Customer Service Request Analysis

In [1]:
```
import pandas as pd
import numpy as np
import os
os.chdir(r"C:\Users\lenovo\Desktop\Simplilearn\Applied Data Science\Project - Applied Data Science with Python\Project_Two_Dataset")
```

In [2]:
```
df_service_requests = pd.read_excel("311_Service_Requests_from_2010_to_Present.xlsx")
```

In [3]:
```
df_service_requests.columns
```

Out[3]:
```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Agency Name',
       '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 State',
       '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')
```

- Identify the shape of the dataset

In [4]:
```
df_service_requests.shape
```

Out[4]:
```
(364558, 53)
```

- Identify variables with null values

In [5]:
```
##df_service_requests[df_service_requests.columns[df_service_requests.isna().any()]]
df_service_requests.isnull().sum()
## All >0 columns has some missing values in them.
```

Out[5]:
```
Unique Key                          0
Created Date                        0
Closed Date                      2381
Agency                              0
Agency Name                         0
Complaint Type                      0
Descriptor                       6501
Location Type                     133
Incident Zip                     2998
Incident Address                51699
Street Name                     51699
Cross Street 1                  57188
Cross Street 2                  57805
Intersection Street 1          313438
Intersection Street 2          314046
Address Type                     3252
City                             2997
Landmark                       364183
Facility Type                    2389
Status                              0
Due Date                            3
Resolution Description              0
Resolution Action Updated Date   2402
Community Board                     0
Borough                             0
X Coordinate (State Plane)       4030
Y Coordinate (State Plane)       4030
Park Facility Name                  0
Park Borough                        0
School Name                         0
School Number                       0
School Region                       1
School Code                         1
School Phone Number                 0
School Address                      0
School City                         0
School State                        0
School Zip                          1
School Not Found                    0
School or Citywide Complaint   364558
Vehicle Type                   364558
Taxi Company Borough           364558
Taxi Pick Up Location          364558
Bridge Highway Name            364261
Bridge Highway Direction       364261
Road Ramp                      364296
Bridge Highway Segment         364296
Garage Lot Name                364558
```

```
Ferry Direction                 364557
Ferry Terminal Name             364556
Latitude                          4030
Longitude                         4030
Location                          4030
dtype: int64
```

- Utilize missing value treatment

> Columns with more than 80% missing values should be dropped as it serves no purpose in the analysis. Also most of them are address related which is not siginificant in our case.

In [6]:
```
df_service_requests.columns
```

Out[6]:
```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Agency Name',
       '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 State',
       '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 [7]:
```
df_service_requests.isnull().sum()*100/len(df_service_requests)
```

Out[7]:
```
Unique Key                      0.000000
Created Date                    0.000000
Closed Date                     0.653120
Agency                          0.000000
Agency Name                     0.000000
Complaint Type                  0.000000
Descriptor                      1.783255
Location Type                   0.036483
Incident Zip                    0.822366
Incident Address               14.181283
Street Name                    14.181283
Cross Street 1                 15.686941
Cross Street 2                 15.856187
Intersection Street 1          85.977540
Intersection Street 2          86.144317
Address Type                    0.892039
City                            0.822091
Landmark                       99.897136
Facility Type                   0.655314
Status                          0.000000
Due Date                        0.000823
Resolution Description          0.000000
Resolution Action Updated Date  0.658880
Community Board                 0.000000
Borough                         0.000000
X Coordinate (State Plane)      1.105448
Y Coordinate (State Plane)      1.105448
Park Facility Name              0.000000
Park Borough                    0.000000
School Name                     0.000000
School Number                   0.000000
School Region                   0.000274
School Code                     0.000274
School Phone Number             0.000000
School Address                  0.000000
School City                     0.000000
School State                    0.000000
School Zip                      0.000274
School Not Found                0.000000
School or Citywide Complaint  100.000000
Vehicle Type                  100.000000
Taxi Company Borough          100.000000
Taxi Pick Up Location         100.000000
Bridge Highway Name            99.918531
Bridge Highway Direction       99.918531
Road Ramp                      99.928132
Bridge Highway Segment         99.928132
Garage Lot Name               100.000000
Ferry Direction                99.999726
Ferry Terminal Name            99.999451
Latitude                        1.105448
Longitude                       1.105448
Location                        1.105448
dtype: float64
```

In [8]:
```
df_service_requests.drop(['Intersection Street 1','Intersection Street 2','Landmark',
                          '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'],axis=1,inplace=True)
```

In [9]:
```
df_service_requests.isnull().sum()*100/len(df_service_requests)
```

Out[9]:
```
Unique Key                        0.000000
Created Date                      0.000000
Closed Date                       0.653120
Agency                            0.000000
Agency Name                       0.000000
Complaint Type                    0.000000
Descriptor                        1.783255
Location Type                     0.036483
Incident Zip                      0.822366
Incident Address                 14.181283
Street Name                      14.181283
Cross Street 1                   15.686941
Cross Street 2                   15.856187
Address Type                      0.892039
City                              0.822091
Facility Type                     0.655314
Status                            0.000000
Due Date                          0.000823
Resolution Description            0.000000
Resolution Action Updated Date    0.658880
Community Board                   0.000000
Borough                           0.000000
X Coordinate (State Plane)        1.105448
Y Coordinate (State Plane)        1.105448
Park Facility Name                0.000000
Park Borough                      0.000000
School Name                       0.000000
School Number                     0.000000
School Region                     0.000274
School Code                       0.000274
School Phone Number               0.000000
School Address                    0.000000
School City                       0.000000
School State                      0.000000
School Zip                        0.000274
School Not Found                  0.000000
Latitude                          1.105448
Longitude                         1.105448
Location                          1.105448
dtype: float64
```

In [10]:
```
# Looking at all remaining columns with missing values
df_service_requests[['Closed Date','Descriptor','Location Type','Incident Zip','Incident Address','Street Name','Cross Street 1','Cross Stre
                     'Address Type','City','Facility Type','X Coordinate (State Plane)','Y Coordinate (State Plane)','Latitude','Longitude','
```

Out[10]:

	Closed Date	Descriptor	Location Type	Incident Zip	Incident Address	Street Name	Cross Street 1	Cross Street 2	Address Type	City	Facility Type	X Coordinate (State Plane)	Y Coordinate (State Plane)	
0	2016-01-01 00:55:15	Loud Music/Party	Street/Sidewalk	10034.0	71 VERMILYEA AVENUE	VERMILYEA AVENUE	ACADEMY STREET	WEST 204 STREET	ADDRESS	NEW YORK	Precinct	1005409.0	254678.0	4
1	2016-01-01 01:26:57	No Access	Street/Sidewalk	11105.0	27-07 23 AVENUE	23 AVENUE	27 STREET	28 STREET	ADDRESS	ASTORIA	Precinct	1007766.0	221986.0	4
2	2016-01-01 04:51:03	No Access	Street/Sidewalk	10458.0	2897 VALENTINE AVENUE	VALENTINE AVENUE	EAST 198 STREET	EAST 199 STREET	ADDRESS	BRONX	Precinct	1015081.0	256380.0	4
3	2016-01-01 07:43:13	Commercial Overnight Parking	Street/Sidewalk	10461.0	2940 BAISLEY AVENUE	BAISLEY AVENUE	EDISON AVENUE	B STREET	ADDRESS	BRONX	Precinct	1031740.0	243899.0	4
4	2016-01-01 03:24:42	Blocked Sidewalk	Street/Sidewalk	11373.0	87-14 57 ROAD	57 ROAD	SEABURY STREET	HOFFMAN DRIVE	ADDRESS	ELMHURST	Precinct	1019123.0	206375.0	4
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
364553	2015-01-01 10:22:31	Blocked Hydrant	Street/Sidewalk	11421.0	84-25 85 ROAD	85 ROAD	FOREST PARKWAY	85 STREET	ADDRESS	WOODHAVEN	Precinct	1022809.0	192567.0	4
364554	2015-01-01 02:25:02	Car/Truck Horn	Street/Sidewalk	10468.0	2555 SEDGWICK AVENUE	SEDGWICK AVENUE	BAILEY AVENUE	BEND	ADDRESS	BRONX	Precinct	1009923.0	255465.0	4
364555	2015-01-01 00:20:33	Loud Music/Party	Street/Sidewalk	10031.0	508 WEST 139 STREET	WEST 139 STREET	AMSTERDAM AVENUE	HAMILTON PLACE	ADDRESS	NEW YORK	Precinct	997847.0	238629.0	4
364556	2015-01-01 02:42:22	No Access	Street/Sidewalk	10466.0	931 EAST 226 STREET	EAST 226 STREET	BRONXWOOD AVENUE	PAULDING AVENUE	ADDRESS	BRONX	Precinct	1024816.0	262237.0	4
364557	2015-01-01 02:47:50	No Access	Street/Sidewalk	11420.0	123-19 135 STREET	135 STREET	ROCKAWAY BOULEVARD	SUTTER AVENUE	ADDRESS	SOUTH OZONE PARK	Precinct	1038733.0	184971.0	4

364558 rows × 16 columns

In [11]:
```
df_service_requests['Facility Type'].unique()
```

Out[11]:
```
array(['Precinct', nan], dtype=object)
```

In [12]:
```
# dropping all columns that has no significance
df_service_requests.drop(['Incident Zip','Incident Address','Street Name','Cross Street 1',
                          'Cross Street 2','Address Type','Location'],axis=1,inplace=True)
```

In [13]:
```
# dropping all rows with missing dates as all of the date columns and others that have a very tiny percentage of missing values and provide
df_service_requests.dropna(subset=['Closed Date','Due Date','Resolution Action Updated Date','School Zip'],axis=0,inplace=True)
```

In [14]:
```
mode1=df_service_requests['Facility Type'].mode().values[0]
mode2=df_service_requests['Descriptor'].mode().values[0]
mode3=df_service_requests['Location Type'].mode().values[0]
mode4=df_service_requests['City'].mode().values[0]
print(mode1)
print(mode2)
print(mode3)
print(mode4)
```

```
Precinct
No Access
Street/Sidewalk
BROOKLYN
```

In [15]:
```
## Using some functions to impute rest of the missing values
df_service_requests['Facility Type'].fillna(mode1,inplace=True)
df_service_requests['Descriptor'].fillna(mode2,inplace=True)
df_service_requests['Location Type'].fillna(mode3,inplace=True)
df_service_requests['City'].fillna(mode4,inplace=True)
df_service_requests['X Coordinate (State Plane)'].fillna(df_service_requests['X Coordinate (State Plane)'].mean(),inplace=True)
df_service_requests['Y Coordinate (State Plane)'].fillna(df_service_requests['Y Coordinate (State Plane)'].mean(),inplace=True)
df_service_requests['Longitude'].fillna(df_service_requests['Longitude'].mean(),inplace=True)
df_service_requests['Latitude'].fillna(df_service_requests['Latitude'].mean(),inplace=True)
```

In [16]:
```
df_service_requests.isnull().sum()*100/len(df_service_requests)
```

Out[16]:
```
Unique Key                      0.0
Created Date                    0.0
Closed Date                     0.0
Agency                          0.0
Agency Name                     0.0
Complaint Type                  0.0
Descriptor                      0.0
Location Type                   0.0
City                            0.0
Facility Type                   0.0
Status                          0.0
Due Date                        0.0
Resolution Description          0.0
Resolution Action Updated Date  0.0
Community Board                 0.0
Borough                         0.0
X Coordinate (State Plane)      0.0
Y Coordinate (State Plane)      0.0
Park Facility Name              0.0
Park Borough                    0.0
School Name                     0.0
School Number                   0.0
School Region                   0.0
School Code                     0.0
School Phone Number             0.0
School Address                  0.0
School City                     0.0
School State                    0.0
School Zip                      0.0
School Not Found                0.0
Latitude                        0.0
Longitude                       0.0
dtype: float64
```

- Find the top 10 types of complaints

In [17]:
```
type_complaint = df_service_requests.groupby(['Complaint Type'],as_index=True).count()['Unique Key']
```

In [18]:
```
type_complaint.sort_values(ascending=False).head(10)
```

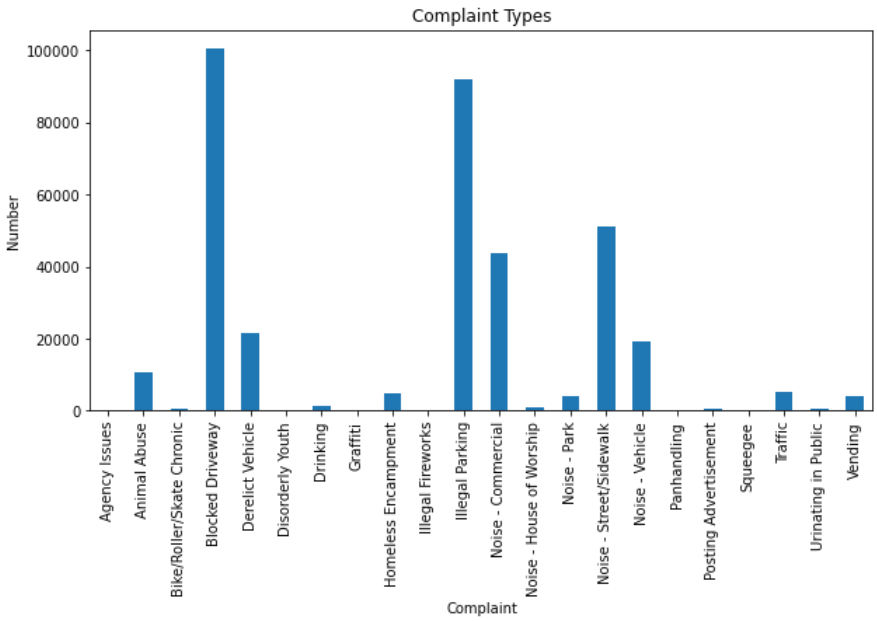
Out[18]:
```
Complaint Type
Blocked Driveway           100618
Illegal Parking             91705
Noise - Street/Sidewalk     51131
Noise - Commercial          43749
Derelict Vehicle            21516
Noise - Vehicle             19300
Animal Abuse                10530
Traffic                      5193
Homeless Encampment          4877
Vending                      4183
Name: Unique Key, dtype: int64
```

- Plot a bar graph of count vs. complaint types

In [19]:
```
import matplotlib.pyplot as plt
%matplotlib inline
```

In [20]:
```
type_complaint.plot(kind="bar",figsize=(10, 5))
plt.title("Complaint Types")
plt.xlabel("Complaint")
plt.ylabel("Number")
```

Out[20]:
```
Text(0, 0.5, 'Number')
```



- Display the types of complaints in each city in a separate dataset

In [21]:
```
complaint_each_city = df_service_requests.groupby(['City','Complaint Type'],as_index=False)['Unique Key'].count()
x = pd.DataFrame(complaint_each_city)
x
## x.loc[x['City'] == 'Astoria', 'Unique Key'].sum()
```

Out[21]:

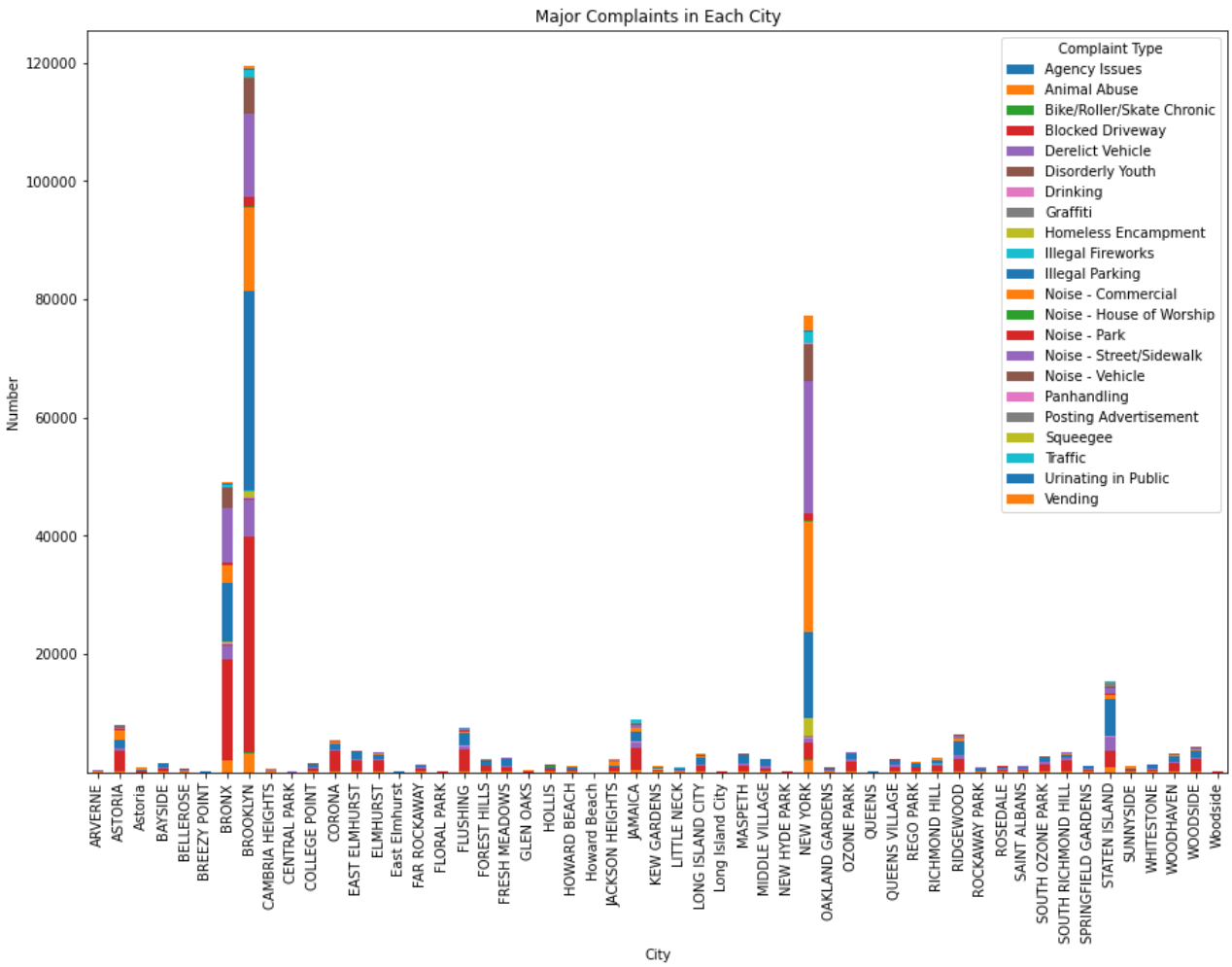
	City	Complaint Type	Unique Key
0	ARVERNE	Animal Abuse	46
1	ARVERNE	Blocked Driveway	50
2	ARVERNE	Derelict Vehicle	32
3	ARVERNE	Disorderly Youth	2
4	ARVERNE	Drinking	1
...	...	...	...
772	Woodside	Blocked Driveway	27
773	Woodside	Derelict Vehicle	8
774	Woodside	Illegal Parking	124
775	Woodside	Noise - Commercial	2
776	Woodside	Noise - Street/Sidewalk	5

777 rows × 3 columns

In [22]:
```
##y = df_service_requests.groupby(['City', 'Complaint Type']).size().unstack()
##y.to_excel('y.xlsx')
```

- Visualize the major types of complaints in each city

In [23]:
```
df_service_requests.groupby(['City', 'Complaint Type']).size().unstack().plot(kind='bar',
                                                                              title='Major Complaints in Each City',
                                                                              stacked=True,
                                                                              figsize=(15, 10),
                                                                              legend=True,
                                                                             xlabel='City',
                                                                             ylabel='Number')
plt.show()
plt.savefig("image.jpg")
```




```
<Figure size 432x288 with 0 Axes>
```

- Draw a frequency plot for city wise complaints

In [24]:
```
freq_plot = df_service_requests.groupby(['City'],as_index=True).count()['Complaint Type']
freq_plot = pd.DataFrame(freq_plot)
```

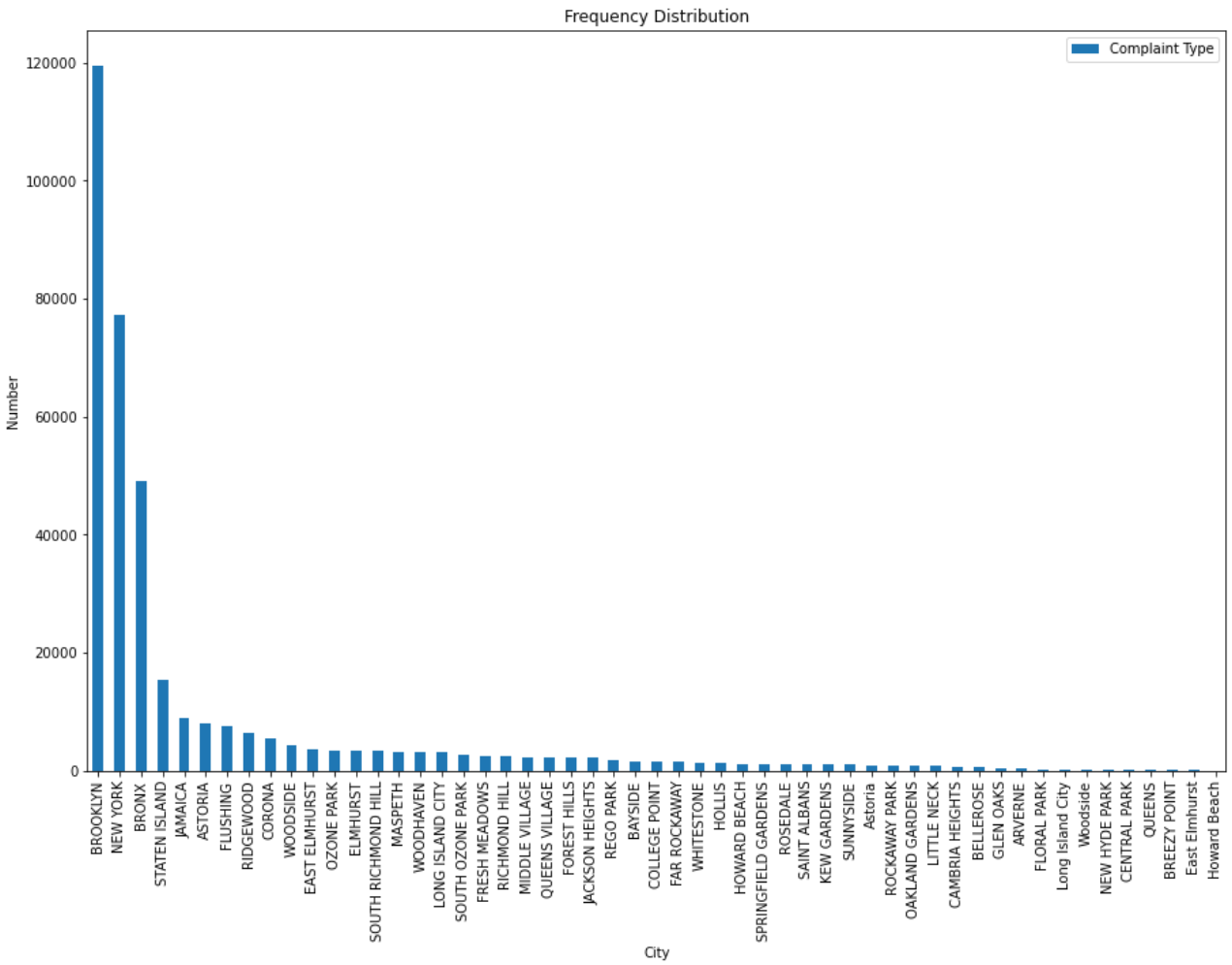
In [25]:
```
freq_plot_df = freq_plot['Complaint Type'].sort_values(ascending=False)
freq_plot_df = pd.DataFrame(freq_plot_df)
freq_plot_df.head()
```

Out[25]:

City	Complaint Type
BROOKLYN	119515
NEW YORK	77281
BRONX	49163
STATEN ISLAND	15332
JAMAICA	8921

In [26]:
```
freq_plot_df.plot.bar(title="Frequency Distribution",figsize=(15,10),xlabel='City',ylabel='Number')
```

Out[26]:
```
<AxesSubplot:title={'center':'Frequency Distribution'}, xlabel='City', ylabel='Number'>
```



In [27]:
```
df_service_requests.columns
```

Out[27]:
```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Agency Name',
       'Complaint Type', 'Descriptor', 'Location Type', 'City',
       '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 State', 'School Zip', 'School Not Found',
       'Latitude', 'Longitude'],
      dtype='object')
```

In [28]:
```
df_service_requests['Created Date'].unique()
```

Out[28]:
```
array(['12/31/2015 11:59:45 PM', '12/31/2015 11:59:44 PM',
       '12/31/2015 11:59:29 PM', ...,
       datetime.datetime(2015, 1, 1, 0, 1, 30),
       datetime.datetime(2015, 1, 1, 0, 1, 29),
       datetime.datetime(2015, 1, 1, 0, 0, 50)], dtype=object)
```

In [29]:
```
df_service_requests['Closed Date'] = pd.to_datetime(df_service_requests['Closed Date'])
print(df_service_requests['Closed Date'].dtypes)
```

```
datetime64[ns]
```

In [30]:
```
df_service_requests['Resolution Action Updated Date'] = pd.to_datetime(df_service_requests['Resolution Action Updated Date'])
print(df_service_requests['Resolution Action Updated Date'].dtypes)
```

```
datetime64[ns]
```

In [31]:
```
df_service_requests['Created Date'] = pd.to_datetime(df_service_requests['Created Date'])
print(df_service_requests['Created Date'].dtypes)
```

```
datetime64[ns]
```

In [32]:
```
##df_service_requests['Created Date'] = df_service_requests['Created Date'].dt.strftime('%m/%d/%Y')
##print(df_service_requests['Created Date'].dtypes)
```

In [33]:
```
print(df_service_requests['Created Date'].dtypes)
```

```
datetime64[ns]
```

In [34]:
```
print(df_service_requests['Closed Date'].dtypes)
```

```
datetime64[ns]
```

In [35]:
```
df_service_requests['Resolution Time'] = df_service_requests['Closed Date']-df_service_requests['Created Date']
```

In [36]:
```
df_service_requests['Resolution Time']
```

Out[36]:
```
0        0 days 00:55:30
1        0 days 01:27:13
2        0 days 04:51:34
3        0 days 07:45:27
4        0 days 03:27:44
              ...
364553   0 days 10:17:47
364554   0 days 02:20:34
364555   0 days 00:19:03
364556   0 days 02:40:53
364557   0 days 02:47:00
Name: Resolution Time, Length: 362137, dtype: timedelta64[ns]
```

In [37]:
```
df_service_requests.head(2)
```

Out[37]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	City	Facility Type	...	School Code	School Phone Number	School Address	Schoo City
0	32310363	2015-12-31 23:59:45	2016-01-01 00:55:15	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	NEW YORK	Precinct	...	Unspecified	Unspecified	Unspecified	Unspecifie
1	32309934	2015-12-31 23:59:44	2016-01-01 01:26:57	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	ASTORIA	Precinct	...	Unspecified	Unspecified	Unspecified	Unspecifie

2 rows × 33 columns

In [38]:
```
df_service_requests.groupby('Complaint Type')['Resolution Time'].mean()
## There are a couple of "Closed" which are in past of the "Created Date" and that is not making sense.
## That is why there are times in negative range
```

Out[38]:
```
Complaint Type
Agency Issues                 -19 days +17:04:49.125000
Animal Abuse                    0 days 07:53:56.658594491
Bike/Roller/Skate Chronic    -1 days +11:16:29.793684211
Blocked Driveway                0 days 06:29:16.258413007
Derelict Vehicle                0 days 10:54:30.989775051
Disorderly Youth             -4 days +03:07:46.606349207
Drinking                     -1 days +23:51:22.839031340
Graffiti                     -2 days +09:58:53.668789809
Homeless Encampment             0 days 13:41:33.729751896
Illegal Fireworks               0 days 02:31:48.831395348
Illegal Parking                 0 days 01:40:38.116820238
Noise - Commercial              0 days 07:20:36.659215067
Noise - House of Worship        0 days 08:18:36.929775280
Noise - Park                    0 days 14:32:14.188111545
Noise - Street/Sidewalk         0 days 12:00:39.265885666
Noise - Vehicle                 0 days 06:06:52.112279792
Panhandling                     1 days 12:53:45.858461538
Posting Advertisement           0 days 14:05:42.038348082
Squeegee                           0 days 04:02:40.250000
Traffic                      -1 days +22:05:46.513768535
Urinating in Public          -1 days +22:19:13.989079564
Vending                         0 days 08:18:40.433899115
Name: Resolution Time, dtype: timedelta64[ns]
```

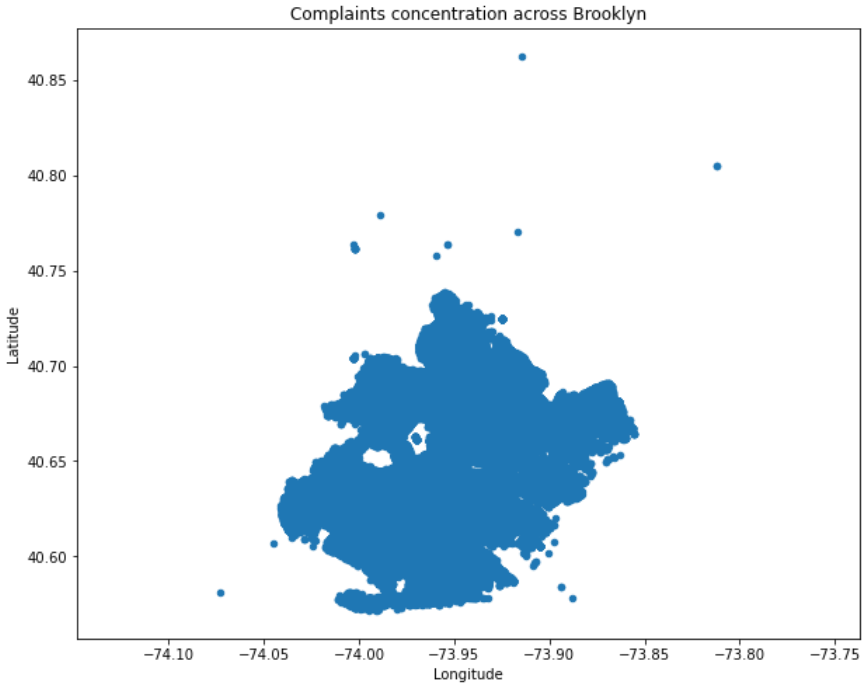
- Draw scatter and hexbin plots for complaint concentration across Brooklyn

In [39]:
```
Brooklyn_plot = df_service_requests.loc[df_service_requests['City']=='BROOKLYN']
```

In [40]:
```
Brooklyn_plot = pd.DataFrame(Brooklyn_plot)
```

In [41]:
```
Brooklyn_plot[['Longitude', 'Latitude']].plot(kind='scatter',
    x='Longitude', y='Latitude', figsize=(10,8),title = 'Complaints concentration across Brooklyn').axis('equal')
```

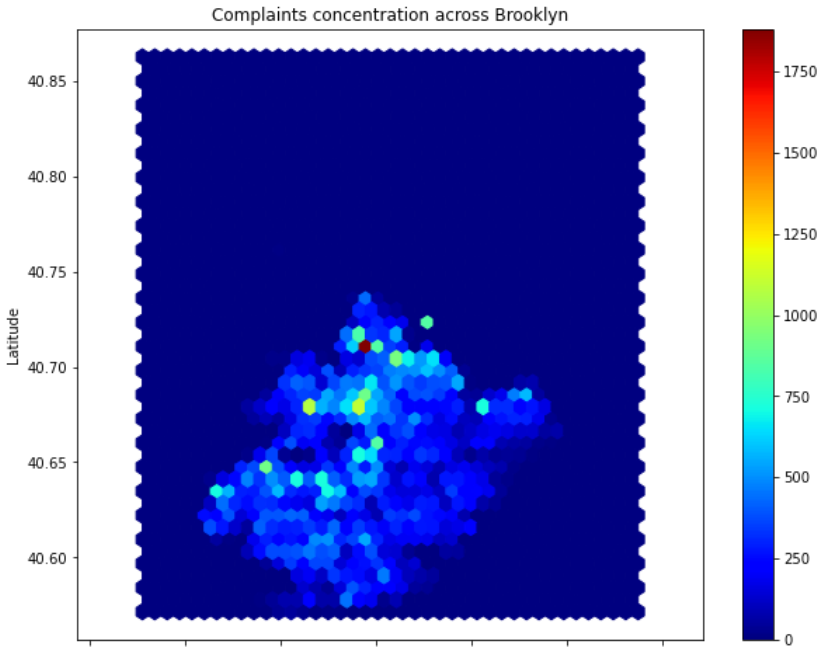
Out[41]:
```
(-74.08561051366016, -73.79949620418894, 40.55696164632341, 40.877267742292496)
```



In [42]:

```
Brooklyn_plot[['Longitude', 'Latitude']].plot(kind='hexbin',
    x='Longitude', y='Latitude', figsize=(10,8),gridsize=40,
    colormap = 'jet',title = 'Complaints concentration across Brooklyn').axis('equal')
```

Out[42]: (-74.08561051394626, -73.79949620390283, 40.55696164632341, 40.877267742292496)



In [ ]: