Author: Shivam Sharma

Problem objective:

Perform a service request data analysis of New York City 311 calls. You will focus on the data wrangling techniques to understand the pattern in the data and also visualize the major complaint types.

In [ ]:
```
### Importing necessary liberaries of python
```

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

Task 1: Importing the 311 NYC Service request dataset using pd.read_csv

In [2]:
```
data = pd.read_csv("311_Service_Requests_from_2010_to_Present.csv")
```

```
C:\Users\krish\anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3146: DtypeWarning: Columns (48,49) have mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [3]:
```
data.head(10)
```

Out[3]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Name	Bridge Highway Direction	Road Ramp	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	
0	32310363	12/31/2015 11:59:45 PM	01-01-16 0:55	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	71 VERMILYEA AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.865682	-73.923501	(40.865681 -73.923500
1	32309934	12/31/2015 11:59:44 PM	01-01-16 1:26	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	11105.0	27-07 23 AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.775945	-73.915094	(40.7759453 -73.915093
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	2897 VALENTINE AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.870325	-73.888525	(40.8703245 -73.888524
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Department	Illegal Parking	Commercial Overnight Parking	Street/Sidewalk	10461.0	2940 BAISLEY AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.835994	-73.828379	(40.835994 -73.828379
4	32306529	12/31/2015 11:56:58 PM	01-01-16 3:24	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	87-14 57 ROAD	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.733060	-73.874170	(40.7330596 -73.874169
5	32306554	12/31/2015 11:56:30 PM	01-01-16 1:50	NYPD	New York City Police Department	Illegal Parking	Posted Parking Sign Violation	Street/Sidewalk	11215.0	260 21 STREET	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.660823	-73.992568	(40.660822 -73.992567
6	32306559	12/31/2015 11:55:32 PM	01-01-16 1:53	NYPD	New York City Police Department	Illegal Parking	Blocked Hydrant	Street/Sidewalk	10032.0	524 WEST 169 STREET	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.840848	-73.937375	(40.8408475 -73.93737
7	32307009	12/31/2015 11:54:05 PM	01-01-16 1:42	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10457.0	501 EAST 171 STREET	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.837503	-73.902905	(40.837502 -73.902905
8	32308581	12/31/2015 11:53:58 PM	01-01-16 8:27	NYPD	New York City Police Department	Illegal Parking	Posted Parking Sign Violation	Street/Sidewalk	11415.0	83-44 LEFFERTS BOULEVARD	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.704977	-73.832605	(40.7049771 -73.83260
9	32308391	12/31/2015 11:53:58 PM	01-01-16 1:17	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	11219.0	1408 66 STREET	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.623793	-73.999539	(40.6237930 -73.999538

10 rows × 53 columns

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

Out[4]: (300698, 53)

There are 300698 rows and 53 columns

In [9]:
```
data.describe()
```

Out[9]:

	Unique Key	Incident Zip	X Coordinate (State Plane)	Y Coordinate (State Plane)	School or Citywide Complaint	Vehicle Type	Taxi Company Borough	Taxi Pick Up Location	Garage Lot Name	Latitude	Longitude
count	3.006980e+05	298083.000000	2.971580e+05	297158.000000	0.0	0.0	0.0	0.0	0.0	297158.000000	297158.000000
mean	3.130054e+07	10848.888645	1.004854e+06	203754.534416	NaN	NaN	NaN	NaN	NaN	40.725885	-73.925630
std	5.738547e+05	583.182081	2.175338e+04	29880.183529	NaN	NaN	NaN	NaN	NaN	0.082012	0.078454
min	3.027948e+07	83.000000	9.133570e+05	121219.000000	NaN	NaN	NaN	NaN	NaN	40.499135	-74.254937
25%	3.080118e+07	10310.000000	9.919752e+05	183343.000000	NaN	NaN	NaN	NaN	NaN	40.669796	-73.972142
50%	3.130436e+07	11208.000000	1.003158e+06	201110.500000	NaN	NaN	NaN	NaN	NaN	40.718661	-73.931781
75%	3.178446e+07	11238.000000	1.018372e+06	224125.250000	NaN	NaN	NaN	NaN	NaN	40.781840	-73.876805
max	3.231065e+07	11697.000000	1.067173e+06	271876.000000	NaN	NaN	NaN	NaN	NaN	40.912869	-73.700760

In [24]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 300697 entries, 0 to 300697
Data columns (total 53 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   Unique Key                      300697 non-null  int64
 1   Created Date                    300697 non-null  object
 2   Closed Date                     298533 non-null  object
 3   Agency                          300697 non-null  object
 4   Agency Name                     300697 non-null  object
 5   Complaint Type                  300697 non-null  object
 6   Descriptor                      294783 non-null  object
 7   Location Type                   300566 non-null  object
 8   Incident Zip                    298083 non-null  float64
 9   Incident Address                256288 non-null  object
 10  Street Name                     256288 non-null  object
 11  Cross Street 1                  251419 non-null  object
 12  Cross Street 2                  250919 non-null  object
 13  Intersection Street 1           43858 non-null   object
 14  Intersection Street 2           43362 non-null   object
 15  Address Type                    297883 non-null  object
 16  City                            298083 non-null  object
 17  Landmark                        349 non-null     object
 18  Facility Type                   298527 non-null  object
 19  Status                          300697 non-null  object
 20  Due Date                        300694 non-null  object
 21  Resolution Description          300697 non-null  object
 22  Resolution Action Updated Date  298510 non-null  object
 23  Community Board                 300697 non-null  object
 24  Borough                         300697 non-null  object
 25  X Coordinate (State Plane)      297158 non-null  float64
 26  Y Coordinate (State Plane)      297158 non-null  float64
 27  Park Facility Name              300697 non-null  object
 28  Park Borough                    300697 non-null  object
 29  School Name                     300697 non-null  object
 30  School Number                   300697 non-null  object
 31  School Region                   300697 non-null  object
 32  School Code                     300697 non-null  object
 33  School Phone Number             300697 non-null  object
 34  School Address                  300697 non-null  object
 35  School City                     300697 non-null  object
 36  School State                    300697 non-null  object
 37  School Zip                      300697 non-null  object
 38  School Not Found                300697 non-null  object
 39  School or Citywide Complaint    0 non-null       float64
 40  Vehicle Type                    0 non-null       float64
 41  Taxi Company Borough            0 non-null       float64
 42  Taxi Pick Up Location           0 non-null       float64
 43  Bridge Highway Name             243 non-null     object
 44  Bridge Highway Direction        243 non-null     object
 45  Road Ramp                       213 non-null     object
 46  Bridge Highway Segment          213 non-null     object
 47  Garage Lot Name                 0 non-null       float64
 48  Ferry Direction                 1 non-null       object
 49  Ferry Terminal Name             2 non-null       object
 50  Latitude                        297158 non-null  float64
 51  Longitude                       297158 non-null  float64
 52  Location                        297158 non-null  object
dtypes: float64(10), int64(1), object(42)
memory usage: 123.9+ MB
```

In [12]:
```
data.columns
```

Out[12]:
```
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 [13]:
```
data.isnull().sum()
```

Out[13]:
```
Unique Key                             0
Created Date                           0
Closed Date                         2164
Agency                                 0
Agency Name                            0
Complaint Type                         0
Descriptor                          5914
Location Type                        131
Incident Zip                        2615
Incident Address                   44410
Street Name                        44410
Cross Street 1                     49279
Cross Street 2                     49779
Intersection Street 1             256840
Intersection Street 2             257336
Address Type                        2815
City                                2614
Landmark                          300349
Facility Type                       2171
Status                                 0
Due Date                               3
Resolution Description                 0
Resolution Action Updated Date      2187
Community Board                        0
Borough                                0
X Coordinate (State Plane)          3540
Y Coordinate (State Plane)          3540
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      300698
Vehicle Type                      300698
Taxi Company Borough              300698
Taxi Pick Up Location             300698
Bridge Highway Name               300455
Bridge Highway Direction          300455
Road Ramp                         300485
Bridge Highway Segment            300485
Garage Lot Name                   300698
Ferry Direction                   300697
Ferry Terminal Name               300696
Latitude                            3540
Longitude                           3540
Location                            3540
dtype: int64
```

In [16]:
```
data['Complaint Type'].unique()
```

Out[16]:
```
array(['Noise - Street/Sidewalk', 'Blocked Driveway', 'Illegal Parking',
       'Derelict Vehicle', 'Noise - Commercial',
       'Noise - House of Worship', 'Posting Advertisement',
       'Noise - Vehicle', 'Animal Abuse', 'Vending', 'Traffic',
       'Drinking', 'Bike/Roller/Skate Chronic', 'Panhandling',
       'Noise - Park', 'Homeless Encampment', 'Urinating in Public',
       'Graffiti', 'Disorderly Youth', 'Illegal Fireworks',
       'Ferry Complaint', 'Agency Issues', 'Squeegee', 'Animal in a Park'],
      dtype=object)
```

In [18]:
```
data[data['Complaint Type']=='Animal in a Park']
```

Out[18]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Name	Bridge Highway Direction	Road Ramp	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	Location
283132	30427220	04/18/2015 09:44:55 AM	05-02-15 10:35	NYPD	New York City Police Department	Animal in a Park	Animal Waste	Park	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

1 rows × 53 columns

In [21]:
```
data.drop(labels=283132, axis=0, inplace=True)
```

In [22]:
```
data.shape
```

Out[22]: (300697, 53)

Earlier it was 300698 rows and 53 columns and after droping one row, now it is 300697 rows and 53 columns.

Task 2: Read or convert the columnss 'Creatted date and Closed date' to datetime datatype and create a new column 'Request_Closing_Time' as the the time elapsed between request creation and request closing.

In [26]:
```
data['Created Date']= pd.to_datetime(data['Created Date'])
data['Closed Date']= pd.to_datetime(data['Closed Date'])
```

In [27]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 300697 entries, 0 to 300697
Data columns (total 53 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   Unique Key                      300697 non-null  int64
 1   Created Date                    300697 non-null  datetime64[ns]
 2   Closed Date                     298533 non-null  datetime64[ns]
 3   Agency                          300697 non-null  object
 4   Agency Name                     300697 non-null  object
 5   Complaint Type                  300697 non-null  object
 6   Descriptor                      294783 non-null  object
 7   Location Type                   300566 non-null  object
 8   Incident Zip                    298083 non-null  float64
 9   Incident Address                256288 non-null  object
 10  Street Name                     256288 non-null  object
 11  Cross Street 1                  251419 non-null  object
 12  Cross Street 2                  250919 non-null  object
 13  Intersection Street 1           43858 non-null   object
 14  Intersection Street 2           43362 non-null   object
 15  Address Type                    297883 non-null  object
 16  City                            298083 non-null  object
 17  Landmark                        349 non-null     object
 18  Facility Type                   298527 non-null  object
 19  Status                          300697 non-null  object
 20  Due Date                        300694 non-null  object
 21  Resolution Description          300697 non-null  object
 22  Resolution Action Updated Date  298510 non-null  object
 23  Community Board                 300697 non-null  object
 24  Borough                         300697 non-null  object
 25  X Coordinate (State Plane)      297158 non-null  float64
 26  Y Coordinate (State Plane)      297158 non-null  float64
 27  Park Facility Name              300697 non-null  object
 28  Park Borough                    300697 non-null  object
 29  School Name                     300697 non-null  object
 30  School Number                   300697 non-null  object
 31  School Region                   300697 non-null  object
 32  School Code                     300697 non-null  object
 33  School Phone Number             300697 non-null  object
 34  School Address                  300697 non-null  object
 35  School City                     300697 non-null  object
 36  School State                    300697 non-null  object
 37  School Zip                      300697 non-null  object
 38  School Not Found                300697 non-null  object
 39  School or Citywide Complaint    0 non-null       float64
 40  Vehicle Type                    0 non-null       float64
 41  Taxi Company Borough            0 non-null       float64
 42  Taxi Pick Up Location           0 non-null       float64
 43  Bridge Highway Name             243 non-null     object
 44  Bridge Highway Direction        243 non-null     object
 45  Road Ramp                       213 non-null     object
 46  Bridge Highway Segment          213 non-null     object
 47  Garage Lot Name                 0 non-null       float64
 48  Ferry Direction                 1 non-null       object
 49  Ferry Terminal Name             2 non-null       object
 50  Latitude                        297158 non-null  float64
 51  Longitude                       297158 non-null  float64
 52  Location                        297158 non-null  object
dtypes: datetime64[ns](2), float64(10), int64(1), object(40)
memory usage: 123.9+ MB
```

As you can see, data number 1 and 2 i.e. created date and closed date,earlier it was object type and now they are of datetime datatype.

In [30]:
```
##Creating a new column Request_closing_time
data['Request_Closing_Time'] = data['Closed Date'].values - data['Created Date'].values
```

In [31]:
```
data['Request_Closing_Time_mins'] = data['Request_Closing_Time']/np.timedelta64(1,'m')
```

In [32]:
```
data.head()
```

Out[32]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	Location	request_Closing_Tin
0	32310363	2015-12-31 23:59:45	2016-01-01 00:55:00	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	71 VERMILYEA AVENUE	...	NaN	NaN	NaN	NaN	40.865682	-73.923501	(40.86568153633767, -73.92350095571744)	0 days 00:55:
1	32309934	2015-12-31 23:59:44	2016-01-01 01:26:00	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	11105.0	27-07 23 AVENUE	...	NaN	NaN	NaN	NaN	40.775945	-73.915094	(40.775945312321085, -73.91509393898605)	0 days 01:26:
2	32309159	2015-12-31 23:59:29	2016-01-01 04:51:00	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	2897 VALENTINE AVENUE	...	NaN	NaN	NaN	NaN	40.870325	-73.888525	(40.870324522111424, -73.88852464418646)	0 days 04:51:
3	32305098	2015-12-31 23:57:46	2016-01-01 07:43:00	NYPD	New York City Police Department	Illegal Parking	Commercial Overnight Parking	Street/Sidewalk	10461.0	2940 BAISLEY AVENUE	...	NaN	NaN	NaN	NaN	40.835994	-73.828379	(40.83599404683083, -73.82837939584206)	0 days 07:45:
4	32306529	2015-12-31 23:56:58	2016-01-01 03:24:00	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	87-14 57 ROAD	...	NaN	NaN	NaN	NaN	40.733060	-73.874170	(40.733059618956815, -73.87416975810375)	0 days 03:27:

5 rows × 56 columns

In [34]:
```
data.shape
```

Out[34]: (300697, 56)

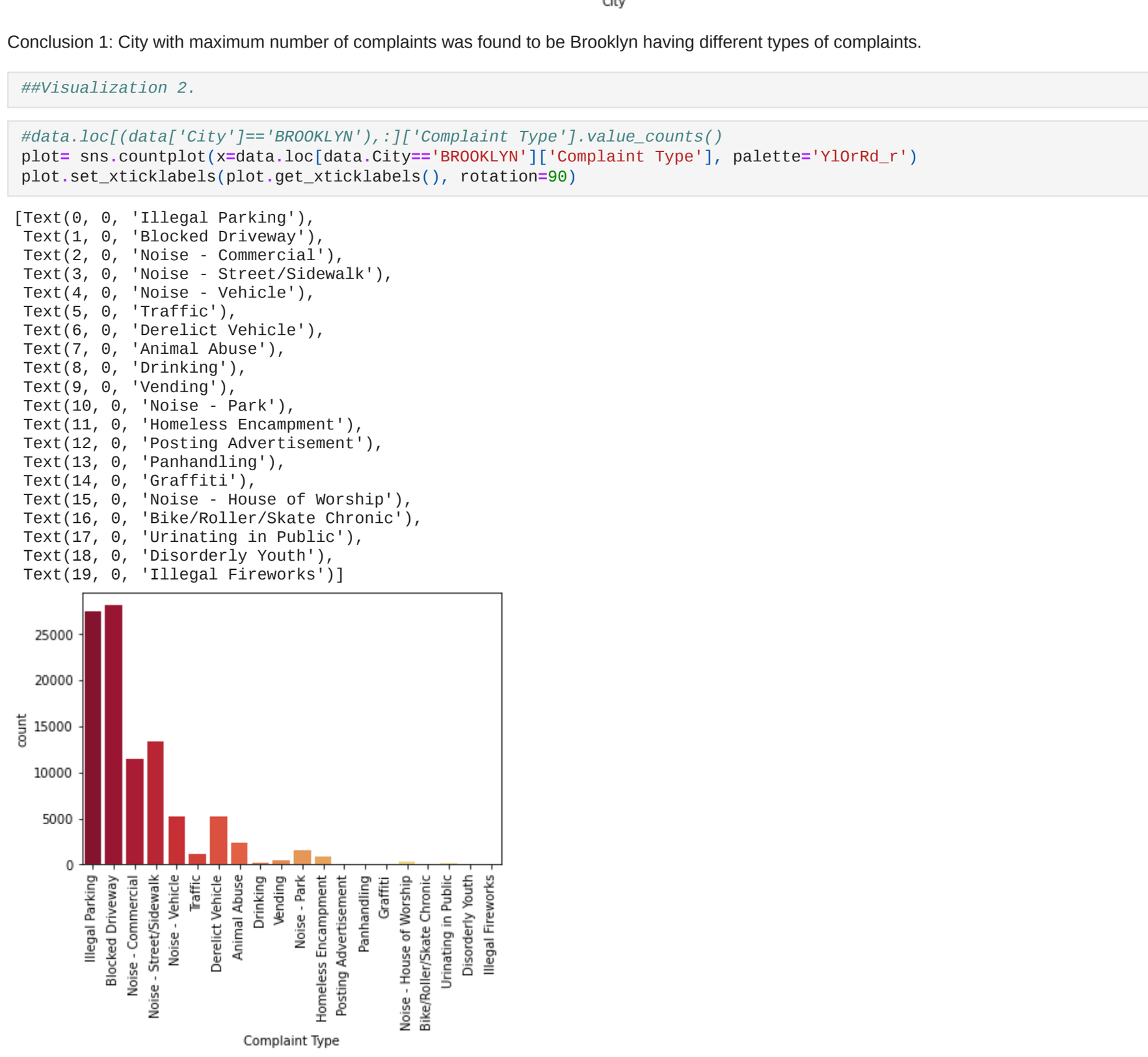
As you can see here.earlier their is 300697 rows and 53 columns and now it is 300697 rows and 56 columns after adding Request_Closing_Time and Request_Closing_mins.

Task 3: Provide major insights/patterns that you can offer in a visual format (graphs or tables)at least 4 major conclusions that you can come up with after generic data mining.

In [40]:
```
##Visualizing the dataset with suitable graphs.
## Visualization 1.
```

In [36]:
```
data_1 = data.groupby(['City','Complaint Type']).size().unstack().fillna(0)
```

In [39]:
```
data_1.plot.bar(figsize=(15,10), stacked=True)
plt.title("Number of complaints in different cities")
plt.xlabel('City')
plt.ylabel('Number of Complains')
plt.show()
```

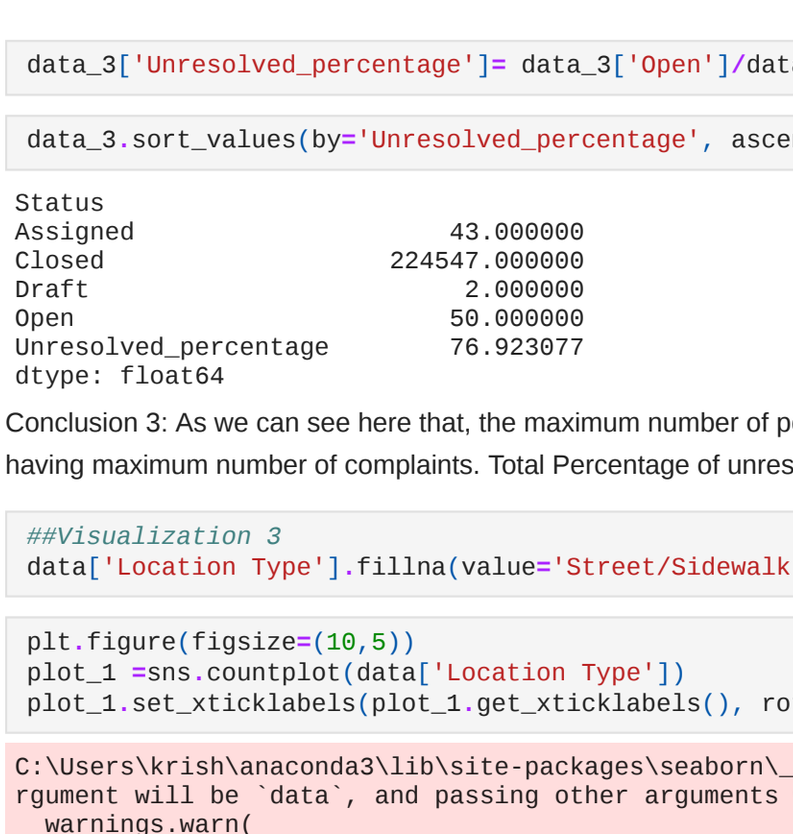


Conclusion 1: City with maximum number of complaints was found to be Brooklyn having different types of complaints.

In [41]:
```
##Visualization 2.
```

In [48]:
```
#data.loc[(data['City']=='BROOKLYN'),:]['Complaint Type'].value_counts()
plot= sns.countplot(x=data.loc[data.City=='BROOKLYN']['Complaint Type'], palette='YlOrRd_r')
plot.set_xticklabels(plot.get_xticklabels(), rotation=90)
```

Out[48]:
```
[Text(0, 0, 'Illegal Parking'),
 Text(1, 0, 'Blocked Driveway'),
 Text(2, 0, 'Noise - Commercial'),
 Text(3, 0, 'Noise - Street/Sidewalk'),
 Text(4, 0, 'Noise - Vehicle'),
 Text(5, 0, 'Traffic'),
 Text(6, 0, 'Derelict Vehicle'),
 Text(7, 0, 'Animal Abuse'),
 Text(8, 0, 'Drinking'),
 Text(9, 0, 'Vending'),
 Text(10, 0, 'Noise - Park'),
 Text(11, 0, 'Homeless Encampment'),
 Text(12, 0, 'Posting Advertisement'),
 Text(13, 0, 'Panhandling'),
 Text(14, 0, 'Graffiti'),
 Text(15, 0, 'Noise - House of Worship'),
 Text(16, 0, 'Bike/Roller/Skate Chronic'),
 Text(17, 0, 'Urinating in Public'),
 Text(18, 0, 'Disorderly Youth'),
 Text(19, 0, 'Illegal Fireworks')]
```



Conclusion 2: As we can see here that,Blocked Driveway is the most lodged complaints followed by Illegal Parking.

In [61]:
```
##Checking the status of Cases in the top five cities.
data_3=data.groupby(['City','Status']).size().unstack().fillna(0)
```

In [58]:
```
data_3.sort_values(by='Open', ascending=False).head()
```

Out[58]:

Status	Assigned	Closed	Draft	Open	Unresolved_percentage
City					
NEW YORK	15.0	65961.0	0.0	18.0	27.692308
BROOKLYN	19.0	98275.0	1.0	12.0	18.461538
JAMAICA	1.0	7286.0	0.0	9.0	13.846154
STATEN ISLAND	2.0	12335.0	0.0	6.0	9.230769
BRONX	6.0	40690.0	1.0	5.0	7.692308

In [59]:
```
data_3['Unresolved_percentage']= data_3['Open']/data_3['Open'].sum()*100
```

In [60]:
```
data_3.sort_values(by='Unresolved_percentage', ascending=False).head().sum()
```

Out[60]:
```
Status
Assigned                     43.000000
Closed                   224547.000000
Draft                         2.000000
Open                         50.000000
Unresolved_percentage        76.923077
dtype: float64
```

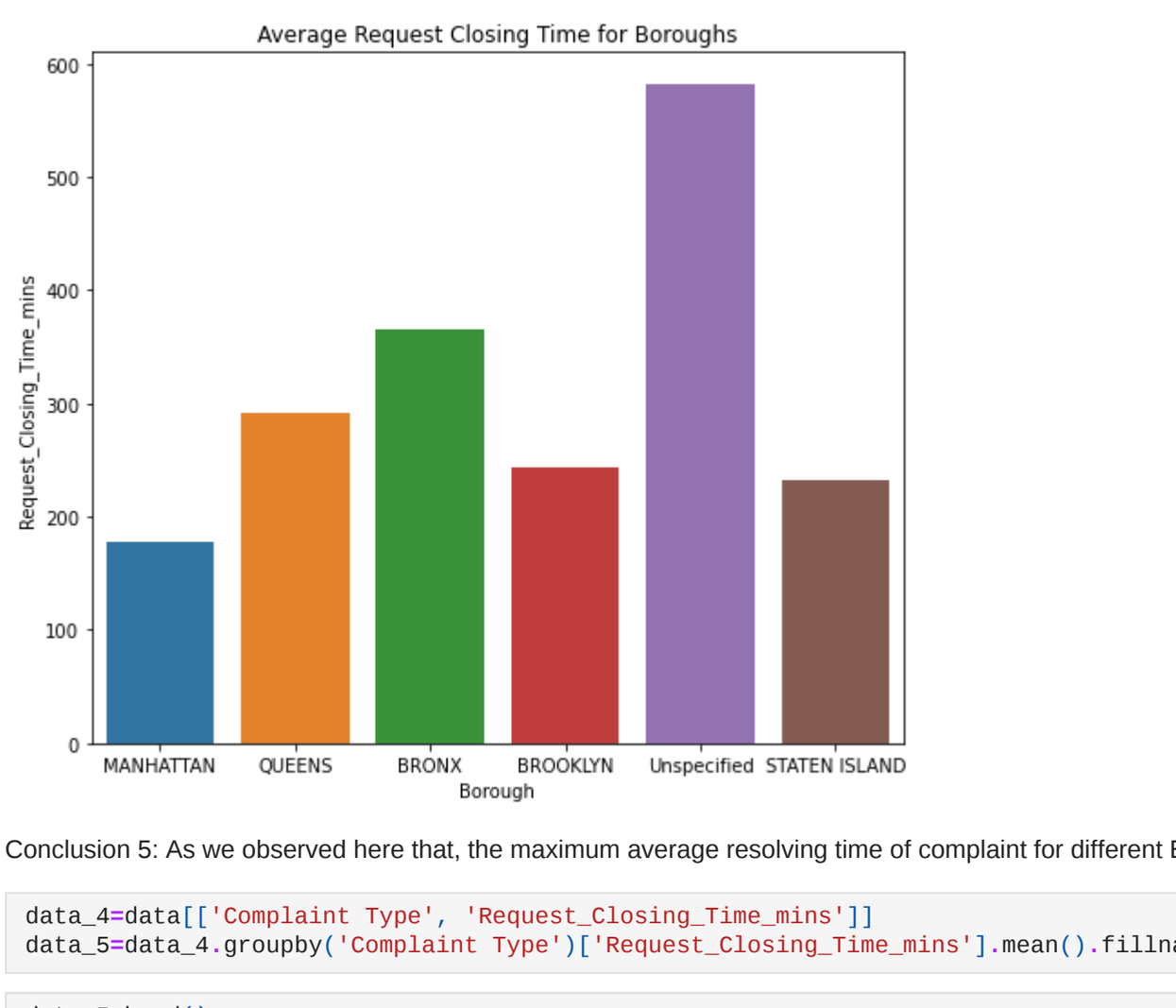
Conclusion 3: As we can see here that, the maximum number of pending cases were found in New York. Maximum Number of complaints has been resolved and the maximum unresolved cases were found in the top 5 cities having maximum number of complaints. Total Percentage of unresolved cases is found to be 79.92.

In [68]:
```
##Visualization 3
data['Location Type'].fillna(value='Street/Sidewalk',inplace=True)
```

In [71]:
```
plt.figure(figsize=(10,5))
plot_1 =sns.countplot(data['Location Type'])
plot_1.set_xticklabels(plot_1.get_xticklabels(), rotation=90)
```

```
C:\Users\krish\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[71]:
```
[Text(0, 0, 'Street/Sidewalk'),
 Text(1, 0, 'Club/Bar/Restaurant'),
 Text(2, 0, 'Store/Commercial'),
 Text(3, 0, 'House of Worship'),
 Text(4, 0, 'Residential Building/House'),
 Text(5, 0, 'Residential Building'),
 Text(6, 0, 'Park/Playground'),
 Text(7, 0, 'Vacant Lot'),
 Text(8, 0, 'House and Store'),
 Text(9, 0, 'Highway'),
 Text(10, 0, 'Commercial'),
 Text(11, 0, 'Roadway Tunnel'),
 Text(12, 0, 'Subway Station'),
 Text(13, 0, 'Parking Lot'),
 Text(14, 0, 'Bridge'),
 Text(15, 0, 'Terminal'),
 Text(16, 0, 'Ferry')]
```

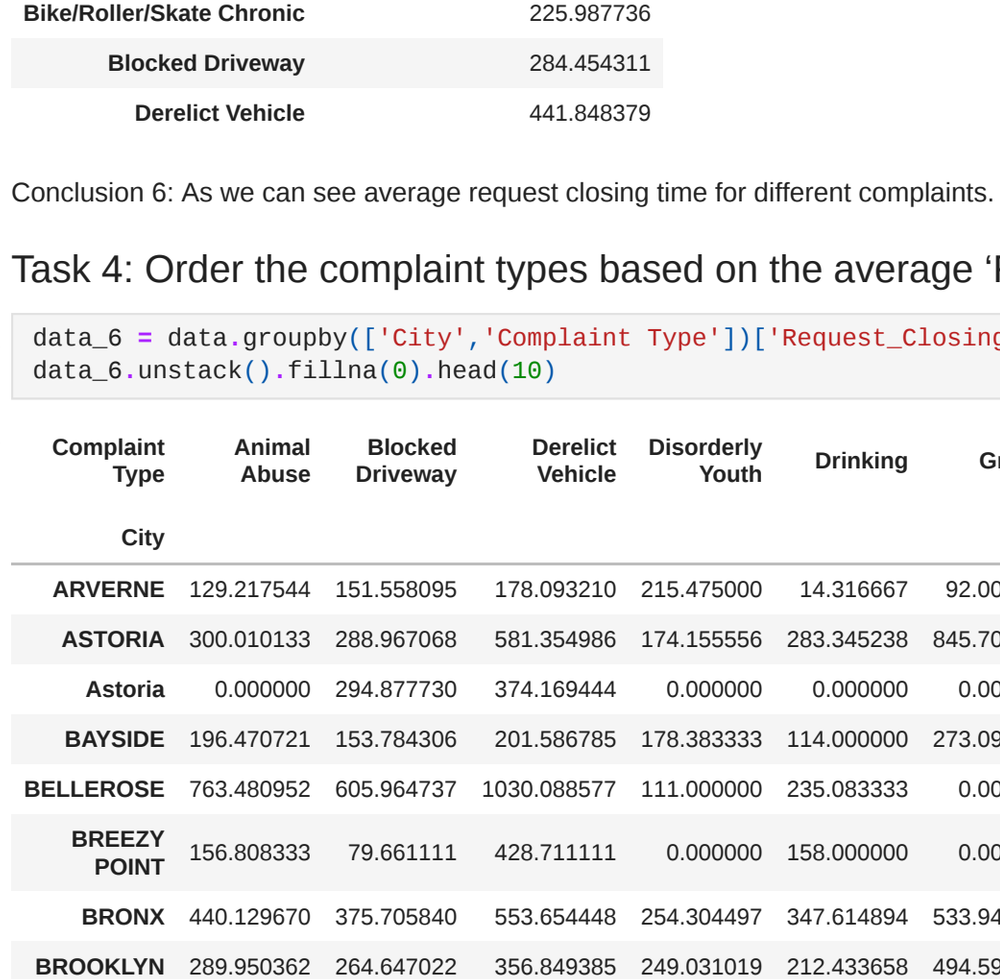


Conclusion 4: The maximum cases were realted to Street/Sideway and it can be resolved if the traffic police strictly look into this matter.

In [93]:
```
##Visualization 4
```

In [97]:
```
plt.figure(figsize=(8,7))
sns.barplot(x='Borough', y='Request_Closing_Time_mins', data=data,ci=0)
plt.title('Average Request Closing Time for Boroughs')
```

Out[97]: Text(0.5, 1.0, 'Average Request Closing Time for Boroughs')



Conclusion 5: As we observed here that, the maximum average resolving time of complaint for different Boroughs was found in Unspecified location.

In [95]:
```
data_4=data[['Complaint Type', 'Request_Closing_Time_mins']]
data_5=data_4.groupby('Complaint Type')['Request_Closing_Time_mins'].mean().fillna(0).to_frame()
```

In [96]:
```
data_5.head()
```

Out[96]:

	Request_Closing_Time_mins
Complaint Type	
Agency Issues	315.619444
Animal Abuse	312.794630
Bike/Roller/Skate Chronic	225.987736
Blocked Driveway	284.454311
Derelict Vehicle	441.848379

Conclusion 6: As we can see average request closing time for different complaints.

Task 4: Order the complaint types based on the average ‘Request_Closing_Time’, grouping them for different locations

In [100…
```
data_6 = data.groupby(['City','Complaint Type'])['Request_Closing_Time_mins'].mean()
data_6.unstack().fillna(0).head(10)
```

Out[100…

Complaint Type	Animal Abuse	Blocked Driveway	Derelict Vehicle	Disorderly Youth	Drinking	Graffiti	Homeless Encampment	Illegal Parking	Noise - Commercial	Noise - House of Worship	...	Noise - Street/Sidewalk	Noise - Vehicle	Panhandling	Urinating in Public	Vending	Bike/Roller/Skate Chronic
City																	
ARVERNE	129.217544	151.558095	178.093210	215.475000	14.316667	92.000000	108.887500	138.981897	137.233333	93.731818	...	119.543678	111.592857	62.000000	41.516667	29.000000	0.000000
ASTORIA	300.010133	288.967068	581.354986	174.155556	283.345238	845.704167	295.055208	290.003464	187.981748	121.333333	...	207.069819	210.550572	69.000000	277.542593	296.125000	104.358889
Astoria	0.000000	294.877730	374.169444	0.000000	0.000000	0.000000	0.000000	282.677387	212.513410	0.000000	...	222.793860	0.000000	0.000000	0.000000	0.000000	0.000000
BAYSIDE	196.470721	153.784306	201.586785	178.383333	114.000000	273.094444	172.533333	153.760019	134.020000	212.091667	...	91.860000	102.505208	0.000000	0.000000	112.675000	0.000000
BELLEROSE	763.480952	605.964737	1030.088577	111.000000	235.083333	0.000000	2348.000000	492.187579	404.446396	131.816667	...	544.093590	154.990000	449.000000	452.483333	0.000000	294.000000
BREEZY POINT	156.808333	79.661111	428.711111	0.000000	158.000000	0.000000	0.000000	236.533333	152.370833	0.000000	...	60.000000	79.466667	0.000000	0.000000	0.000000	0.000000
BRONX	440.129670	375.705840	553.654448	254.304497	347.614894	533.942593	446.514035	394.850575	281.841054	273.572785	...	313.578511	333.647576	852.823684	323.406209	409.541821	207.538333
BROOKLYN	289.950362	264.647022	356.849385	249.031019	212.433658	494.592248	281.689187	256.334473	179.165509	184.191618	...	197.760122	197.006591	258.988776	233.958824	271.686278	300.282282
CAMBRIA HEIGHTS	681.350000	461.758730	966.646667	0.000000	0.000000	0.000000	1367.366667	674.606140	228.601389	158.458333	...	276.482667	415.025541	0.000000	0.000000	0.000000	0.000000
CENTRAL PARK	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	275.658333	0.000000	0.000000	...	196.016491	0.000000	0.000000	0.000000	0.000000	0.000000

10 rows × 21 columns

Task 5:Perform a statistical test for the following:Please note: For the below statements you need to state the Null and Alternate and then provide a statistical test to accept or reject the Null Hypothesis along with the corresponding ‘p-value’.

- Whether the average response time across complaint types is similar or not (overall)
- Are the type of complaint or service requested and location related?

1)ANOVA Analysis (Checking for top 5 complaints)

- Null Hypothesis: The average response time across complaint types is not similar.
- Alternate Hypothesis: The average response time across complaint types is similar.

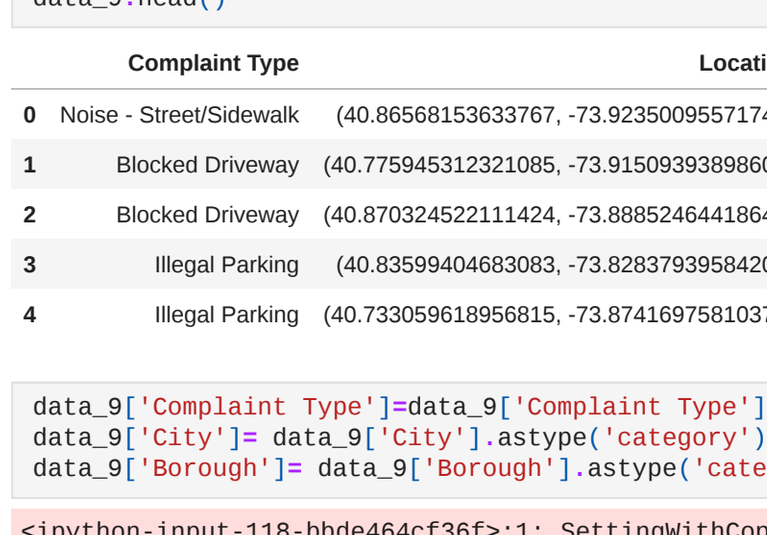
In [110…
```
from scipy.stats import f_oneway
stat,p = f_oneway(dataset['Noise - Street/Sidewalk'], dataset['Blocked Driveway'], dataset['Illegal Parking'], dataset['Derelict Vehicle'],
              dataset['Noise - Commercial'])

alpha=0.05
if p>0.05:
    print('Null Hypothesis is accepted')
else:
    print('Null hypothesis is rejected')
```

```
Null hypothesis is rejected
```

So, We can say that average response time across complaint types are similar.

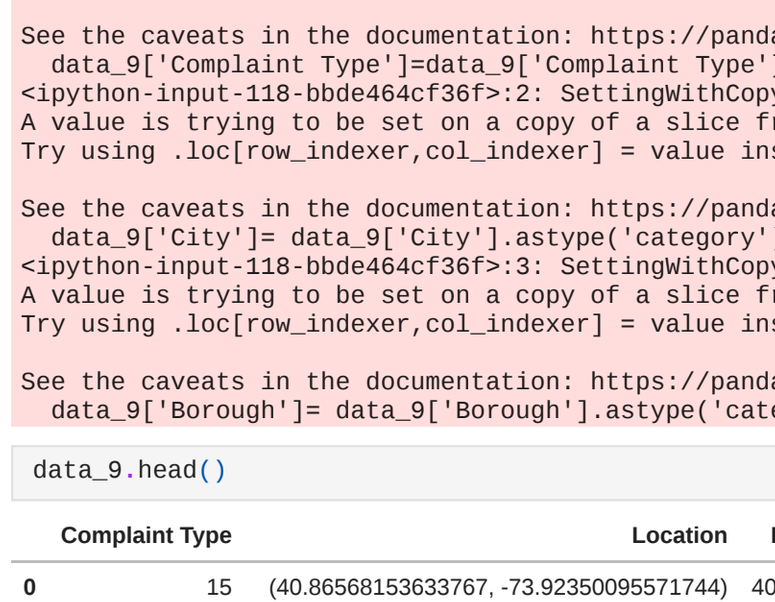
In [113…
```
data_7= data[data['Complaint Type']== 'Blocked Driveway']['Request_Closing_Time_mins']
data_7.hist(range=(0,1500))
```

Out[113…: <AxesSubplot:>



In [114…
```
data_8= data[data['Complaint Type']== 'Noise - Street/Sidewalk']['Request_Closing_Time_mins']
data_8.hist(range=(0,1500))
```

Out[114…: <AxesSubplot:>



From the given histogram, we can see that, the average responsise time for across complaints types are similar.

2)Are the type of complaint or service requested and location related?

In [115…
```
data_9= data[['Complaint Type','Location','Latitude','Longitude','City','Borough']]
data_9.head()
```

Out[115…

	Complaint Type	Location	Latitude	Longitude	City	Borough
0	Noise - Street/Sidewalk	(40.86568153633767, -73.92350095571744)	40.865682	-73.923501	NEW YORK	MANHATTAN
1	Blocked Driveway	(40.775945312321085, -73.91509393898605)	40.775945	-73.915094	ASTORIA	QUEENS
2	Blocked Driveway	(40.870324522111424, -73.88852464418646)	40.870325	-73.888525	BRONX	BRONX
3	Illegal Parking	(40.83599404683083, -73.82837939584206)	40.835994	-73.828379	BRONX	BRONX
4	Illegal Parking	(40.733059618956815, -73.87416975810375)	40.733060	-73.874170	ELMHURST	QUEENS

In [118…
```
data_9['Complaint Type']=data_9['Complaint Type'].astype('category').cat.codes
data_9['City']= data_9['City'].astype('category').cat.codes
data_9['Borough']= data_9['Borough'].astype('category').cat.codes
```

```
<ipython-input-118-bbde464cf36f>:1: 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: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_9['Complaint Type']=data_9['Complaint Type'].astype('category').cat.codes
<ipython-input-118-bbde464cf36f>:2: 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: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_9['City']= data_9['City'].astype('category').cat.codes
<ipython-input-118-bbde464cf36f>: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: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_9['Borough']= data_9['Borough'].astype('category').cat.codes
```

In [120…
```
data_9.head()
```

Out[120…

	Complaint Type	Location	Latitude	Longitude	City	Borough
0	15	(40.86568153633767, -73.92350095571744)	40.865682	-73.923501	33	2
1	3	(40.775945312321085, -73.91509393898605)	40.775945	-73.915094	1	3
2	3	(40.870324522111424, -73.88852464418646)	40.870325	-73.888525	6	0
3	11	(40.83599404683083, -73.82837939584206)	40.835994	-73.828379	6	0
4	11	(40.733059618956815, -73.87416975810375)	40.733060	-73.874170	13	3

In [122…
```
data_9.corr(method='pearson')
```

Out[122…

	Complaint Type	Latitude	Longitude	City	Borough
Complaint Type	1.000000	0.151318	-0.185947	0.092497	-0.058457
Latitude	0.151318	1.000000	0.364966	-0.000571	-0.249501
Longitude	-0.185947	0.364966	1.000000	-0.123933	0.021277
City	0.092497	-0.000571	-0.123933	1.000000	0.654636
Borough	-0.058457	-0.249501	0.021277	0.654636	1.000000

As we can see here from the first line of table that, complaint type is not dependent upon location.

Summary

From the give analysis we have found out some of the conclusions:

- Conclusion 1: City with maximum number of complaints was found to be Brooklyn having different types of complaints.
- Conclusion 2: As we can see here that,Blocked Driveway is the most lodged complaints followed by Illegal Parking.
- Conclusion 3: As we can see here that, the maximum number of pending cases were found in New York.Maximum Number of complaints has been resolved and the maximum unresolved cases were found in the top 5 cities having maximum number of complaints.Total Percentage of unresolved cases is found to be 79.92.
- Conclusion 4: The maximum cases were realted to Street/Sideway and it can be resolved if the traffic police strictly look into this matter.
- Conclusion 5: As we observed here that, the maximum average resolving time of complaint for different Boroughs was found in Unspecified location.

Result of Statistical testing:

- We can say that average response time across complaint types are similar.
- Complaints types are not dependent on location or we can say that types of complaints or services requested and location is not realted.

In [ ]: