1)],
[(75, 1), (76, 1), (224, 1)],
[(1, 1), (48, 1), (49, 1)],
[(1, 1), (2, 1), (97, 1)],
[(2, 1), (3, 1), (97, 1)],
[(1, 1), (38, 1), (334, 1)],
[(1, 1), (161, 1), (199, 1), (269, 1), (335, 1), (336, 1)],
[(1, 1), (38, 1), (74, 1), (212, 1)],
[(48, 1), (49, 1), (337, 1), (338, 1), (339, 1), (340, 1)],
[(1, 1), (8, 1), (341, 1), (342, 1)],
[(1, 1), (343, 1)],
[(78, 1), (121, 1), (344, 1)],
[(3, 1), (28, 1), (292, 1), (345, 1)],
[(1, 1), (3, 1), (25, 1), (196, 1)],
[(286, 1), (346, 1)],
[(2, 1), (3, 1), (292, 1)],
[(38, 1), (159, 1)],
[(1, 1), (347, 1), (348, 1)],
[(1, 1),
 (8, 1),
 (38, 1),
```

```
 (69, 1),
 (84, 1),
 (349, 1),
 (350, 1),
 (351, 1),
 (352, 1)],
[(1, 1), (48, 1), (49, 1), (246, 1), (353, 1)],
[(1, 1), (15, 1), (20, 1), (199, 1)],
[(1, 1), (38, 1), (82, 1), (101, 1)],
[(1, 1), (2, 1), (3, 1)],
[(1, 1), (2, 1), (8, 1), (97, 1)],
[(1, 1), (2, 1), (97, 1)],
[(1, 1), (2, 1), (354, 1)],
[(1, 1), (71, 1), (179, 1), (211, 1), (355, 1), (356, 1), (357, 1)],
[(1, 1), (8, 1), (358, 1)],
[(1, 1)],
[(1, 1)],
[(8, 1), (32, 1), (91, 1), (359, 1)],
[(38, 1), (252, 1)],
[(38, 1), (360, 1)],
[(361, 1)],
[(1, 1), (2, 1), (25, 1)],
[(1, 1), (38, 1), (229, 1)],
[(38, 1), (199, 1)],
[(2, 1)],
[(360, 1), (362, 1)],
[(232, 1), (233, 1), (363, 1)],
[(8, 1), (208, 1), (364, 1), (365, 1)],
[(2, 1), (158, 1), (265, 1)],
[(1, 1), (8, 1), (99, 1)],
[(8, 1), (21, 1), (261, 1), (366, 1)],
[(1, 1), (8, 1)],
[(8, 1), (72, 1), (210, 1)],
[(8, 1), (63, 1), (67, 1), (119, 1)],
[(1, 1)],
[(2, 1), (8, 1), (367, 1)],
[(1, 1), (3, 1), (38, 1), (82, 1)],
[(8, 1), (299, 1), (368, 1), (369, 1), (370, 1)],
[(1, 1), (164, 1)],
[(2, 1), (25, 1)],
[(38, 1), (74, 1), (212, 1)],
[(38, 1), (82, 1), (371, 1)],
[(1, 1), (8, 1), (372, 1)],
[(20, 1), (23, 1)],
[(224, 1), (373, 1)],
[(1, 1), (38, 1), (374, 1)],
[(1, 1)],
[(2, 1), (97, 1)],
[(2, 1), (8, 1)],
[(90, 1), (121, 1), (375, 1)],
```

```
[(1, 1),
 (3, 1),
 (38, 1),
 (57, 1),
 (283, 1),
 (292, 1),
 (376, 1),
 (377, 1),
 (378, 1)],
[(1, 1), (52, 1), (285, 1), (313, 1), (379, 1)],
[(1, 1), (63, 1), (155, 1), (380, 1)],
[(3, 1), (97, 1), (225, 1), (381, 1)],
[(1, 1), (2, 1), (25, 1), (382, 1)],
[(1, 1), (383, 1)],
[(1, 1), (8, 1), (38, 1), (82, 1), (110, 1), (384, 1)],
[(38, 1), (385, 1)],
[(8, 1), (168, 1), (386, 1), (387, 1)],
[(1, 1), (388, 1)],
[(1, 1), (36, 1), (158, 1), (185, 1), (368, 1), (389, 1)],
[(2, 1), (390, 1)],
[(1, 1), (35, 1)],
[(1, 1), (2, 1), (8, 1), (391, 1), (392, 1), (393, 1)],
[(21, 1), (269, 1), (294, 1), (313, 1)],
[(1, 1), (155, 1), (364, 1), (394, 1), (395, 1)],
[(57, 1), (121, 1), (139, 1), (187, 1), (396, 1), (397, 1)],
[(1, 1), (2, 1)],
[(1, 1), (2, 1)],
[(8, 1), (82, 1)],
[(1, 1), (90, 1), (199, 1), (398, 1)],
[(2, 1), (58, 1)],
[(1, 1), (10, 1), (15, 1)],
[(1, 1), (10, 1), (15, 1), (20, 1)],
[(1, 1), (10, 1), (20, 1), (399, 1), (400, 1)],
[(2, 1), (8, 1)],
[(8, 1)],
[(8, 1), (38, 1), (249, 1), (401, 1), (402, 1)],
[(15, 1), (20, 1), (38, 1)],
[(75, 1), (76, 1), (403, 1), (404, 1)],
[(2, 1), (3, 1)],
[(1, 1), (199, 1), (296, 1), (405, 1)],
[(1, 1), (2, 1), (406, 1)],
[(1, 1), (22, 1), (35, 1), (407, 1), (408, 1)],
[(1, 1), (57, 1)],
[(1, 1), (2, 1), (3, 1)],
[(1, 1), (57, 1)],
[(10, 1), (20, 1)],
[(1, 1), (15, 1), (20, 1), (82, 1), (352, 1), (409, 1)],
[(1, 1), (15, 1), (20, 1), (82, 1), (352, 1), (409, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (15, 1), (20, 1), (410, 1)],
```

```
 [(1, 1), (2, 1), (10, 1), (20, 1), (411, 1)],
 [(1, 1), (21, 2), (105, 1), (324, 1), (395, 1), (412, 1), (413, 1),
(414, 1)],
 [(0, 1), (1, 1), (225, 1), (265, 1), (415, 1), (416, 1), (417, 1)],
 [(1, 1), (8, 1), (82, 1), (418, 1), (419, 1)],
 [(1, 1), (29, 1), (78, 1), (120, 1), (364, 1), (420, 1), (421, 1)],
 [(1, 1), (2, 2), (102, 1), (148, 1), (232, 1), (422, 1)],
 [(1, 1), (2, 1), (10, 1), (15, 1)],
 [(1, 1), (8, 1), (210, 1)],
 [(1, 1), (10, 1), (20, 1), (423, 1)],
 [(1, 1), (2, 1), (8, 1), (25, 1)],
 [(82, 1), (424, 1)],
 [(199, 1), (425, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (158, 1), (426, 1), (427, 1), (428, 1), (429, 1), (430, 1)],
 [(1, 1), (2, 1)],
 [(1, 1), (9, 1), (10, 1), (20, 1)],
 [(2, 1), (3, 1), (264, 1)],
 [(8, 1), (35, 1), (73, 1), (431, 1), (432, 1), (433, 1), (434, 1),
(435, 1)],
 [(1, 1), (2, 1), (3, 1), (35, 1)],
 [(1, 1), (436, 1)],
 [(63, 1), (437, 1), (438, 1), (439, 1)],
 [(2, 1), (82, 1), (320, 1)],
 [(90, 1)],
 [(117, 1)],
 [(1, 1), (440, 1), (441, 1)],
 [(1, 1), (95, 1), (442, 1)],
 [(1, 1), (443, 1)],
 [(8, 1), (72, 1), (178, 1), (444, 1)],
 [(1, 1), (48, 1), (49, 1), (246, 1)],
 [(445, 1), (446, 1)],
 [(1, 1), (8, 2), (72, 1), (82, 1)],
 [(1, 1), (224, 1), (314, 1)],
 [(1, 1), (54, 1)],
 [(1, 1), (3, 1), (10, 1), (20, 1), (25, 1)],
 [(259, 1), (447, 1), (448, 1), (449, 1)],
 [(1, 1), (155, 1)],
 [(199, 1), (252, 1), (432, 1), (450, 1), (451, 1)],
 [(1, 1), (57, 1), (384, 1)],
 [(1, 1), (2, 1), (225, 1), (452, 1)],
 [(95, 1), (103, 1), (225, 1), (453, 1), (454, 1)],
 [(1, 1), (455, 1), (456, 1), (457, 1), (458, 1), (459, 1)],
 [(38, 1), (112, 1)],
 [(1, 1), (57, 1)],
 [(1, 1)],
 [(2, 1), (3, 1), (299, 1)],
 [(1, 1), (52, 1), (115, 1), (460, 1)],
 [(1, 1), (82, 1), (86, 1)],
 [(1, 1), (2, 1)],
```

```
[(1, 1)],
[(1, 1), (8, 1), (72, 1), (210, 1), (461, 1), (462, 1)],
[(1, 1), (463, 1), (464, 1)],
[(1, 1), (2, 1)],
[(8, 1), (66, 1), (199, 1), (465, 1), (466, 1), (467, 1)],
[(2, 1), (8, 1), (38, 1), (57, 1), (72, 1), (97, 1), (210, 1)],
[(8, 1)],
[(1, 1), (32, 1)],
[(1, 1), (2, 1), (3, 1), (225, 1)],
[(0, 1), (1, 1), (2, 1)],
[(1, 1), (8, 1), (395, 1), (468, 1)],
[(1, 1)],
[(1, 1), (120, 1), (199, 1), (469, 1)],
[(1, 1), (8, 1), (19, 1), (470, 1)],
[(1, 1), (35, 1), (70, 1), (171, 1), (471, 1)],
[(2, 1), (8, 1), (55, 1), (199, 1), (229, 1), (395, 1)],
[(38, 1), (74, 1), (212, 1)],
[(1, 1), (472, 1)],
[(473, 1), (474, 1)],
[(1, 1), (74, 1), (102, 1), (212, 1)],
[(2, 1), (3, 1), (97, 1)],
[(8, 1), (121, 1), (375, 1), (475, 1)],
[(1, 1),
 (7, 1),
 (19, 1),
 (21, 1),
 (61, 1),
 (158, 1),
 (476, 1),
 (477, 1),
 (478, 1),
 (479, 1)],
[(8, 1), (139, 1), (407, 1)],
[(3, 1), (8, 1), (480, 1), (481, 1)],
[(1, 1), (8, 1), (38, 1)],
[(38, 1), (74, 1), (212, 1)],
[(35, 1), (90, 1), (99, 1), (482, 1), (483, 1)],
[(90, 1), (234, 1), (484, 1)],
[(1, 1), (2, 1), (50, 1), (51, 1), (53, 1)],
[(8, 1), (485, 1)],
[(1, 1), (38, 1), (91, 1), (229, 1), (486, 1), (487, 1)],
[(1, 1), (2, 1), (3, 1)],
[(1, 1), (411, 1), (488, 1)],
[(1, 1), (38, 1)],
[(0, 1), (1, 1), (2, 1), (176, 1), (489, 1)],
[(2, 1), (32, 1), (225, 1)],
[(1, 1), (2, 1), (3, 1), (25, 1)],
[(1, 1), (24, 1), (90, 1), (199, 1), (490, 1)],
[(1, 1), (8, 1), (32, 1)],
[(1, 1), (38, 1)],
```

```
 [(199, 1), (491, 1)],
 [(139, 1)],
 [(2, 1), (371, 1)],
 [(139, 1)],
 [(117, 1), (225, 1), (492, 1)],
 [(1, 1), (50, 1), (90, 1), (357, 1), (448, 1), (493, 1), (494, 1)],
 [(8, 1), (82, 1)],
 [(1, 1), (2, 1), (32, 1)],
 [(1, 1)],
 [(15, 1), (217, 1), (495, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (38, 1), (74, 1)],
 [(8, 1), (72, 1), (210, 1)],
 [(2, 1), (3, 1)],
 [(1, 1), (60, 1), (142, 1), (496, 1), (497, 1)],
 [(1, 1), (498, 1), (499, 1), (500, 1), (501, 1), (502, 1), (503, 1)],
 [(8, 1), (108, 1), (168, 1), (443, 1), (504, 1)],
 [(25, 1), (90, 1), (340, 1), (505, 1), (506, 1)],
 [(1, 1), (21, 1), (249, 1)],
 [(82, 1), (507, 1)],
 [(35, 1), (508, 1), (509, 1)],
 [(1, 1), (38, 1), (212, 1)],
 [(1, 1), (129, 1), (436, 1)],
 [(1, 1), (8, 1), (57, 1)],
 [(158, 1), (199, 1), (510, 1)],
 [(38, 1)],
 [(2, 1), (176, 1), (224, 1)],
 [(3, 1), (8, 1), (38, 1), (156, 1), (511, 1), (512, 1)],
 [(1, 1), (8, 1), (513, 1)],
 [(61, 1), (324, 1)],
 [(1, 1), (8, 1), (324, 1), (514, 1), (515, 1), (516, 1), (517, 1),
(518, 1)],
 [(1, 1), (90, 1)],
 [(1, 1), (8, 1), (244, 1)],
 [(1, 1), (2, 1), (3, 1), (97, 1)],
 [(1, 1), (8, 1)],
 [(2, 1), (158, 1), (519, 1), (520, 1)],
 [(1, 1), (8, 1), (38, 1)],
 [(1, 1), (521, 1)],
 [(1, 1), (74, 1), (522, 1), (523, 1)],
 [(3, 1), (264, 1)],
 [(8, 1), (524, 1)],
 [(1, 1), (8, 1), (81, 1), (443, 1), (474, 1)],
 [(8, 1), (72, 1), (203, 1), (214, 1), (443, 1), (525, 1)],
 [(1, 1), (8, 1), (526, 1), (527, 1)],
 [(38, 1), (528, 1)],
 [(2, 1), (139, 1)],
 [(58, 1), (358, 1)],
 [(1, 1), (155, 1), (158, 1)],
 [(38, 1), (74, 1), (212, 1)],
```

```
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (2, 1), (97, 1), (529, 1)],
 [(1, 1), (21, 1), (29, 1), (195, 1), (283, 1), (296, 1), (530, 1)],
 [(1, 1)],
 [(0, 1), (2, 1), (35, 1), (82, 1), (212, 1), (531, 1)],
 [(1, 1), (2, 1), (3, 1), (532, 1)],
 [(0, 1), (2, 1)],
 [(9, 1), (10, 1), (20, 1), (70, 1), (533, 1)],
 [(1, 1), (8, 1), (90, 1), (232, 1), (233, 1)],
 [(1, 1), (75, 1), (76, 1)],
 [(1, 1), (10, 1), (20, 1), (192, 1), (193, 1)],
 [(10, 1), (15, 1), (20, 1)],
 [(10, 1), (20, 1)],
 [(15, 1), (20, 1)],
 [(78, 1), (534, 1), (535, 1), (536, 1)],
 [(1, 1), (10, 1), (20, 1), (537, 1), (538, 1)],
 [(1, 1), (10, 1), (15, 1)],
 [(1, 1), (2, 1), (8, 1), (197, 1), (462, 1)],
 [(539, 1), (540, 1), (541, 1), (542, 1)],
 [(1, 1), (57, 1)],
 [(1, 1), (2, 1), (38, 1), (82, 1), (176, 1)],
 [(1, 1), (19, 1), (21, 1), (90, 1), (137, 1), (195, 1), (312, 1),
(543, 1)],
 [(38, 1), (544, 1)],
 [(1, 1), (2, 2), (10, 1), (90, 1), (436, 1)],
 [(1, 1), (10, 1), (20, 1), (147, 1), (150, 1), (545, 1)],
 [(1, 1), (2, 1), (8, 1), (546, 1)],
 [(1, 1), (143, 1), (199, 1)],
 [(1, 1), (10, 1), (20, 1), (547, 1)],
 [(38, 1), (91, 1), (199, 1)],
 [(1, 1),
  (10, 1),
  (20, 1),
  (23, 1),
  (38, 1),
  (74, 1),
  (102, 1),
  (156, 1),
  (358, 1),
  (548, 1)],
 [(38, 1), (74, 1), (109, 1)],
 [(38, 1), (57, 1)],
 [(1, 1), (38, 1), (74, 1), (212, 1)],
 [(1, 1), (45, 1), (549, 1), (550, 1), (551, 1)],
 [(2, 1), (3, 1)],
 [(38, 1), (74, 1), (552, 1), (553, 1)],
 [(60, 1), (554, 1)],
 [(1, 1), (90, 1), (246, 1), (285, 1)],
 [(1, 1), (40, 1), (555, 1), (556, 1), (557, 1)],
 [(340, 1), (558, 1), (559, 1), (560, 1)],
```

```
 [(2, 1), (3, 1), (35, 1), (368, 1)],
 [(1, 1), (2, 1), (199, 1), (523, 1), (561, 1)],
 [(1, 1), (2, 2), (3, 1), (25, 1), (546, 1), (562, 1)],
 [(3, 1), (97, 1)],
 [(38, 1), (563, 1)],
 [(1, 1), (2, 1), (224, 1)],
 [(10, 1), (20, 1), (82, 1), (564, 1), (565, 1)],
 [(1, 1), (20, 1), (38, 1)],
 [(10, 1), (20, 1)],
 [(1, 1)],
 [(1, 1)],
 [(1, 1)],
 [(2, 1), (32, 1), (566, 1), (567, 1), (568, 1)],
 [(1, 1), (2, 1)],
 [(1, 1), (38, 1), (569, 1)],
 [(109, 1), (111, 1), (570, 1)],
 [(571, 1), (572, 1)],
 [(35, 2), (204, 1), (468, 1), (573, 1), (574, 1), (575, 1), (576,
1)],
 [(555, 1), (577, 1)],
 [(1, 1), (28, 1), (81, 1), (578, 1)],
 [(21, 1)],
 [(0, 1), (1, 1), (579, 1), (580, 1)],
 [(218, 1), (577, 1)],
 [(1, 1)],
 [(1, 1), (38, 1), (74, 1), (212, 1), (384, 1)],
 [(1, 1), (158, 1), (212, 1)],
 [(1, 1), (8, 1)],
 [(1, 1), (2, 1), (3, 1), (97, 1), (345, 1)],
 [(1, 1), (2, 1), (8, 1), (38, 1), (155, 1)],
 [(1, 1), (3, 1), (38, 1)],
 [(1, 1), (8, 1), (60, 1), (78, 1), (121, 1), (130, 1), (168, 1)],
 [(1, 1), (8, 1), (178, 1), (581, 1)],
 [(2, 1), (3, 1), (66, 1), (97, 1), (221, 1), (345, 1)],
 [(267, 1), (582, 1), (583, 1)],
 [(48, 1), (49, 1), (115, 1), (584, 1)],
 [(1, 1),
  (8, 1),
  (36, 1),
  (63, 1),
  (158, 1),
  (585, 1),
  (586, 1),
  (587, 1),
  (588, 1)],
 [(21, 1), (413, 1), (443, 1), (589, 1)],
 [(2, 1), (97, 1)],
 [(2, 1), (3, 1), (95, 1), (103, 1), (590, 1)],
 [(1, 1), (8, 1), (67, 1), (72, 1), (591, 1), (592, 1), (593, 1)],
 [(1, 1), (57, 1)],
```

```
[(67, 1), (594, 1)],
[(2, 1), (35, 1), (595, 1)],
[(1, 1), (3, 1), (14, 1), (25, 1), (449, 1)],
[(2, 1), (3, 1), (97, 1), (263, 1)],
[(2, 1), (3, 1), (134, 1), (596, 1), (597, 1)],
[(8, 1), (67, 1), (136, 1)],
[(2, 1), (97, 1)],
[(1, 1),
 (29, 1),
 (67, 1),
 (120, 1),
 (137, 1),
 (195, 1),
 (296, 1),
 (598, 1),
 (599, 1),
 (600, 1)],
[(187, 1), (577, 1), (601, 1)],
[(21, 1), (78, 1), (108, 1), (118, 1), (252, 1)],
[(2, 1), (8, 2), (602, 1)],
[(2, 1), (8, 1), (602, 1)],
[(8, 1), (199, 1), (212, 1), (603, 1)],
[(1, 1), (7, 1), (476, 1)],
[(32, 1), (74, 1), (212, 1)],
[(334, 1), (604, 1)],
[(1, 1), (8, 1)],
[(1, 1), (38, 1), (74, 1)],
[(1, 1)],
[(1, 1), (605, 1)],
[(3, 1), (86, 1), (97, 1), (225, 1)],
[(1, 1), (3, 1), (198, 1), (292, 1), (606, 1)],
[(1, 1), (8, 1)],
[(174, 1), (296, 1), (607, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (38, 1), (212, 1)],
[(1, 1)],
[(8, 1), (97, 1)],
[(1, 1), (2, 1)],
[(1, 1)],
[(2, 1), (82, 1)],
[(8, 1), (102, 1), (608, 1)],
[(609, 1), (610, 1), (611, 1)],
[(143, 1), (179, 1)],
[(1, 1), (2, 1), (8, 1), (57, 1)],
[(38, 1), (82, 1)],
[(1, 1), (8, 1), (25, 1), (210, 1)],
[(1, 1),
 (10, 1),
 (15, 1),
 (20, 1),
```

```
 (29, 1),
 (38, 1),
 (317, 1),
 (612, 1),
 (613, 1),
 (614, 1),
 (615, 1),
 (616, 1)],
[(8, 1), (286, 1), (327, 1)],
[(1, 1), (8, 1), (210, 1)],
[(10, 1), (617, 1), (618, 1)],
[(1, 1), (10, 1), (20, 1)],
[(3, 1), (8, 1), (97, 1), (210, 1)],
[(8, 1), (38, 1)],
[(1, 1), (619, 1)],
[(1, 1),
 (2, 1),
 (10, 1),
 (15, 1),
 (154, 1),
 (395, 1),
 (617, 1),
 (618, 1),
 (620, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (10, 1), (20, 1), (621, 1), (622, 1)],
[(1, 1), (424, 1)],
[(21, 1), (623, 1), (624, 1)],
[(1, 1), (2, 1), (155, 1)],
[(1, 1), (2, 1), (38, 1)],
[(1, 1), (90, 1), (625, 1), (626, 1)],
[(1, 1), (38, 1), (82, 1)],
[(1, 1), (2, 1)],
[(1, 1), (32, 1), (514, 1), (627, 1)],
[(1, 1), (57, 1), (628, 1), (629, 1), (630, 1)],
[(1, 1), (8, 1), (178, 1)],
[(1, 1), (8, 1), (57, 1), (197, 1), (631, 1)],
[(10, 1), (20, 1)],
[(2, 1), (3, 1), (8, 1)],
[(1, 1), (35, 1), (90, 1), (632, 1), (633, 1)],
[(38, 1), (571, 1)],
[(28, 1),
 (320, 1),
 (335, 1),
 (409, 1),
 (411, 1),
 (567, 1),
 (634, 1),
 (635, 1),
 (636, 1),
```

```
  (637, 1),
  (638, 1),
  (639, 1)],
 [(1, 1), (411, 1), (640, 1)],
 [(1, 1), (2, 1), (8, 1)],
 [(1, 1), (78, 1), (158, 1), (395, 1), (641, 1), (642, 1), (643, 1)],
 [(38, 1), (74, 1), (212, 1)],
 [(199, 1), (294, 1)],
 [(1, 1), (19, 1), (368, 1), (644, 1)],
 [(20, 1), (139, 1), (645, 1)],
 [(224, 1)],
 [(179, 1), (208, 1), (412, 1), (596, 1)],
 [(1, 1), (38, 1), (143, 1)],
 [(1, 1), (12, 1), (76, 1), (615, 1), (646, 1), (647, 1), (648, 2),
(649, 1)],
 [(1, 1), (82, 1), (219, 1)],
 [(10, 1), (101, 1), (286, 1), (650, 1), (651, 1)],
 [(1, 1), (2, 1), (3, 1), (241, 1), (652, 1)],
 [(224, 1), (653, 1)],
 [(2, 1), (224, 1), (654, 1), (655, 1), (656, 1), (657, 1), (658, 1)],
 [(8, 1), (292, 1), (462, 1), (659, 1)],
 [(8, 1), (513, 1)],
 [(1, 1), (8, 1), (38, 1), (57, 1), (72, 1)],
 [(1, 1), (25, 1)],
 [(8, 2), (57, 1), (358, 1), (660, 1)],
 [(8, 2), (57, 1), (358, 1), (660, 1)],
 [(1, 1), (2, 1), (38, 1), (661, 1), (662, 1)],
 [(8, 1), (120, 1), (663, 1), (664, 1), (665, 1)],
 [(1, 1), (2, 1), (21, 1), (136, 1), (509, 1), (666, 1)],
 [(54, 1), (667, 1)],
 [(38, 1), (82, 1)],
 [(1, 1), (38, 1), (74, 1), (212, 1)],
 [(1, 1),
  (8, 1),
  (38, 1),
  (57, 1),
  (109, 1),
  (315, 1),
  (358, 1),
  (668, 1),
  (669, 1)],
 [(1, 1), (2, 1), (3, 1), (57, 1)],
 [(1, 1), (38, 1), (82, 1)],
 [(1, 1), (670, 1), (671, 1)],
 [(1, 1), (2, 1), (208, 1), (350, 1), (672, 1), (673, 1)],
 [(1, 1), (35, 1), (632, 1)],
 [(84, 1), (200, 1), (674, 1), (675, 1)],
 [(1, 1)],
 [(1, 1)],
 [(1, 1), (82, 1)],
```

```
 [(1, 1), (8, 1), (232, 1)],
 [(139, 1)],
 [(1, 1), (8, 1), (38, 1), (82, 1)],
 [(8, 1), (210, 1)],
 [(10, 1), (20, 1)],
 [(1, 1)],
 [(2, 1), (38, 1)],
 [(1, 1), (35, 1), (676, 1)],
 [(1, 1), (8, 1), (82, 1), (271, 1), (677, 1), (678, 1), (679, 1)],
 [(38, 1), (82, 1), (680, 1), (681, 1)],
 [(1, 1), (38, 1), (682, 1)],
 [(1, 1), (8, 1)],
 [(2, 1), (422, 1), (561, 1)],
 [(8, 1), (324, 1), (327, 1)],
 [(17, 1), (86, 1), (99, 1)],
 [(10, 1), (20, 1), (22, 1)],
 [(2, 1), (3, 1), (82, 1), (225, 1)],
 [(1, 1), (2, 1)],
 [(0, 1), (1, 1), (69, 1), (136, 1), (259, 1), (683, 1), (684, 1)],
 [(2, 1), (10, 1)],
 [(358, 1), (596, 1), (685, 1), (686, 1), (687, 1)],
 [(1, 1), (3, 1), (25, 1)],
 [(1, 1)],
 [(1, 1), (2, 1), (25, 1)],
 [(12, 1), (39, 1), (45, 1), (200, 2), (688, 1), (689, 1), (690, 1)],
 [(1, 1), (2, 1), (3, 1), (82, 2), (340, 1), (691, 1), (692, 1), (693,
1)],
 [(1, 1), (40, 1), (694, 1)],
 [(139, 1)],
 [(1, 1), (2, 1), (358, 1), (555, 1), (567, 1)],
 [(38, 1), (82, 1)],
 [(1, 1), (67, 1), (695, 1)],
 [(1, 1), (8, 1), (696, 1)],
 [(1, 1), (360, 1)],
 [(109, 1), (697, 1)],
 [(1, 1), (7, 1), (118, 1), (698, 1)],
 [(2, 1)],
 [(90, 1), (122, 1), (134, 1), (617, 1), (699, 1)],
 [(1, 1), (82, 1)],
 [(2, 1), (20, 1), (546, 1), (700, 1)],
 [(0, 1), (1, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(1, 1)],
 [(1, 1), (10, 1), (20, 1)],
 [(3, 1), (32, 1), (63, 1), (105, 1), (701, 1)],
 [(1, 1),
  (102, 1),
  (208, 1),
  (309, 1),
```

```
  (387, 1),
  (702, 1),
  (703, 1),
  (704, 1),
  (705, 1)],
 [(0, 1), (1, 1), (579, 1)],
 [(1, 1), (38, 1)],
 [(48, 1), (49, 1), (52, 1), (58, 1), (90, 1), (358, 1), (460, 1),
(706, 1)],
 [(100, 1), (395, 2), (707, 1), (708, 1), (709, 1), (710, 1)],
 [(36, 1), (214, 1)],
 [(1, 1), (38, 1), (212, 1)],
 [(1, 1), (78, 1), (369, 1), (711, 1), (712, 1), (713, 1)],
 [(1, 1), (19, 1), (199, 1), (714, 1)],
 [(199, 1), (715, 1)],
 [(1, 1), (57, 1)],
 [(18, 1), (35, 1), (508, 1)],
 [(1, 1), (38, 1), (57, 1)],
 [(2, 1), (3, 1), (716, 1)],
 [(2, 1), (3, 1), (225, 1), (454, 1)],
 [(2, 1)],
 [(2, 1), (262, 1)],
 [(109, 1), (697, 1)],
 [(38, 1), (82, 1), (569, 1), (635, 1), (717, 1)],
 [(718, 1), (719, 1)],
 [(8, 1), (38, 1), (139, 1), (142, 1), (143, 1), (210, 1)],
 [(10, 1), (20, 1), (289, 1)],
 [(1, 1), (20, 1), (199, 1)],
 [(1, 1), (2, 1), (45, 1), (140, 1), (369, 1), (634, 1)],
 [(63, 1), (99, 1), (474, 1), (720, 1), (721, 1)],
 [(1, 1), (2, 1), (35, 1), (82, 1), (158, 1), (722, 1)],
 [(3, 1), (299, 1), (723, 1)],
 [(2, 1), (3, 1), (90, 1)],
 [(1, 1), (38, 1)],
 [(8, 1), (724, 1), (725, 1)],
 [(97, 1), (726, 1)],
 [(1, 1), (8, 1), (200, 1), (405, 1)],
 [(8, 1), (39, 1), (45, 1), (727, 1)],
 [(8, 1), (117, 1)],
 [(164, 1), (728, 1)],
 [(10, 1), (20, 1), (729, 1)],
 [(3, 1), (8, 1), (99, 1), (139, 1), (265, 1)],
 [(3, 1), (8, 1), (99, 1), (139, 1), (265, 1)],
 [(24, 1), (199, 1)],
 [(0, 1), (1, 1), (2, 1), (730, 1)],
 [(1, 1), (38, 1), (368, 1)],
 [(1, 1), (2, 1), (8, 1), (35, 1), (731, 1)],
 [(2, 1), (340, 1), (513, 1)],
 [(2, 1), (732, 1), (733, 1)],
 [(1, 1), (27, 1), (155, 1), (734, 1), (735, 1), (736, 1), (737, 1)],
```

```
[(10, 1), (20, 1)],
[(672, 1), (738, 1), (739, 1)],
[(38, 1), (74, 1), (212, 1)],
[(1, 1), (35, 1), (368, 1)],
[(38, 1), (223, 1), (295, 1), (298, 1), (740, 1), (741, 1)],
[(1, 1), (21, 1), (324, 1), (405, 1), (742, 1), (743, 1), (744, 1)],
[(8, 1), (139, 1)],
[(1, 1), (513, 1)],
[(176, 1), (660, 1), (745, 1), (746, 1)],
[(10, 1), (20, 1), (24, 1)],
[(1, 1), (2, 1), (314, 1), (616, 1), (747, 1), (748, 1)],
[(2, 1), (225, 1), (262, 1)],
[(158, 1),
 (300, 1),
 (318, 1),
 (343, 1),
 (395, 1),
 (486, 1),
 (639, 1),
 (749, 1),
 (750, 1),
 (751, 1)],
[(1, 1)],
[(1, 1), (2, 1)],
[(1, 1)],
[(1, 1), (2, 1), (8, 1), (72, 1), (82, 1), (171, 1), (539, 1)],
[(3, 1), (264, 1)],
[(2, 1), (290, 1), (291, 1), (292, 1), (752, 1)],
[(314, 1), (753, 1), (754, 1), (755, 1)],
[(1, 1)],
[(1, 1)],
[(1, 1), (2, 1), (8, 1)],
[(1, 1), (368, 1)],
[(1, 1), (204, 1)],
[(1, 1), (199, 1), (508, 1), (756, 1)],
[(2, 1), (155, 1)],
[(1, 1), (295, 1), (757, 1), (758, 1), (759, 1), (760, 1)],
[(177, 1), (708, 1)],
[(3, 1), (69, 1), (324, 1)],
[(1, 1), (488, 1)],
[(1, 1), (3, 1), (97, 1), (761, 1)],
[(10, 1), (20, 1)],
[(1, 1), (38, 1), (57, 1)],
[(667, 1), (724, 1)],
[(1, 1), (129, 1)],
[(25, 1), (139, 1)],
[(1, 1),
 (2, 1),
 (100, 2),
 (114, 1),
```

```
 (176, 1),
 (208, 1),
 (350, 1),
 (660, 1),
 (762, 1),
 (763, 1),
 (764, 1)],
[(1, 1), (765, 1)],
[(3, 1), (119, 1), (299, 1)],
[(1, 1), (3, 1), (25, 1)],
[(1, 1), (38, 1)],
[(1, 1), (38, 1), (143, 1)],
[(1, 1), (25, 1)],
[(1, 1), (2, 1), (3, 1), (45, 1), (241, 1)],
[(1, 1), (2, 1), (8, 1), (120, 1), (360, 1), (468, 1)],
[(1, 1), (8, 1), (208, 1), (296, 1), (723, 1), (766, 1)],
[(74, 1), (109, 1), (212, 1), (697, 1)],
[(1, 1), (2, 1), (15, 1), (158, 1)],
[(1, 1), (10, 1), (20, 1)],
[(38, 1), (82, 1)],
[(1, 1), (38, 1), (74, 1)],
[(7, 1), (265, 1)],
[(1, 1), (221, 1)],
[(1, 1), (176, 1), (251, 1), (578, 1), (767, 1)],
[(1, 1), (15, 1), (20, 1), (211, 1)],
[(1, 1), (15, 1), (20, 1), (768, 1)],
[(0, 1)],
[(199, 1)],
[(1, 1), (10, 1), (20, 1)],
[(1, 1), (10, 1), (15, 1), (20, 1)],
[(1, 1), (2, 1), (19, 1), (23, 1), (309, 1), (769, 1), (770, 1)],
[(20, 1), (24, 1), (199, 1)],
[(2, 1)],
[(8, 1), (102, 1), (539, 1), (724, 1), (771, 1), (772, 1)],
[(1, 1), (8, 1), (46, 1)],
[(199, 1), (773, 1)],
[(38, 1), (82, 1), (774, 1)],
[(1, 1), (19, 1), (21, 1), (136, 1), (509, 1)],
[(1, 1), (8, 1), (775, 1)],
[(78, 1), (468, 1), (776, 1)],
[(1, 1), (143, 1), (199, 1)],
[(1, 1), (10, 1), (20, 1), (199, 1), (777, 1)],
[(0, 1), (1, 1), (199, 1), (252, 1)],
[(0, 1), (1, 1), (199, 1), (252, 1)],
[(1, 1), (74, 1), (143, 1), (224, 1)],
[(1, 1), (156, 1)],
[(778, 1)],
[(3, 1), (25, 1)],
[(264, 1), (324, 1), (779, 1)],
[(1, 1), (214, 1), (780, 1)],
```

```
[(2, 1), (3, 1)],
[(1, 1), (90, 1)],
[(0, 1), (2, 1), (558, 1)],
[(0, 1), (2, 1), (176, 1), (558, 1)],
[(1, 1), (2, 1), (8, 1), (176, 1), (360, 1)],
[(2, 1), (38, 1), (225, 1)],
[(1, 1), (2, 1), (35, 1), (265, 1)],
[(1, 1)],
[(1, 1), (8, 1), (29, 1), (200, 1)],
[(360, 1), (781, 1), (782, 1)],
[(158, 1), (411, 1), (575, 1), (783, 1), (784, 1)],
[(411, 1), (488, 1)],
[(1, 1), (29, 1), (296, 1), (572, 1), (785, 1), (786, 1), (787, 1)],
[(1, 1), (10, 1), (20, 1)],
[(10, 1), (20, 1)],
[(1, 1), (78, 1), (155, 1)],
[(8, 1), (262, 1)],
[(788, 1)],
[(1, 1)],
[(158, 1), (289, 1)],
[(8, 1), (74, 1), (102, 1), (109, 1), (211, 1), (789, 1)],
[(38, 1), (283, 1)],
[(8, 1), (665, 1)],
[(38, 1), (790, 1)],
[(2, 1), (3, 1), (66, 1), (134, 1)],
[(1, 1), (8, 1), (40, 1)],
[(38, 1), (791, 1), (792, 1)],
[(2, 1), (532, 1), (615, 1)],
[(158, 1), (475, 1), (793, 1)],
[(1, 1), (199, 1), (794, 1)],
[(1, 1), (25, 1)],
[(2, 1), (8, 1), (63, 1), (67, 1), (366, 1)],
[(12, 1), (38, 1), (82, 1), (179, 1)],
[(1, 1), (3, 1), (25, 1), (35, 1), (265, 1)],
[(0, 1), (1, 1), (185, 1), (224, 1), (795, 1), (796, 1)],
[(1, 1), (38, 1)],
[(797, 1)],
[(1, 1), (2, 1), (97, 1)],
[(2, 1), (8, 1), (158, 1), (289, 1), (422, 1), (798, 1)],
[(25, 1)],
[(1, 1), (2, 1), (8, 1), (57, 1)],
[(5, 1),
 (6, 1),
 (7, 1),
 (8, 1),
 (54, 1),
 (71, 1),
 (169, 1),
 (177, 1),
 (198, 1),
```

```
  (210, 1),
  (462, 1),
  (530, 1),
  (681, 2),
  (799, 1)],
 [(1, 1)],
 [(1, 1), (90, 1), (443, 1), (588, 1), (800, 1)],
 [(2, 1), (34, 1), (225, 1)],
 [(1, 1), (8, 1), (82, 1)],
 [(1, 1), (8, 1), (199, 1), (368, 1), (801, 1), (802, 1)],
 [(1, 1), (8, 1), (244, 1), (299, 1), (647, 1)],
 [(1, 1), (158, 1), (213, 1), (405, 1), (432, 1), (575, 1), (586, 1)],
 [(2, 1),
  (3, 1),
  (8, 1),
  (35, 1),
  (72, 1),
  (178, 1),
  (210, 1),
  (265, 1),
  (803, 1)],
 [(1, 1), (75, 1), (76, 1), (368, 1), (525, 1)],
 [(1, 1),
  (2, 1),
  (8, 1),
  (38, 1),
  (468, 1),
  (508, 1),
  (569, 1),
  (804, 1),
  (805, 1),
  (806, 1)],
 [(1, 1), (2, 1), (807, 1), (808, 1)],
 [(809, 1), (810, 1)],
 [(1, 1), (811, 1)],
 [(1, 1), (2, 1), (3, 1), (57, 1), (90, 1), (292, 1), (812, 1), (813,
1)],
 [(38, 1), (121, 1), (218, 1)],
 [(1, 1), (8, 1), (19, 1), (21, 1), (82, 1), (613, 1), (814, 1)],
 [(1, 1)],
 [(8, 1), (84, 1), (168, 1), (369, 1), (815, 1), (816, 1), (817, 1)],
 [(10, 1), (20, 1), (152, 1), (818, 1)],
 [(246, 1), (285, 1)],
 [(3, 1), (264, 1), (763, 1), (819, 1)],
 [(8, 1), (21, 1), (72, 1), (443, 1), (820, 1)],
 [(10, 1), (20, 1), (90, 1)],
 [(1, 1), (8, 1)],
 [(63, 1), (275, 1), (324, 1), (821, 1), (822, 1), (823, 1), (824,
1)],
 [(8, 1), (21, 1), (136, 1), (643, 1), (825, 1), (826, 1), (827, 1)],
```

```
[(78, 1), (136, 1), (828, 1), (829, 1), (830, 1)],
[(82, 2), (158, 1), (394, 1), (831, 1), (832, 1)],
[(1, 1)],
[(1, 1), (8, 1), (40, 1), (69, 1), (833, 1)],
[(21, 1), (834, 1), (835, 1), (836, 1)],
[(8, 1), (84, 1), (158, 1), (265, 1), (518, 1), (837, 1)],
[(1, 1)],
[(1, 1), (314, 1), (838, 1)],
[(1, 1), (38, 1)],
[(1, 1), (72, 1), (839, 1), (840, 1)],
[(1, 1), (72, 1), (839, 1), (840, 1)],
[(2, 1), (8, 1)],
[(49, 1), (71, 1), (841, 1)],
[(1, 1), (8, 1), (72, 1), (76, 1), (81, 1), (411, 1), (842, 1)],
[(1, 1), (8, 1), (38, 1), (155, 1), (843, 1)],
[(2, 1), (139, 1), (632, 1)],
[(122, 1), (155, 1), (224, 1), (762, 1)],
[(1, 1), (102, 1), (179, 1), (844, 1)],
[(98, 1),
 (137, 1),
 (195, 1),
 (309, 1),
 (324, 1),
 (395, 1),
 (845, 1),
 (846, 1),
 (847, 1)],
[(1, 1), (38, 1)],
[(1, 1),
 (2, 1),
 (8, 1),
 (61, 1),
 (65, 1),
 (323, 1),
 (546, 1),
 (848, 1),
 (849, 1)],
[(1, 1), (8, 1)],
[(25, 1)],
[(1, 1), (660, 1), (850, 1)],
[(294, 1)],
[(139, 1)],
[(1, 1), (2, 1), (264, 1)],
[(8, 2),
 (38, 1),
 (74, 1),
 (82, 1),
 (197, 1),
 (212, 1),
 (225, 1),
```

```
 (288, 1),
 (697, 1)],
[(1, 1), (8, 1), (295, 1), (851, 1), (852, 1), (853, 1)],
[(38, 1), (137, 1), (384, 1), (678, 1), (854, 1)],
[(1, 1), (15, 1), (20, 1), (760, 1), (855, 1)],
[(121, 1), (218, 1), (436, 1)],
[(2, 1), (90, 1)],
[(158, 1), (856, 1)],
[(2, 1), (204, 1)],
[(1, 1), (2, 1), (580, 1), (857, 1)],
[(1, 2), (2, 1), (8, 1), (102, 1), (108, 1), (858, 1)],
[(45, 1),
 (134, 1),
 (136, 1),
 (158, 1),
 (179, 2),
 (356, 1),
 (727, 1),
 (859, 1),
 (860, 1),
 (861, 1)],
[(82, 1), (850, 1)],
[(2, 1), (730, 1)],
[(1, 1), (8, 1), (72, 1)],
[(1, 1), (8, 1), (38, 1)],
[(1, 1), (3, 1), (82, 1), (104, 1)],
[(1, 1), (91, 1), (465, 1), (596, 1), (862, 1)],
[(1, 1), (57, 1)],
[(70, 1), (143, 1), (286, 1), (863, 1), (864, 1)],
[(1, 1), (29, 1), (200, 1), (865, 1)],
[(8, 1), (72, 1), (866, 1)],
[(550, 1), (867, 1), (868, 1)],
[(1, 1), (8, 1), (17, 1), (635, 1)],
[(2, 1), (8, 1), (82, 1)],
[(0, 1), (1, 1), (340, 1)],
[(1, 1), (57, 1)],
[(1, 1)],
[(1, 1), (230, 1), (869, 1)],
[(1, 1)],
[(204, 1)],
[(1, 1), (8, 1), (72, 1)],
[(1, 1), (2, 1), (8, 2), (66, 1), (72, 1)],
[(2, 1), (225, 1), (539, 1)],
[(752, 1), (870, 1)],
[(8, 1), (122, 1), (358, 1), (577, 1)],
[(1, 1), (8, 1)],
[(1, 1), (2, 1), (57, 1)],
[(1, 1), (8, 1), (17, 1)],
[(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)],
 ...]
```

```
from gensim.models import LdaModel

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, '0.130*"speed" + 0.109*"internet" + 0.091*"comcast" + 0.043*"slow"
+ 0.017*"without" + 0.017*"bill" + 0.016*"service" + 0.015*"fee" +
0.014*"back" + 0.012*"refund"')

(1, '0.105*"comcast" + 0.028*"show" + 0.028*"charged" + 0.027*"price"
+ 0.027*"charging" + 0.022*"service" + 0.019*"appointment" +
0.017*"plan" + 0.017*"hbo" + 0.016*"go"')

(2, '0.183*"billing" + 0.116*"comcast" + 0.077*"service" +
0.055*"practice" + 0.052*"issue" + 0.043*"unfair" + 0.021*"complaint"
+ 0.015*"failure" + 0.013*"monopolistic" + 0.012*"connection"')

(3, '0.241*"comcast" + 0.123*"data" + 0.102*"cap" + 0.051*"charge" +
0.042*"complaint" + 0.024*"usage" + 0.017*"xfinity" + 0.011*"overage"
+ 0.010*"limit" + 0.009*"cramming"')

(4, '0.188*"service" + 0.079*"customer" + 0.077*"comcast" +
0.044*"poor" + 0.037*"internet" + 0.028*"comcastxfinity" +
0.022*"outage" + 0.021*"access" + 0.013*"bad" + 0.013*"horrible"')

(5, '0.051*"price" + 0.050*"xfinity" + 0.034*"help" + 0.030*"2" +
0.029*"account" + 0.020*"service" + 0.019*"please" +
0.018*"unauthorized" + 0.018*"contract" + 0.017*"lied"')

(6, '0.249*"internet" + 0.154*"comcast" + 0.094*"service" +
0.032*"pricing" + 0.026*"throttling" + 0.020*"problem" +
0.018*"terrible" + 0.014*"issue" + 0.014*"connectivity" +
0.010*"home"')

(7, '0.038*"switch" + 0.032*"paying" + 0.028*"installation" +
0.028*"intermittent" + 0.028*"service" + 0.027*"get" + 0.026*"bait" +
0.024*"high" + 0.021*"promised" + 0.019*"fee"')

(8, '0.082*"comcast" + 0.068*"bill" + 0.058*"cable" + 0.046*"service"
+ 0.031*"deceptive" + 0.025*"day" + 0.024*"sale" + 0.022*"false" +
0.022*"contract" + 0.018*"advertising"')
```

```
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)
```

```
     topic # 0      topic # 1       topic # 2   topic # 3       topic
# 4  \
0        speed        comcast         billing     comcast
service
1     internet           show         comcast        data
```

customer					
2	comcast	charged	service	cap	comcast
3	slow	price	practice	charge	poor
4	without	charging	issue	complaint	internet
5	bill	service	unfair	usage	comcastxfinity
6	service	appointment	complaint	xfinity	outage
7	fee	plan	failure	overage	access
8	back	hbo	monopolistic	limit	bad
9	refund	go	connection	cramming	horrible
10	misleading	credit	equipment	modem	call
11	phone	blocking	unreliable	bandwidth	shitty
12	email	bundle	xfinitycomcast	fraudulent	lack
13	quality	communication	provide	monthly	extremely
14	charged	bill	12	rate	incorrect
15	overcharge	area	contract	mb	get
16	ps4	added	information	fee	isp
17	throttle	much	month	300gb	inability
18	promised	data	provided	monopoly	attempt
19	hbogo	u	billed	regarding	paid

	topic # 5	topic # 6	topic # 7	topic # 8
0	price	internet	switch	comcast
1	xfinity	comcast	paying	bill
2	help	service	installation	cable
3	2	pricing	intermittent	service
4	account	throttling	service	deceptive
5	service	problem	get	day
6	please	terrible	bait	sale
7	unauthorized	issue	high	false
8	contract	connectivity	promised	contract
9	lied	home	fee	advertising
10	people	business	advertised	payment

```
11      monopoly           low      equipment        issue
12          scam  availability             10       signal
13          lack     broadband       provider         time
14          week    connection  disconnection      several
15        system       xfinity            pay      slowing
16      security           one          false    throttled
17         every           day      excessive         loss
18       install         speed        getting         year
19        cancel      download   inconsistent       change
```

```
df['Status'].unique()
```

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

```
df['new_Status']=['Open' if st=="Open" or st=="Pending" else "Closed"
for st in df['Status']]         #4.Created new categorical variable
with value as Open and Closed
```

```
df
```

```
     Ticket #                                  Customer Complaint
Date  \
0      250635                     Comcast Cable Internet Speeds 2015-
04-22
1      223441       Payment Disappear - Service Got Disconnected 2015-
04-08
2      242732                                  Speed And Service 2015-
04-18
3      277946  Comcast Imposed A New Usage Cap Of 300Gb That ... 2015-
05-07
4      307175         Comcast Not Working And No Service To Boot 2015-
05-26
...       ...                                                  ...
...
2219   213550                               Service Availability 2015-
04-02
2220   318775         Comcast Monthly Billing For Returned Modem 2015-
06-02
2221   331188                            Complaint About Comcast 2015-
06-09
2222   360489             Extremely Unsatisfied Comcast Customer 2015-
06-23
2223   363614               Comcast, Ypsilanti Mi Internet Speed 2015-
06-24

     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
...              ...          ...                 ...         ...
...
2219       04-Feb-15   9:13:18 AM  Customer Care Call  Youngstown
Florida
2220       06-Feb-15   1:24:39 PM  Customer Care Call   Ypsilanti
Michigan
2221       06-Sep-15   5:28:41 PM            Internet   Ypsilanti
Michigan
2222       23-Jun-15  11:13:30 PM  Customer Care Call   Ypsilanti
Michigan
2223       24-Jun-15  10:28:33 PM  Customer Care Call   Ypsilanti
Michigan
```

	Zip code	Status	Filing on Behalf of Someone	month	new_Status
0	21009	Closed	No	April	Closed
1	30102	Closed	No	April	Closed
2	30101	Closed	Yes	April	Closed
3	30101	Open	Yes	May	Open
4	30101	Solved	No	May	Closed
...	...	...	...	...	...
2219	32466	Closed	No	April	Closed
2220	48197	Solved	No	June	Closed
2221	48197	Solved	No	June	Closed
2222	48197	Solved	No	June	Closed
2223	48198	Open	Yes	June	Open

[2224 rows x 13 columns]

```
df.groupby(['State','new_Status']).size().unstack()
```

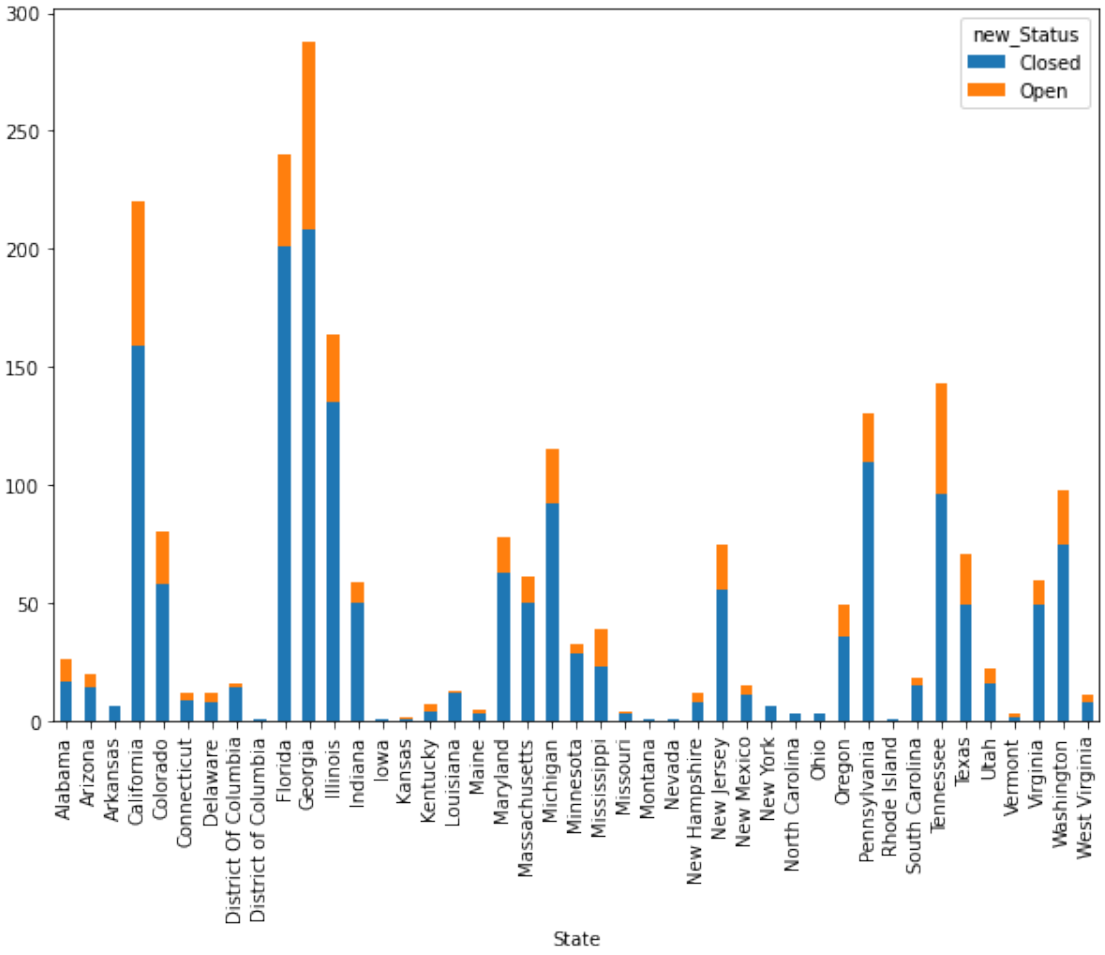
new_Status	Closed	Open
State		
Alabama	17.0	9.0
Arizona	14.0	6.0
Arkansas	6.0	NaN
California	159.0	61.0
Colorado	58.0	22.0
Connecticut	9.0	3.0
Delaware	8.0	4.0
District Of Columbia	14.0	2.0
District of Columbia	1.0	NaN
Florida	201.0	39.0
Georgia	208.0	80.0
Illinois	135.0	29.0

```
Indiana                50.0   9.0
Iowa                    1.0   NaN
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
Michigan               92.0  23.0
Minnesota              29.0   4.0
Mississippi            23.0  16.0
Missouri                3.0   1.0
Montana                 1.0   NaN
Nevada                  1.0   NaN
New Hampshire           8.0   4.0
New Jersey             56.0  19.0
New Mexico             11.0   4.0
New York                6.0   NaN
North Carolina          3.0   NaN
Ohio                    3.0   NaN
Oregon                 36.0  13.0
Pennsylvania          110.0  20.0
Rhode Island            1.0   NaN
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
```

```
state_complain=df.groupby(['State','new_Status']).size().unstack()
```

```
state_complain.plot.bar(stacked=True,figsize=(10,7))
#Provide state wise status of complaints in a stacked bar chart.
```

```
<AxesSubplot:xlabel='State'>
```




```
df.groupby('State').size()
```

```
State
Alabama                    26
Arizona                    20
Arkansas                    6
California                220
Colorado                   80
Connecticut                12
Delaware                   12
District Of Columbia       16
District of Columbia        1
Florida                   240
Georgia                   288
Illinois                  164
Indiana                    59
Iowa                        1
Kansas                      2
Kentucky                    7
Louisiana                  13
Maine                       5
```

```
Maryland                78
Massachusetts           61
Michigan               115
Minnesota               33
Mississippi             39
Missouri                 4
Montana                  1
Nevada                   1
New Hampshire           12
New Jersey              75
New Mexico              15
New York                 6
North Carolina           3
Ohio                     3
Oregon                  49
Pennsylvania           130
Rhode Island             1
South Carolina          18
Tennessee              143
Texas                   71
Utah                    22
Vermont                  3
Virginia                60
Washington              98
West Virginia           11
dtype: int64
```

```
df.groupby('State').size().sort_values(ascending=False)
```

```
State
Georgia                288
Florida                240
California             220
Illinois               164
Tennessee              143
Pennsylvania           130
Michigan               115
Washington              98
Colorado                80
Maryland                78
New Jersey              75
Texas                   71
Massachusetts           61
Virginia                60
Indiana                 59
Oregon                  49
Mississippi             39
Minnesota               33
Alabama                 26
Utah                    22
Arizona                 20
```

```
South Carolina           18
District Of Columbia     16
New Mexico               15
Louisiana                13
Connecticut              12
New Hampshire            12
Delaware                 12
West Virginia            11
Kentucky                  7
Arkansas                  6
New York                  6
Maine                     5
Missouri                  4
North Carolina            3
Vermont                   3
Ohio                      3
Kansas                    2
District of Columbia      1
Rhode Island              1
Iowa                      1
Nevada                    1
Montana                   1
dtype: int64
```

```
len(df.groupby('State').size().sort_values(ascending=False))
```

```
43
```

```
df.groupby('State').size().sort_values(ascending=False)[0:5]
#create bar graph
```

```
State
Georgia       288
Florida       240
California    220
Illinois      164
Tennessee     143
dtype: int64
```

```
df.groupby(['State','new_Status']).size().unstack()
```

```
new_Status            Closed  Open
State
Alabama                 17.0   9.0
Arizona                 14.0   6.0
Arkansas                 6.0   NaN
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   NaN
Florida                201.0  39.0
Georgia                208.0  80.0
Illinois               135.0  29.0
Indiana                 50.0   9.0
Iowa                     1.0   NaN
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
Michigan                92.0  23.0
Minnesota               29.0   4.0
Mississippi             23.0  16.0
Missouri                 3.0   1.0
Montana                  1.0   NaN
Nevada                   1.0   NaN
New Hampshire            8.0   4.0
New Jersey              56.0  19.0
New Mexico              11.0   4.0
New York                 6.0   NaN
North Carolina           3.0   NaN
Ohio                     3.0   NaN
Oregon                  36.0  13.0
Pennsylvania           110.0  20.0
Rhode Island             1.0   NaN
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
```

```
df.groupby(['State','new_Status']).size().unstack().fillna(0).sort_val
ues(by='Open',ascending=False)
```

```
new_Status            Closed  Open
State
Georgia                208.0  80.0
California             159.0  61.0
Tennessee               96.0  47.0
Florida                201.0  39.0
Illinois               135.0  29.0
Washington              75.0  23.0
Michigan                92.0  23.0
Colorado                58.0  22.0
Texas                   49.0  22.0
Pennsylvania           110.0  20.0
```

```
New Jersey              56.0  19.0
Mississippi             23.0  16.0
Maryland                63.0  15.0
Oregon                  36.0  13.0
Virginia                49.0  11.0
Massachusetts           50.0  11.0
Alabama                 17.0   9.0
Indiana                 50.0   9.0
Utah                    16.0   6.0
Arizona                 14.0   6.0
New Hampshire            8.0   4.0
New Mexico              11.0   4.0
Minnesota               29.0   4.0
Delaware                 8.0   4.0
West Virginia            8.0   3.0
Connecticut              9.0   3.0
Kentucky                 4.0   3.0
South Carolina          15.0   3.0
Maine                    3.0   2.0
District Of Columbia    14.0   2.0
Kansas                   1.0   1.0
Vermont                  2.0   1.0
Missouri                 3.0   1.0
Louisiana               12.0   1.0
Montana                  1.0   0.0
Rhode Island             1.0   0.0
Ohio                     3.0   0.0
District of Columbia     1.0   0.0
North Carolina           3.0   0.0
New York                 6.0   0.0
Nevada                   1.0   0.0
Arkansas                 6.0   0.0
Iowa                     1.0   0.0
```

```
unresolved_data=df.groupby(['State','new_Status']).size().unstack().fi
llna(0).sort_values(by='Open',ascending=False)
```

```
unresolved_data
```

```
new_Status            Closed  Open
State
Georgia                208.0  80.0
California             159.0  61.0
Tennessee               96.0  47.0
Florida                201.0  39.0
Illinois               135.0  29.0
Washington              75.0  23.0
Michigan                92.0  23.0
Colorado                58.0  22.0
Texas                   49.0  22.0
Pennsylvania           110.0  20.0
```

```
New Jersey              56.0  19.0
Mississippi             23.0  16.0
Maryland                63.0  15.0
Oregon                  36.0  13.0
Virginia                49.0  11.0
Massachusetts           50.0  11.0
Alabama                 17.0   9.0
Indiana                 50.0   9.0
Utah                    16.0   6.0
Arizona                 14.0   6.0
New Hampshire            8.0   4.0
New Mexico              11.0   4.0
Minnesota               29.0   4.0
Delaware                 8.0   4.0
West Virginia            8.0   3.0
Connecticut              9.0   3.0
Kentucky                 4.0   3.0
South Carolina          15.0   3.0
Maine                    3.0   2.0
District Of Columbia    14.0   2.0
Kansas                   1.0   1.0
Vermont                  2.0   1.0
Missouri                 3.0   1.0
Louisiana               12.0   1.0
Montana                  1.0   0.0
Rhode Island             1.0   0.0
Ohio                     3.0   0.0
District of Columbia     1.0   0.0
North Carolina           3.0   0.0
New York                 6.0   0.0
Nevada                   1.0   0.0
Arkansas                 6.0   0.0
Iowa                     1.0   0.0
```

```
unresolved_data['unresolved_cmp_percentage']=unresolved_data['Open']/
unresolved_data['Open'].sum()*100            #unresolved complaints
```

```
unresolved_data
```

```
new_Status            Closed  Open  unresolved_cmp_percentage
State
Georgia                208.0  80.0                  15.473888
California             159.0  61.0                  11.798839
Tennessee               96.0  47.0                   9.090909
Florida                201.0  39.0                   7.543520
Illinois               135.0  29.0                   5.609284
Washington              75.0  23.0                   4.448743
Michigan                92.0  23.0                   4.448743
Colorado                58.0  22.0                   4.255319
Texas                   49.0  22.0                   4.255319
Pennsylvania           110.0  20.0                   3.868472
```

```
New Jersey              56.0  19.0                  3.675048
Mississippi             23.0  16.0                  3.094778
Maryland                63.0  15.0                  2.901354
Oregon                  36.0  13.0                  2.514507
Virginia                49.0  11.0                  2.127660
Massachusetts           50.0  11.0                  2.127660
Alabama                 17.0   9.0                  1.740812
Indiana                 50.0   9.0                  1.740812
Utah                    16.0   6.0                  1.160542
Arizona                 14.0   6.0                  1.160542
New Hampshire            8.0   4.0                  0.773694
New Mexico              11.0   4.0                  0.773694
Minnesota               29.0   4.0                  0.773694
Delaware                 8.0   4.0                  0.773694
West Virginia            8.0   3.0                  0.580271
Connecticut              9.0   3.0                  0.580271
Kentucky                 4.0   3.0                  0.580271
South Carolina          15.0   3.0                  0.580271
Maine                    3.0   2.0                  0.386847
District Of Columbia    14.0   2.0                  0.386847
Kansas                   1.0   1.0                  0.193424
Vermont                  2.0   1.0                  0.193424
Missouri                 3.0   1.0                  0.193424
Louisiana               12.0   1.0                  0.193424
Montana                  1.0   0.0                  0.000000
Rhode Island             1.0   0.0                  0.000000
Ohio                     3.0   0.0                  0.000000
District of Columbia     1.0   0.0                  0.000000
North Carolina           3.0   0.0                  0.000000
New York                 6.0   0.0                  0.000000
Nevada                   1.0   0.0                  0.000000
Arkansas                 6.0   0.0                  0.000000
Iowa                     1.0   0.0                  0.000000

df.groupby(['Received Via','new_Status']).size().unstack()

new_Status          Closed  Open
Received Via
Customer Care Call     864   255
Internet               843   262

resolved_data=df.groupby(['Received
Via','new_Status']).size().unstack()

resolved_data

new_Status          Closed  Open
Received Via
Customer Care Call     864   255
Internet               843   262
```

```
resolved_data['resolved']=resolved_data['Closed']/
resolved_data['Closed'].sum()*100

resolved_data['resolved']
```

```
Received Via
Customer Care Call    50.615114
Internet              49.384886
Name: resolved, dtype: float64
```