Python Project : Customer Service Requests Analysis

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Importing Libraries

In [125]:

```python
#import required library

import numpy as np
import pandas as pd
```

Importing Datasets of NYC 311 Project

In [126]:

```python
#Import data set

NYC_DATASET=pd.read_csv("311_Service_Requests_from_2010_to_Present.csv")
```

View All the columns of dataset

In [127]:

```python
#view all columns of dataset

NYC_DATASET.columns
```

Out[127]:

```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Agency Nam
e',
       'Complaint Type', 'Descriptor', 'Location Type', 'Incident Zip',
       'Incident Address', 'Street Name', 'Cross Street 1', 'Cross Street
2',
       'Intersection Street 1', 'Intersection Street 2', 'Address Type',
       'City', 'Landmark', 'Facility Type', 'Status', 'Due Date',
       'Resolution Description', 'Resolution Action Updated Date',
       'Community Board', 'Borough', 'X Coordinate (State Plane)',
       'Y Coordinate (State Plane)', 'Park Facility Name', 'Park Borough',
       'School Name', 'School Number', 'School Region', 'School Code',
       'School Phone Number', 'School Address', 'School City', 'School Sta
te',
       'School Zip', 'School Not Found', 'School or Citywide Complaint',
       'Vehicle Type', 'Taxi Company Borough', 'Taxi Pick Up Location',
       'Bridge Highway Name', 'Bridge Highway Direction', 'Road Ramp',
       'Bridge Highway Segment', 'Garage Lot Name', 'Ferry Direction',
       'Ferry Terminal Name', 'Latitude', 'Longitude', 'Location'],
      dtype='object')
```

In [181]:

```
#selecting only required dta from dataset

NYC_DATASET_SELECTED_COLUMN=NYC_DATASET[['Unique Key', 'Created Date', 'Closed Date',
'Agency', 'Agency Name',
        'Complaint Type','Incident Zip','City']]
NYC_DATASET_WITHOUT_NA=NYC_DATASET_SELECTED_COLUMN.dropna()
```

In [183]:

```
NYC_DATASET_WITHOUT_NA
#CHEKC IF NA VALUE IS PRESENT IN DATASET
NYC_DATASET_WITHOUT_NA.isna()
NYC_DATASET_REFINED=NYC_DATASET_WITHOUT_NA
```

Converting the columns 'Created Date' and Closed Date' to datetime datatype

In [184]:

```
#Convert Data type of Created date and closing date to Date Time
df_Created_Date=pd.to_datetime(NYC_DATASET_REFINED['Created Date'])
df_Closed_Date=pd.to_datetime(NYC_DATASET_REFINED['Closed Date'])
```

4. Creating a new column 'Request_Closing_Time' as the time elapsed between request creation and request closing.

In [185]:

```
Request_Closing_Time=df_Closed_Date-df_Created_Date
#df_c_data=pd.merge(NYC_DATASET,Request_Closing_Time)
NYC_DATASET_REFINED['Request_Closing_Time']=Request_Closing_Time #Crating news column a
nd adding data to the column
NYC_DATASET_REFINED
```

```
C:\Users\Shiv Ranjan\Anaconda3\lib\site-packages\ipykernel_launcher.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy
  This is separate from the ipykernel package so we can avoid doing import
s until
```

Out[185]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Incident Zip	
0	32310363	12/31/2015 11:59:45 PM	01-01-16 0:55	NYPD	New York City Police Department	Noise - Street/Sidewalk	10034.0	NE
1	32309934	12/31/2015 11:59:44 PM	01-01-16 1:26	NYPD	New York City Police Department	Blocked Driveway	11105.0	
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway	10458.0	
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Department	Illegal Parking	10461.0	
4	32306529	12/31/2015 11:56:58 PM	01-01-16 3:24	NYPD	New York City Police Department	Illegal Parking	11373.0	EL
5	32306554	12/31/2015 11:56:30 PM	01-01-16 1:50	NYPD	New York City Police Department	Illegal Parking	11215.0	BF
6	32306559	12/31/2015 11:55:32 PM	01-01-16 1:53	NYPD	New York City Police Department	Illegal Parking	10032.0	NE
7	32307009	12/31/2015 11:54:05 PM	01-01-16 1:42	NYPD	New York City Police Department	Blocked Driveway	10457.0	
8	32308581	12/31/2015 11:53:58 PM	01-01-16 8:27	NYPD	New York City Police Department	Illegal Parking	11415.0	G
9	32308391	12/31/2015 11:53:58 PM	01-01-16 1:17	NYPD	New York City Police Department	Blocked Driveway	11219.0	BF
10	32305071	12/31/2015 11:52:58 PM	01-01-16 7:41	NYPD	New York City Police Department	Blocked Driveway	11372.0	J
11	32306260	12/31/2015 11:50:57 PM	01-01-16 10:58	NYPD	New York City Police Department	Blocked Driveway	10453.0	
12	32306612	12/31/2015 11:48:03 PM	01-01-16 2:17	NYPD	New York City Police Department	Noise - Street/Sidewalk	10461.0	
13	32305074	12/31/2015 11:47:58 PM	01-01-16 8:18	NYPD	New York City Police Department	Illegal Parking	11208.0	BF
14	32309424	12/31/2015 11:47:37 PM	01-01-16 10:17	NYPD	New York City Police Department	Derelict Vehicle	11379.0	
15	32309853	12/31/2015 11:47:30 PM	01-01-16 15:20	NYPD	New York City Police Department	Blocked Driveway	11374.0	RE
16	32305538	12/31/2015 11:47:02 PM	01-01-16 4:39	NYPD	New York City Police Department	Blocked Driveway	11412.0	

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Incident Zip	
17	32310273	12/31/2015 11:44:52 PM	01-01-16 0:36	NYPD	New York City Police Department	Noise - Commercial	11217.0	BF
18	32306617	12/31/2015 11:40:59 PM	01-01-16 2:37	NYPD	New York City Police Department	Noise - Commercial	11234.0	BF
19	32308195	12/31/2015 11:40:55 PM	01-01-16 0:28	NYPD	New York City Police Department	Noise - Street/Sidewalk	10026.0	NE
20	32310127	12/31/2015 11:40:43 PM	01-01-16 4:12	NYPD	New York City Police Department	Illegal Parking	10456.0	
21	32307994	12/31/2015 11:38:51 PM	01-01-16 9:11	NYPD	New York City Police Department	Illegal Parking	11379.0	
22	32307233	12/31/2015 11:34:18 PM	01-01-16 0:50	NYPD	New York City Police Department	Noise - Commercial	11234.0	BF
23	32308765	12/31/2015 11:32:46 PM	01-01-16 0:25	NYPD	New York City Police Department	Illegal Parking	10030.0	NE
24	32308423	12/31/2015 11:31:40 PM	01-03-16 16:22	NYPD	New York City Police Department	Blocked Driveway	10467.0	
25	32308426	12/31/2015 11:30:28 PM	01-01-16 2:47	NYPD	New York City Police Department	Blocked Driveway	11432.0	
26	32305916	12/31/2015 11:26:41 PM	12/31/2015 11:53:31 PM	NYPD	New York City Police Department	Noise - House of Worship	10031.0	NE
27	32308379	12/31/2015 11:26:35 PM	01-01-16 5:07	NYPD	New York City Police Department	Blocked Driveway	11419.0	RI(
28	32309402	12/31/2015 11:25:56 PM	01-01-16 1:12	NYPD	New York City Police Department	Illegal Parking	10024.0	NE
29	32308850	12/31/2015 11:25:01 PM	01-01-16 1:55	NYPD	New York City Police Department	Noise - Commercial	11201.0	BF
...	...	...	...	...	...	...	...	
300667	30279563	03/29/2015 01:04:01 AM	03/29/2015 01:23:04 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	10014.0	NE
300668	30282107	03/29/2015 01:03:20 AM	03/29/2015 03:40:19 AM	NYPD	New York City Police Department	Noise - Commercial	11216.0	BF
300669	30283741	03/29/2015 01:02:05 AM	03/29/2015 05:26:38 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	10031.0	NE
300670	30284125	03/29/2015 01:01:25 AM	03/29/2015 09:26:52 AM	NYPD	New York City Police Department	Illegal Parking	11354.0	F
300671	30283901	03/29/2015 12:58:08 AM	03/29/2015 04:44:02 AM	NYPD	New York City Police Department	Illegal Parking	10019.0	NE

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Incident Zip	
300672	30282374	03/29/2015 12:57:27 AM	03/29/2015 04:39:53 PM	NYPD	New York City Police Department	Blocked Driveway	11208.0	BF
300673	30280817	03/29/2015 12:57:25 AM	03/29/2015 02:25:31 AM	NYPD	New York City Police Department	Noise - Commercial	11203.0	BF
300674	30283364	03/29/2015 12:57:19 AM	03/29/2015 03:17:59 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	10025.0	NE
300675	30280353	03/29/2015 12:56:22 AM	03/29/2015 01:57:52 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	10031.0	NE
300676	30280974	03/29/2015 12:55:56 AM	03/29/2015 08:08:27 AM	NYPD	New York City Police Department	Noise - Commercial	11377.0	W(
300677	30280622	03/29/2015 12:55:33 AM	03/29/2015 07:12:39 AM	NYPD	New York City Police Department	Noise - Commercial	11237.0	BF
300678	30282979	03/29/2015 12:50:12 AM	03/29/2015 07:06:29 AM	NYPD	New York City Police Department	Noise - Vehicle	11206.0	BF
300679	30281254	03/29/2015 12:49:51 AM	03/29/2015 02:02:21 AM	NYPD	New York City Police Department	Blocked Driveway	11385.0	RID(
300680	30281090	03/29/2015 12:49:27 AM	03/29/2015 04:25:53 AM	NYPD	New York City Police Department	Noise - Vehicle	10028.0	NE
300681	30283933	03/29/2015 12:48:23 AM	03/29/2015 03:42:33 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	11238.0	BF
300682	30283186	03/29/2015 12:46:26 AM	03/29/2015 07:12:20 AM	NYPD	New York City Police Department	Noise - Commercial	11249.0	BF
300683	30284534	03/29/2015 12:44:36 AM	03/29/2015 03:40:20 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	11238.0	BF
300684	30281081	03/29/2015 12:43:20 AM	03/29/2015 01:10:55 AM	NYPD	New York City Police Department	Noise - Commercial	10002.0	NE
300685	30280506	03/29/2015 12:43:16 AM	03/29/2015 04:25:50 AM	NYPD	New York City Police Department	Noise - Vehicle	10028.0	NE
300686	30281145	03/29/2015 12:43:06 AM	03/29/2015 12:57:23 AM	NYPD	New York City Police Department	Noise - Commercial	10014.0	NE
300687	30282599	03/29/2015 12:42:48 AM	03/29/2015 02:57:41 AM	NYPD	New York City Police Department	Blocked Driveway	11385.0	RID(
300688	30280732	03/29/2015 12:37:15 AM	03/29/2015 01:02:39 AM	NYPD	New York City Police Department	Noise - Commercial	10014.0	NE
300689	30283432	03/29/2015 12:35:28 AM	03/29/2015 04:14:27 AM	NYPD	New York City Police Department	Noise - Street/Sidewalk	11233.0	BF

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Incident Zip	
300690	30280538	03/29/2015 12:35:23 AM	03/29/2015 08:41:24 AM	NYPD	New York City Police Department	Illegal Parking	10466.0	
300691	30279999	03/29/2015 12:35:04 AM	03/29/2015 02:52:28 AM	NYPD	New York City Police Department	Noise - Commercial	10034.0	NE
300692	30281370	03/29/2015 12:34:32 AM	03/29/2015 01:13:01 AM	NYPD	New York City Police Department	Noise - Commercial	10002.0	NE
300694	30281230	03/29/2015 12:33:28 AM	03/29/2015 02:33:59 AM	NYPD	New York City Police Department	Blocked Driveway	11418.0	RI(
300695	30283424	03/29/2015 12:33:03 AM	03/29/2015 03:40:20 AM	NYPD	New York City Police Department	Noise - Commercial	11206.0	BF
300696	30280004	03/29/2015 12:33:02 AM	03/29/2015 04:38:35 AM	NYPD	New York City Police Department	Noise - Commercial	10461.0	
300697	30281825	03/29/2015 12:33:01 AM	03/29/2015 04:41:50 AM	NYPD	New York City Police Department	Noise - Commercial	10036.0	NE

298024 rows × 9 columns

In [186]:

```
NYC_DATASET_REFINED.Request_Closing_Time.describe()
#NYC_DATASET.describe()
```

Out[186]:

```
count                         298024
mean     0 days 04:18:18.415795
std      0 days 06:02:51.382496
min             0 days 00:01:00
25%      0 days 01:16:24.750000
50%             0 days 02:42:36
75%      0 days 05:20:23.250000
max            24 days 16:52:22
Name: Request_Closing_Time, dtype: object
```

In [187]:

```
#Obsersation
# Maximum time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.max()
# Minumum time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.min()
# Average time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.mean()
# Total Number of request in dataset
NYC_DATASET_REFINED.Request_Closing_Time.count()
```

Out[187]:

298024

```
#Obsersation
# Maximum time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.max()
# Minumum time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.min()
# Average time taken to close a request
NYC_DATASET_REFINED.Request_Closing_Time.mean()
# Total Number of request in dataset
NYC_DATASET_REFINED.Request_Closing_Time.count()
```

In [188]:

```python
#Display Complaint Type and City
NYC_DATASET_REFINED.loc[:,['Complaint Type','City']]
```

Out[188]:

	Complaint Type	City
0	Noise - Street/Sidewalk	NEW YORK
1	Blocked Driveway	ASTORIA
2	Blocked Driveway	BRONX
3	Illegal Parking	BRONX
4	Illegal Parking	ELMHURST
5	Illegal Parking	BROOKLYN
6	Illegal Parking	NEW YORK
7	Blocked Driveway	BRONX
8	Illegal Parking	KEW GARDENS
9	Blocked Driveway	BROOKLYN
10	Blocked Driveway	JACKSON HEIGHTS
11	Blocked Driveway	BRONX
12	Noise - Street/Sidewalk	BRONX
13	Illegal Parking	BROOKLYN
14	Derelict Vehicle	MIDDLE VILLAGE
15	Blocked Driveway	REGO PARK
16	Blocked Driveway	SAINT ALBANS
17	Noise - Commercial	BROOKLYN
18	Noise - Commercial	BROOKLYN
19	Noise - Street/Sidewalk	NEW YORK
20	Illegal Parking	BRONX
21	Illegal Parking	MIDDLE VILLAGE
22	Noise - Commercial	BROOKLYN
23	Illegal Parking	NEW YORK
24	Blocked Driveway	BRONX
25	Blocked Driveway	JAMAICA
26	Noise - House of Worship	NEW YORK
27	Blocked Driveway	SOUTH RICHMOND HILL
28	Illegal Parking	NEW YORK
29	Noise - Commercial	BROOKLYN
...	...	...
300667	Noise - Street/Sidewalk	NEW YORK
300668	Noise - Commercial	BROOKLYN
300669	Noise - Street/Sidewalk	NEW YORK
300670	Illegal Parking	FLUSHING
300671	Illegal Parking	NEW YORK
300672	Blocked Driveway	BROOKLYN

	Complaint Type	City
300673	Noise - Commercial	BROOKLYN
300674	Noise - Street/Sidewalk	NEW YORK
300675	Noise - Street/Sidewalk	NEW YORK
300676	Noise - Commercial	WOODSIDE
300677	Noise - Commercial	BROOKLYN
300678	Noise - Vehicle	BROOKLYN
300679	Blocked Driveway	RIDGEWOOD
300680	Noise - Vehicle	NEW YORK
300681	Noise - Street/Sidewalk	BROOKLYN
300682	Noise - Commercial	BROOKLYN
300683	Noise - Street/Sidewalk	BROOKLYN
300684	Noise - Commercial	NEW YORK
300685	Noise - Vehicle	NEW YORK
300686	Noise - Commercial	NEW YORK
300687	Blocked Driveway	RIDGEWOOD
300688	Noise - Commercial	NEW YORK
300689	Noise - Street/Sidewalk	BROOKLYN
300690	Illegal Parking	BRONX
300691	Noise - Commercial	NEW YORK
300692	Noise - Commercial	NEW YORK
300694	Blocked Driveway	RICHMOND HILL
300695	Noise - Commercial	BROOKLYN
300696	Noise - Commercial	BRONX
300697	Noise - Commercial	NEW YORK

298024 rows × 2 columns

In [189]:

```python
#display Complaint Type
DF_Complaint_Type=NYC_DATASET_REFINED.loc[:,"Complaint Type"]
#Find major complaint type
DF_Complaint_Type
```

Out[189]:

```
0            Noise - Street/Sidewalk
1                   Blocked Driveway
2                   Blocked Driveway
3                    Illegal Parking
4                    Illegal Parking
5                    Illegal Parking
6                    Illegal Parking
7                   Blocked Driveway
8                    Illegal Parking
9                   Blocked Driveway
10                  Blocked Driveway
11                  Blocked Driveway
12           Noise - Street/Sidewalk
13                   Illegal Parking
14                   Derelict Vehicle
15                  Blocked Driveway
16                  Blocked Driveway
17                 Noise - Commercial
18                 Noise - Commercial
19           Noise - Street/Sidewalk
20                   Illegal Parking
21                   Illegal Parking
22                 Noise - Commercial
23                   Illegal Parking
24                  Blocked Driveway
25                  Blocked Driveway
26          Noise - House of Worship
27                  Blocked Driveway
28                   Illegal Parking
29                 Noise - Commercial
                     ...
300667       Noise - Street/Sidewalk
300668             Noise - Commercial
300669       Noise - Street/Sidewalk
300670               Illegal Parking
300671               Illegal Parking
300672              Blocked Driveway
300673             Noise - Commercial
300674       Noise - Street/Sidewalk
300675       Noise - Street/Sidewalk
300676             Noise - Commercial
300677             Noise - Commercial
300678                Noise - Vehicle
300679              Blocked Driveway
300680                Noise - Vehicle
300681       Noise - Street/Sidewalk
300682             Noise - Commercial
300683       Noise - Street/Sidewalk
300684             Noise - Commercial
300685                Noise - Vehicle
300686             Noise - Commercial
300687              Blocked Driveway
300688             Noise - Commercial
300689       Noise - Street/Sidewalk
300690               Illegal Parking
300691             Noise - Commercial
300692             Noise - Commercial
300694              Blocked Driveway
300695             Noise - Commercial
```

```
300696          Noise - Commercial
300697          Noise - Commercial
Name: Complaint Type, Length: 298024, dtype: object
```

In [178]:

```python
#find unique complaint type
DF_Complaint_Type.unique()
#find number of unique complaint type
DF_Complaint_Type.nunique()
#count value of complaint type and arrange in descending order
DF_Complaint_Type.value_counts()
```

Out[178]:

```
Blocked Driveway            77044
Illegal Parking             75361
Noise - Street/Sidewalk     48612
Noise - Commercial          35577
Derelict Vehicle            17718
Noise - Vehicle             17083
Animal Abuse                 7778
Traffic                      4498
Homeless Encampment          4416
Noise - Park                 4042
Vending                      3802
Drinking                     1280
Noise - House of Worship      931
Posting Advertisement         650
Urinating in Public           592
Bike/Roller/Skate Chronic     427
Panhandling                   307
Disorderly Youth              286
Illegal Fireworks             168
Graffiti                      113
Agency Issues                   6
Squeegee                        4
Ferry Complaint                 2
Animal in a Park                1
Name: Complaint Type, dtype: int64
```

In [190]:

```python
#visualie with graph complaint type and their count
%matplotlib inline
DF_Complaint_Type.value_counts().plot(kind='bar',title='count vs. complaint types')
```

Out[190]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29a6183a908>
```
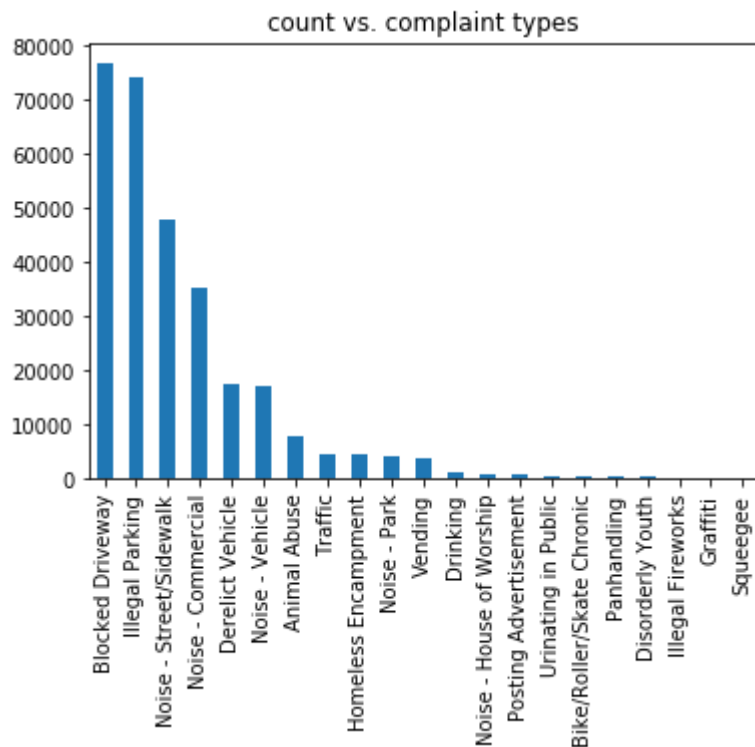
In [191]:

```
#top 10 Complaint Type and their count
DF_Complaint_Type.value_counts().head(10).plot(kind='bar',title='count vs. complaint ty
pes')
```

Out[191]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29a5da3d2e8>
```
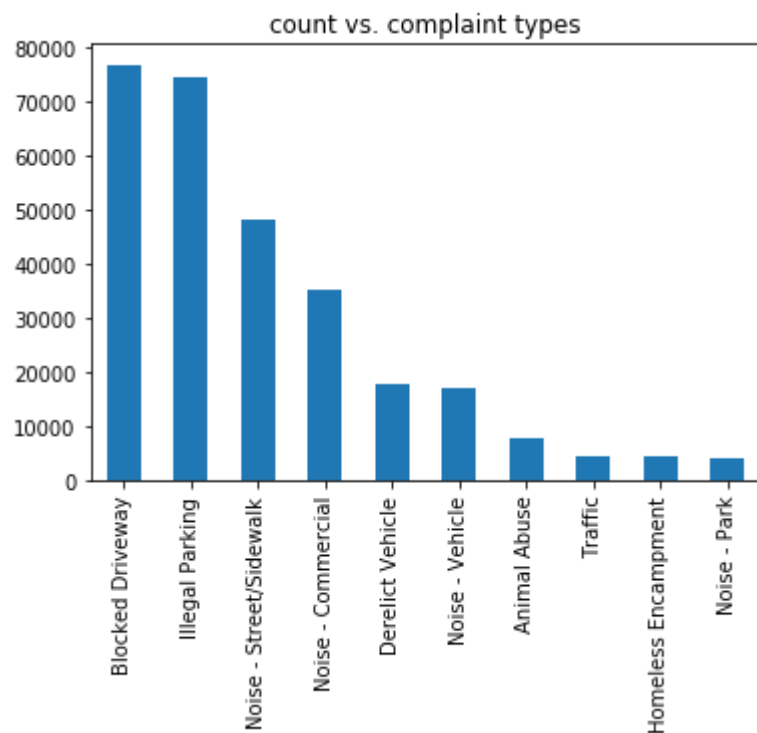
In [194]:

```
#display Complaint CITY
DF_Complaint_City=NYC_DATASET_REFINED.loc[:,"City"]
#Find major complaint CITY
DF_Complaint_City
```

Out[194]:

```
0                    NEW YORK
1                     ASTORIA
2                       BRONX
3                       BRONX
4                    ELMHURST
5                    BROOKLYN
6                    NEW YORK
7                       BRONX
8                 KEW GARDENS
9                    BROOKLYN
10            JACKSON HEIGHTS
11                      BRONX
12                      BRONX
13                   BROOKLYN
14             MIDDLE VILLAGE
15                  REGO PARK
16               SAINT ALBANS
17                   BROOKLYN
18                   BROOKLYN
19                   NEW YORK
20                      BRONX
21             MIDDLE VILLAGE
22                   BROOKLYN
23                   NEW YORK
24                      BRONX
25                    JAMAICA
26                   NEW YORK
27         SOUTH RICHMOND HILL
28                   NEW YORK
29                   BROOKLYN
                     ...
300667               NEW YORK
300668               BROOKLYN
300669               NEW YORK
300670               FLUSHING
300671               NEW YORK
300672               BROOKLYN
300673               BROOKLYN
300674               NEW YORK
300675               NEW YORK
300676               WOODSIDE
300677               BROOKLYN
300678               BROOKLYN
300679               RIDGEWOOD
300680               NEW YORK
300681               BROOKLYN
300682               BROOKLYN
300683               BROOKLYN
300684               NEW YORK
300685               NEW YORK
300686               NEW YORK
300687               RIDGEWOOD
300688               NEW YORK
300689               BROOKLYN
300690                  BRONX
300691               NEW YORK
300692               NEW YORK
300694          RICHMOND HILL
300695               BROOKLYN
```

```
300696                    BRONX
300697                    NEW YORK
Name: City, Length: 298024, dtype: object
```

In [195]:

```python
#find unique complaint type
DF_Complaint_City.unique()
```

Out[195]:

```
array(['NEW YORK', 'ASTORIA', 'BRONX', 'ELMHURST', 'BROOKLYN',
       'KEW GARDENS', 'JACKSON HEIGHTS', 'MIDDLE VILLAGE', 'REGO PARK',
       'SAINT ALBANS', 'JAMAICA', 'SOUTH RICHMOND HILL', 'RIDGEWOOD',
       'HOWARD BEACH', 'FOREST HILLS', 'STATEN ISLAND', 'OZONE PARK',
       'RICHMOND HILL', 'WOODHAVEN', 'FLUSHING', 'CORONA',
       'QUEENS VILLAGE', 'OAKLAND GARDENS', 'HOLLIS', 'MASPETH',
       'EAST ELMHURST', 'SOUTH OZONE PARK', 'WOODSIDE', 'FRESH MEADOWS',
       'LONG ISLAND CITY', 'ROCKAWAY PARK', 'SPRINGFIELD GARDENS',
       'COLLEGE POINT', 'BAYSIDE', 'GLEN OAKS', 'FAR ROCKAWAY',
       'BELLEROSE', 'LITTLE NECK', 'CAMBRIA HEIGHTS', 'ROSEDALE',
       'SUNNYSIDE', 'WHITESTONE', 'ARVERNE', 'FLORAL PARK',
       'NEW HYDE PARK', 'CENTRAL PARK', 'BREEZY POINT', 'QUEENS',
       'Astoria', 'Long Island City', 'Woodside', 'East Elmhurst',
       'Howard Beach'], dtype=object)
```

In [196]:

```python
#find number of unique complaint City
DF_Complaint_City.nunique()
```

Out[196]:

```
53
```

In [197]:

```
#count value of complaint City and arrange in descending order
DF_Complaint_City.value_counts()
```

Out[197]:

```
BROOKLYN                98295
NEW YORK                65971
BRONX                   40695
STATEN ISLAND           12338
JAMAICA                  7294
ASTORIA                  6330
FLUSHING                 5970
RIDGEWOOD                5162
CORONA                   4295
WOODSIDE                 3544
SOUTH RICHMOND HILL      2774
OZONE PARK               2755
EAST ELMHURST            2733
ELMHURST                 2673
WOODHAVEN                2463
MASPETH                  2461
LONG ISLAND CITY         2436
SOUTH OZONE PARK         2173
RICHMOND HILL            1902
FRESH MEADOWS            1899
QUEENS VILLAGE           1814
MIDDLE VILLAGE           1765
FOREST HILLS             1688
JACKSON HEIGHTS          1688
REGO PARK                1486
BAYSIDE                  1221
COLLEGE POINT            1220
FAR ROCKAWAY             1179
WHITESTONE               1098
HOLLIS                   1012
HOWARD BEACH              931
ROSEDALE                  922
SPRINGFIELD GARDENS       883
SAINT ALBANS              834
KEW GARDENS               771
ROCKAWAY PARK             745
SUNNYSIDE                 723
Astoria                   716
LITTLE NECK               559
OAKLAND GARDENS           551
CAMBRIA HEIGHTS           477
BELLEROSE                 375
GLEN OAKS                 306
ARVERNE                   220
FLORAL PARK               152
Long Island City          134
Woodside                  120
NEW HYDE PARK              98
CENTRAL PARK              97
QUEENS                    31
BREEZY POINT              30
East Elmhurst             14
Howard Beach               1
Name: City, dtype: int64
```

In [198]:

```python
#visualie with graph complaint City and their count
%matplotlib inline
DF_Complaint_City.value_counts().plot(kind='bar',title='count vs. complaint City')
```

Out[198]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29a608726d8>
```
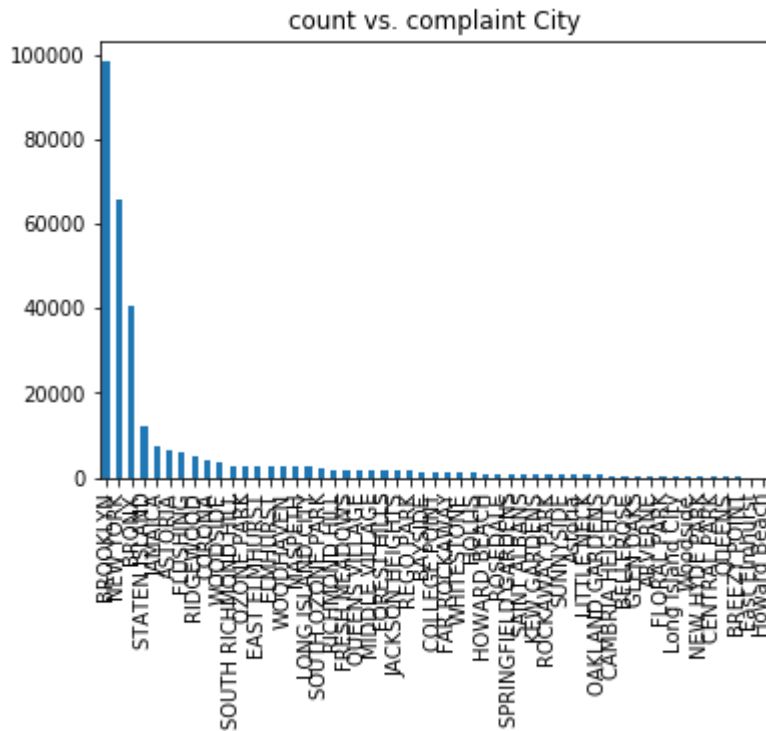
In [199]:

```python
#visualie with graph top 10 complaint City and their count
%matplotlib inline
DF_Complaint_City.value_counts().head(10).plot(kind='bar',title='count vs. complaint Ci
ty')
```

Out[199]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x29a54c65f98>
```
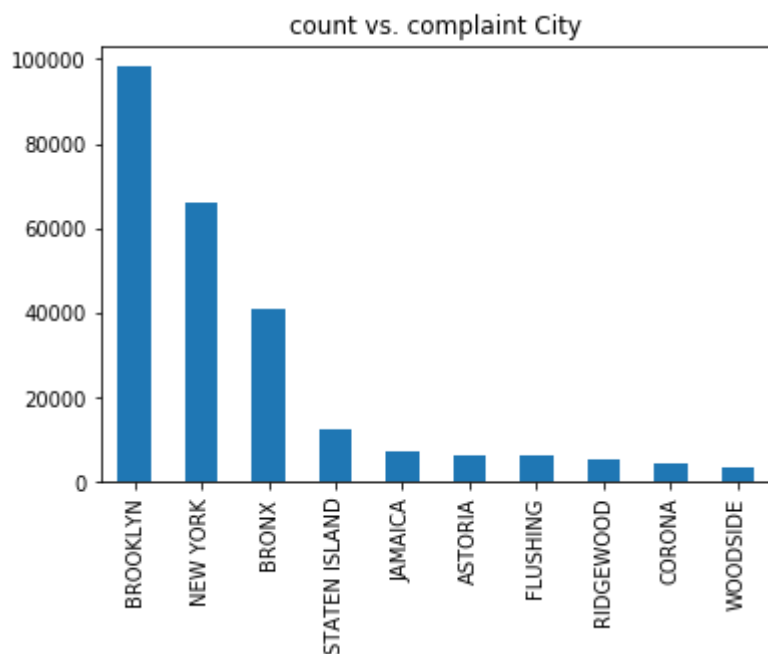
In [209]:

```
#group data on city and complaint type order by request closing time
grouped=NYC_DATASET_REFINED.groupby(['City','Complaint Type']).apply(lambda x:x.sort_va
lues(['Request_Closing_Time']))
grouped
```

Out[209]:

City	Complaint Type		Unique Key	Created Date	Closed Date	Agency	Agency Name
ARVERNE	Animal Abuse	157311	31260690	08-07-15 12:17	08-07-15 12:46	NYPD	New York City Police Department
		191461	31022179	07-07-15 20:54	07-07-15 21:35	NYPD	New York City Police Department
		86898	31712701	10-08-15 8:05	10-08-15 8:51	NYPD	New York City Police Department
		134836	31407911	08/27/2015 04:19:06 PM	08/27/2015 05:10:15 PM	NYPD	New York City Police Department
		207213	30927589	06/24/2015 02:32:03 PM	06/24/2015 03:24:41 PM	NYPD	New York City Police Department
		101256	31606334	09/24/2015 10:06:42 PM	09/24/2015 11:00:08 PM	NYPD	New York City Police Department
		79001	31759911	10/15/2015 11:07:08 AM	10/15/2015 12:03:06 PM	NYPD	New York City Police Department
		218315	30847350	06/14/2015 08:00:58 PM	06/14/2015 09:02:20 PM	NYPD	New York City Police Department
		100832	31611044	09/25/2015 08:12:27 AM	09/25/2015 09:20:18 AM	NYPD	New York City Police Department
		152408	31287200	08-11-15 13:55	08-11-15 15:08	NYPD	New York City Police Department
		163268	31217128	08-01-15 21:56	08-01-15 23:15	NYPD	New York City Police Department
		192012	31022155	07-07-15 8:57	07-07-15 10:25	NYPD	New York City Police Department
		163288	31216215	08-01-15 21:40	08-01-15 23:15	NYPD	New York City Police Department
		7932	32256799	12/22/2015 08:26:39 PM	12/22/2015 10:02:31 PM	NYPD	New York City Police Department
		8260	32257644	12/22/2015 12:47:17 PM	12/22/2015 02:24:10 PM	NYPD	New York City Police Department
		130673	31422504	08/30/2015 07:39:01 PM	08/30/2015 09:16:17 PM	NYPD	New York City Police Department
		218629	30845068	06/14/2015 03:07:03 PM	06/14/2015 04:45:15 PM	NYPD	New York City Police Department

City	Complaint Type		Unique Key	Created Date	Closed Date	Agency	Agency Name
		192017	31019016	07-07-15 8:43	07-07-15 10:25	NYPD	New York City Police Department
		240088	30709744	05/27/2015 02:35:39 PM	05/27/2015 04:19:45 PM	NYPD	New York City Police Department
		101865	31608180	09/24/2015 10:18:52 AM	09/24/2015 12:16:10 PM	NYPD	New York City Police Department
		263799	30566658	05-07-15 9:02	05-07-15 11:04	NYPD	New York City Police Department
		215809	30869624	06/17/2015 10:00:19 AM	06/17/2015 12:07:40 PM	NYPD	New York City Police Department
		71185	31855353	10/22/2015 06:23:05 PM	10/22/2015 08:31:12 PM	NYPD	New York City Police Department
		97769	31627160	09/27/2015 09:26:58 AM	09/27/2015 11:44:36 AM	NYPD	New York City Police Department
		231870	30763085	06-03-15 19:52	06-03-15 22:15	NYPD	New York City Police Department
		262506	30578493	05-08-15 10:06	05-08-15 12:35	NYPD	New York City Police Department
		43154	32011973	11/18/2015 06:53:47 AM	11/18/2015 09:27:24 AM	NYPD	New York City Police Department
		13960	32211005	12/16/2015 05:59:27 PM	12/16/2015 08:39:40 PM	NYPD	New York City Police Department
		97786	31628401	09/27/2015 08:50:57 AM	09/27/2015 11:44:37 AM	NYPD	New York City Police Department
		143620	31345709	08/19/2015 07:56:25 PM	08/19/2015 10:50:22 PM	NYPD	New York City Police Department
...	**...**	**...**	...	...	...	...	...
Woodside	**Illegal Parking**	**291762**	30361795	04-08-15 22:56	04-09-15 6:19	NYPD	New York City Police Department
		76105	31775837	10/17/2015 11:29:37 PM	10/18/2015 06:57:17 AM	NYPD	New York City Police Department
		292976	30352377	04-07-15 8:08	04-07-15 15:39	NYPD	New York City Police Department
		288167	30394446	04/13/2015 08:18:47 AM	04/13/2015 03:50:30 PM	NYPD	New York City Police Department

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City	Complaint Type	Unique Key		Created Date	Closed Date	Agency	Agency Name
		252124	30633327	05/16/2015 11:37:30 PM	05/17/2015 07:11:34 AM	NYPD	New York City Police Department
		114335	31526415	09/13/2015 11:38:33 PM	09/14/2015 07:28:18 AM	NYPD	New York City Police Department
		255661	30609469	05/13/2015 09:36:52 PM	05/14/2015 05:50:12 AM	NYPD	New York City Police Department
		246860	30672562	05/21/2015 09:56:38 PM	05/22/2015 06:31:55 AM	NYPD	New York City Police Department
		247823	30658486	05/20/2015 09:41:18 PM	05/21/2015 07:06:14 AM	NYPD	New York City Police Department
		97354	31627187	09/27/2015 05:14:13 PM	09/28/2015 02:47:45 AM	NYPD	New York City Police Department
		90033	31681440	10-04-15 23:21	10-05-15 8:59	NYPD	New York City Police Department
		240234	30710091	05/27/2015 11:33:34 AM	05/27/2015 09:30:42 PM	NYPD	New York City Police Department
		289452	30378566	04-11-15 22:37	04-12-15 8:51	NYPD	New York City Police Department
		278262	30462940	04/23/2015 09:49:39 AM	04/23/2015 09:29:31 PM	NYPD	New York City Police Department
		207068	30928837	06/24/2015 05:34:37 PM	06/25/2015 05:19:03 AM	NYPD	New York City Police Department
		141789	31364498	08/21/2015 05:37:11 PM	08/22/2015 05:58:42 AM	NYPD	New York City Police Department
		234195	30743731	06-01-15 9:57	06-01-15 22:28	NYPD	New York City Police Department
		221419	30832477	06-12-15 11:10	06/13/2015 12:37:41 AM	NYPD	New York City Police Department
		221434	30831403	06-12-15 10:53	06/13/2015 12:35:28 AM	NYPD	New York City Police Department
		222784	30828178	06-11-15 8:17	06-11-15 23:51	NYPD	New York City Police Department
		100887	31615832	09/25/2015 06:53:12 AM	09/25/2015 11:00:48 PM	NYPD	New York City Police Department

| City	Complaint Type	Unique Key	Created Date	Closed Date	Agency	Agency Name	
		116516 31516268	09-12-15 7:21	09/13/2015 12:16:53 AM	NYPD	New York City Police Department	
		258365 30591035	05-11-15 9:17	05-12-15 13:27	NYPD	New York City Police Department	
	Noise - Commercial	**281590** 30434150	04/19/2015 12:22:05 PM	04/19/2015 01:12:44 PM	NYPD	New York City Police Department	
		282845 30429546	04/18/2015 03:55:48 PM	04/18/2015 07:52:27 PM	NYPD	New York City Police Department	
	Noise - Street/Sidewalk	**246190** 30678644	05/22/2015 03:24:05 PM	05/22/2015 06:17:10 PM	NYPD	New York City Police Department	S
		249650 30647648	05/18/2015 11:57:41 PM	05/19/2015 03:00:06 AM	NYPD	New York City Police Department	S
		293043 30348400	04-07-15 3:52	04-07-15 6:58	NYPD	New York City Police Department	S
		266087 30553028	05-05-15 9:18	05-05-15 12:28	NYPD	New York City Police Department	S
		236996 30726281	05/30/2015 12:44:56 AM	05/30/2015 05:36:49 AM	NYPD	New York City Police Department	S

298024 rows × 9 columns

In [231]:

```
# s1=NYC_DATASET_REFINED[['Complaint Type','Request_Closing_Time']]
# ss=s1.groupby(['Complaint Type','Request_Closing_Time']).apply(lambda x:x.sort_values
(['Request_Closing_Time']))
# ss.head()
#ss=NYC_DATASET_REFINED.groupby(['City','Complaint Type']).apply(lambda x:x.sort_values
(['Request_Closing_Time']))
```

In [235]:

```python
# Complaint type and city wise statistical plot
contingency_table=pd.crosstab(NYC_DATASET_REFINED['Complaint Type'],NYC_DATASET_REFINED
.City).plot(kind='bar',stacked= True,figsize = (10,15),legend = True)
```
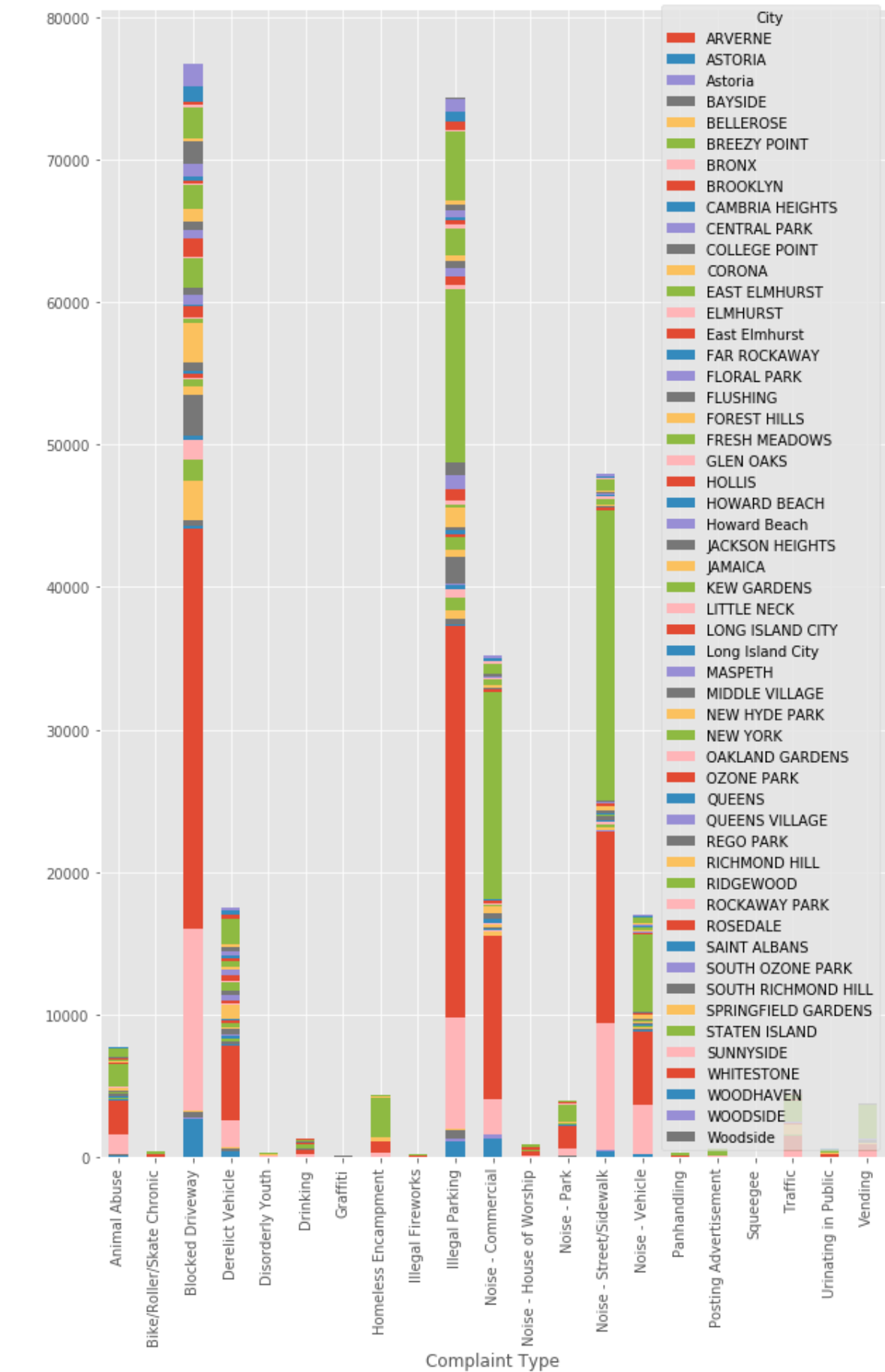
In [242]:

```python
contingency_table=pd.crosstab(NYC_DATASET_REFINED['Complaint Type'],NYC_DATASET_REFINED
.Request_Closing_Time)
print('contingency_table :-\n',contingency_table)
```

```
contingency_table :-
 Request_Closing_Time       0 days 00:01:00  0 days 00:02:00  0 days 00:0
2:26  \
Complaint Type
Animal Abuse                             0                0
0
Bike/Roller/Skate Chronic                0                0
0
Blocked Driveway                         0                0
0
Derelict Vehicle                         0                0
0
Disorderly Youth                         0                0
0
Drinking                                 0                0
0
Graffiti                                 0                0
0
Homeless Encampment                      0                0
0
Illegal Fireworks                        0                0
0
Illegal Parking                          0                0
0
Noise - Commercial                       1                2
0
Noise - House of Worship                 0                0
0
Noise - Park                             0                0
0
Noise - Street/Sidewalk                  0                1
0
Noise - Vehicle                          0                0
0
Panhandling                              0                0
0
Posting Advertisement                    0                1
1
Squeegee                                 0                0
0
Traffic                                  0                0
0
Urinating in Public                      0                0
0
Vending                                  0                0
0

Request_Closing_Time       0 days 00:02:28  0 days 00:02:30  0 days 00:02:
34  \
Complaint Type
Animal Abuse                             0                0
0
Bike/Roller/Skate Chronic                0                0
0
Blocked Driveway                         0                0
0
Derelict Vehicle                         0                0
0
Disorderly Youth                         0                0
0
Drinking                                 0                0
```

0
Complaint Type		
Graffiti	0	0
0		
Homeless Encampment	0	0
0		
Illegal Fireworks	0	0
0		
Illegal Parking	0	0
0		
Noise - Commercial	0	0
0		
Noise - House of Worship	0	0
0		
Noise - Park	0	0
0		
Noise - Street/Sidewalk	1	0
2		
Noise - Vehicle	0	0
0		
Panhandling	0	0
0		
Posting Advertisement	0	1
0		
Squeegee	0	0
0		
Traffic	0	0
0		
Urinating in Public	0	0
0		
Vending	0	0
0		

Request_Closing_Time	0 days 00:02:37	0 days 00:02:41	0 days 00:02:43 \
Complaint Type			
Animal Abuse	0	0	
0			
Bike/Roller/Skate Chronic	0	0	
0			
Blocked Driveway	0	0	
0			
Derelict Vehicle	0	0	
0			
Disorderly Youth	0	0	
0			
Drinking	0	0	
0			
Graffiti	0	0	
0			
Homeless Encampment	0	0	
0			
Illegal Fireworks	0	0	
0			
Illegal Parking	1	0	
0			
Noise - Commercial	1	0	
0			
Noise - House of Worship	0	0	
0			
Noise - Park	0	0	
0			

```
Noise - Street/Sidewalk              0                 1
0
Noise - Vehicle                      0                 0
1
Panhandling                          0                 0
0
Posting Advertisement                0                 0
0
Squeegee                             0                 0
0
Traffic                              0                 0
0
Urinating in Public                  0                 0
0
Vending                              0                 0
0


Request_Closing_Time     0 days 00:02:47  ...  6 days 20:02:37  \
Complaint Type                            ...
Animal Abuse                         0 ...                0
Bike/Roller/Skate Chronic            0 ...                0
Blocked Driveway                     0 ...                0
Derelict Vehicle                     0 ...                0
Disorderly Youth                     0 ...                0
Drinking                             0 ...                0
Graffiti                             0 ...                0
Homeless Encampment                  0 ...                0
Illegal Fireworks                    0 ...                0
Illegal Parking                      1 ...                1
Noise - Commercial                   0 ...                0
Noise - House of Worship             0 ...                0
Noise - Park                         0 ...                0
Noise - Street/Sidewalk              0 ...                0
Noise - Vehicle                      0 ...                0
Panhandling                          0 ...                0
Posting Advertisement                0 ...                0
Squeegee                             0 ...                0
Traffic                              0 ...                0
Urinating in Public                  0 ...                0
Vending                              0 ...                0


Request_Closing_Time     7 days 01:06:48  8 days 00:36:08  8 days 08:33:
39  \
Complaint Type
Animal Abuse                         0                 0
0
Bike/Roller/Skate Chronic            0                 0
0
Blocked Driveway                     0                 0
0
Derelict Vehicle                     1                 1
1
Disorderly Youth                     0                 0
0
Drinking                             0                 0
0
Graffiti                             0                 0
0
Homeless Encampment                  0                 0
0
Illegal Fireworks                    0                 0
```

```
                                         0
Illegal Parking                          0                 0
                                         0
Noise - Commercial                       0                 0
                                         0
Noise - House of Worship                 0                 0
                                         0
Noise - Park                             0                 0
                                         0
Noise - Street/Sidewalk                  0                 0
                                         0
Noise - Vehicle                          0                 0
                                         0
Panhandling                              0                 0
                                         0
Posting Advertisement                    0                 0
                                         0
Squeegee                                 0                 0
                                         0
Traffic                                  0                 0
                                         0
Urinating in Public                      0                 0
                                         0
Vending                                  0                 0
                                         0

Request_Closing_Time    8 days 08:39:06  9 days 07:21:06  9 days 07:22:
12  \
Complaint Type
Animal Abuse                             0                 0
                                         0
Bike/Roller/Skate Chronic                0                 0
                                         0
Blocked Driveway                         0                 0
                                         0
Derelict Vehicle                         1                 1
1
Disorderly Youth                         0                 0
                                         0
Drinking                                 0                 0
                                         0
Graffiti                                 0                 0
                                         0
Homeless Encampment                      0                 0
                                         0
Illegal Fireworks                        0                 0
                                         0
Illegal Parking                          0                 0
                                         0
Noise - Commercial                       0                 0
                                         0
Noise - House of Worship                 0                 0
                                         0
Noise - Park                             0                 0
                                         0
Noise - Street/Sidewalk                  0                 0
                                         0
Noise - Vehicle                          0                 0
                                         0
Panhandling                              0                 0
                                         0
```

```
Posting Advertisement                    0                    0
0
Squeegee                                 0                    0
0
Traffic                                  0                    0
0
Urinating in Public                      0                    0
0
Vending                                  0                    0
0


Request_Closing_Time       21 days 15:16:01  24 days 01:21:36  \
Complaint Type
Animal Abuse                             1                    0
Bike/Roller/Skate Chronic                0                    0
Blocked Driveway                         0                    0
Derelict Vehicle                         0                    0
Disorderly Youth                         0                    0
Drinking                                 0                    0
Graffiti                                 0                    0
Homeless Encampment                      0                    0
Illegal Fireworks                        0                    0
Illegal Parking                          0                    1
Noise - Commercial                       0                    0
Noise - House of Worship                 0                    0
Noise - Park                             0                    0
Noise - Street/Sidewalk                  0                    0
Noise - Vehicle                          0                    0
Panhandling                              0                    0
Posting Advertisement                    0                    0
Squeegee                                 0                    0
Traffic                                  0                    0
Urinating in Public                      0                    0
Vending                                  0                    0


Request_Closing_Time       24 days 16:52:22
Complaint Type
Animal Abuse                             0
Bike/Roller/Skate Chronic                0
Blocked Driveway                         0
Derelict Vehicle                         0
Disorderly Youth                         0
Drinking                                 0
Graffiti                                 0
Homeless Encampment                      0
Illegal Fireworks                        0
Illegal Parking                          0
Noise - Commercial                       0
Noise - House of Worship                 0
Noise - Park                             0
Noise - Street/Sidewalk                  1
Noise - Vehicle                          0
Panhandling                              0
Posting Advertisement                    0
Squeegee                                 0
Traffic                                  0
Urinating in Public                      0
Vending                                  0

[21 rows x 47503 columns]
```

In [243]:

```python
#Observed Values
Observed_Values = contingency_table.values
print("Observed Values :-\n",Observed_Values)
```

```
Observed Values :-
 [[0 0 0 ... 1 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 ...
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]]
```

In [244]:

```python
b=stats.chi2_contingency(contingency_table)
Expected_Values = b[3]
print("Expected Values :-\n",Expected_Values)
```

```
Expected Values :-
 [[0.02606166 0.10424664 0.02606166 ... 0.02606166 0.02606166 0.02606166]
 [0.00141599 0.00566397 0.00141599 ... 0.00141599 0.00141599 0.00141599]
 [0.25753631 1.03014522 0.25753631 ... 0.25753631 0.25753631 0.25753631]
 ...
 [0.01507597 0.06030387 0.01507597 ... 0.01507597 0.01507597 0.01507597]
 [0.00198642 0.00794567 0.00198642 ... 0.00198642 0.00198642 0.00198642]
 [0.01273052 0.05092207 0.01273052 ... 0.01273052 0.01273052 0.01273052]]
```

In [245]:

```
no_of_rows=len(contingency_table.iloc[0:2,0])
no_of_columns=len(contingency_table.iloc[0,0:2])
df11=(no_of_rows-1)*(no_of_columns-1)
print("Degree of Freedom:-",df)
alpha = 0.05
```

```
Degree of Freedom:- Blocked Driveway              77044
Illegal Parking                75361
Noise - Street/Sidewalk        48612
Noise - Commercial             35577
Derelict Vehicle               17718
Noise - Vehicle                17083
Animal Abuse                    7778
Traffic                         4498
Homeless Encampment             4416
Noise - Park                    4042
Vending                         3802
Drinking                        1280
Noise - House of Worship         931
Posting Advertisement            650
Urinating in Public              592
Bike/Roller/Skate Chronic        427
Panhandling                      307
Disorderly Youth                 286
Illegal Fireworks                168
Graffiti                         113
Agency Issues                      6
Squeegee                           4
Ferry Complaint                    2
Animal in a Park                   1
Name: Complaint Type, dtype: int64
```

In [246]:

```
from scipy.stats import chi2
chi_square=sum([(o-e)**2./e for o,e in zip(Observed_Values,Expected_Values)])
chi_square_statistic=chi_square[0]+chi_square[1]
print("chi-square statistic:-",chi_square_statistic)
```

```
chi-square statistic:- 128.47193847376684
```

In [247]:

```
critical_value=chi2.ppf(q=1-alpha,df=df11)
print('critical_value:',critical_value)
```

```
critical_value: 3.841458820694124
```

In [248]:

```
#p-value
p_value=1-chi2.cdf(x=chi_square_statistic,df=df11)
print('p-value:',p_value)
```

```
p-value: 0.0
```

In [249]:

```python
print('Significance level: ',alpha)
print('Degree of Freedom: ',df11)
print('chi-square statistic:',chi_square_statistic)
print('critical_value:',critical_value)
print('p-value:',p_value)
```

```
Significance level:  0.05
Degree of Freedom:  1
chi-square statistic: 128.47193847376684
critical_value: 3.841458820694124
p-value: 0.0
```

In [250]:

```python
if chi_square_statistic>=critical_value:
    print("Reject H0,There is a relationship between 2 categorical variables")
else:
    print("Retain H0,There is no relationship between 2 categorical variables")

if p_value<=alpha:
    print("Reject H0,There is a relationship between 2 categorical variables")
else:
    print("Retain H0,There is no relationship between 2 categorical variables")
```

```
Reject H0,There is a relationship between 2 categorical variables
Reject H0,There is a relationship between 2 categorical variables
```