Customer Service Requests Analysis

DATASET : 311_Service_Requests_from_2010_to_Present

Solutions

1. Import a 311 NYC service request.

In [8]:

```
# importing required libraries

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib import style
%matplotlib inline
import seaborn as sns
import datetime
```

In [9]:

```
from scipy.stats import chi2_contingency
from scipy.stats import chi2
```

In [5]:

```
# reading the dataset (datacsra-Custemer_Service_Requests_Analysis)
datacsra= pd.read_csv('C:\\SimpliLearn\\2. Data science with Python\\Customer Service R
```

```
C:\ProgramData\Anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3165: DtypeW
arning: Columns (48,49) have mixed types.Specify dtype option on import or set low_memor
y=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [11]:

```
# View the top 5 elements of the dataset
datacsra.head()
```

Out[11]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incid
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	100
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	111
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	104
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	104

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incid
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	113

5 rows × 53 columns

In [15]:

```
# size of the dataset
datacsra.size
```

Out[15]:

```
15936994
```

In [14]:

```
# shape of the dataset
datacsra.shape
```

Out[14]:

```
(300698, 53)
```

In [16]:

```
# information of the dataset
datacsra.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 300698 entries, 0 to 300697
Data columns (total 53 columns):
 #   Column                          Non-Null Count   Dtype  
---  ------                          --------------   -----  
 0   Unique Key                      300698 non-null  int64  
 1   Created Date                    300698 non-null  object 
 2   Closed Date                     298534 non-null  object 
 3   Agency                          300698 non-null  object 
 4   Agency Name                     300698 non-null  object 
 5   Complaint Type                  300698 non-null  object 
 6   Descriptor                      294784 non-null  object 
 7   Location Type                   300567 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                            298084 non-null  object 
 17  Landmark                        349 non-null     object 
 18  Facility Type                   298527 non-null  object 
 19  Status                          300698 non-null  object 
 20  Due Date                        300695 non-null  object 
 21  Resolution Description          300698 non-null  object 
 22  Resolution Action Updated Date  298511 non-null  object 
 23  Community Board                 300698 non-null  object 
 24  Borough                         300698 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              300698 non-null  object 
 28  Park Borough                    300698 non-null  object
 29  School Name                     300698 non-null  object
 30  School Number                   300698 non-null  object
 31  School Region                   300697 non-null  object
 32  School Code                     300697 non-null  object
 33  School Phone Number             300698 non-null  object
 34  School Address                  300698 non-null  object
 35  School City                     300698 non-null  object
 36  School State                    300698 non-null  object
 37  School Zip                      300697 non-null  object
 38  School Not Found                300698 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: 121.6+ MB
```

In [17]:

```
# columns names
datacsra.columns
```

Out[17]:

```
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')
```

Columns having null values are dropped/ Dropping of unnecesary column

In [18]:

```
# Columns names to be dropped

drop_columns=['Agency Name','Incident Address','Street Name','Cross Street 1','Cross St
'Intersection Street 2','Address Type','Park Facility Name','Park Borough','School Name
'School Number','School Region','School Code','School Phone Number','School Address','S
'School State','School Zip','School Not Found','School or Citywide Complaint','Vehicle 
'Taxi Company Borough','Taxi Pick Up Location','Bridge Highway Name','Bridge Highway Di
'Road Ramp','Bridge Highway Segment','Garage Lot Name','Ferry Direction','Ferry Termina
'X Coordinate (State Plane)','Y Coordinate (State Plane)','Due Date','Resolution Action
'Location']
```

In [19]:

```
# Columns having null values are dropped

datacsra = datacsra.drop(drop_columns, axis=1)
```

In [20]:

```
# size of the dataset after dropping column
datacsra.size
```

Out[20]:

```
4209772
```

In [21]:

```
#shape of the dataset after dropping column
datacsra.shape
```

Out[21]:

```
(300698, 14)
```

Columns are reduced from 53 to 14

In [22]:

```
# information of dataset after dropping column
datacsra.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 300698 entries, 0 to 300697
Data columns (total 14 columns):
 #   Column                  Non-Null Count   Dtype  
---  ------                  --------------   -----  
 0   Unique Key              300698 non-null  int64  
 1   Created Date            300698 non-null  object 
 2   Closed Date             298534 non-null  object 
 3   Agency                  300698 non-null  object 
 4   Complaint Type          300698 non-null  object 
 5   Descriptor              294784 non-null  object 
 6   Location Type           300567 non-null  object 
 7   Incident Zip            298083 non-null  float64
 8   City                    298084 non-null  object 
 9   Status                  300698 non-null  object 
 10  Resolution Description  300698 non-null  object 
 11  Borough                 300698 non-null  object 
 12  Latitude                297158 non-null  float64
 13  Longitude               297158 non-null  float64
dtypes: float64(3), int64(1), object(10)
memory usage: 32.1+ MB
```

In [23]:

```
# checking the number of null

datacsra.isnull().sum()
```

Out[23]:

```
Unique Key                   0
Created Date                 0
Closed Date               2164
Agency                       0
Complaint Type               0
Descriptor                5914
Location Type              131
Incident Zip              2615
City                      2614
Status                       0
Resolution Description       0
```

```
Borough                         0
Latitude                     3540
Longitude                    3540
dtype: int64
```

In [24]:

```
# choosing the closed cases only to eliminate the null values

datacsra= datacsra[datacsra['Status'] == 'Closed']
```

In [25]:

```
datacsra.isnull().sum()
```

Out[25]:

```
Unique Key                      0
Created Date                    0
Closed Date                     0
Agency                          0
Complaint Type                  0
Descriptor                   5903
Location Type                  65
Incident Zip                  507
City                          506
Status                          0
Resolution Description          0
Borough                         0
Latitude                     1432
Longitude                    1432
dtype: int64
```

In [27]:

```
# all the cases are of closed cases
#drop the column Status as every value of its data are same
datacsra = datacsra.drop(['Status'], axis = 1)
```

In [28]:

```
# shape of the dataset after droping
datacsra.shape
```

Out[28]:

```
(298471, 13)
```

In [29]:

```
# Descriptor, Latitude and Longitude has over 1000 plus null values

datacsra = datacsra[(datacsra['Descriptor'].notnull()) & (datacsra['Latitude'].notnull(
```

In [31]:

```
# check remaining null values in dataset
datacsra.isnull().sum()
```

Out[31]:

```
Unique Key                    0
Created Date                  0
Closed Date                   0
Agency                        0
Complaint Type                0
Descriptor                    0
Location Type                55
Incident Zip                 40
City                         40
Resolution Description        0
Borough                       0
Latitude                      0
```

```
Longitude                  0
dtype: int64
```

In [32]:

```
# few null values in our dataset. we will remove them

datacsra = datacsra[(datacsra['Location Type'].notnull()) & (datacsra['Incident Zip'].n
```

In [33]:

```
# check remaining null values in dataset
datacsra.isnull().sum()
```

Out[33]:

```
Unique Key                0
Created Date              0
Closed Date               0
Agency                    0
Complaint Type            0
Descriptor                0
Location Type             0
Incident Zip              0
City                      0
Resolution Description    0
Borough                   0
Latitude                  0
Longitude                 0
dtype: int64
```

In [34]:

```
datacsra.shape
```

Out[34]:

```
(291107, 13)
```

1. Read or convert the columns 'Created Date' and Closed Date' to datetime datatype and create a new column 'Request_Closing_Time' as the time elapsed between request creation and request closing. (Hint: Explore the package/module datetime)

In [36]:

```
# converting 'Created Date' and 'Closed Date' to datetime datatype

cols = ['Created Date', 'Closed Date']
for col in cols:
    datacsra[col] = pd.to_datetime(datacsra[col],infer_datetime_format=True)
```

In [37]:

```
# creating a new column Request_Closing_Time lapsed between request creation and reques

datacsra['Request_Closing_Time'] = datacsra[cols[1]] - datacsra[cols[0]]
```

In [39]:

```
datacsra.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 291107 entries, 0 to 300697
Data columns (total 14 columns):
 #   Column                  Non-Null Count   Dtype
---  ------                  --------------   -----
 0   Unique Key              291107 non-null  int64
 1   Created Date            291107 non-null  datetime64[ns]
 2   Closed Date             291107 non-null  datetime64[ns]
 3   Agency                  291107 non-null  object
 4   Complaint Type          291107 non-null  object
 5   Descriptor              291107 non-null  object
 6   Location Type           291107 non-null  object
 7   Incident Zip            291107 non-null  float64
 8   City                    291107 non-null  object
 9   Resolution Description  291107 non-null  object
 10  Borough                 291107 non-null  object
 11  Latitude                291107 non-null  float64
 12  Longitude               291107 non-null  float64
 13  Request_Closing_Time    291107 non-null  timedelta64[ns]
dtypes: datetime64[ns](2), float64(3), int64(1), object(7), timedelta64[ns](1)
memory usage: 33.3+ MB
```

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]:

```
# shape of the dataset
datacsra.shape
```

Out[40]:

```
(291107, 14)
```

In [41]:

```
# applying describe on the dataset
datacsra.describe()
```

Out[41]:

	Unique Key	Incident Zip	Latitude	Longitude	Request_Closing_Time
count	2.911070e+05	291107.000000	291107.000000	291107.000000	291107
mean	3.130158e+07	10857.977349	40.725681	-73.925035	0 days 04:18:32.132665995
std	5.753777e+05	580.280774	0.082411	0.078654	0 days 06:03:45.509089128
min	3.027948e+07	83.000000	40.499135	-74.254937	0 days 00:01:00
25%	3.079934e+07	10314.000000	40.668926	-73.970957	0 days 01:16:30
50%	3.130675e+07	11209.000000	40.717782	-73.930774	0 days 02:42:38
75%	3.179091e+07	11238.000000	40.782973	-73.875788	0 days 05:20:24
max	3.231065e+07	11697.000000	40.912869	-73.700760	24 days 16:52:22

In [42]:

```
# columns names
datacsra.columns
```

Out[42]:

```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Complaint Type',
       'Descriptor', 'Location Type', 'Incident Zip', 'City',
       'Resolution Description', 'Borough', 'Latitude', 'Longitude',
       'Request_Closing_Time'],
      dtype='object')
```

4 major conclusions

In [43]:

```
# All the complaints are under the same agency

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

Out[43]:

```
NYPD    291107
Name: Agency, dtype: int64
```

In [44]:

```
# complaint types

datacsra['Complaint Type'].value_counts()
```

Out[44]:

```
Blocked Driveway            76676
Illegal Parking             74021
Noise - Street/Sidewalk     47747
Noise - Commercial          35144
Derelict Vehicle            17506
Noise - Vehicle             16868
Animal Abuse                 7744
Traffic                      4466
Noise - Park                 3927
Vending                      3773
Drinking                     1270
Noise - House of Worship      920
Posting Advertisement         647
Disorderly Youth              285
Graffiti                      113
Name: Complaint Type, dtype: int64
```

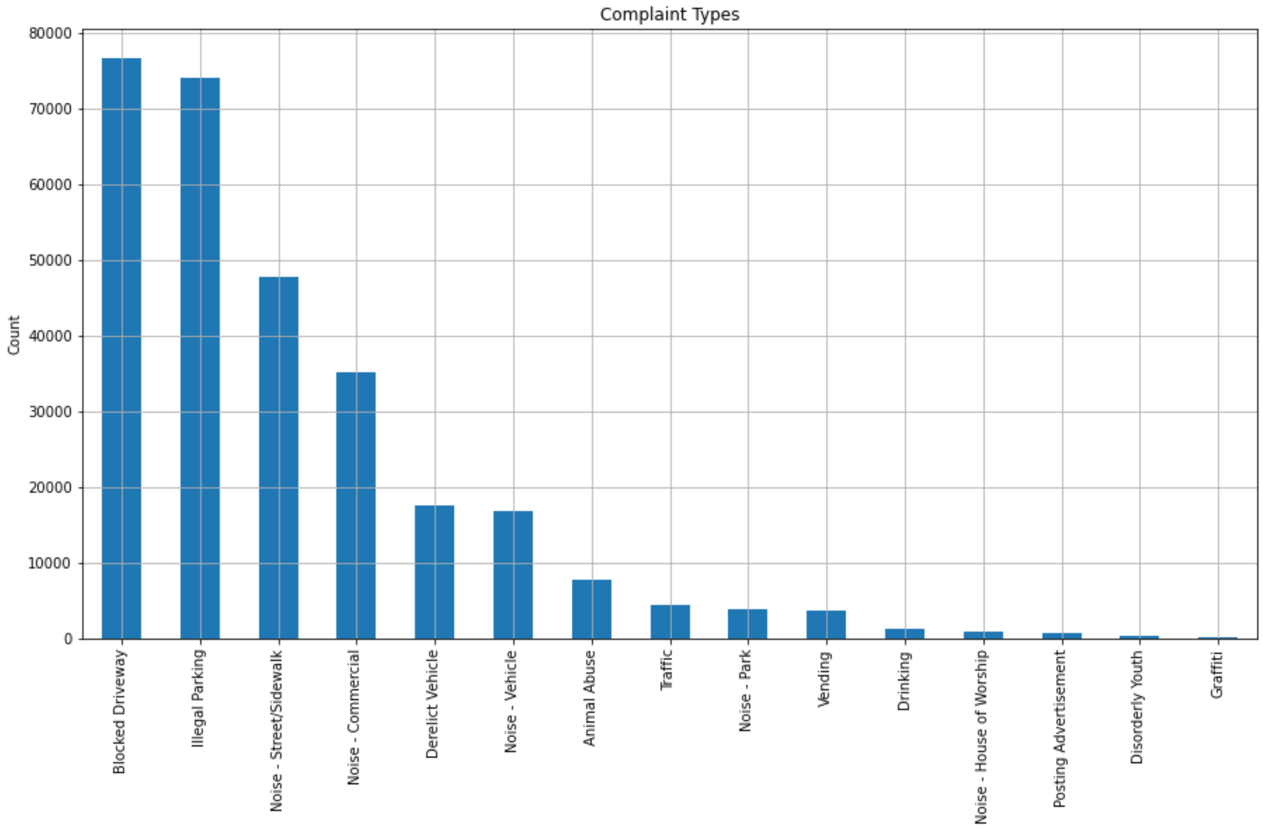
In [45]:

```
# plotting the complaint types

datacsra['Complaint Type'].value_counts().plot(kind = 'bar', figsize=(15, 8), title='Co
```

Out[45]:

```
<AxesSubplot:title={'center':'Complaint Types'}, ylabel='Count'>
```



Maximum Complaint type are Blocked Driveway followed by Illegal Parking, Noise-Street/Sidewalk,

Noise-Commercial

In [46]:

```
# Descriptors

datacsra['Descriptor'].value_counts()
```

Out[46]:

```
Loud Music/Party                  60444
No Access                         56725
Posted Parking Sign Violation     22103
Loud Talking                      21254
Partial Access                    19951
With License Plate                17506
Blocked Hydrant                   15837
Commercial Overnight Parking      11908
Car/Truck Music                   11114
Blocked Sidewalk                  10930
Double Parked Blocking Traffic     5558
Double Parked Blocking Vehicle     4147
Engine Idling                      4134
Banging/Pounding                   4090
Neglected                          3771
Car/Truck Horn                     3477
Congestion/Gridlock                2736
In Prohibited Area                 2017
Other (complaint details)          1961
Unlicensed                         1756
Overnight Commercial Storage       1746
Unauthorized Bus Layover           1333
Truck Route Violation              1010
In Public                           923
Tortured                            849
Vehicle                             587
Chained                             534
Detached Trailer                    459
No Shelter                          381
Chronic Stoplight Violation         280
Underage - Licensed Est             270
Chronic Speeding                    266
In Car                              248
Playing in Unsuitable Place         245
Drag Racing                         174
Loud Television                      93
Police Report Requested              90
After Hours - Licensed Est           77
Building                             60
Nuisance/Truant                      40
Police Report Not Requested          23
Name: Descriptor, dtype: int64
```

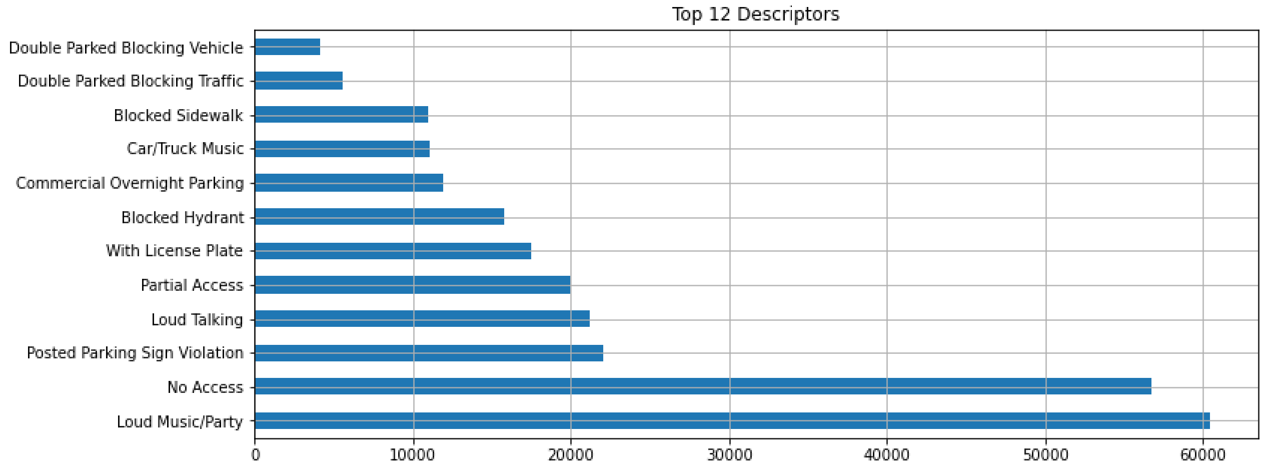
In [48]:

```
# plotting top 12 Descriptors

datacsra['Descriptor'].value_counts().head(12).plot(kind='barh', grid=True, figsize=(12
```

Out[48]:

```
<AxesSubplot:title={'center':'Top 12 Descriptors'}>
```



maximum complaints for descriptor are from Loud Music/Party followed by No Access, Posted Parking Sign Violation, Loud Taking,Partial Access.

In [53]:

```
# Top 6 Location Type

datacsra['Location Type'].value_counts().head(6)
```

Out[53]:

```
Street/Sidewalk                 242765
Store/Commercial                 19425
Club/Bar/Restaurant              17172
Residential Building/House        5753
Park/Playground                   4246
House of Worship                   920
Name: Location Type, dtype: int64
```

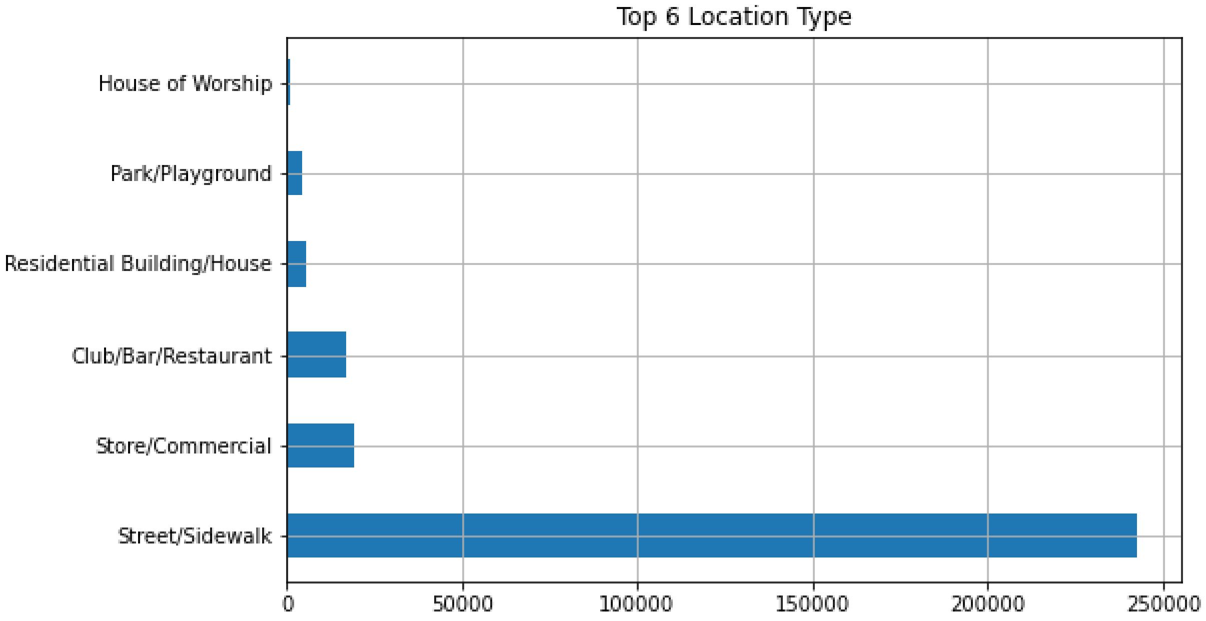
In [57]:

```
# plotting Top 6 Location Type

datacsra['Location Type'].value_counts().head(6).plot(kind='barh', grid=True, figsize=(
```

Out[57]:

```
<AxesSubplot:title={'center':'Top 6 Location Type'}>
```



Street/Sidewalk is a lot more than any other members of its category

In [59]:

```
# City

datacsra['City'].value_counts().head(12)
```

Out[59]:

```
BROOKLYN               96858
NEW YORK               61935
BRONX                  40216
STATEN ISLAND          12211
JAMAICA                 7155
ASTORIA                 6254
FLUSHING                5916
RIDGEWOOD               5124
CORONA                  4265
WOODSIDE                3493
SOUTH RICHMOND HILL     2759
OZONE PARK              2733
Name: City, dtype: int64
```

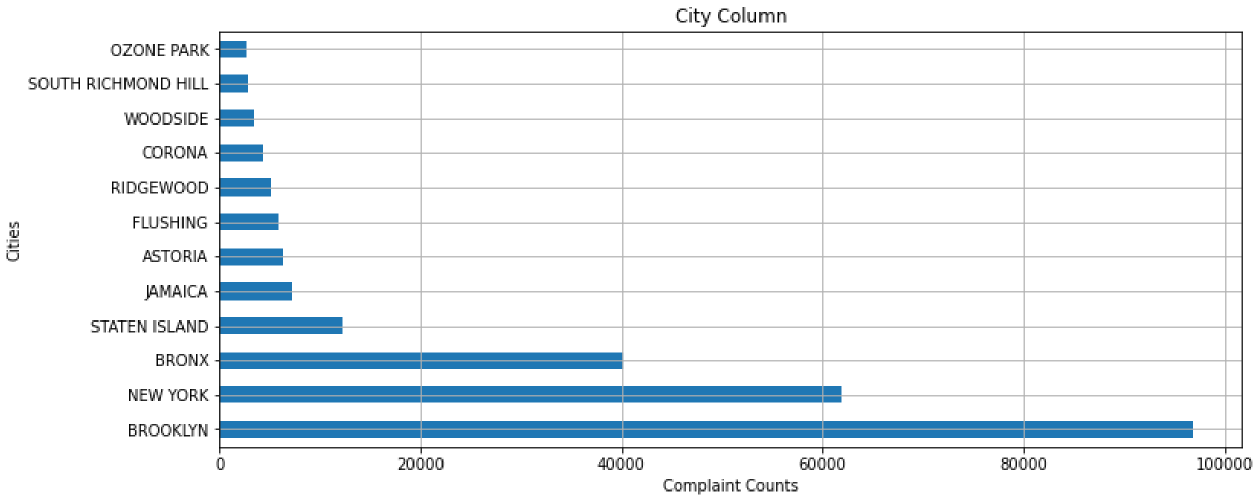
In [60]:

```
# plotting the cities

datacsra['City'].value_counts().head(12).plot(kind='barh', grid=True, figsize=(12, 5),
plt.xlabel('Complaint Counts')
```

Out[60]:

```
Text(0.5, 0, 'Complaint Counts')
```



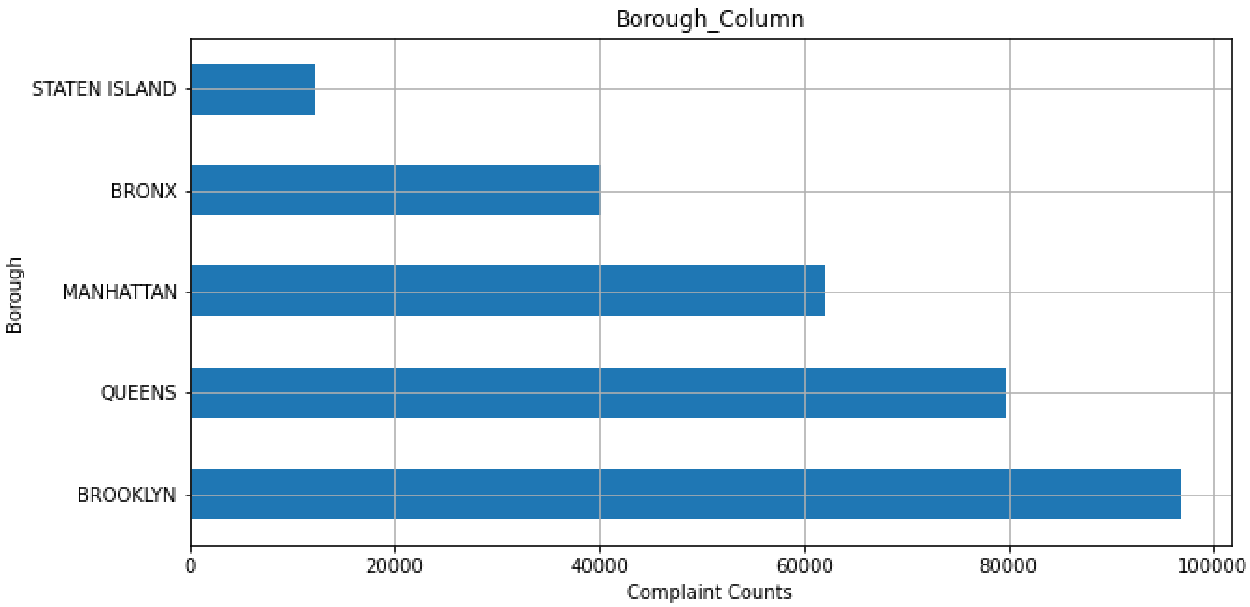
maximum complaints are from BROOKLYN followed New York, Bronx, Staten Island in City wise

In [66]:

```
# Borough
datacsra['Borough'].value_counts().head(5).plot(kind='barh', grid=True, figsize=(10, 5)
plt.xlabel('Complaint Counts')
```

Out[66]:

```
Text(0.5, 0, 'Complaint Counts')
```



Maximum complaints are from BROOKLYN followed Queens, Manhattan, Bronx and Staten Island in Borough wise

Analyse Borough and Complaint Types

Borough per Complaint Type

In [73]:

```
# Top Complaints

top_5_complaints = datacsra['Complaint Type'].value_counts()[:5].keys()
top_5_complaints
```

Out[73]:

```
Index(['Blocked Driveway', 'Illegal Parking', 'Noise - Street/Sidewalk',
       'Noise - Commercial', 'Derelict Vehicle'],
      dtype='object')
```

In [74]:

```
# Borough per Complaints

borough_complaints = datacsra.groupby(['Borough', 'Complaint Type']).size().unstack()
borough_complaints = borough_complaints[top_5_complaints]
borough_complaints
```

Out[74]:

Complaint Type	Blocked Driveway	Illegal Parking	Noise - Street/Sidewalk	Noise - Commercial	Derelict Vehicle
Borough					
BRONX	12740	7829	8864	2431	1948
BROOKLYN	28119	27386	13315	11451	5164
MANHATTAN	2055	11981	20362	14528	530
QUEENS	31621	21944	4391	6057	8102
STATEN ISLAND	2141	4881	815	677	1762

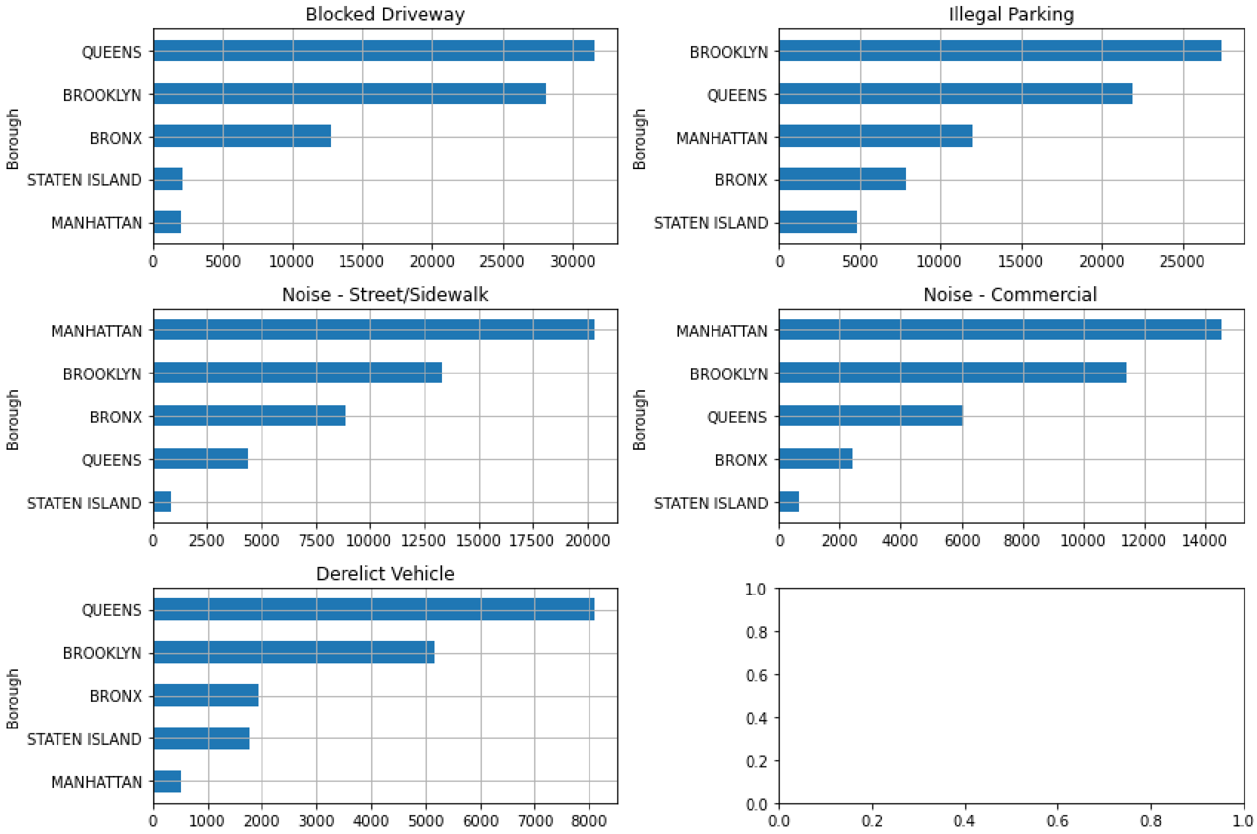
In [75]:

```
# Plotting Borough per Complaint Type

col_number = 2
row_number = 3
fig, axes = plt.subplots(row_number,col_number, figsize=(12,8))

for i, (label,col) in enumerate(borough_complaints.iteritems()):
    ax = axes[int(i/col_number), i%col_number]
    col = col.sort_values(ascending=True)[:15]
    col.plot(kind='barh', ax=ax, grid=True)
    ax.set_title(label)

plt.tight_layout()
```



- Blocked Driveway is maximum in QUEENS
- Illegal Parking is maximum in BROOKLYN
- Noise - Street/Sidewalk is maximum in MANHATTAN
- Noise - Commercial is maximum in MANHATTAN
- Derelict Vehicle is maximum in QUEENS

Complaints per Borough

In [76]:

```
# similarly for Complaints per Borough
top_borough = datacsra['Borough'].value_counts().keys()

complaint_per_borough = datacsra.groupby(['Complaint Type', 'Borough']).size().unstack(
complaint_per_borough = complaint_per_borough[top_borough]
complaint_per_borough
```

Out[76]:

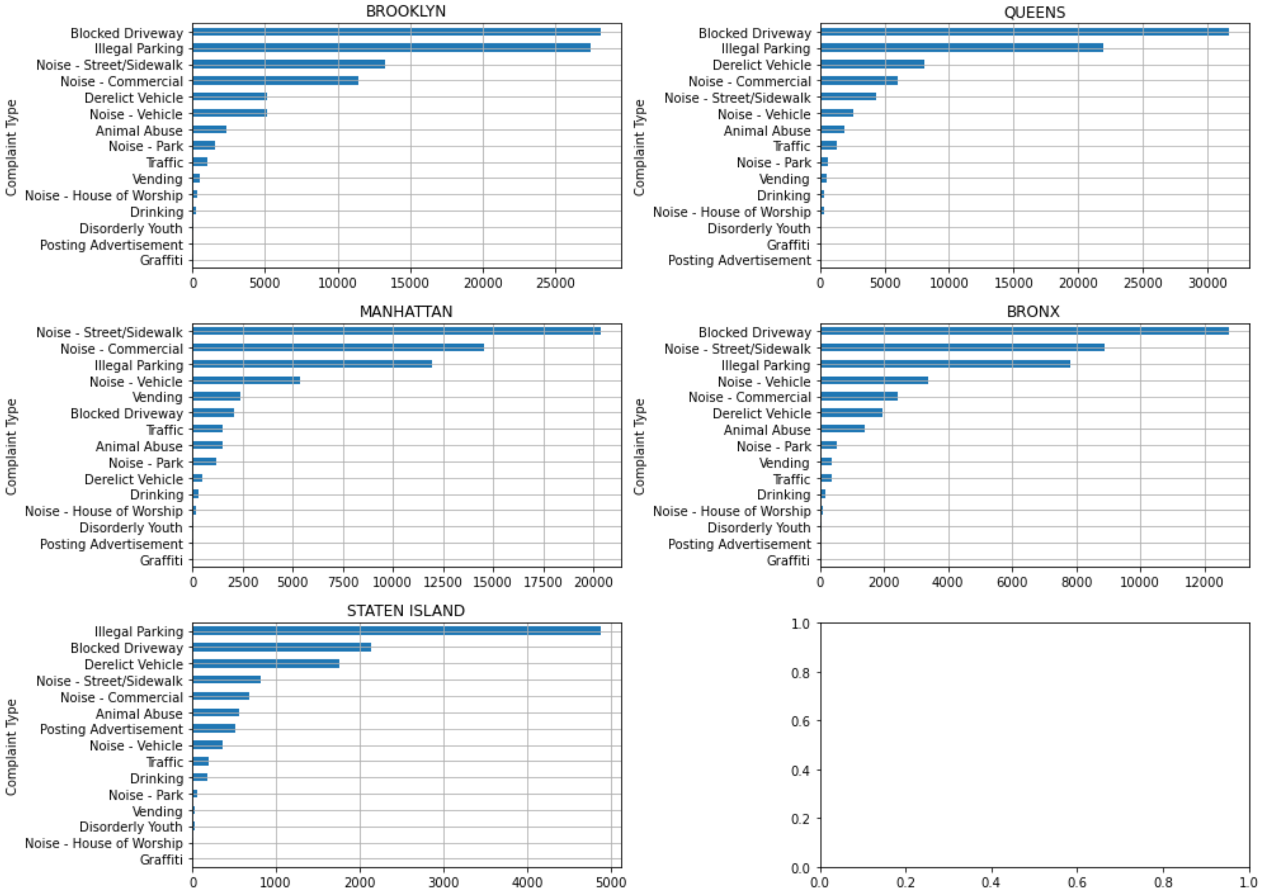
Borough	BROOKLYN	QUEENS	MANHATTAN	BRONX	STATEN ISLAND
Complaint Type					
Animal Abuse	2390	1874	1511	1412	557
Blocked Driveway	28119	31621	2055	12740	2141
Derelict Vehicle	5164	8102	530	1948	1762
Disorderly Youth	72	59	68	63	23
Drinking	257	357	294	187	175
Graffiti	43	37	22	9	2
Illegal Parking	27386	21944	11981	7829	4881
Noise - Commercial	11451	6057	14528	2431	677
Noise - House of Worship	338	297	189	79	17
Noise - Park	1537	634	1167	522	67
Noise - Street/Sidewalk	13315	4391	20362	8864	815
Noise - Vehicle	5145	2608	5374	3385	356
Posting Advertisement	45	30	41	16	515
Traffic	1082	1302	1531	355	196
Vending	514	477	2380	377	25

In [82]:

```python
# Plotting Complaints per Borough
col_number = 2
row_number = 3
fig, axes = plt.subplots(row_number,col_number, figsize=(14,10))

for i, (label,col) in enumerate(complaint_per_borough.iteritems()):
    ax = axes[int(i/col_number), i%col_number]
    col = col.sort_values(ascending=True)[:15]
    col.plot(kind='barh', ax=ax, grid=True)
    ax.set_title(label)

plt.tight_layout()
```



- BROOKLYN, QUEENS and BRONX has most complaints of Blocked Driveway.
- MANHATTAN has most complaints of Noise - Street/Sidewalk.
- STATEN ISLAND has most complaints of Illegal Parking

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

In [84]:

```
# Creating a column Request_Closing_Time_in_Hours for time in Hours
# and we will say the said complaint has been closed under x hours

datacsra['Request_Closing_Time_in_Hours'] = datacsra['Request_Closing_Time'].astype('ti

# viewing the Two columns side by side for first 20 entries

datacsra[['Request_Closing_Time', 'Request_Closing_Time_in_Hours']].head(10)
```

Out[84]:

	Request_Closing_Time	Request_Closing_Time_in_Hours
0	0 days 00:55:15	1.0
1	0 days 01:26:16	2.0
2	0 days 04:51:31	5.0
3	0 days 07:45:14	8.0

	Request_Closing_Time	Request_Closing_Time_in_Hours
4	0 days 03:27:02	4.0
5	0 days 01:53:30	2.0
6	0 days 01:57:28	2.0
7	0 days 01:47:55	2.0
8	0 days 08:33:02	9.0
9	0 days 01:23:02	2.0

In [86]:

```
#  Ordering the complaint types based on the average ‘Request_Closing_Time’ in Hours, g

data_avg_time_in_hrs = datacsra.groupby(['City', 'Complaint Type'])['Request_Closing_Ti
data_avg_time_in_hrs.head(10)
```

Out[86]:

```
City     Complaint Type
ARVERNE  Animal Abuse                2.631579
         Blocked Driveway            3.028571
         Derelict Vehicle            3.407407
         Disorderly Youth            4.000000
         Drinking                    1.000000
         Graffiti                    2.000000
         Illegal Parking             2.827586
         Noise - Commercial          3.000000
         Noise - House of Worship    2.090909
         Noise - Park                1.500000
Name: Request_Closing_Time_in_Hours, dtype: float64
```

In [89]:

```
datacsra['Request_Closing_Time_in_Seconds'] = datacsra['Request_Closing_Time'].astype('


datacsra[['Request_Closing_Time', 'Request_Closing_Time_in_Hours','Request_Closing_Time
```

Out[89]:

	Request_Closing_Time	Request_Closing_Time_in_Hours	Request_Closing_Time_in_Seconds
0	0 days 00:55:15	1.0	3315.0
1	0 days 01:26:16	2.0	5176.0
2	0 days 04:51:31	5.0	17491.0
3	0 days 07:45:14	8.0	27914.0
4	0 days 03:27:02	4.0	12422.0
5	0 days 01:53:30	2.0	6810.0

In [92]:

```
#  Order the complaint types based on the average ‘Request_Closing_Time’ in seconds,
#  grouping them for different locations.
data_avg_in_seconds = datacsra.groupby(['City', 'Complaint Type']).Request_Closing_Time
data_avg_in_seconds.head(8)
```

Out[92]:

```
City     Complaint Type
ARVERNE  Animal Abuse         7753.052632
         Blocked Driveway     9093.485714
         Derelict Vehicle      10685.592593
         Disorderly Youth      12928.500000
         Drinking                859.000000
         Graffiti               5520.000000
         Illegal Parking        8338.913793
         Noise - Commercial     8234.000000
Name: Request_Closing_Time_in_Seconds, dtype: float64
```

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?

In [93]:

```
datacsra.columns
```

Out[93]:

```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Complaint Type',
       'Descriptor', 'Location Type', 'Incident Zip', 'City',
       'Resolution Description', 'Borough', 'Latitude', 'Longitude',
       'Request_Closing_Time', 'Request_Closing_Time_in_Hours',
       'Request_Closing_Time_in_Seconds'],
      dtype='object')
```

In [94]:

```
#  the average response time in seconds for different complaint types
avg_response_time = datacsra.groupby(['Complaint Type']).Request_Closing_Time_in_Second
avg_response_time
```

Out[94]:

```
Complaint Type
Posting Advertisement        7113.582689
Noise - Commercial          11294.078335
Noise - House of Worship    11519.116304
Noise - Park                12249.610644
Noise - Street/Sidewalk     12392.210610
Traffic                     12426.186968
Disorderly Youth            12847.733333
Noise - Vehicle             12953.606711
Drinking                    13885.939370
Vending                     14442.301617
Illegal Parking             16140.427217
Blocked Driveway            17056.511751
Animal Abuse                18786.728951
Graffiti                    25744.504425
Derelict Vehicle            26450.507426
Name: Request_Closing_Time_in_Seconds, dtype: float64
```

Testing for our Hypothesis

In [96]:

```
# to calculate the p-value log of time taken to close the complaint per complaint is
data = {}
for complaint in datacsra['Complaint Type'].unique():
    data[complaint] = np.log(datacsra[datacsra['Complaint Type']==complaint]['Request_C
```

In [103…

```
data.keys()
```

Out[103…

```
dict_keys(['Noise - Street/Sidewalk', 'Blocked Driveway', 'Illegal Parking', 'Derelict V
ehicle', 'Noise - Commercial', 'Noise - House of Worship', 'Posting Advertisement', 'Noi
se - Vehicle', 'Animal Abuse', 'Vending', 'Traffic', 'Drinking', 'Noise - Park', 'Graffi
ti', 'Disorderly Youth'])
```

In [104…

```python
for complaint in data.keys():
    print(data[complaint].std())
```

```
1.1029853481161118
0.9759835331364468
1.07759350645833
1.2579717580716774
1.0889851891911977
1.1764769203426566
1.2223658746794284
1.0766368282265082
1.0439938309706467
1.1124255292109804
1.183766057955533
1.0462752311468753
1.119443436237754
1.0644915295126962
1.0383245818152775
```

In [105…

```python
# importing f_oneway from scipy.stats library
from scipy.stats import f_oneway
# taking top 5 complaints
stat, p = f_oneway(data['Blocked Driveway'], data['Illegal Parking'], data['Noise - Str

                   data['Derelict Vehicle'], data['Noise - Commercial'])
print('Statistics= %.3f, p = %.3f' % (stat, p))
# interpret
alpha = 0.05
if p > alpha:
    print('Same distributions (fail to reject H0)')
else:
    print('We have Different distributions (reject H0)')
```

```
Statistics= 2452.471, p = 0.000
We have Different distributions (reject H0)
```

In [ ]: