In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import numpy as np
import warnings
import seaborn as sns
```

In [2]:
```
df = pd.read_csv('Call.csv')
```

In [3]:
```
df.head()
```

Out[3]:

	id	customer_name	sentiment	csat_score	call_timestamp	reason	city	state	channel	response_time	call_Call_dura in min
0	DKK-57076809-w-055481-fU	Analise Gairdner	Neutral	7.0	10/29/2020	Billing Question	Detroit	Michigan	Call-Center	Within SLA	
1	QGK-72219678-w-102139-KY	Crichton Kidsley	Very Positive	NaN	10/5/2020	Service Outage	Spartanburg	South Carolina	Chatbot	Within SLA	
2	GYJ-30025932-A-023015-LD	Averill Brundrett	Negative	NaN	10/4/2020	Billing Question	Gainesville	Florida	Call-Center	Above SLA	
3	ZJI-96807559-i-620008-m7	Noreen Lafflina	Very Negative	1.0	10/17/2020	Billing Question	Portland	Oregon	Chatbot	Within SLA	
4	DDU-69451719-O-176482-Fm	Toma Van der Beken	Very Positive	NaN	10/17/2020	Payments	Fort Wayne	Indiana	Call-Center	Within SLA	

In [4]:
```
df.csat_score
```

Out[4]:
```
0        7.0
1        NaN
2        NaN
3        1.0
4        NaN
        ...
32936    NaN
32937    NaN
32938    NaN
32939    8.0
32940    NaN
Name: csat_score, Length: 32941, dtype: float64
```

In [5]:
```
df.csat_score.median()
```

Out[5]:
```
5.0
```

In [6]:
```
#Data Preprocessing filling in nan with median values
df.csat_score = df.csat_score.fillna(df.csat_score.median())
df.head()
```

Out[6]:

	id	customer_name	sentiment	csat_score	call_timestamp	reason	city	state	channel	response_time	call_Call_dura in min
0	DKK-57076809-w-055481-fU	Analise Gairdner	Neutral	7.0	10/29/2020	Billing Question	Detroit	Michigan	Call-Center	Within SLA	
1	QGK-72219678-w-102139-KY	Crichton Kidsley	Very Positive	5.0	10/5/2020	Service Outage	Spartanburg	South Carolina	Chatbot	Within SLA	
2	GYJ-30025932-A-023015-LD	Averill Brundrett	Negative	5.0	10/4/2020	Billing Question	Gainesville	Florida	Call-Center	Above SLA	
3	ZJI-96807559-i-620008-m7	Noreen Lafflina	Very Negative	1.0	10/17/2020	Billing Question	Portland	Oregon	Chatbot	Within SLA	
4	DDU-69451719-O-176482-Fm	Toma Van der Beken	Very Positive	5.0	10/17/2020	Payments	Fort Wayne	Indiana	Call-Center	Within SLA	

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32941 entries, 0 to 32940
Data columns (total 12 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   id                              32941 non-null  object 
 1   customer_name                   32941 non-null  object 
 2   sentiment                       32941 non-null  object 
 3   csat_score                      32941 non-null  float64
 4   call_timestamp                  32941 non-null  object 
 5   reason                          32941 non-null  object 
 6   city                            32941 non-null  object 
 7   state                           32941 non-null  object 
 8   channel                         32941 non-null  object 
 9   response_time                   32941 non-null  object 
 10  call_Call_duration in minutes   32941 non-null  int64  
 11  call_center                     32941 non-null  object 
dtypes: float64(1), int64(1), object(10)
memory usage: 3.0+ MB
```

In [8]:
```
df.columns
```

Out[8]:
```
Index(['id', 'customer_name', 'sentiment', 'csat_score', 'call_timestamp',
       'reason', 'city', 'state', 'channel', 'response_time',
       'call_Call_duration in minutes', 'call_center'],
      dtype='object')
```

In [9]:
```
#Checking the stats
df.describe()
```

Out[9]:

	csat_score	call_Call_duration in minutes
count	32941.000000	32941.000000
mean	5.204305	25.021159
std	1.471207	11.816218
min	1.000000	5.000000
25%	5.000000	15.000000
50%	5.000000	25.000000
75%	5.000000	35.000000
max	10.000000	45.000000

In [10]:
```
df.shape
```

Out[10]:
```
(32941, 12)
```

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
id                              0
customer_name                   0
sentiment                       0
csat_score                      0
call_timestamp                  0
reason                          0
city                            0
state                           0
channel                         0
response_time                   0
call_Call_duration in minutes   0
call_center                     0
dtype: int64
```

EXPLORATORY ANALYSIS

* The major reason for reaching out to the customer service team

*Billing questions were the major reasons

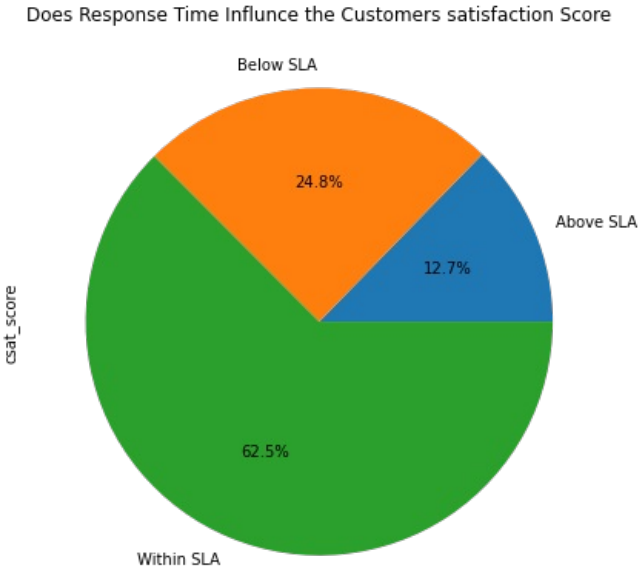
In [12]:
```
df_1= df.pivot_table(index='reason', columns='sentiment', aggfunc='size')
df_1.style.background_gradient('Greens')
```

Out[12]:

sentiment reason	Negative	Neutral	Positive	Very Negative	Very Positive
Billing Question	7868	6232	2775	4300	2287
Payments	1593	1238	552	897	469
Service Outage	1602	1284	601	829	414

Does Response Time Influence the Customers satisfaction Score?

In [13]:
```
#How many subscriber per level?
plt.figure(figsize = (6.8,7.3))

#df.groupby('level')['num_subscribers'].sum().plot(kind='pie', autopct='%1.1f%%')
#plt.show()
df.groupby('response_time')['csat_score'].sum().plot(kind='pie', autopct='%1.1f%%', title='Does Response Time I
plt.show()
```



Does the Customer's sentiment influence the satisfacton score ?*

- From the csat score, it shows that customers with Nagative Sentiment gave a higher rating than those with [Positive] and [Very Positive] Sentiment.
- Probably the reason for the high rating in the neagtive sentiment was due to the effectivness of the Customer Service team

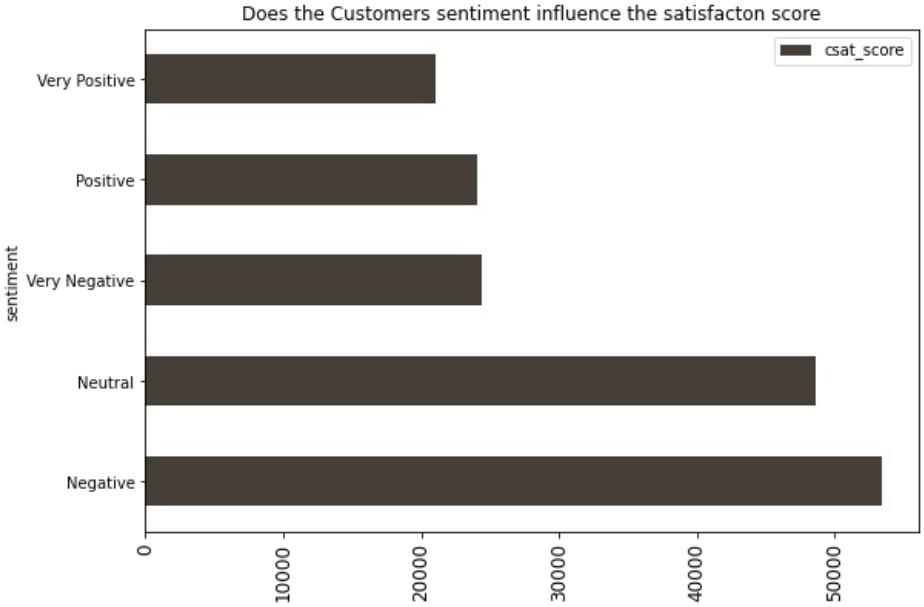
In [14]:
```
#From the csat score, it shows that customers with Nagative Sentiment gave a higher rating than those with
#[Positive] and [Very Positive] Sentiment.

#Probably the reason for the high rating in the neagtive sentiment was due to the effectivness of the Customer
sentiment_score_df = pd.DataFrame(df.groupby('sentiment').sum()['csat_score'])
sentiment_score_df.sort_values ('csat_score', ascending=False)
```

Out[14]:

sentiment	csat_score
Negative	53386.0
Neutral	48578.0
Very Negative	24343.0
Positive	24106.0
Very Positive	21022.0

In [183…
```
sentiment_score_df = pd.DataFrame(df.groupby('sentiment').sum()['csat_score'])
sentiment_score_df.sort_values ('csat_score', ascending=False) .plot(kind='barh', title='Does the Customers sen
plt.xticks(rotation='vertical', size=12)
plt.plot()
```

Out[183]:
```
[]
```



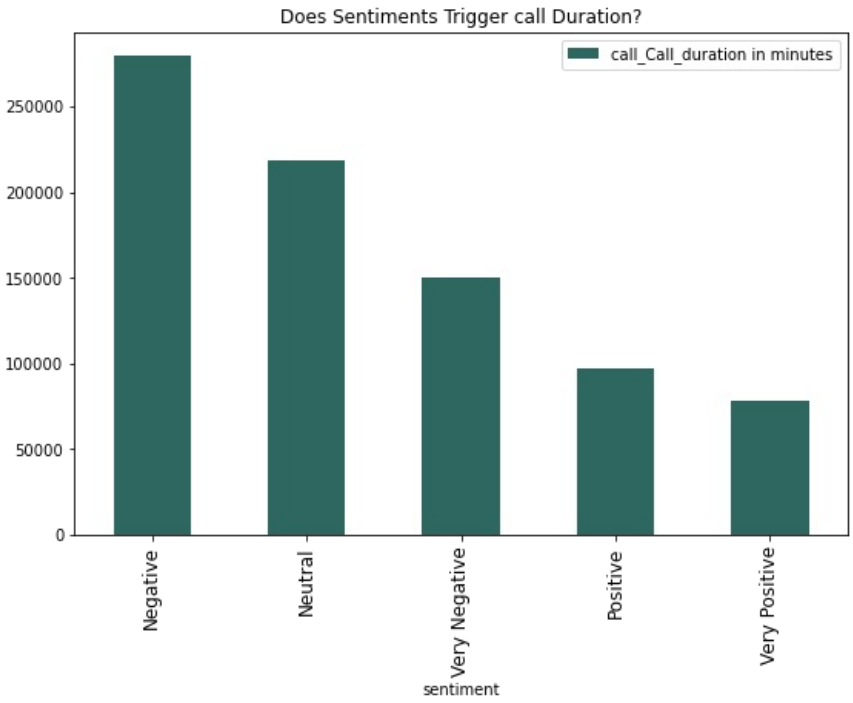
Does Sentiments Trigger call Duration?

In [17]:
```
#Looking at the progression below, it shows that customers with [Negative]
#sentiment had a higher call duration than people with [postive] and [very postive] sentiment.
sentiment_call_df = pd.DataFrame(df.groupby('sentiment').sum()['call_Call_duration in minutes'])
sentiment_call_df.sort_values ('call_Call_duration in minutes', ascending=False)
```

Out[17]:

sentiment	call_Call_duration in minutes
Negative	279471
Neutral	218323
Very Negative	150283
Positive	97658
Very Positive	78487

In [182…
```
sentiment_call_df = pd.DataFrame(df.groupby('sentiment').sum()['call_Call_duration in minutes'])
sentiment_call_df.sort_values ('call_Call_duration in minutes', ascending=False).plot(kind='bar', title='Does S
plt.xticks(rotation='vertical', size=12)
plt.show()
```

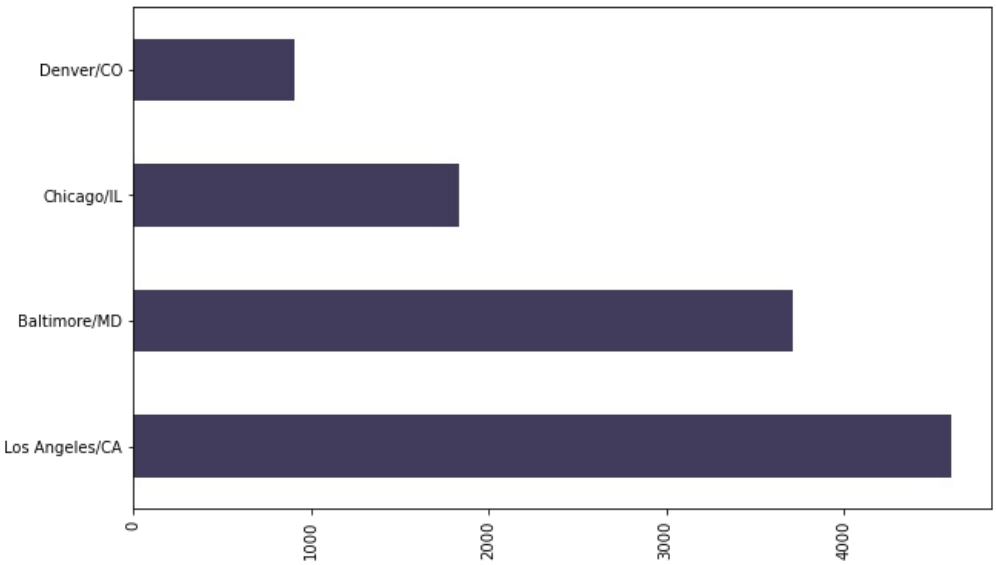


Location of Contact centers that received the most negative

sentiment from customers

- Los Angeles /CA was the Highest

In [178…
```
#Location of Contact centers that received the most negative sentiment from customers
df[df['sentiment']== 'Negative'].call_center.value_counts().plot(kind='barh', color='#413b5c', figsize = [10,6]
plt.xticks(rotation='vertical', size=10)
plt.show()
```



Channels through which Customers reached out to the Contact center Team*

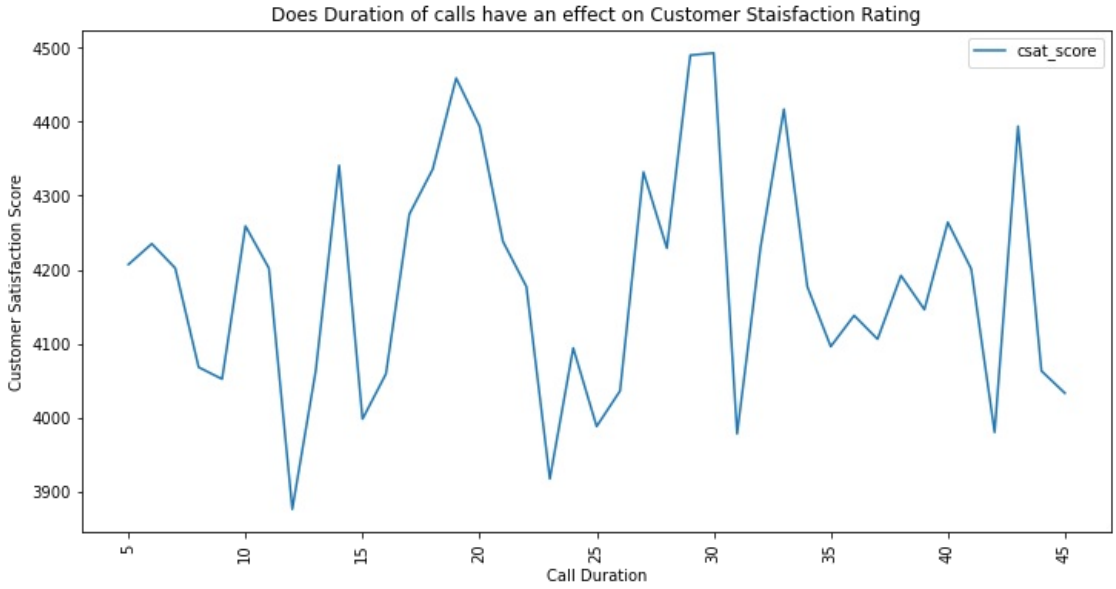
- Calls from the Call-Centre had the highest Traffic
- The least was the web

In [20]:
```
df['channel'].value_counts(normalize='True')
```

Out[20]:
```
Call-Center    0.322971
Chatbot        0.250630
Email          0.226769
Web            0.199630
Name: channel, dtype: float64
```

Does call duration ? have an effect on Customer Staisfaction Rating

In [21]:
```
## Does Duration of calls have an effect on Customer Staisfaction Survey
duration_call_df =pd.DataFrame(df.groupby('call_Call_duration in minutes').sum()['csat_score']).plot(figsize =
plt.xlabel('Call Duration')
plt.ylabel('Customer Satisfaction Score')
plt.title('Does Duration of calls have an effect on Customer Staisfaction Rating')
plt.xticks(rotation='vertical', size=10)
plt.show()
```



In [22]:
```
pd.DataFrame(df.groupby('call_Call_duration in minutes').sum()['csat_score']).head()
```

Out[22]:

call_Call_duration in minutes	csat_score
5	4207.0
6	4235.0
7	4202.0
8	4068.0
9	4052.0

filter that dataframe and create seperate tables of customers that that experessed different sentiements

In [107…
```
#Customer #Customer Who had negative Sentiments
Negative =df[(df.sentiment== 'Negative')]
```

In [108…
```
Negative=Negative[[ 'id','customer_name','sentiment','reason']]
```

In [109…
```
Negative.head()
```

Out[109]:

	id	customer_name	sentiment	reason
2	GYJ-30025932-A-023015-LD	Averill Brundrett	Negative	Billing Question
10	RJF-00263922-O-647027-TB	Ella Cristoforo	Negative	Billing Question
11	ZQN-32874873-e-786499-kJ	Aubrey Surcombe	Negative	Billing Question
15	BEJ-69711449-V-758715-cp	Dani Stanfield	Negative	Billing Question
16	DEC-83767217-S-314070-eR	Margarette Jehaes	Negative	Billing Question

In [110…
```
#Customer Who had a Neutral Sentiments
Neutral =df[(df.sentiment== 'Neutral')]
```

In [111…
```
Neutral=Neutral[['id','customer_name','sentiment','reason']]
```

In [112…
```
Neutral.head()
```

Out[112]:

	id	customer_name	sentiment	reason
0	DKK-57076809-w-055481-fU	Analise Gairdner	Neutral	Billing Question
5	JVI-79728660-U-224285-4a	Kaylyn Emlen	Neutral	Billing Question
6	AZI-95054097-e-185542-PT	Phillipe Bowring	Neutral	Billing Question
9	RLC-64108207-Z-285141-VS	Port Inggall	Neutral	Billing Question
17	XNY-04106353-Y-318117-I9	Noni Greatrakes	Neutral	Billing Question

In [113…
```
#Customer Who had a Very Negative Sentiments
Very_Negative =df[(df.sentiment== 'Very Negative')]
```

In [114…
```
Very_Negative=Very_Negative[['id','customer_name','sentiment','reason']]
```

In [115…
```
Very_Negative.head()
```

Out[115]:

	id	customer_name	sentiment	reason
3	ZJI-96807559-i-620008-m7	Noreen Lafflina	Very Negative	Billing Question
8	XNG-44599118-P-344473-ZU	Oran Lifsey	Very Negative	Billing Question
14	ZOV-95861398-a-333622-9r	Odell Cathesyed	Very Negative	Payments
19	DJU-19977844-M-356042-cQ	Tammie Bettinson	Very Negative	Payments
22	GZD-50459522-O-178569-D2	Sophie Kleinerman	Very Negative	Billing Question

In [116…
```
#Customer Who had a Positive Sentiments
Positive =df[(df.sentiment== 'Positive')]
```

In [117…
```
Positive=Positive[['id','customer_name','sentiment','reason']]
```

In [118…
```
Positive.head()
```

Out[118]:

	id	customer_name	sentiment	reason
7	TWX-27007918-I-608789-Xw	Krysta de Tocqueville	Positive	Billing Question
13	DPT-56483482-P-371409-CQ	Melesa Ricardot	Positive	Billing Question
25	ISK-94965442-x-233388-Vz	Bethina Fazzioli	Positive	Billing Question
34	IZI-93062579-M-779259-Aj	Quinton Marchelli	Positive	Payments
47	RTW-93566842-a-737480-ex	Luca Castel	Positive	Payments

In [119…
```
# #Customer Who had a Very Positive Sentiments
Very_Positive =df[(df.sentiment== 'Very Positive')]
```

In [120…
```
Very_Positive=Very_Positive[['id','customer_name','sentiment','reason']]
```

In [121…
```
Very_Positive.head()
```

Out[121]:

	id	customer_name	sentiment	reason
1	QGK-72219678-w-102139-KY	Crichton Kidsley	Very Positive	Service Outage
4	DDU-69451719-O-176482-Fm	Toma Van der Beken	Very Positive	Payments
12	JDP-35147568-w-630120-3l	Nicolle Fareweather	Very Positive	Billing Question
27	PKG-51691289-6-484895-mg	Anissa Kinrade	Very Positive	Payments
28	YSU-89393344-7-508964-gG	Bradly Dinkin	Very Positive	Billing Question

export each filtered dataframe to csv

In [122…
```
Very_Negative.dtypes
```

Out[122]:
```
id              object
customer_name   object
sentiment       object
reason          object
dtype: object
```

In [135…
```
Negative.to_csv('Negative.csv',index=False, encoding='utf-8')

Negative_file =open('Negative.csv')
print('file opened in memory')
```

```
file opened in memory
```

In [ ]:
```
Neutral.to_csv('Neutral.csv',index=False,encoding='utf-8')

Neutral =open('Neutral.csv')
print('file opened in memory')
```

In [140…
```
Very_Negative.to_csv('Very_Negative',index=False,encoding='utf-8')

Very_Negative =open('Very_Negative.csv')
print('file opened in memory')
```

```
file opened in memory
```

In [142…
```
Positive.to_csv('Positive',index=False,encoding='utf-8')
Positive =open('Positive.csv')
print('file opened in memory')
```

```
file opened in memory
```

In [144…
```
Very_Positive.to_csv('Very_Positive',index=False,encoding='utf-8')
Very_Positive =open('Very_Positive.csv')
print('file opened in memory')
```

```
file opened in memory
```

CONVERTED PANDAS DATATYPES INTO SQL DATATYPES

In [95]:
```
    #conversion process using a dictionary
    replacements = {
        'object': 'varchar'
}
replacements
```

Out[95]:
```
{'object': 'varchar'}
```

- looping through the dictioanry and changing the datatypes from object to varchar

In [184…
```
#looping through the dictioanry and changing the datatypes from object to varchar
```

In [97]:
```
Negative_col_str = ", ".join("{} {}".format(n, d) for (n, d) in zip(Negative.columns, Negative.dtypes.replace(r
Negative_col_str
```

Out[97]:
```
'id varchar, customer_name varchar, sentiment varchar, reason varchar'
```

In [99]:
```
Neutral_col_str = ", ".join("{} {}".format(n, d) for (n, d) in zip(Neutral.columns, Neutral.dtypes.replace(repl
Neutral_col_str
```

Out[99]:
```
'id varchar, customer_name varchar, sentiment varchar, reason varchar'
```

In [98]:
```
Very_Negative_col_str = ", ".join("{} {}".format(n, d) for (n, d) in zip(Very_Negative.columns, Very_Negative.d
Very_Negative_col_str
```

Out[98]:
```
'id varchar, customer_name varchar, sentiment varchar, reason varchar'
```

In [100…
```
Positive_col_str = ", ".join("{} {}".format(n, d) for (n, d) in zip(Positive.columns, Positive.dtypes.replace(r
Positive_col_str
```

Out[100]:
```
'id varchar, customer_name varchar, sentiment varchar, reason varchar'
```

In [101…
```
Very_Positive_col_str = ", ".join("{} {}".format(n, d) for (n, d) in zip(Very_Positive.columns, Very_Positive.d
Very_Positive_col_str
```

Out[101]:
```
'id varchar, customer_name varchar, sentiment varchar, reason varchar'
```

In [ ]:
```
id              object
customer_name   object
sentiment       object
reason
```

Exported five csv files that contains the Customers Data into a Postgres sql server

In [168…
```
import psycopg2
```

In [166…
```
conn= psycopg2.connect('dbname=demo user=postgres host=localhost password=stipulated port=5434')
conn
```

Out[166]:
```
<connection object at 0x000002E1D1C8D370; dsn: 'user=postgres password=xxx dbname=demo host=localhost port=543
4', closed: 0>
```

In [167…
```
cursor=conn.cursor()
```

- CREATED TABLES IN SQL SERVER

In [106…
```
cursor.execute("create table Negative (id varchar, customer_name varchar, sentiment varchar, reason varchar)")
```

In [129…
```
cursor.execute("create table Neutral (id varchar, customer_name varchar, sentiment varchar, reason varchar)")
```

In [130…
```
cursor.execute("create table Very_Negative (id varchar, customer_name varchar, sentiment varchar, reason varcha
```

In [131…
```
cursor.execute("create table Positive (id varchar, customer_name varchar, sentiment varchar, reason varchar)")
```

In [132…
```
cursor.execute("create table Very_Positive (id varchar, customer_name varchar, sentiment varchar, reason varcha
```

- IMPORTING csv files into postgres server AND FETCHING tabels FROM DATABASE

In [ ]:
```
#IMPORTING csv files into postgres AND FETCHING tabels FROM DATABASE
SQL_QUERY="""
COPY Negative FROM STDIN WITH
    CSV
    HEADER
    DELIMITER AS ','

"""

cursor.copy_expert(sql=SQL_QUERY, file=Negative)
print('file copied to db')
```

In [171…
```
cursor.execute('SELECT * FROM Negative LIMIT 3')
cursor.fetchall()
```

Out[171]:
```
[('GYJ-30025932-A-023015-LD',
  'Averill Brundrett',
  'Negative',
  'Billing Question'),
 ('RJF-00263922-O-647027-TB',
  'Ella Cristoforo',
  'Negative',
  'Billing Question'),
 ('ZQN-32874873-e-786499-kJ',
  'Aubrey Surcombe',
  'Negative',
  'Billing Question')]
```

In [155…
```
SQL_QUERY="""
COPY Neutral FROM STDIN WITH
    CSV
    HEADER
    DELIMITER AS ','

"""

cursor.copy_expert(sql=SQL_QUERY, file=Neutral)
print('file copied to db')

conn.commit()
```

```
file copied to db
```

In [172…
```
cursor.execute('SELECT * FROM Neutral LIMIT 3')
cursor.fetchall()
```

Out[172]:
```
[('DKK-57076809-w-055481-fU',
  'Analise Gairdner',
  'Neutral',
  'Billing Question'),
 ('JVI-79728660-U-224285-4a', 'Kaylyn Emlen', 'Neutral', 'Billing Question'),
 ('AZI-95054097-e-185542-PT',
  'Phillipe Bowring',
  'Neutral',
  'Billing Question')]
```

In [161…
```
SQL_QUERY="""
COPY Very_Negative FROM STDIN WITH
    CSV
    HEADER
    DELIMITER AS ','

"""

cursor.copy_expert(sql=SQL_QUERY, file=Very_Negative)
print('file copied to db')

conn.commit()
```

```
file copied to db
```

In [173…
```
cursor.execute('SELECT * FROM Very_Negative LIMIT 3')
cursor.fetchall()
```

Out[173]:
```
[('ZJI-96807559-i-620008-m7',
  'Noreen Lafflina',
  'Very Negative',
  'Billing Question'),
 ('XNG-44599118-P-344473-ZU',
  'Oran Lifsey',
  'Very Negative',
  'Billing Question'),
 ('ZOV-95861398-a-333622-9r', 'Odell Cathesyed', 'Very Negative', 'Payments')]
```

In [162…
```
SQL_QUERY="""
```

```
COPY Positive FROM STDIN WITH
    CSV
    HEADER
    DELIMITER AS ','

"""

cursor.copy_expert(sql=SQL_QUERY, file=Positive)
print('file copied to db')

conn.commit()
```

```
file copied to db
```

In [174…
```
cursor.execute('SELECT * FROM Positive LIMIT 3')
cursor.fetchall()
```

Out[174]:
```
[('TWX-27007918-I-608789-Xw',
  'Krysta de Tocqueville',
  'Positive',
  'Billing Question'),
 ('DPT-56483482-P-371409-CQ',
  'Melesa Ricardot',
  'Positive',
  'Billing Question'),
 ('ISK-94965442-x-233388-Vz',
  'Bethina Fazzioli',
  'Positive',
  'Billing Question')]
```

In [163…
```
SQL_QUERY="""
COPY Very_Positive FROM STDIN WITH
    CSV
    HEADER
    DELIMITER AS ','

"""

cursor.copy_expert(sql=SQL_QUERY, file=Very_Positive)
print('file copied to db')

conn.commit()
```

```
file copied to db
```

In [175…
```
cursor.execute('SELECT * FROM Very_Positive LIMIT 3')
cursor.fetchall()
```

Out[175]:
```
[('QGK-72219678-w-102139-KY',
  'Crichton Kidsley',
  'Very Positive',
  'Service Outage'),
 ('DDU-69451719-O-176482-Fm',
  'Toma Van der Beken',
  'Very Positive',
  'Payments'),
 ('JDP-35147568-w-630120-3l',
  'Nicolle Fareweather',
  'Very Positive',
  'Billing Question')]
```

In [ ]:
```

```