

# Project 2 - Customer Service Request Analysis - Sachin Agarwal

September 25, 2022

## 0.0.1 Project 2 - Customer Service Request Analysis

```
[1]: import numpy as np
import pandas as pd
```

```
[2]: # Reading the CSV file
nyc = pd.read_csv('C:\\Sachin new\\Simplilearn\\Course 2 - Applied DS with Python\\Project 2\\311_Service_Requests_from_2010_to_Present.csv')
```

C:\Users\14sac\AppData\Local\Temp\ipykernel\_24544\3510675285.py:2: DtypeWarning: Columns (48,49) have mixed types. Specify dtype option on import or set low\_memory=False.

```
nyc = pd.read_csv('C:\\Sachin new\\Simplilearn\\Course 2 - Applied DS with Python\\Project 2\\311_Service_Requests_from_2010_to_Present.csv')
```

```
[3]: nyc.head()
```

```
[3]:
```

|   | Unique Key | Created Date           | Closed Date            | Agency | \ |
|---|------------|------------------------|------------------------|--------|---|
| 0 | 32310363   | 12/31/2015 11:59:45 PM | 01/01/2016 12:55:15 AM | NYPD   |   |
| 1 | 32309934   | 12/31/2015 11:59:44 PM | 01/01/2016 01:26:57 AM | NYPD   |   |
| 2 | 32309159   | 12/31/2015 11:59:29 PM | 01/01/2016 04:51:03 AM | NYPD   |   |
| 3 | 32305098   | 12/31/2015 11:57:46 PM | 01/01/2016 07:43:13 AM | NYPD   |   |
| 4 | 32306529   | 12/31/2015 11:56:58 PM | 01/01/2016 03:24:42 AM | NYPD   |   |

|   | Agency Name                     | Complaint Type          | \ |
|---|---------------------------------|-------------------------|---|
| 0 | New York City Police Department | Noise - Street/Sidewalk |   |
| 1 | New York City Police Department | Blocked Driveway        |   |
| 2 | New York City Police Department | Blocked Driveway        |   |
| 3 | New York City Police Department | Illegal Parking         |   |
| 4 | New York City Police Department | Illegal Parking         |   |

|   | Descriptor                   | Location Type   | Incident Zip | \ |
|---|------------------------------|-----------------|--------------|---|
| 0 | Loud Music/Party             | Street/Sidewalk | 10034.0      |   |
| 1 | No Access                    | Street/Sidewalk | 11105.0      |   |
| 2 | No Access                    | Street/Sidewalk | 10458.0      |   |
| 3 | Commercial Overnight Parking | Street/Sidewalk | 10461.0      |   |
| 4 | Blocked Sidewalk             | Street/Sidewalk | 11373.0      |   |

| Incident Address | ... | Bridge Highway Name | Bridge Highway Direction | \ |
|------------------|-----|---------------------|--------------------------|---|
|------------------|-----|---------------------|--------------------------|---|

|   |                       |     |     |     |
|---|-----------------------|-----|-----|-----|
| 0 | 71 VERMILYEA AVENUE   | ... | NaN | NaN |
| 1 | 27-07 23 AVENUE       | ... | NaN | NaN |
| 2 | 2897 VALENTINE AVENUE | ... | NaN | NaN |
| 3 | 2940 BAISLEY AVENUE   | ... | NaN | NaN |
| 4 | 87-14 57 ROAD         | ... | NaN | NaN |

|   | Road | Ramp | Bridge | Highway | Segment | Garage | Lot | Name | Ferry | Direction | \ |
|---|------|------|--------|---------|---------|--------|-----|------|-------|-----------|---|
| 0 |      | NaN  |        |         | NaN     |        |     | NaN  |       | NaN       |   |
| 1 |      | NaN  |        |         | NaN     |        |     | NaN  |       | NaN       |   |
| 2 |      | NaN  |        |         | NaN     |        |     | NaN  |       | NaN       |   |
| 3 |      | NaN  |        |         | NaN     |        |     | NaN  |       | NaN       |   |
| 4 |      | NaN  |        |         | NaN     |        |     | NaN  |       | NaN       |   |

|   | Ferry | Terminal | Name | Latitude  | Longitude  | \ |
|---|-------|----------|------|-----------|------------|---|
| 0 |       | NaN      |      | 40.865682 | -73.923501 |   |
| 1 |       | NaN      |      | 40.775945 | -73.915094 |   |
| 2 |       | NaN      |      | 40.870325 | -73.888525 |   |
| 3 |       | NaN      |      | 40.835994 | -73.828379 |   |
| 4 |       | NaN      |      | 40.733060 | -73.874170 |   |

|   | Location                                 |
|---|--|
| 0 | (40.86568153633767, -73.92350095571744)  |
| 1 | (40.775945312321085, -73.91509393898605) |
| 2 | (40.870324522111424, -73.88852464418646) |
| 3 | (40.83599404683083, -73.82837939584206)  |
| 4 | (40.733059618956815, -73.87416975810375) |

[5 rows x 53 columns]

## 0.0.2 1. Understanding the dataset

```
[4]: # Identify the shape of the dataset
```

```
nyc.shape
```

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

```
[5]: nyc.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 364558 entries, 0 to 364557
Data columns (total 53 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   Unique Key                           364558 non-null  int64
1   Created Date                          364558 non-null  object
2   Closed Date                           362177 non-null  object
3   Agency                               364558 non-null  object
```

|    |                                |                 |         |
|----|--------------------------------|-----------------|---------|
| 4  | Agency Name                    | 364558 non-null | object  |
| 5  | Complaint Type                 | 364558 non-null | object  |
| 6  | Descriptor                     | 358057 non-null | object  |
| 7  | Location Type                  | 364425 non-null | object  |
| 8  | Incident Zip                   | 361560 non-null | float64 |
| 9  | Incident Address               | 312859 non-null | object  |
| 10 | Street Name                    | 312859 non-null | object  |
| 11 | Cross Street 1                 | 307370 non-null | object  |
| 12 | Cross Street 2                 | 306753 non-null | object  |
| 13 | Intersection Street 1          | 51120 non-null  | object  |
| 14 | Intersection Street 2          | 50512 non-null  | object  |
| 15 | Address Type                   | 361306 non-null | object  |
| 16 | City                           | 361561 non-null | object  |
| 17 | Landmark                       | 375 non-null    | object  |
| 18 | Facility Type                  | 362169 non-null | object  |
| 19 | Status                         | 364558 non-null | object  |
| 20 | Due Date                       | 364555 non-null | object  |
| 21 | Resolution Description         | 364558 non-null | object  |
| 22 | Resolution Action Updated Date | 362156 non-null | object  |
| 23 | Community Board                | 364558 non-null | object  |
| 24 | Borough                        | 364558 non-null | object  |
| 25 | X Coordinate (State Plane)     | 360528 non-null | float64 |
| 26 | Y Coordinate (State Plane)     | 360528 non-null | float64 |
| 27 | Park Facility Name             | 364558 non-null | object  |
| 28 | Park Borough                   | 364558 non-null | object  |
| 29 | School Name                    | 364558 non-null | object  |
| 30 | School Number                  | 364558 non-null | object  |
| 31 | School Region                  | 364557 non-null | object  |
| 32 | School Code                    | 364557 non-null | object  |
| 33 | School Phone Number            | 364558 non-null | object  |
| 34 | School Address                 | 364558 non-null | object  |
| 35 | School City                    | 364558 non-null | object  |
| 36 | School State                   | 364558 non-null | object  |
| 37 | School Zip                     | 364557 non-null | object  |
| 38 | School Not Found               | 364558 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            | 297 non-null    | object  |
| 44 | Bridge Highway Direction       | 297 non-null    | object  |
| 45 | Road Ramp                      | 262 non-null    | object  |
| 46 | Bridge Highway Segment         | 262 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                       | 360528 non-null | float64 |
| 51 | Longitude                      | 360528 non-null | float64 |

```
52 Location 360528 non-null object
dtypes: float64(10), int64(1), object(42)
memory usage: 147.4+ MB
```

```
[6]: # Identifying the variables with null values
```

```
nyc.isnull().sum()
```

```
[6]: 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  |

### 0.0.3 2. Basic Exploratory Data Analysis

```
[7]: # Finding out the number of rows for each of the categorical values:
      # no. of rows for each value of Agency
```

```
nyc['Agency'].value_counts()
```

```
[7]: NYPD      364558
      Name: Agency, dtype: int64
```

```
[8]: nyc['Complaint Type'].value_counts()
```

```
[8]: Blocked Driveway      100881
      Illegal Parking      92679
      Noise - Street/Sidewalk  51692
      Noise - Commercial   44109
      Derelict Vehicle     21661
      Noise - Vehicle      19352
      Animal Abuse        10541
      Traffic             5198
      Homeless Encampment  4879
      Vending             4192
      Noise - Park        4109
      Drinking            1409
      Noise - House of Worship 1070
      Posting Advertisement  681
      Urinating in Public   641
      Bike/Roller/Skate Chronic 478
      Panhandling          327
      Disorderly Youth     315
      Illegal Fireworks    172
```

|                  |     |
|------------------|-----|
| Graffiti         | 157 |
| Agency Issues    | 8   |
| Squeegee         | 4   |
| Ferry Complaint  | 2   |
| Animal in a Park | 1   |

Name: Complaint Type, dtype: int64

```
[9]: nyc['Descriptor'].value_counts()
```

```
[9]: No Access 75888
Loud Music/Party 69708
Posted Parking Sign Violation 27200
Partial Access 24993
Loud Talking 23810
With License Plate 21661
Blocked Hydrant 19989
Commercial Overnight Parking 14997
Blocked Sidewalk 13860
Car/Truck Music 11940
Double Parked Blocking Traffic 7164
Engine Idling 5323
Double Parked Blocking Vehicle 5167
Neglected 5131
Banging/Pounding 4959
Car/Truck Horn 4478
Congestion/Gridlock 3237
Other (complaint details) 2489
In Prohibited Area 2206
Overnight Commercial Storage 2102
Unlicensed 1986
Unauthorized Bus Layover 1618
Truck Route Violation 1125
Tortured 1041
In Public 971
No Shelter 886
Chained 695
Vehicle 602
Detached Trailer 582
Underage - Licensed Est 345
Chronic Stoplight Violation 339
Chronic Speeding 306
In Car 299
Playing in Unsuitable Place 272
Drag Racing 191
Police Report Requested 122
Loud Television 114
After Hours - Licensed Est 93
```

```

Building          79
Nuisance/Truant   43
Police Report Not Requested 35
Language Access Complaint 8
Homeless Issue    1
Disruptive Passenger 1
Animal Waste      1
Name: Descriptor, dtype: int64

```

```

[10]: #to find out different types of descriptor for each complaint type

pd.crosstab(index = nyc['Complaint Type'], columns = nyc['Descriptor'])

```

```

[10]: Descriptor          After Hours - Licensed Est  Animal Waste  \
Complaint Type
Agency Issues                0            0
Animal Abuse                  0            0
Animal in a Park              0            1
Blocked Driveway              0            0
Derelict Vehicle              0            0
Disorderly Youth              0            0
Drinking                     93            0
Ferry Complaint               0            0
Graffiti                     0            0
Illegal Parking               0            0
Noise - Commercial            0            0
Noise - House of Worship      0            0
Noise - Park                  0            0
Noise - Street/Sidewalk       0            0
Noise - Vehicle                0            0
Posting Advertisement          0            0
Traffic                       0            0
Vending                       0            0

Descriptor          Banging/Pounding  Blocked Hydrant  Blocked Sidewalk  \
Complaint Type
Agency Issues                0            0            0
Animal Abuse                  0            0            0
Animal in a Park              0            0            0
Blocked Driveway              0            0            0
Derelict Vehicle              0            0            0
Disorderly Youth              0            0            0
Drinking                       0            0            0
Ferry Complaint               0            0            0
Graffiti                      0            0            0
Illegal Parking                0          19989          13860
Noise - Commercial            4663            0            0

```

|                          |     |   |   |
|--------------------------|-----|---|---|
| Noise - House of Worship | 296 | 0 | 0 |
| Noise - Park             | 0   | 0 | 0 |
| Noise - Street/Sidewalk  | 0   | 0 | 0 |
| Noise - Vehicle          | 0   | 0 | 0 |
| Posting Advertisement    | 0   | 0 | 0 |
| Traffic                  | 0   | 0 | 0 |
| Vending                  | 0   | 0 | 0 |

| Descriptor               | Building | Car/Truck Horn | Car/Truck Music | Chained \ |
|--------------------------|----------|----------------|-----------------|-----------|
| Complaint Type           |          |                |                 |           |
| Agency Issues            | 0        | 0              | 0               | 0         |
| Animal Abuse             | 0        | 0              | 0               | 695       |
| Animal in a Park         | 0        | 0              | 0               | 0         |
| Blocked Driveway         | 0        | 0              | 0               | 0         |
| Derelect Vehicle         | 0        | 0              | 0               | 0         |
| Disorderly Youth         | 0        | 0              | 0               | 0         |
| Drinking                 | 0        | 0              | 0               | 0         |
| Ferry Complaint          | 0        | 0              | 0               | 0         |
| Graffiti                 | 0        | 0              | 0               | 0         |
| Illegal Parking          | 0        | 0              | 0               | 0         |
| Noise - Commercial       | 0        | 1368           | 1021            | 0         |
| Noise - House of Worship | 0        | 0              | 0               | 0         |
| Noise - Park             | 0        | 0              | 0               | 0         |
| Noise - Street/Sidewalk  | 0        | 0              | 0               | 0         |
| Noise - Vehicle          | 0        | 3110           | 10919           | 0         |
| Posting Advertisement    | 79       | 0              | 0               | 0         |
| Traffic                  | 0        | 0              | 0               | 0         |
| Vending                  | 0        | 0              | 0               | 0         |

| Descriptor               | Chronic Speeding ... | Police Report Not Requested \ |
|--------------------------|----------------------|-------------------------------|
| Complaint Type           | ...                  |                               |
| Agency Issues            | 0 ...                | 0                             |
| Animal Abuse             | 0 ...                | 0                             |
| Animal in a Park         | 0 ...                | 0                             |
| Blocked Driveway         | 0 ...                | 0                             |
| Derelect Vehicle         | 0 ...                | 0                             |
| Disorderly Youth         | 0 ...                | 0                             |
| Drinking                 | 0 ...                | 0                             |
| Ferry Complaint          | 0 ...                | 0                             |
| Graffiti                 | 0 ...                | 35                            |
| Illegal Parking          | 0 ...                | 0                             |
| Noise - Commercial       | 0 ...                | 0                             |
| Noise - House of Worship | 0 ...                | 0                             |
| Noise - Park             | 0 ...                | 0                             |
| Noise - Street/Sidewalk  | 0 ...                | 0                             |
| Noise - Vehicle          | 0 ...                | 0                             |
| Posting Advertisement    | 0 ...                | 0                             |



|         |         |   |
|---------|---------|---|
| Traffic | 306 ... | 0 |
| Vending | 0 ...   | 0 |

| Descriptor               | Police Report Requested \ |
|--------------------------|---------------------------|
| Complaint Type           |                           |
| Agency Issues            | 0                         |
| Animal Abuse             | 0                         |
| Animal in a Park         | 0                         |
| Blocked Driveway         | 0                         |
| Derelict Vehicle         | 0                         |
| Disorderly Youth         | 0                         |
| Drinking                 | 0                         |
| Ferry Complaint          | 0                         |
| Graffiti                 | 122                       |
| Illegal Parking          | 0                         |
| Noise - Commercial       | 0                         |
| Noise - House of Worship | 0                         |
| Noise - Park             | 0                         |
| Noise - Street/Sidewalk  | 0                         |
| Noise - Vehicle          | 0                         |
| Posting Advertisement    | 0                         |
| Traffic                  | 0                         |
| Vending                  | 0                         |

| Descriptor               | Posted Parking Sign Violation | Tortured \ |
|--------------------------|-------------------------------|------------|
| Complaint Type           |                               |            |
| Agency Issues            | 0                             | 0          |
| Animal Abuse             | 0                             | 1041       |
| Animal in a Park         | 0                             | 0          |
| Blocked Driveway         | 0                             | 0          |
| Derelict Vehicle         | 0                             | 0          |
| Disorderly Youth         | 0                             | 0          |
| Drinking                 | 0                             | 0          |
| Ferry Complaint          | 0                             | 0          |
| Graffiti                 | 0                             | 0          |
| Illegal Parking          | 27200                         | 0          |
| Noise - Commercial       | 0                             | 0          |
| Noise - House of Worship | 0                             | 0          |
| Noise - Park             | 0                             | 0          |
| Noise - Street/Sidewalk  | 0                             | 0          |
| Noise - Vehicle          | 0                             | 0          |
| Posting Advertisement    | 0                             | 0          |
| Traffic                  | 0                             | 0          |
| Vending                  | 0                             | 0          |

| Descriptor     | Truck Route Violation | Unauthorized Bus Layover \ |
|----------------|-----------------------|----------------------------|
| Complaint Type |                       |                            |

|                          |      |      |
|--------------------------|------|------|
| Agency Issues            | 0    | 0    |
| Animal Abuse             | 0    | 0    |
| Animal in a Park         | 0    | 0    |
| Blocked Driveway         | 0    | 0    |
| Derelict Vehicle         | 0    | 0    |
| Disorderly Youth         | 0    | 0    |
| Drinking                 | 0    | 0    |
| Ferry Complaint          | 0    | 0    |
| Graffiti                 | 0    | 0    |
| Illegal Parking          | 0    | 1618 |
| Noise - Commercial       | 0    | 0    |
| Noise - House of Worship | 0    | 0    |
| Noise - Park             | 0    | 0    |
| Noise - Street/Sidewalk  | 0    | 0    |
| Noise - Vehicle          | 0    | 0    |
| Posting Advertisement    | 0    | 0    |
| Traffic                  | 1125 | 0    |
| Vending                  | 0    | 0    |

| Descriptor               | Underage - Licensed Est | Unlicensed | Vehicle \ |
|--------------------------|-------------------------|------------|-----------|
| Complaint Type           |                         |            |           |
| Agency Issues            | 0                       | 0          | 0         |
| Animal Abuse             | 0                       | 0          | 0         |
| Animal in a Park         | 0                       | 0          | 0         |
| Blocked Driveway         | 0                       | 0          | 0         |
| Derelict Vehicle         | 0                       | 0          | 0         |
| Disorderly Youth         | 0                       | 0          | 0         |
| Drinking                 | 345                     | 0          | 0         |
| Ferry Complaint          | 0                       | 0          | 0         |
| Graffiti                 | 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         |
| Posting Advertisement    | 0                       | 0          | 602       |
| Traffic                  | 0                       | 0          | 0         |
| Vending                  | 0                       | 1986       | 0         |

| Descriptor       | With License Plate |
|------------------|--------------------|
| Complaint Type   |                    |
| Agency Issues    | 0                  |
| Animal Abuse     | 0                  |
| Animal in a Park | 0                  |
| Blocked Driveway | 0                  |
| Derelict Vehicle | 21661              |

|                          |   |
|--------------------------|---|
| Disorderly Youth         | 0 |
| Drinking                 | 0 |
| Ferry Complaint          | 0 |
| Graffiti                 | 0 |
| Illegal Parking          | 0 |
| Noise - Commercial       | 0 |
| Noise - House of Worship | 0 |
| Noise - Park             | 0 |
| Noise - Street/Sidewalk  | 0 |
| Noise - Vehicle          | 0 |
| Posting Advertisement    | 0 |
| Traffic                  | 0 |
| Vending                  | 0 |

[18 rows x 45 columns]

```
[ ]: # 1. Utilize missing value treatment
```

```
[11]: nyc['Facility Type'].value_counts()
```

```
[11]: Precinct      362169
      Name: Facility Type, dtype: int64
```

```
[12]: # There are 2389 missing values for 'Facility Type'.
      # Since the facility type is 'Precinct' for most of the cases, the missing_
      ↪ values are utilised by updating the missing values
      # by 'Precinct'

      nyc['Facility Type'].fillna(value = 'Precinct', inplace = True)
```

```
[13]: # Now there are no missing values in 'Facility Type'
      nyc.isnull().sum()
```

```
[13]: 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                  | 0      |
| 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  |

```
[ ]: # 2. Analyze the date column and remove the entries if it has an incorrect
      ↪ timeline
```

```
[15]: # To convert 'Created Date' and 'Closed Date' in datetime format

nyc['Created Date']=pd.to_datetime(nyc['Created Date'])
```

```
nyc['Closed Date']=pd.to_datetime(nyc['Closed Date'])
```

```
[48]: # to convert date and time into date only
```

```
nyc['Create_date1']=nyc['Created Date'].dt.date
```

```
[49]: # to check outliers in the date column using Boxplot graph
```

```
nyc['Create_date1'].describe()
```

```
[49]: count          364558  
      unique           365  
      top      2015-05-10  
      freq           1540  
      Name: Create_date1, dtype: object
```

```
[50]: nyc['Create_date1'].min()
```

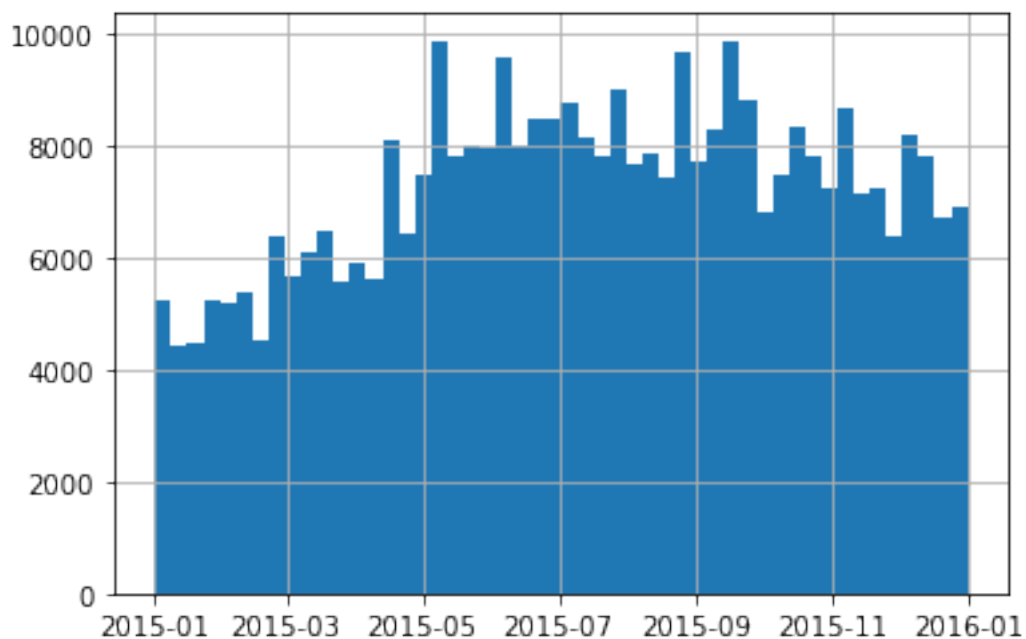
```
[50]: datetime.date(2015, 1, 1)
```

```
[51]: nyc['Create_date1'].max()
```

```
[51]: datetime.date(2015, 12, 31)
```

```
[52]: nyc['Create_date1'].hist(bins=50)
```

```
[52]: <AxesSubplot:>
```



```
[54]: # since the dates are within one year period, there are no outliers observed in
      ↪ the dataset.
```

```
# we can also checked with the response time, whether there are any outliers in
      ↪ the dates.
```

```
[55]: nyc['Created Date'].value_counts()
```

```
[55]: 2015-02-11 22:56:36      3
      2015-08-15 22:49:03      3
      2015-06-03 22:16:23      3
      2015-05-09 21:32:57      3
      2015-09-10 21:19:51      3
      ..
      2015-09-07 14:12:47      1
      2015-09-07 14:16:39      1
      2015-09-07 14:18:47      1
      2015-09-07 14:19:56      1
      2015-01-01 00:00:50      1
      Name: Created Date, Length: 362018, dtype: int64
```

```
[56]: nyc['Closed Date'].value_counts()
```

```
[56]: 2015-09-10 07:12:49      3
      2015-07-11 05:58:23      2
      2015-04-08 05:29:52      2
      2015-05-17 18:21:40      2
      2015-10-17 03:46:25      2
      ..
      2015-09-05 05:16:07      1
      2015-09-05 04:55:08      1
      2015-09-05 05:34:52      1
      2015-09-05 07:31:42      1
      2015-01-01 02:42:22      1
      Name: Closed Date, Length: 339837, dtype: int64
```

```
[57]: # Response time is calculated, which is equal to 'Closed Date' - 'Created Date'
      # Response time in timestamp
```

```
nyc['response_time'] = nyc['Closed Date'] - nyc['Created Date']
```

```
[58]: nyc['response_time']
```

```
[58]: 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: response_time, Length: 364558, dtype: timedelta64[ns]

```

```
[59]: nyc['response_time'].describe()
```

```

[59]: count          362177
      mean      0 days 04:11:53.299632500
      std       0 days 05:51:42.547519569
      min              0 days 00:01:01
      25%              0 days 01:15:33
      50%              0 days 02:40:16
      75%              0 days 05:14:38
      max          24 days 16:52:22
      Name: response_time, dtype: object

```

```
[60]: # converting the response time in days
      nyc['response_days']=nyc['response_time']/np.timedelta64(1,'D')
```

```
[62]: nyc['response_days']
```

```

[62]: 0          0.038542
      1          0.060567
      2          0.202477
      3          0.323229
      4          0.144259
...
364553     0.429016
364554     0.097616
364555     0.013229
364556     0.111725
364557     0.115972
      Name: response_days, Length: 364558, dtype: float64

```

```
[63]: # converting the response time in hours
      nyc['response_hours']=nyc['response_time']/np.timedelta64(1,'h')
```

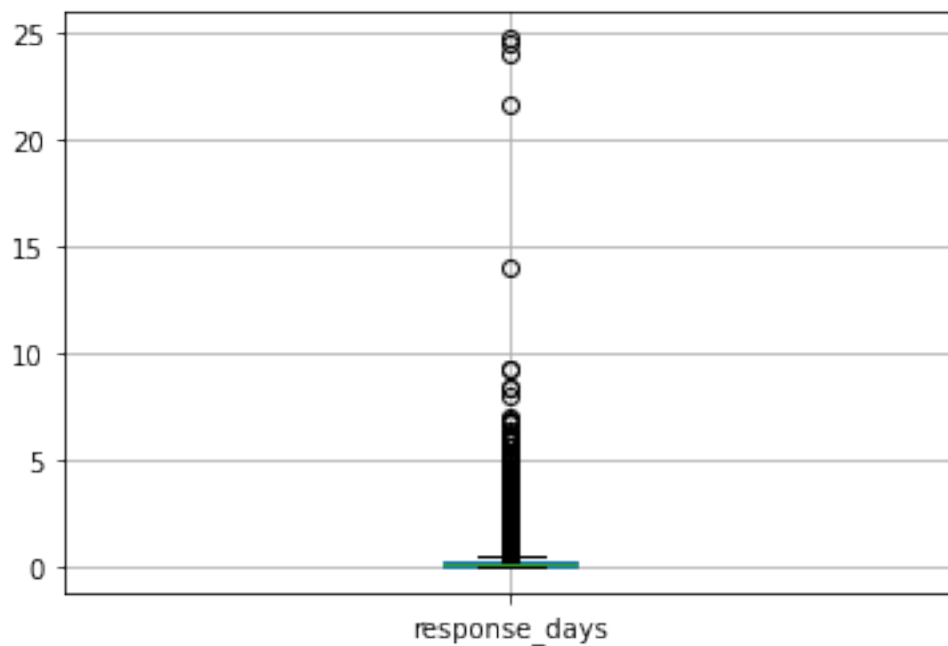
```
[64]: nyc['response_hours']
```

```
[64]: 0          0.925000
      1          1.453611
      2          4.859444
      3          7.757500
      4          3.462222
      ...
      364553     10.296389
      364554       2.342778
      364555       0.317500
      364556       2.681389
      364557       2.783333
      Name: response_hours, Length: 364558, dtype: float64
```

```
[65]: # to check outliers in the date columns using Boxplot graph

nyc.boxplot(column = 'response_days')
```

```
[65]: <AxesSubplot:>
```



```
[66]: # to check distribution of values in response_days

nyc['response_days'].describe()
```

```
[66]: count      362177.000000
      mean         0.174922
      std         0.244242
```



```

min            0.000706
25%            0.052465
50%            0.111296
75%            0.218495
max            24.703032
Name: response_days, dtype: float64

```

```

[68]: # to check number of values in response_days above a particular threshold

nyc['response_days'].value_counts(bins=[0,5,10,15,20,25])

```

```

[68]: (-0.001, 5.0]      362118
      (5.0, 10.0]       54
      (20.0, 25.0]       4
      (10.0, 15.0]       1
      (15.0, 20.0]       0
      Name: response_days, dtype: int64

```

```

[69]: # Since there are not many outliers in response time, it can be concluded that
      ↪ there are no outliers in the dates.

```

```

[1]: # 3. Draw a frequency plot for city-wise complaints

```

```

[70]: # To get the count of city wise complaints

nyc['City'].value_counts()

```

```

[70]: BROOKLYN          118862
      NEW YORK          77312
      BRONX             49171
      STATEN ISLAND     15340
      JAMAICA            8932
      ASTORIA            7991
      FLUSHING           7487
      RIDGEWOOD          6392
      CORONA             5383
      WOODSIDE           4357
      EAST ELMHURST      3558
      OZONE PARK         3446
      ELMHURST           3438
      SOUTH RICHMOND HILL 3431
      MASPETH            3118
      WOODHAVEN          3103
      LONG ISLAND CITY   3028
      SOUTH OZONE PARK   2668
      FRESH MEADOWS      2453
      RICHMOND HILL      2335

```

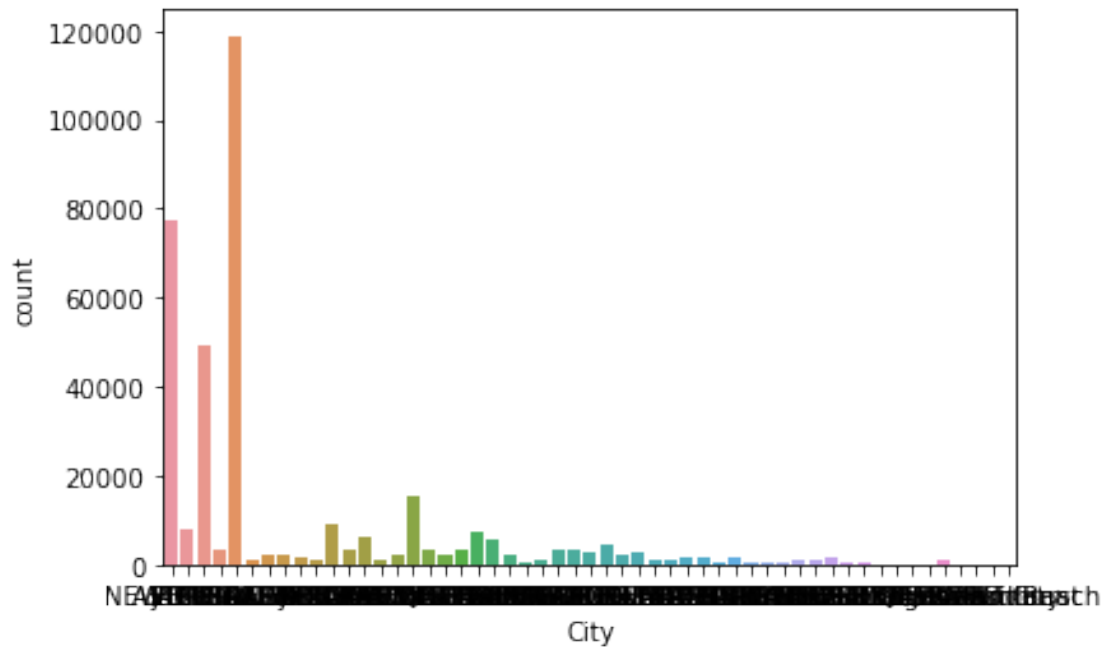
|                     |      |
|---------------------|------|
| MIDDLE VILLAGE      | 2291 |
| QUEENS VILLAGE      | 2251 |
| FOREST HILLS        | 2122 |
| JACKSON HEIGHTS     | 2106 |
| REGO PARK           | 1807 |
| BAYSIDE             | 1550 |
| COLLEGE POINT       | 1544 |
| FAR ROCKAWAY        | 1397 |
| WHITESTONE          | 1369 |
| HOLLIS              | 1231 |
| HOWARD BEACH        | 1144 |
| SPRINGFIELD GARDENS | 1094 |
| ROSEDALE            | 1091 |
| SAINT ALBANS        | 1047 |
| KEW GARDENS         | 1008 |
| SUNNYSIDE           | 944  |
| Astoria             | 906  |
| ROCKAWAY PARK       | 831  |
| OAKLAND GARDENS     | 717  |
| LITTLE NECK         | 712  |
| CAMBRIA HEIGHTS     | 617  |
| BELLEROSE           | 487  |
| GLEN OAKS           | 361  |
| ARVERNE             | 259  |
| FLORAL PARK         | 196  |
| Long Island City    | 170  |
| Woodside            | 166  |
| NEW HYDE PARK       | 129  |
| CENTRAL PARK        | 110  |
| QUEENS              | 37   |
| BREEZY POINT        | 31   |
| East Elmhurst       | 30   |
| Howard Beach        | 1    |

Name: City, dtype: int64

```
[71]: import seaborn as sns
```

```
[72]: sns.countplot(x='City',data=nyc)
```

```
[72]: <AxesSubplot:xlabel='City', ylabel='count'>
```



[73]: *# since number of cities are many, drawing countplot for top 15 cities*

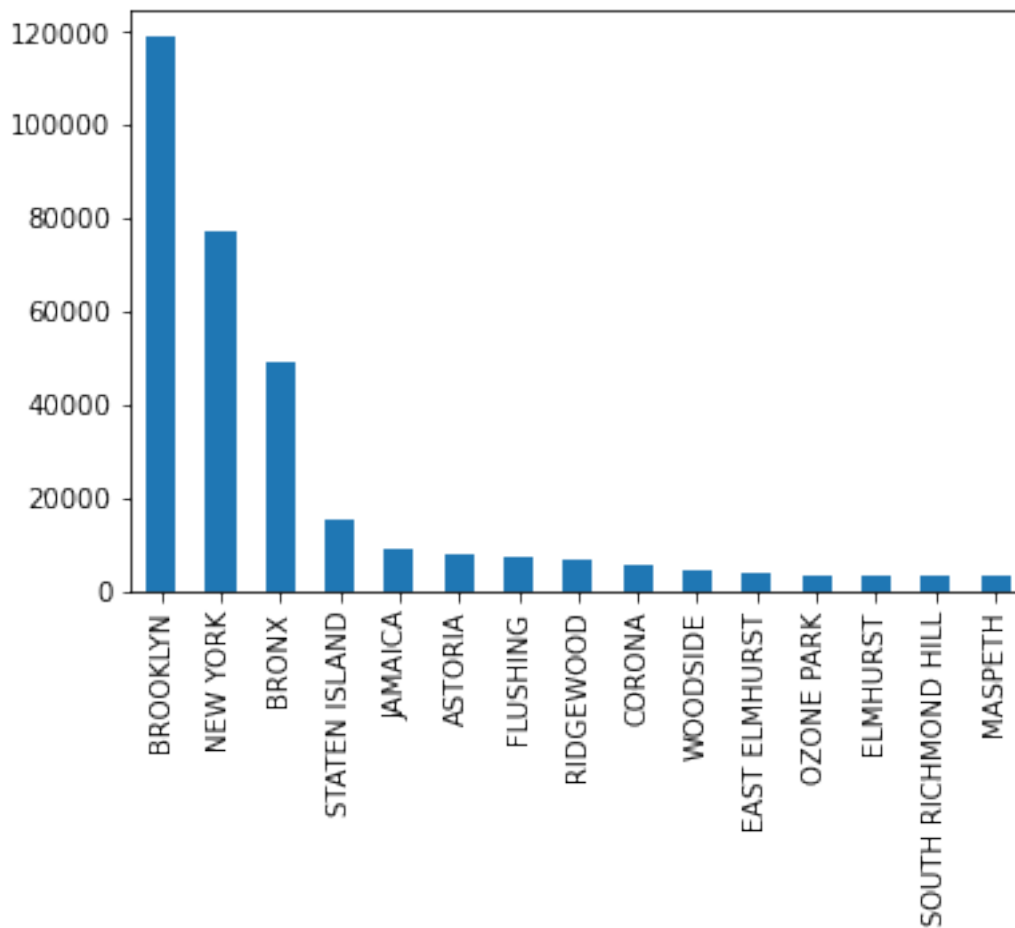
```
top_15=nyc['City'].value_counts()[:15]
top_15
```

```
[73]: BROOKLYN          118862
      NEW YORK          77312
      BRONX            49171
      STATEN ISLAND    15340
      JAMAICA           8932
      ASTORIA           7991
      FLUSHING          7487
      RIDGEWOOD        6392
      CORONA            5383
      WOODSIDE          4357
      EAST ELMHURST     3558
      OZONE PARK        3446
      ELMHURST          3438
      SOUTH RICHMOND HILL 3431
      MASPETH           3118
      Name: City, dtype: int64
```

[74]: *# Bar graph for top 15 cities*

```
top_15.plot(kind='bar')
```

[74]: <AxesSubplot:>



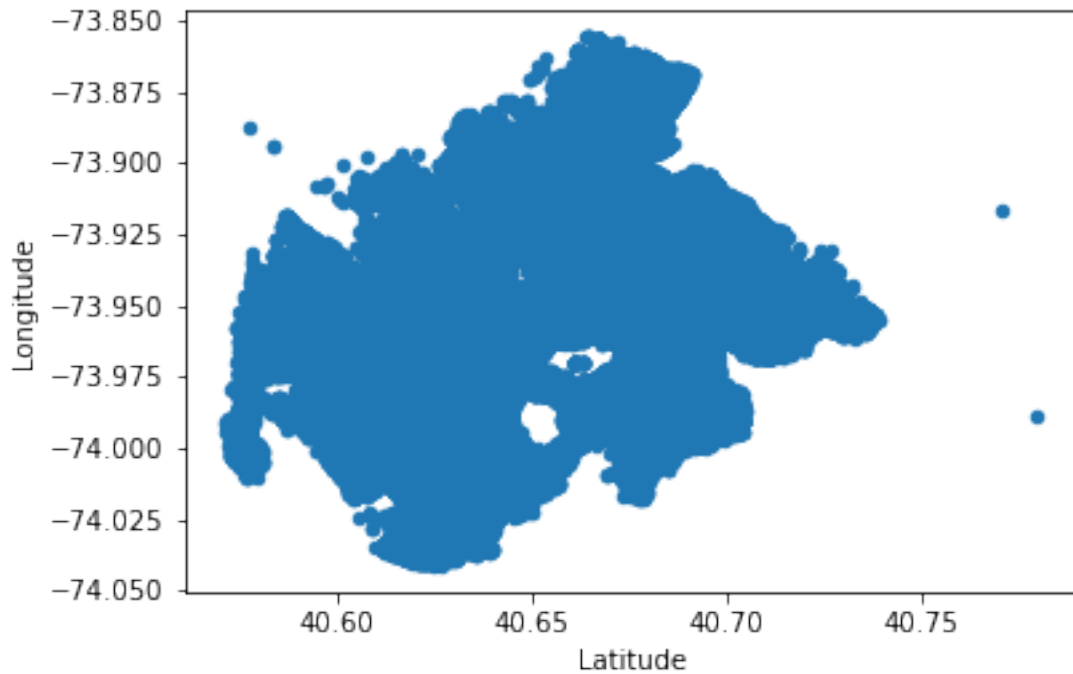
```
[2]: # 4. Draw scatter and hexbin plots for complaint concentration across Brooklyn
```

```
[75]: brook=nyc[nyc['City']=='BROOKLYN']
```

```
[76]: # scatter plot for complaint types in Brooklyn using Latitude and Longitude
```

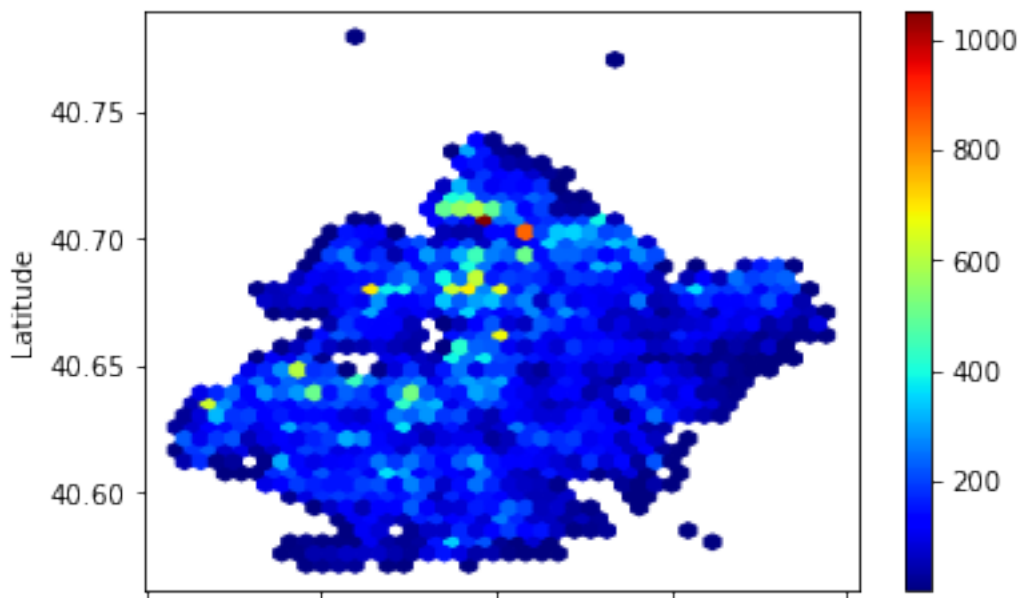
```
brook[['Latitude','Longitude']].plot(kind='scatter',x='Latitude',y='Longitude')
```

[76]: <AxesSubplot:xlabel='Latitude', ylabel='Longitude'>



```
[77]: # Hexbin plot for complaint types in Brooklyn using Latitude and Longitude
brook.
plot(kind='hexbin',x='Longitude',y='Latitude',gridsize=40,colormap='jet',mincnt=1)
```

[77]: <AxesSubplot:xlabel='Longitude', ylabel='Latitude'>



### 0.0.4 3. Find major types of complaints

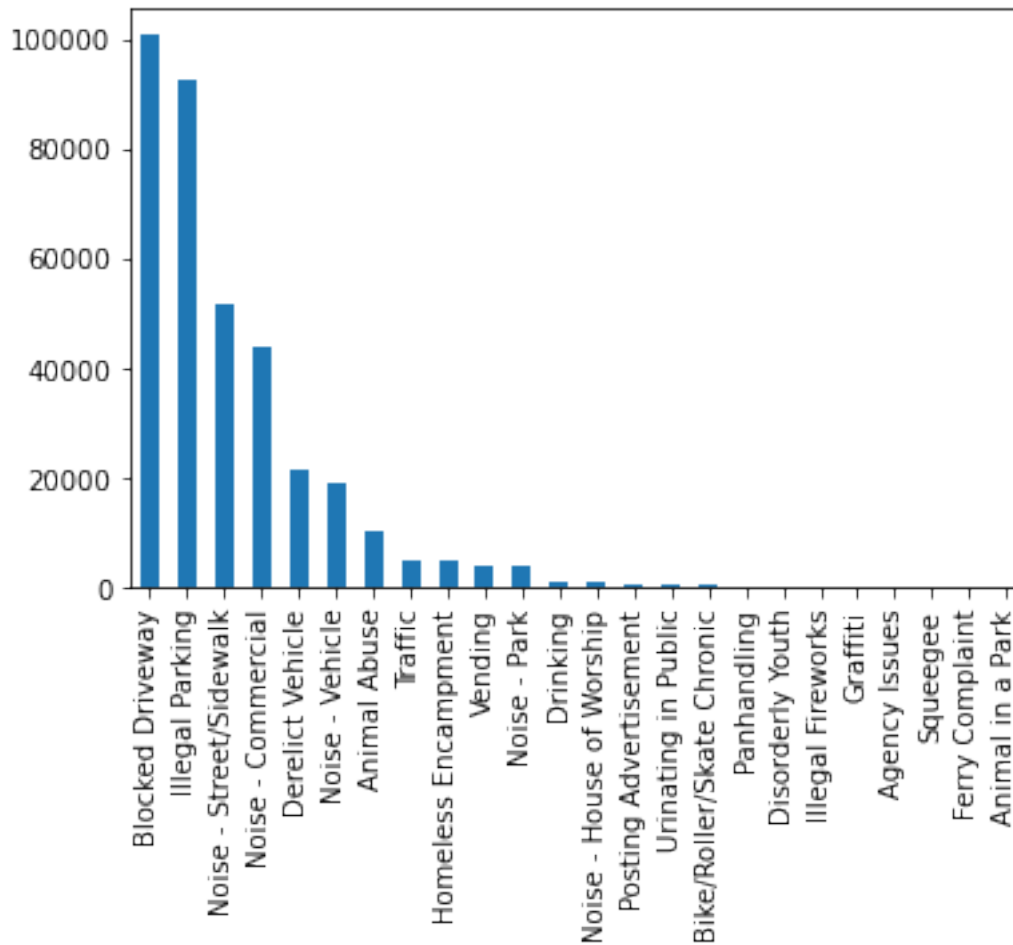
#### 0.0.5 (a) Plot a bar graph of count vs. complaint types

```
[78]: comp_type=nyc['Complaint Type'].value_counts()  
      comp_type
```

```
[78]: Blocked Driveway          100881  
      Illegal Parking          92679  
      Noise - Street/Sidewalk   51692  
      Noise - Commercial        44109  
      Derelict Vehicle          21661  
      Noise - Vehicle           19352  
      Animal Abuse              10541  
      Traffic                   5198  
      Homeless Encampment       4879  
      Vending                   4192  
      Noise - Park              4109  
      Drinking                  1409  
      Noise - House of Worship  1070  
      Posting Advertisement      681  
      Urinating in Public        641  
      Bike/Roller/Skate Chronic  478  
      Panhandling               327  
      Disorderly Youth          315  
      Illegal Fireworks          172  
      Graffiti                 157  
      Agency Issues              8  
      Squeegee                  4  
      Ferry Complaint            2  
      Animal in a Park           1  
      Name: Complaint Type, dtype: int64
```

```
[79]: comp_type.plot(kind='bar')
```

```
[79]: <AxesSubplot:>
```



#### 0.0.6 (b) Find the top 10 types of complaints

```
[80]: comp_type[:10]
```

```
[80]: Blocked Driveway      100881
      Illegal Parking      92679
      Noise - Street/Sidewalk  51692
      Noise - Commercial    44109
      Derelict Vehicle      21661
      Noise - Vehicle       19352
      Animal Abuse          10541
      Traffic               5198
      Homeless Encampment   4879
      Vending               4192
      Name: Complaint Type, dtype: int64
```

### 0.0.7 (c) Display the types of complaints in each city in a separate dataset

[81]: *# using crosstab method*

```
city_comp_type=pd.crosstab(index=nyc['City'],columns=nyc['Complaint Type'])
city_comp_type
```

```
[81]: Complaint Type      Animal Abuse  Animal in a Park  \
City
ARVERNE                  46                0
ASTORIA                 170                0
Astoria                  0                0
BAYSIDE                  53                0
BELLEROSE                15                0
BREEZY POINT            2                0
BRONX                   1971                0
BROOKLYN                3191                0
CAMBRIA HEIGHTS         15                0
CENTRAL PARK            0                0
COLLEGE POINT           35                0
CORONA                  104                0
EAST ELMHURST           85                0
ELMHURST                59                0
East Elmhurst           0                0
FAR ROCKAWAY           111                0
FLORAL PARK             7                0
FLUSHING                191                0
FOREST HILLS            78                0
FRESH MEADOWS           66                0
GLEN OAKS                5                0
HOLLIS                  39                0
HOWARD BEACH            51                0
Howard Beach            0                0
JACKSON HEIGHTS         50                0
JAMAICA                 317                0
KEW GARDENS             26                0
LITTLE NECK            21                0
LONG ISLAND CITY        40                0
Long Island City        0                0
MASPETH                 56                0
MIDDLE VILLAGE          36                0
NEW HYDE PARK           1                0
NEW YORK                1941                0
OAKLAND GARDENS         29                0
OZONE PARK              72                0
QUEENS                  1                1
QUEENS VILLAGE          90                0
```



|                     |     |   |
|---------------------|-----|---|
| REGO PARK           | 33  | 0 |
| RICHMOND HILL       | 55  | 0 |
| RIDGEWOOD           | 154 | 0 |
| ROCKAWAY PARK       | 33  | 0 |
| ROSEDALE            | 44  | 0 |
| SAINT ALBANS        | 43  | 0 |
| SOUTH OZONE PARK    | 74  | 0 |
| SOUTH RICHMOND HILL | 40  | 0 |
| SPRINGFIELD GARDENS | 42  | 0 |
| STATEN ISLAND       | 786 | 0 |
| SUNNYSIDE           | 40  | 0 |
| WHITESTONE          | 43  | 0 |
| WOODHAVEN           | 57  | 0 |
| WOODSIDE            | 111 | 0 |
| Woodside            | 0   | 0 |

| Complaint Type   | Bike/Roller/Skate Chronic | Blocked Driveway \ |
|------------------|---------------------------|--------------------|
| City             |                           |                    |
| ARVERNE          | 0                         | 50                 |
| ASTORIA          | 16                        | 3436               |
| Astoria          | 0                         | 159                |
| BAYSIDE          | 0                         | 514                |
| BELLEROSE        | 1                         | 138                |
| BREEZY POINT     | 0                         | 3                  |
| BRONX            | 22                        | 17063              |
| BROOKLYN         | 124                       | 36447              |
| CAMBRIA HEIGHTS  | 0                         | 177                |
| CENTRAL PARK     | 0                         | 0                  |
| COLLEGE POINT    | 0                         | 597                |
| CORONA           | 0                         | 3597               |
| EAST ELMHURST    | 1                         | 1925               |
| ELMHURST         | 2                         | 1992               |
| East Elmhurst    | 0                         | 0                  |
| FAR ROCKAWAY     | 0                         | 383                |
| FLORAL PARK      | 0                         | 33                 |
| FLUSHING         | 3                         | 3641               |
| FOREST HILLS     | 6                         | 873                |
| FRESH MEADOWS    | 0                         | 682                |
| GLEN OAKS        | 0                         | 48                 |
| HOLLIS           | 0                         | 442                |
| HOWARD BEACH     | 1                         | 215                |
| Howard Beach     | 0                         | 1                  |
| JACKSON HEIGHTS  | 2                         | 703                |
| JAMAICA          | 3                         | 3621               |
| KEW GARDENS      | 0                         | 429                |
| LITTLE NECK      | 0                         | 174                |
| LONG ISLAND CITY | 3                         | 1052               |

|                     |     |      |
|---------------------|-----|------|
| Long Island City    | 0   | 55   |
| MASPETH             | 1   | 1000 |
| MIDDLE VILLAGE      | 1   | 663  |
| NEW HYDE PARK       | 0   | 76   |
| NEW YORK            | 254 | 2707 |
| OAKLAND GARDENS     | 2   | 177  |
| OZONE PARK          | 1   | 1681 |
| QUEENS              | 0   | 3    |
| QUEENS VILLAGE      | 0   | 772  |
| REGO PARK           | 0   | 780  |
| RICHMOND HILL       | 0   | 1100 |
| RIDGEWOOD           | 3   | 2162 |
| ROCKAWAY PARK       | 0   | 80   |
| ROSEDALE            | 2   | 270  |
| SAINT ALBANS        | 0   | 318  |
| SOUTH OZONE PARK    | 1   | 1202 |
| SOUTH RICHMOND HILL | 1   | 1946 |
| SPRINGFIELD GARDENS | 0   | 330  |
| STATEN ISLAND       | 10  | 2845 |
| SUNNYSIDE           | 2   | 278  |
| WHITESTONE          | 4   | 279  |
| WOODHAVEN           | 2   | 1364 |
| WOODSIDE            | 5   | 2038 |
| Woodside            | 0   | 27   |

| Complaint Type  | Derelict Vehicle | Disorderly Youth | Drinking | Graffiti \ |
|-----------------|------------------|------------------|----------|------------|
| City            |                  |                  |          |            |
| ARVERNE         | 32               | 2                | 1        | 1          |
| ASTORIA         | 426              | 5                | 43       | 4          |
| Astoria         | 14               | 0                | 0        | 0          |
| BAYSIDE         | 231              | 2                | 1        | 3          |
| BELLEROSE       | 120              | 2                | 1        | 0          |
| BREEZY POINT    | 3                | 0                | 1        | 0          |
| BRONX           | 2403             | 66               | 206      | 15         |
| BROOKLYN        | 6259             | 79               | 291      | 60         |
| CAMBRIA HEIGHTS | 148              | 0                | 0        | 0          |
| CENTRAL PARK    | 0                | 0                | 0        | 0          |
| COLLEGE POINT   | 223              | 1                | 1        | 2          |
| CORONA          | 72               | 6                | 34       | 4          |
| EAST ELMHURST   | 136              | 1                | 9        | 3          |
| ELMHURST        | 94               | 2                | 13       | 1          |
| East Elmhurst   | 2                | 0                | 0        | 0          |
| FAR ROCKAWAY    | 215              | 1                | 4        | 0          |
| FLORAL PARK     | 74               | 1                | 1        | 0          |
| FLUSHING        | 532              | 2                | 47       | 6          |
| FOREST HILLS    | 71               | 1                | 1        | 3          |
| FRESH MEADOWS   | 347              | 0                | 2        | 0          |

|                     |      |    |     |    |
|---------------------|------|----|-----|----|
| GLEN OAKS           | 57   | 0  | 0   | 0  |
| HOLLIS              | 162  | 1  | 3   | 0  |
| HOWARD BEACH        | 172  | 1  | 4   | 0  |
| Howard Beach        | 0    | 0  | 0   | 0  |
| JACKSON HEIGHTS     | 41   | 0  | 10  | 1  |
| JAMAICA             | 1133 | 9  | 40  | 3  |
| KEW GARDENS         | 16   | 0  | 1   | 0  |
| LITTLE NECK         | 73   | 2  | 1   | 0  |
| LONG ISLAND CITY    | 220  | 2  | 8   | 3  |
| Long Island City    | 4    | 0  | 0   | 0  |
| MASPETH             | 510  | 2  | 9   | 1  |
| MIDDLE VILLAGE      | 366  | 0  | 2   | 0  |
| NEW HYDE PARK       | 14   | 0  | 0   | 0  |
| NEW YORK            | 695  | 81 | 321 | 25 |
| OAKLAND GARDENS     | 117  | 1  | 2   | 0  |
| OZONE PARK          | 479  | 4  | 20  | 0  |
| QUEENS              | 2    | 0  | 0   | 0  |
| QUEENS VILLAGE      | 478  | 0  | 5   | 1  |
| REGO PARK           | 94   | 0  | 4   | 1  |
| RICHMOND HILL       | 201  | 0  | 10  | 1  |
| RIDGEWOOD           | 507  | 3  | 10  | 3  |
| ROCKAWAY PARK       | 19   | 4  | 23  | 0  |
| ROSEDALE            | 247  | 0  | 2   | 2  |
| SAINT ALBANS        | 248  | 1  | 3   | 0  |
| SOUTH OZONE PARK    | 425  | 2  | 14  | 2  |
| SOUTH RICHMOND HILL | 356  | 2  | 25  | 0  |
| SPRINGFIELD GARDENS | 267  | 0  | 6   | 0  |
| STATEN ISLAND       | 2184 | 25 | 188 | 6  |
| SUNNYSIDE           | 17   | 2  | 12  | 1  |
| WHITESTONE          | 279  | 1  | 3   | 1  |
| WOODHAVEN           | 369  | 0  | 4   | 0  |
| WOODSIDE            | 298  | 1  | 15  | 4  |
| Woodside            | 8    | 0  | 0   | 0  |

| Complaint Type  | Homeless Encampment | Illegal Fireworks | ... | \ |
|-----------------|---------------------|-------------------|-----|---|
| City            |                     |                   | ... |   |
| ARVERNE         | 4                   | 0                 | ... |   |
| ASTORIA         | 32                  | 4                 | ... |   |
| Astoria         | 0                   | 0                 | ... |   |
| BAYSIDE         | 2                   | 0                 | ... |   |
| BELLEROSE       | 1                   | 1                 | ... |   |
| BREEZY POINT    | 0                   | 0                 | ... |   |
| BRONX           | 275                 | 24                | ... |   |
| BROOKLYN        | 948                 | 61                | ... |   |
| CAMBRIA HEIGHTS | 6                   | 1                 | ... |   |
| CENTRAL PARK    | 0                   | 0                 | ... |   |
| COLLEGE POINT   | 3                   | 0                 | ... |   |

|                     |      |        |
|---------------------|------|--------|
| CORONA              | 26   | 0 ...  |
| EAST ELMHURST       | 2    | 0 ...  |
| ELMHURST            | 34   | 1 ...  |
| East Elmhurst       | 0    | 0 ...  |
| FAR ROCKAWAY        | 16   | 0 ...  |
| FLORAL PARK         | 0    | 0 ...  |
| FLUSHING            | 26   | 2 ...  |
| FOREST HILLS        | 18   | 1 ...  |
| FRESH MEADOWS       | 6    | 0 ...  |
| GLEN OAKS           | 0    | 0 ...  |
| HOLLIS              | 9    | 0 ...  |
| HOWARD BEACH        | 3    | 4 ...  |
| Howard Beach        | 0    | 0 ...  |
| JACKSON HEIGHTS     | 11   | 1 ...  |
| JAMAICA             | 93   | 4 ...  |
| KEW GARDENS         | 5    | 0 ...  |
| LITTLE NECK         | 0    | 0 ...  |
| LONG ISLAND CITY    | 10   | 0 ...  |
| Long Island City    | 0    | 0 ...  |
| MASPETH             | 11   | 1 ...  |
| MIDDLE VILLAGE      | 5    | 0 ...  |
| NEW HYDE PARK       | 0    | 0 ...  |
| NEW YORK            | 3060 | 38 ... |
| OAKLAND GARDENS     | 1    | 0 ...  |
| OZONE PARK          | 8    | 1 ...  |
| QUEENS              | 2    | 0 ...  |
| QUEENS VILLAGE      | 19   | 5 ...  |
| REGO PARK           | 6    | 0 ...  |
| RICHMOND HILL       | 30   | 4 ...  |
| RIDGEWOOD           | 26   | 2 ...  |
| ROCKAWAY PARK       | 4    | 0 ...  |
| ROSEDALE            | 4    | 0 ...  |
| SAINT ALBANS        | 11   | 0 ...  |
| SOUTH OZONE PARK    | 5    | 1 ...  |
| SOUTH RICHMOND HILL | 12   | 2 ...  |
| SPRINGFIELD GARDENS | 7    | 1 ...  |
| STATEN ISLAND       | 77   | 11 ... |
| SUNNYSIDE           | 12   | 0 ...  |
| WHITESTONE          | 0    | 1 ...  |
| WOODHAVEN           | 10   | 0 ...  |
| WOODSIDE            | 38   | 1 ...  |
| Woodside            | 0    | 0 ...  |

| Complaint Type | Noise - House of Worship | Noise - Park \ |
|----------------|--------------------------|----------------|
| City           |                          |                |
| ARVERNE        | 14                       | 2              |
| ASTORIA        | 21                       | 64             |

|                     |     |      |
|---------------------|-----|------|
| Astoria             | 0   | 0    |
| BAYSIDE             | 3   | 4    |
| BELLEROSE           | 1   | 1    |
| BREEZY POINT        | 0   | 0    |
| BRONX               | 90  | 548  |
| BROOKLYN            | 389 | 1575 |
| CAMBRIA HEIGHTS     | 2   | 0    |
| CENTRAL PARK        | 0   | 0    |
| COLLEGE POINT       | 2   | 2    |
| CORONA              | 3   | 24   |
| EAST ELMHURST       | 25  | 5    |
| ELMHURST            | 6   | 35   |
| East Elmhurst       | 0   | 0    |
| FAR ROCKAWAY        | 1   | 23   |
| FLORAL PARK         | 0   | 0    |
| FLUSHING            | 5   | 61   |
| FOREST HILLS        | 1   | 20   |
| FRESH MEADOWS       | 0   | 8    |
| GLEN OAKS           | 0   | 38   |
| HOLLIS              | 215 | 17   |
| HOWARD BEACH        | 1   | 2    |
| Howard Beach        | 0   | 0    |
| JACKSON HEIGHTS     | 2   | 8    |
| JAMAICA             | 15  | 38   |
| KEW GARDENS         | 1   | 0    |
| LITTLE NECK         | 0   | 2    |
| LONG ISLAND CITY    | 0   | 55   |
| Long Island City    | 0   | 0    |
| MASPETH             | 2   | 3    |
| MIDDLE VILLAGE      | 0   | 4    |
| NEW HYDE PARK       | 0   | 0    |
| NEW YORK            | 222 | 1244 |
| OAKLAND GARDENS     | 0   | 14   |
| OZONE PARK          | 4   | 20   |
| QUEENS              | 1   | 0    |
| QUEENS VILLAGE      | 2   | 2    |
| REGO PARK           | 1   | 22   |
| RICHMOND HILL       | 0   | 4    |
| RIDGEWOOD           | 2   | 28   |
| ROCKAWAY PARK       | 0   | 2    |
| ROSEDALE            | 2   | 69   |
| SAINT ALBANS        | 1   | 1    |
| SOUTH OZONE PARK    | 5   | 4    |
| SOUTH RICHMOND HILL | 3   | 2    |
| SPRINGFIELD GARDENS | 1   | 1    |
| STATEN ISLAND       | 18  | 67   |
| SUNNYSIDE           | 0   | 16   |

|            |   |    |
|------------|---|----|
| WHITESTONE | 0 | 7  |
| WOODHAVEN  | 3 | 3  |
| WOODSIDE   | 4 | 38 |
| Woodside   | 0 | 0  |

| Complaint Type<br>City | Noise - Street/Sidewalk | Noise - Vehicle | Panhandling \ |
|------------------------|-------------------------|-----------------|---------------|
| ARVERNE                | 29                      | 10              | 1             |
| ASTORIA                | 409                     | 236             | 2             |
| Astoria                | 145                     | 0               | 0             |
| BAYSIDE                | 17                      | 24              | 0             |
| BELLEROSE              | 13                      | 11              | 1             |
| BREEZY POINT           | 1                       | 1               | 0             |
| BRONX                  | 9146                    | 3556            | 20            |
| BROOKLYN               | 13984                   | 5966            | 49            |
| CAMBRIA HEIGHTS        | 29                      | 100             | 0             |
| CENTRAL PARK           | 105                     | 0               | 0             |
| COLLEGE POINT          | 34                      | 140             | 0             |
| CORONA                 | 243                     | 110             | 1             |
| EAST ELMHURST          | 110                     | 82              | 0             |
| ELMHURST               | 228                     | 69              | 3             |
| East Elmhurst          | 0                       | 0               | 0             |
| FAR ROCKAWAY           | 140                     | 83              | 0             |
| FLORAL PARK            | 3                       | 2               | 0             |
| FLUSHING               | 241                     | 147             | 2             |
| FOREST HILLS           | 102                     | 70              | 6             |
| FRESH MEADOWS          | 48                      | 97              | 1             |
| GLEN OAKS              | 6                       | 4               | 0             |
| HOLLIS                 | 43                      | 52              | 0             |
| HOWARD BEACH           | 22                      | 10              | 2             |
| Howard Beach           | 0                       | 0               | 0             |
| JACKSON HEIGHTS        | 238                     | 75              | 1             |
| JAMAICA                | 365                     | 337             | 3             |
| KEW GARDENS            | 13                      | 23              | 0             |
| LITTLE NECK            | 10                      | 8               | 0             |
| LONG ISLAND CITY       | 133                     | 124             | 2             |
| Long Island City       | 28                      | 0               | 0             |
| MASPETH                | 124                     | 26              | 0             |
| MIDDLE VILLAGE         | 38                      | 45              | 0             |
| NEW HYDE PARK          | 0                       | 2               | 0             |
| NEW YORK               | 22252                   | 6295            | 206           |
| OAKLAND GARDENS        | 20                      | 7               | 0             |
| OZONE PARK             | 140                     | 81              | 7             |
| QUEENS                 | 6                       | 2               | 0             |
| QUEENS VILLAGE         | 69                      | 54              | 1             |
| REGO PARK              | 64                      | 60              | 0             |
| RICHMOND HILL          | 93                      | 69              | 0             |

|                     |     |     |    |
|---------------------|-----|-----|----|
| RIDGEWOOD           | 448 | 249 | 0  |
| ROCKAWAY PARK       | 218 | 29  | 0  |
| ROSEDALE            | 26  | 25  | 0  |
| SAINT ALBANS        | 81  | 50  | 0  |
| SOUTH OZONE PARK    | 108 | 97  | 0  |
| SOUTH RICHMOND HILL | 93  | 93  | 0  |
| SPRINGFIELD GARDENS | 42  | 48  | 2  |
| STATEN ISLAND       | 888 | 424 | 13 |
| SUNNYSIDE           | 69  | 53  | 0  |
| WHITESTONE          | 35  | 31  | 0  |
| WOODHAVEN           | 89  | 81  | 1  |
| WOODSIDE            | 261 | 136 | 0  |
| Woodside            | 5   | 0   | 0  |

| Complaint Type<br>City | Posting Advertisement | Squeegee | Traffic \ |
|------------------------|-----------------------|----------|-----------|
| ARVERNE                | 0                     | 0        | 1         |
| ASTORIA                | 3                     | 0        | 60        |
| Astoria                | 0                     | 0        | 0         |
| BAYSIDE                | 0                     | 0        | 9         |
| BELLEROSE              | 1                     | 0        | 9         |
| BREEZY POINT           | 0                     | 0        | 0         |
| BRONX                  | 18                    | 0        | 427       |
| BROOKLYN               | 58                    | 0        | 1258      |
| CAMBRIA HEIGHTS        | 0                     | 0        | 7         |
| CENTRAL PARK           | 0                     | 0        | 0         |
| COLLEGE POINT          | 0                     | 0        | 16        |
| CORONA                 | 1                     | 0        | 14        |
| EAST ELMHURST          | 1                     | 0        | 24        |
| ELMHURST               | 1                     | 0        | 18        |
| East Elmhurst          | 0                     | 0        | 0         |
| FAR ROCKAWAY           | 0                     | 0        | 11        |
| FLORAL PARK            | 0                     | 0        | 0         |
| FLUSHING               | 1                     | 0        | 59        |
| FOREST HILLS           | 4                     | 0        | 65        |
| FRESH MEADOWS          | 0                     | 0        | 15        |
| GLEN OAKS              | 0                     | 0        | 3         |
| HOLLIS                 | 0                     | 0        | 11        |
| HOWARD BEACH           | 0                     | 0        | 9         |
| Howard Beach           | 0                     | 0        | 0         |
| JACKSON HEIGHTS        | 1                     | 0        | 13        |
| JAMAICA                | 8                     | 0        | 632       |
| KEW GARDENS            | 1                     | 0        | 10        |
| LITTLE NECK            | 1                     | 0        | 20        |
| LONG ISLAND CITY       | 2                     | 0        | 83        |
| Long Island City       | 0                     | 0        | 0         |
| MASPETH                | 0                     | 0        | 71        |

|                     |     |   |      |
|---------------------|-----|---|------|
| MIDDLE VILLAGE      | 0   | 0 | 14   |
| NEW HYDE PARK       | 0   | 0 | 0    |
| NEW YORK            | 49  | 4 | 1770 |
| OAKLAND GARDENS     | 0   | 0 | 6    |
| OZONE PARK          | 3   | 0 | 21   |
| QUEENS              | 0   | 0 | 2    |
| QUEENS VILLAGE      | 1   | 0 | 27   |
| REGO PARK           | 0   | 0 | 16   |
| RICHMOND HILL       | 2   | 0 | 8    |
| RIDGEWOOD           | 1   | 0 | 50   |
| ROCKAWAY PARK       | 0   | 0 | 7    |
| ROSEDALE            | 0   | 0 | 25   |
| SAINT ALBANS        | 0   | 0 | 14   |
| SOUTH OZONE PARK    | 1   | 0 | 36   |
| SOUTH RICHMOND HILL | 0   | 0 | 12   |
| SPRINGFIELD GARDENS | 2   | 0 | 12   |
| STATEN ISLAND       | 517 | 0 | 229  |
| SUNNYSIDE           | 3   | 0 | 17   |
| WHITESTONE          | 0   | 0 | 32   |
| WOODHAVEN           | 0   | 0 | 7    |
| WOODSIDE            | 0   | 0 | 45   |
| Woodside            | 0   | 0 | 0    |

| Complaint Type  | Urinating in Public | Vending |
|-----------------|---------------------|---------|
| City            |                     |         |
| ARVERNE         | 1                   | 1       |
| ASTORIA         | 10                  | 57      |
| Astoria         | 0                   | 0       |
| BAYSIDE         | 0                   | 2       |
| BELLEROSE       | 1                   | 0       |
| BREEZY POINT    | 0                   | 0       |
| BRONX           | 54                  | 433     |
| BROOKLYN        | 155                 | 575     |
| CAMBRIA HEIGHTS | 0                   | 0       |
| CENTRAL PARK    | 0                   | 0       |
| COLLEGE POINT   | 0                   | 1       |
| CORONA          | 7                   | 65      |
| EAST ELMHURST   | 6                   | 9       |
| ELMHURST        | 10                  | 25      |
| East Elmhurst   | 0                   | 0       |
| FAR ROCKAWAY    | 1                   | 10      |
| FLORAL PARK     | 0                   | 0       |
| FLUSHING        | 12                  | 37      |
| FOREST HILLS    | 2                   | 10      |
| FRESH MEADOWS   | 1                   | 1       |
| GLEN OAKS       | 2                   | 19      |
| HOLLIS          | 2                   | 0       |



|                     |     |      |
|---------------------|-----|------|
| HOWARD BEACH        | 0   | 5    |
| Howard Beach        | 0   | 0    |
| JACKSON HEIGHTS     | 3   | 86   |
| JAMAICA             | 37  | 24   |
| KEW GARDENS         | 3   | 1    |
| LITTLE NECK         | 1   | 0    |
| LONG ISLAND CITY    | 3   | 31   |
| Long Island City    | 0   | 0    |
| MASPETH             | 2   | 7    |
| MIDDLE VILLAGE      | 0   | 0    |
| NEW HYDE PARK       | 0   | 0    |
| NEW YORK            | 264 | 2639 |
| OAKLAND GARDENS     | 0   | 2    |
| OZONE PARK          | 4   | 1    |
| QUEENS              | 1   | 0    |
| QUEENS VILLAGE      | 5   | 2    |
| REGO PARK           | 1   | 3    |
| RICHMOND HILL       | 5   | 15   |
| RIDGEWOOD           | 9   | 9    |
| ROCKAWAY PARK       | 1   | 2    |
| ROSEDALE            | 0   | 19   |
| SAINT ALBANS        | 1   | 2    |
| SOUTH OZONE PARK    | 2   | 5    |
| SOUTH RICHMOND HILL | 1   | 24   |
| SPRINGFIELD GARDENS | 3   | 1    |
| STATEN ISLAND       | 19  | 25   |
| SUNNYSIDE           | 2   | 15   |
| WHITESTONE          | 0   | 1    |
| WOODHAVEN           | 2   | 6    |
| WOODSIDE            | 8   | 15   |
| Woodside            | 0   | 0    |

[53 rows x 22 columns]

#### 0.0.8 4. Visualize the major types of complaints in each city

```
[82]: comp_type
```

```
[82]: Blocked Driveway      100881
      Illegal Parking      92679
      Noise - Street/Sidewalk 51692
      Noise - Commercial    44109
      Derelict Vehicle      21661
      Noise - Vehicle       19352
      Animal Abuse          10541
      Traffic               5198
      Homeless Encampment   4879
```

|                           |      |
|---------------------------|------|
| Vending                   | 4192 |
| Noise - Park              | 4109 |
| Drinking                  | 1409 |
| Noise - House of Worship  | 1070 |
| Posting Advertisement     | 681  |
| Urinating in Public       | 641  |
| Bike/Roller/Skate Chronic | 478  |
| Panhandling               | 327  |
| Disorderly Youth          | 315  |
| Illegal Fireworks         | 172  |
| Graffiti                  | 157  |
| Agency Issues             | 8    |
| Squeegee                  | 4    |
| Ferry Complaint           | 2    |
| Animal in a Park          | 1    |

Name: Complaint Type, dtype: int64

#### 0.0.9 5. Check if the average response time across various types of complaints is different

```
[83]: # To check the response time (in hours) is different for various complaint types
# since there are more than 3 types of complaints, we shall use the ANOVA test
      ↳ to validate the average response time
# for top 5 complaint types
```

```
[84]: # For complaint type = 'Blocked Driveway', we take the response hours in a new
      ↳ data frame
# since some complaints have not closed, the response time in hours is blank
      ↳ for those cases.
# The same has been removed using dropna() method

df1=nyc[nyc['Complaint Type']=='Blocked Driveway']['response_hours'].dropna()
```

```
[85]: df1
```

```
[85]: 1      1.453611
      2      4.859444
      7      1.813611
      9      1.395000
     10      7.811111
      ...
    364548  2.563611
    364549  1.161389
    364550  5.976389
    364556  2.681389
    364557  2.783333
Name: response_hours, Length: 100624, dtype: float64
```

```
[86]: # For complaint type = 'Illegal Parking', we take the response hours in a new
      ↪ data frame

      df2=nyc[nyc['Complaint Type']=='Illegal Parking']['response_hours'].dropna()

[87]: # For complaint type = 'Noise - Street/Sidewalk', we take the response hours in
      ↪ a new data frame

      df3=nyc[nyc['Complaint Type']=='Noise - Street/Sidewalk']['response_hours'].
      ↪ dropna()

[88]: # For complaint type = 'Noise - Commercial', we take the response hours in a
      ↪ new data frame

      df4=nyc[nyc['Complaint Type']=='Noise - Commercial']['response_hours'].dropna()

[89]: # For complaint type = 'Derelict Vehicle', we take the response hours in a new
      ↪ data frame

      df5=nyc[nyc['Complaint Type']=='Derelict Vehicle']['response_hours'].dropna()

[90]: # Under the ANOVA test:

      # H0: the average response time is the same across different complaint types
      # Ha: the average response time is different

[91]: from scipy import stats

[92]: # Using one way ANOVA test

      stats.f_oneway(df1,df2,df3,df4,df5)

[92]: F_onewayResult(statistic=2012.0389087633791, pvalue=0.0)

[93]: # Alpha is assumed at 5%

      # p value = 0.0

      # Since P value is less than Alpha ( $p < \alpha$ ), we shall reject the H0.
      # i.e. the average response time across types of complaints is different
```

## 0.0.10 6. Identify significant variables by performing a statistical analysis using p-values and chi-square values (Optional)

```
[ ]: # Chisquare test is carried out to check the relationship between two variables.
# Let us check the relationship between 'city' and 'complaint types'
# considering that there are many cities, we shall check the relationship
↳ between top 5 cities w.r.t. number of complaints
```

```
[95]: top5_city = nyc['City'].value_counts()[:5]
top5_city
```

```
[95]: BROOKLYN      118862
NEW YORK         77312
BRONX            49171
STATEN ISLAND    15340
JAMAICA          8932
Name: City, dtype: int64
```

```
[96]: # To create a separate dataframe with top 5 cities

df_top5city=nyc[nyc['City'].isin(top5_city.index)]
df_top5city
```

```
[96]:
```

|        | Unique Key | Created Date        | Closed Date         | Agency | \ |
|--------|------------|---------------------|---------------------|--------|---|
| 0      | 32310363   | 2015-12-31 23:59:45 | 2016-01-01 00:55:15 | NYPD   |   |
| 2      | 32309159   | 2015-12-31 23:59:29 | 2016-01-01 04:51:03 | NYPD   |   |
| 3      | 32305098   | 2015-12-31 23:57:46 | 2016-01-01 07:43:13 | NYPD   |   |
| 5      | 32306554   | 2015-12-31 23:56:30 | 2016-01-01 01:50:11 | NYPD   |   |
| 6      | 32306559   | 2015-12-31 23:55:32 | 2016-01-01 01:53:54 | NYPD   |   |
| ...    | ...        | ...                 | ...                 | ...    |   |
| 364551 | 29607567   | 2015-01-01 00:06:02 | 2015-01-01 00:43:41 | NYPD   |   |
| 364552 | 29610051   | 2015-01-01 00:05:05 | 2015-01-01 01:22:10 | NYPD   |   |
| 364554 | 29608392   | 2015-01-01 00:04:28 | 2015-01-01 02:25:02 | NYPD   |   |
| 364555 | 29607589   | 2015-01-01 00:01:30 | 2015-01-01 00:20:33 | NYPD   |   |
| 364556 | 29610889   | 2015-01-01 00:01:29 | 2015-01-01 02:42:22 | NYPD   |   |

|        | Agency Name                     | Complaint Type          | \ |
|--------|---------------------------------|-------------------------|---|
| 0      | New York City Police Department | Noise - Street/Sidewalk |   |
| 2      | New York City Police Department | Blocked Driveway        |   |
| 3      | New York City Police Department | Illegal Parking         |   |
| 5      | New York City Police Department | Illegal Parking         |   |
| 6      | New York City Police Department | Illegal Parking         |   |
| ...    | ...                             | ...                     |   |
| 364551 | New York City Police Department | Noise - Street/Sidewalk |   |
| 364552 | New York City Police Department | Noise - Street/Sidewalk |   |
| 364554 | New York City Police Department | Noise - Vehicle         |   |
| 364555 | New York City Police Department | Noise - Street/Sidewalk |   |
| 364556 | New York City Police Department | Blocked Driveway        |   |

|        | Descriptor                    | Location Type   | Incident Zip | \ |
|--------|-------------------------------|-----------------|--------------|---|
| 0      | Loud Music/Party              | Street/Sidewalk | 10034.0      |   |
| 2      | No Access                     | Street/Sidewalk | 10458.0      |   |
| 3      | Commercial Overnight Parking  | Street/Sidewalk | 10461.0      |   |
| 5      | Posted Parking Sign Violation | Street/Sidewalk | 11215.0      |   |
| 6      | Blocked Hydrant               | Street/Sidewalk | 10032.0      |   |
| ...    | ...                           | ...             | ...          |   |
| 364551 | Loud Music/Party              | Street/Sidewalk | 10453.0      |   |
| 364552 | Loud Music/Party              | Street/Sidewalk | 10002.0      |   |
| 364554 | Car/Truck Horn                | Street/Sidewalk | 10468.0      |   |
| 364555 | Loud Music/Party              | Street/Sidewalk | 10031.0      |   |
| 364556 | No Access                     | Street/Sidewalk | 10466.0      |   |

|        | Incident Address      | ... | Garage Lot Name | Ferry Direction | \ |
|--------|-----------------------|-----|-----------------|-----------------|---|
| 0      | 71 VERMILYEA AVENUE   | ... | NaN             | NaN             |   |
| 2      | 2897 VALENTINE AVENUE | ... | NaN             | NaN             |   |
| 3      | 2940 BAISLEY AVENUE   | ... | NaN             | NaN             |   |
| 5      | 260 21 STREET         | ... | NaN             | NaN             |   |
| 6      | 524 WEST 169 STREET   | ... | NaN             | NaN             |   |
| ...    | ...                   | ... | ...             | ...             |   |
| 364551 | NaN                   | ... | NaN             | NaN             |   |
| 364552 | NaN                   | ... | NaN             | NaN             |   |
| 364554 | 2555 SEDGWICK AVENUE  | ... | NaN             | NaN             |   |
| 364555 | 508 WEST 139 STREET   | ... | NaN             | NaN             |   |
| 364556 | 931 EAST 226 STREET   | ... | NaN             | NaN             |   |

|        | Ferry Terminal Name | Latitude  | Longitude  | \ |
|--------|---------------------|-----------|------------|---|
| 0      | NaN                 | 40.865682 | -73.923501 |   |
| 2      | NaN                 | 40.870325 | -73.888525 |   |
| 3      | NaN                 | 40.835994 | -73.828379 |   |
| 5      | NaN                 | 40.660823 | -73.992568 |   |
| 6      | NaN                 | 40.840848 | -73.937375 |   |
| ...    | ...                 | ...       | ...        |   |
| 364551 | NaN                 | 40.848639 | -73.911679 |   |
| 364552 | NaN                 | 40.721235 | -73.987770 |   |
| 364554 | NaN                 | 40.867830 | -73.907178 |   |
| 364555 | NaN                 | 40.821647 | -73.950873 |   |
| 364556 | NaN                 | 40.886361 | -73.853290 |   |

|     | Location                                 | Create_date1 | response_time   | \ |
|-----|--|--------------|-----------------|---|
| 0   | (40.86568153633767, -73.92350095571744)  | 2015-12-31   | 0 days 00:55:30 |   |
| 2   | (40.870324522111424, -73.88852464418646) | 2015-12-31   | 0 days 04:51:34 |   |
| 3   | (40.83599404683083, -73.82837939584206)  | 2015-12-31   | 0 days 07:45:27 |   |
| 5   | (40.66082272389114, -73.99256786342693)  | 2015-12-31   | 0 days 01:53:41 |   |
| 6   | (40.840847591440415, -73.9373750864581)  | 2015-12-31   | 0 days 01:58:22 |   |
| ... | ...                                      | ...          | ...             |   |

```

364551 (40.84863947227845, -73.91167941229558) 2015-01-01 0 days 00:37:39
364552 (40.72123468734571, -73.98777023226815) 2015-01-01 0 days 01:17:05
364554 (40.86782963689454, -73.90717786644662) 2015-01-01 0 days 02:20:34
364555 (40.821646626438095, -73.95087342885292) 2015-01-01 0 days 00:19:03
364556 (40.88636077906953, -73.85329048666742) 2015-01-01 0 days 02:40:53

```

```

      response_days response_hours
0          0.038542         0.925000
2          0.202477         4.859444
3          0.323229         7.757500
5          0.078947         1.894722
6          0.082199         1.972778
...          ...             ...
364551      0.026146         0.627500
364552      0.053530         1.284722
364554      0.097616         2.342778
364555      0.013229         0.317500
364556      0.111725         2.681389

```

[269617 rows x 57 columns]

[106]: *# to get a count of complaint types for the top 5 cities*

```

city_comp_top5=pd.
    ↪crosstab(index=df_top5city['City'],columns=df_top5city['Complaint Type'])
city_comp_top5

```

[106]:

| Complaint Type | Animal Abuse | Bike/Roller/Skate | Chronic | Blocked Driveway | \     |
|----------------|--------------|-------------------|---------|------------------|-------|
| City           |              |                   |         |                  |       |
| BRONX          | 1971         |                   | 22      |                  | 17063 |
| BROOKLYN       | 3191         |                   | 124     |                  | 36447 |
| JAMAICA        | 317          |                   | 3       |                  | 3621  |
| NEW YORK       | 1941         |                   | 254     |                  | 2707  |
| STATEN ISLAND  | 786          |                   | 10      |                  | 2845  |

| Complaint Type | Derelict Vehicle | Disorderly Youth | Drinking | Graffiti | \  |
|----------------|------------------|------------------|----------|----------|----|
| City           |                  |                  |          |          |    |
| BRONX          | 2403             | 66               | 206      |          | 15 |
| BROOKLYN       | 6259             | 79               | 291      |          | 60 |
| JAMAICA        | 1133             | 9                | 40       |          | 3  |
| NEW YORK       | 695              | 81               | 321      |          | 25 |
| STATEN ISLAND  | 2184             | 25               | 188      |          | 6  |

| Complaint Type | Homeless Encampment | Illegal Fireworks | Illegal Parking | ... | \   |
|----------------|---------------------|-------------------|-----------------|-----|-----|
| City           |                     |                   |                 |     |     |
| BRONX          | 275                 | 24                | 9889            |     | ... |
| BROOKLYN       | 948                 | 61                | 33533           |     | ... |

|               |      |    |       |     |
|---------------|------|----|-------|-----|
| JAMAICA       | 93   | 4  | 1698  | ... |
| NEW YORK      | 3060 | 38 | 14553 | ... |
| STATEN ISLAND | 77   | 11 | 6224  | ... |

| Complaint Type | Noise - House of Worship | Noise - Park \ |
|----------------|--------------------------|----------------|
| City           |                          |                |
| BRONX          | 90                       | 548            |
| BROOKLYN       | 389                      | 1575           |
| JAMAICA        | 15                       | 38             |
| NEW YORK       | 222                      | 1244           |
| STATEN ISLAND  | 18                       | 67             |

| Complaint Type | Noise - Street/Sidewalk | Noise - Vehicle | Panhandling \ |
|----------------|-------------------------|-----------------|---------------|
| City           |                         |                 |               |
| BRONX          | 9146                    | 3556            | 20            |
| BROOKLYN       | 13984                   | 5966            | 49            |
| JAMAICA        | 365                     | 337             | 3             |
| NEW YORK       | 22252                   | 6295            | 206           |
| STATEN ISLAND  | 888                     | 424             | 13            |

| Complaint Type | Posting Advertisement | Squeegee | Traffic | Urinating in Public \ |
|----------------|-----------------------|----------|---------|-----------------------|
| City           |                       |          |         |                       |
| BRONX          | 18                    | 0        | 427     | 54                    |
| BROOKLYN       | 58                    | 0        | 1258    | 155                   |
| JAMAICA        | 8                     | 0        | 632     | 37                    |
| NEW YORK       | 49                    | 4        | 1770    | 264                   |
| STATEN ISLAND  | 517                   | 0        | 229     | 19                    |

| Complaint Type | Vending |
|----------------|---------|
| City           |         |
| BRONX          | 433     |
| BROOKLYN       | 575     |
| JAMAICA        | 24      |
| NEW YORK       | 2639    |
| STATEN ISLAND  | 25      |

[5 rows x 21 columns]

```
[99]: # To validate using chi-square test, the relationship between cities and
      ↪ complaint types
```

```
# h0: there is no relationship between city and complaint type
# ha: there is a relationship between city and complaint type
```

```
[107]: from scipy.stats import chi2_contingency
```

```
[108]: chi_square_stat,pval,deg_freedom,exp_value=chi2_contingency(city_comp_top5)
```

```
[109]: chi_square_stat
```

```
[109]: 69088.72108304541
```

```
[110]: pval
```

```
[110]: 0.0
```

```
[111]: deg_freedom
```

```
[111]: 80
```

```
[112]: exp_value
```

```
[112]: array([[1.49655706e+03, 7.53202617e+01, 1.14317190e+04, 2.31140193e+03,
          4.74171139e+01, 1.90762697e+02, 1.98787131e+01, 8.12109262e+02,
          2.51675451e+01, 1.20178675e+04, 6.71736368e+03, 1.33862160e+02,
          6.33200844e+02, 8.50498887e+03, 3.02338813e+03, 5.30706929e+01,
          1.18542785e+02, 7.29494060e-01, 7.87124091e+02, 9.64755894e+01,
          6.74052512e+02],
          [3.61765605e+03, 1.82073111e+02, 2.76341134e+04, 5.58739615e+03,
          1.14622298e+02, 4.61134320e+02, 4.80531940e+01, 1.96312727e+03,
          6.08379887e+01, 2.90510213e+04, 1.62380119e+04, 3.23587563e+02,
          1.53064853e+03, 2.05592725e+04, 7.30849403e+03, 1.28288802e+02,
          2.86555744e+02, 1.76341996e+00, 1.90273014e+03, 2.33212290e+02,
          1.62940005e+03],
          [2.71852265e+02, 1.36820601e+01, 2.07659219e+03, 4.19870290e+02,
          8.61340346e+00, 3.46523847e+01, 3.61100376e+00, 1.47521098e+02,
          4.57172953e+00, 2.18306711e+03, 1.22022111e+03, 2.43163005e+01,
          1.15022065e+02, 1.54494642e+03, 5.49203856e+02, 9.64038618e+00,
          2.15335086e+01, 1.32513899e-01, 1.42982497e+02, 1.75249632e+01,
          1.22442843e+02],
          [2.35304996e+03, 1.18426716e+02, 1.79741934e+04, 3.63423778e+03,
          7.45543493e+01, 2.99937882e+02, 3.12554772e+01, 1.27688661e+03,
          3.95711546e+01, 1.88957998e+04, 1.05617706e+04, 2.10472663e+02,
          9.95587311e+02, 1.33724695e+04, 4.75370001e+03, 8.34435217e+01,
          1.86385873e+02, 1.14698999e+00, 1.23760220e+03, 1.51689426e+02,
          1.05981875e+03],
          [4.66884655e+02, 2.34978507e+01, 3.56638202e+03, 7.21093848e+02,
          1.47928358e+01, 5.95127162e+01, 6.20161192e+00, 2.53355760e+02,
          7.85158206e+00, 3.74924422e+03, 2.09563277e+03, 4.17613133e+01,
          1.97541253e+02, 2.65332268e+03, 9.43213966e+02, 1.65565970e+01,
          3.69820894e+01, 2.27582089e-01, 2.45561074e+02, 3.00977312e+01,
          2.10285850e+02]])
```

```
[113]: # Alpha = 5% i.e. 0.05
        # Since P-value 0.0 is lower than Alpha 0.05, we reject the null hypothesis H0
```



```
# Therefore, there is a relationship between city and complaint types.
```

```
[ ]:
```