Customer Service Requests Analysis Project 1

June 25, 2020

1 Customer Service Request Analysis

[1]:
```
#import the required libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

[2]:
```
#import the dataset
customer_dataframe = pd.read_csv("311_Service_Requests_from_2010_to_Present.
↪csv")
```

```
C:\Users\Debidutta\anaconda3\lib\site-
packages\IPython\core\interactiveshell.py:3063: DtypeWarning: Columns (48,49)
have mixed types.Specify dtype option on import or set low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

[3]:
```
#view the first 5 observations
customer_dataframe.head()
```

[3]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip
0	32310363	12/31/2015 11:59:45 PM	01-01-16 0:55	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0
1	32309934	12/31/2015 11:59:44 PM	01-01-16 1:26	NYPD	New York City Police Department	Blocked Driveway			
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway			
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Department	Illegal Parking			
4	32306529	12/31/2015 11:56:58 PM	01-01-16 3:24	NYPD	New York City Police Department	Illegal Parking			

```
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]
```

[4]:
```
#explore the dataset
customer_dataframe.describe
```

[4]:
```
<bound method NDFrame.describe of         Unique Key            Created Date
Closed Date Agency  \
0         32310363  12/31/2015 11:59:45 PM           01-01-16 0:55   NYPD
1         32309934  12/31/2015 11:59:44 PM           01-01-16 1:26   NYPD
2         32309159  12/31/2015 11:59:29 PM           01-01-16 4:51   NYPD
3         32305098  12/31/2015 11:57:46 PM           01-01-16 7:43   NYPD
4         32306529  12/31/2015 11:56:58 PM           01-01-16 3:24   NYPD
…              …                     …                      …    …
300693    30281872  03/29/2015 12:33:41 AM                    NaN   NYPD
```

```
300694    30281230  03/29/2015 12:33:28 AM  03/29/2015 02:33:59 AM   NYPD
300695    30283424  03/29/2015 12:33:03 AM  03/29/2015 03:40:20 AM   NYPD
300696    30280004  03/29/2015 12:33:02 AM  03/29/2015 04:38:35 AM   NYPD
300697    30281825  03/29/2015 12:33:01 AM  03/29/2015 04:41:50 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
…                                   …                       …
300693  New York City Police Department       Noise - Commercial
300694  New York City Police Department         Blocked Driveway
300695  New York City Police Department       Noise - Commercial
300696  New York City Police Department       Noise - Commercial
300697  New York City Police Department       Noise - Commercial

                         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
…                              …                   …           …
300693            Loud Music/Party  Club/Bar/Restaurant           NaN
300694              Partial Access      Street/Sidewalk       11418.0
300695            Loud Music/Party  Club/Bar/Restaurant       11206.0
300696            Loud Music/Party  Club/Bar/Restaurant       10461.0
300697            Loud Music/Party     Store/Commercial       10036.0

               Incident Address  … Bridge Highway Name  \
0           71 VERMILYEA AVENUE  …                 NaN
1               27-07 23 AVENUE  …                 NaN
2          2897 VALENTINE AVENUE  …                 NaN
3            2940 BAISLEY AVENUE  …                 NaN
4                 87-14 57 ROAD  …                 NaN
…                           …  …                   …
300693          CRESCENT AVENUE  …                 NaN
300694         100-17 87 AVENUE  …                 NaN
300695        162 THROOP AVENUE  …                 NaN
300696  3151 EAST TREMONT AVENUE  …                 NaN
300697        251 WEST 48 STREET  …                 NaN

       Bridge Highway Direction Road Ramp Bridge Highway Segment  \
0                           NaN       NaN                    NaN
1                           NaN       NaN                    NaN
```

```
2                            NaN       NaN                    NaN
3                            NaN       NaN                    NaN
4                            NaN       NaN                    NaN
…                            …         …                      …
300693                       NaN       NaN                    NaN
300694                       NaN       NaN                    NaN
300695                       NaN       NaN                    NaN
300696                       NaN       NaN                    NaN
300697                       NaN       NaN                    NaN

       Garage Lot Name Ferry Direction Ferry Terminal Name   Latitude  \
0                    NaN             NaN                  NaN  40.865682
1                    NaN             NaN                  NaN  40.775945
2                    NaN             NaN                  NaN  40.870325
3                    NaN             NaN                  NaN  40.835994
4                    NaN             NaN                  NaN  40.733060
…                    …               …                    …        …
300693               NaN             NaN                  NaN       NaN
300694               NaN             NaN                  NaN  40.694077
300695               NaN             NaN                  NaN  40.699590
300696               NaN             NaN                  NaN  40.837708
300697               NaN             NaN                  NaN  40.760583

        Longitude                                   Location
0      -73.923501   (40.86568153633767, -73.92350095571744)
1      -73.915094  (40.775945312321085, -73.91509393898605)
2      -73.888525  (40.870324522111424, -73.88852464418646)
3      -73.828379   (40.83599404683083, -73.82837939584206)
4      -73.874170  (40.733059618956815, -73.87416975810375)
…           …                                          …
300693        NaN                                       NaN
300694 -73.846087    (40.69407728322387, -73.8460866160573)
300695 -73.944234   (40.69959035300927, -73.94423377144169)
300696 -73.834587    (40.8377075854206, -73.83458731019586)
300697 -73.985922   (40.76058322950115, -73.98592204392392)

[300698 rows x 53 columns]>
```

[5]:
```
customer_dataframe.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
```

[6]:
```
#convert the columns created date and closed date to pandas datetime format
customer_dataframe["Created Date"] = pd.to_datetime(customer_dataframe['Created␣
↪Date'])
customer_dataframe["Closed Date"] = pd.to_datetime(customer_dataframe['Closed␣
↪Date'])
customer_dataframe.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  datetime64[ns]
 2   Closed Date                     298534 non-null  datetime64[ns]
 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: datetime64[ns](2), float64(10), int64(1), object(40)
memory usage: 121.6+ MB
```

[7]:
```
#create a new column 'Request_Closing_Time' as the time elapsed between request␣
↪creation and request closing
customer_dataframe['Request_Closing_Time'] = customer_dataframe['Closed Date']␣
↪- customer_dataframe['Created Date']
customer_dataframe.head()
```

[7]:
```
   Unique Key        Created Date         Closed Date Agency  \
0    32310363 2015-12-31 23:59:45 2016-01-01 00:55:00   NYPD
1    32309934 2015-12-31 23:59:44 2016-01-01 01:26:00   NYPD
2    32309159 2015-12-31 23:59:29 2016-01-01 04:51:00   NYPD
3    32305098 2015-12-31 23:57:46 2016-01-01 07:43:00   NYPD
4    32306529 2015-12-31 23:56:58 2016-01-01 03:24:00   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 Direction Road Ramp  \
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

  Bridge Highway Segment Garage Lot Name Ferry Direction Ferry Terminal Name  \
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

    Latitude  Longitude                                  Location  \
0  40.865682 -73.923501   (40.86568153633767, -73.92350095571744)
1  40.775945 -73.915094  (40.775945312321085, -73.91509393898605)
2  40.870325 -73.888525  (40.870324522111424, -73.88852464418646)
3  40.835994 -73.828379   (40.83599404683083, -73.82837939584206)
4  40.733060 -73.874170  (40.733059618956815, -73.87416975810375)

  Request_Closing_Time
0             00:55:15
1             01:26:16
2             04:51:31
3             07:45:14
4             03:27:02

[5 rows x 54 columns]
```

[8]:
```
#move the column Request_Closing_Time to the 3rd index
customer_dataframe.insert(3, 'Request_Closing_Time', customer_dataframe.
 ↪pop('Request_Closing_Time'))
customer_dataframe.head(10)
```

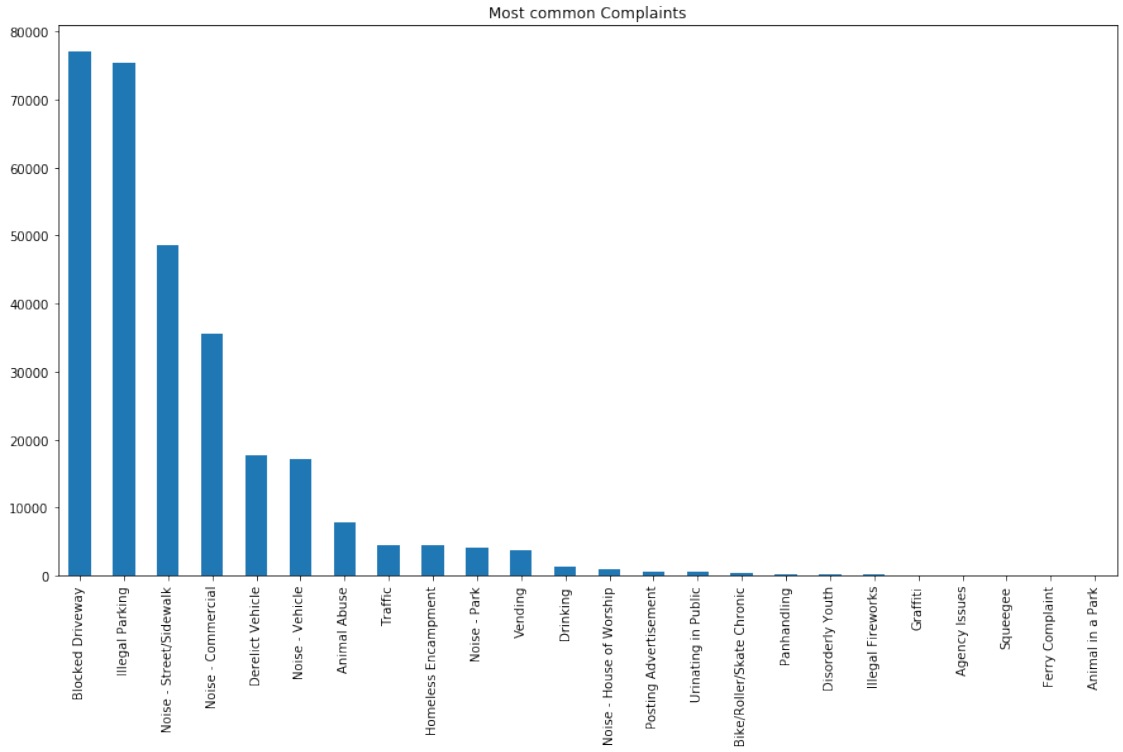
[8]:
```
   Unique Key        Created Date         Closed Date Request_Closing_Time  \
0    32310363 2015-12-31 23:59:45 2016-01-01 00:55:00             00:55:15
1    32309934 2015-12-31 23:59:44 2016-01-01 01:26:00             01:26:16
2    32309159 2015-12-31 23:59:29 2016-01-01 04:51:00             04:51:31
3    32305098 2015-12-31 23:57:46 2016-01-01 07:43:00             07:45:14
4    32306529 2015-12-31 23:56:58 2016-01-01 03:24:00             03:27:02
```

```
5    32306554 2015-12-31 23:56:30 2016-01-01 01:50:00             01:53:30
6    32306559 2015-12-31 23:55:32 2016-01-01 01:53:00             01:57:28
7    32307009 2015-12-31 23:54:05 2016-01-01 01:42:00             01:47:55
8    32308581 2015-12-31 23:53:58 2016-01-01 08:27:00             08:33:02
9    32308391 2015-12-31 23:53:58 2016-01-01 01:17:00             01:23:02

  Agency                      Agency Name           Complaint Type  \
0   NYPD  New York City Police Department  Noise - Street/Sidewalk
1   NYPD  New York City Police Department         Blocked Driveway
2   NYPD  New York City Police Department         Blocked Driveway
3   NYPD  New York City Police Department          Illegal Parking
4   NYPD  New York City Police Department          Illegal Parking
5   NYPD  New York City Police Department          Illegal Parking
6   NYPD  New York City Police Department          Illegal Parking
7   NYPD  New York City Police Department         Blocked Driveway
8   NYPD  New York City Police Department          Illegal Parking
9   NYPD  New York City Police Department         Blocked Driveway

                     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  …
5  Posted Parking Sign Violation  Street/Sidewalk       11215.0  …
6                Blocked Hydrant  Street/Sidewalk       10032.0  …
7                     No Access  Street/Sidewalk       10457.0  …
8  Posted Parking Sign Violation  Street/Sidewalk       11415.0  …
9                     No Access  Street/Sidewalk       11219.0  …

  Bridge Highway Name Bridge Highway Direction Road Ramp  \
0                 NaN                       NaN       NaN
1                 NaN                       NaN       NaN
2                 NaN                       NaN       NaN
3                 NaN                       NaN       NaN
4                 NaN                       NaN       NaN
5                 NaN                       NaN       NaN
6                 NaN                       NaN       NaN
7                 NaN                       NaN       NaN
8                 NaN                       NaN       NaN
9                 NaN                       NaN       NaN

  Bridge Highway Segment Garage Lot Name Ferry Direction Ferry Terminal Name  \
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
5                    NaN             NaN             NaN                NaN
6                    NaN             NaN             NaN                NaN
7                    NaN             NaN             NaN                NaN
8                    NaN             NaN             NaN                NaN
9                    NaN             NaN             NaN                NaN

    Latitude  Longitude                                  Location
0  40.865682 -73.923501   (40.86568153633767, -73.92350095571744)
1  40.775945 -73.915094  (40.775945312321085, -73.91509393898605)
2  40.870325 -73.888525  (40.870324522111424, -73.88852464418646)
3  40.835994 -73.828379   (40.83599404683083, -73.82837939584206)
4  40.733060 -73.874170  (40.733059618956815, -73.87416975810375)
5  40.660823 -73.992568   (40.66082272389114, -73.99256786342693)
6  40.840848 -73.937375   (40.840847591440415, -73.9373750864581)
7  40.837503 -73.902905   (40.83750262540012, -73.90290517326568)
8  40.704977 -73.832605   (40.704977164399935, -73.8326047502584)
9  40.623793 -73.999539  (40.623793065806524, -73.99953890121567)

[10 rows x 54 columns]
```

[9]:
```
#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

#insight 1
#The most received complaint type
(customer_dataframe['Complaint Type'].value_counts()).plot(kind='bar',
                    figsize=(15,8), title = 'Most common Complaints')
```

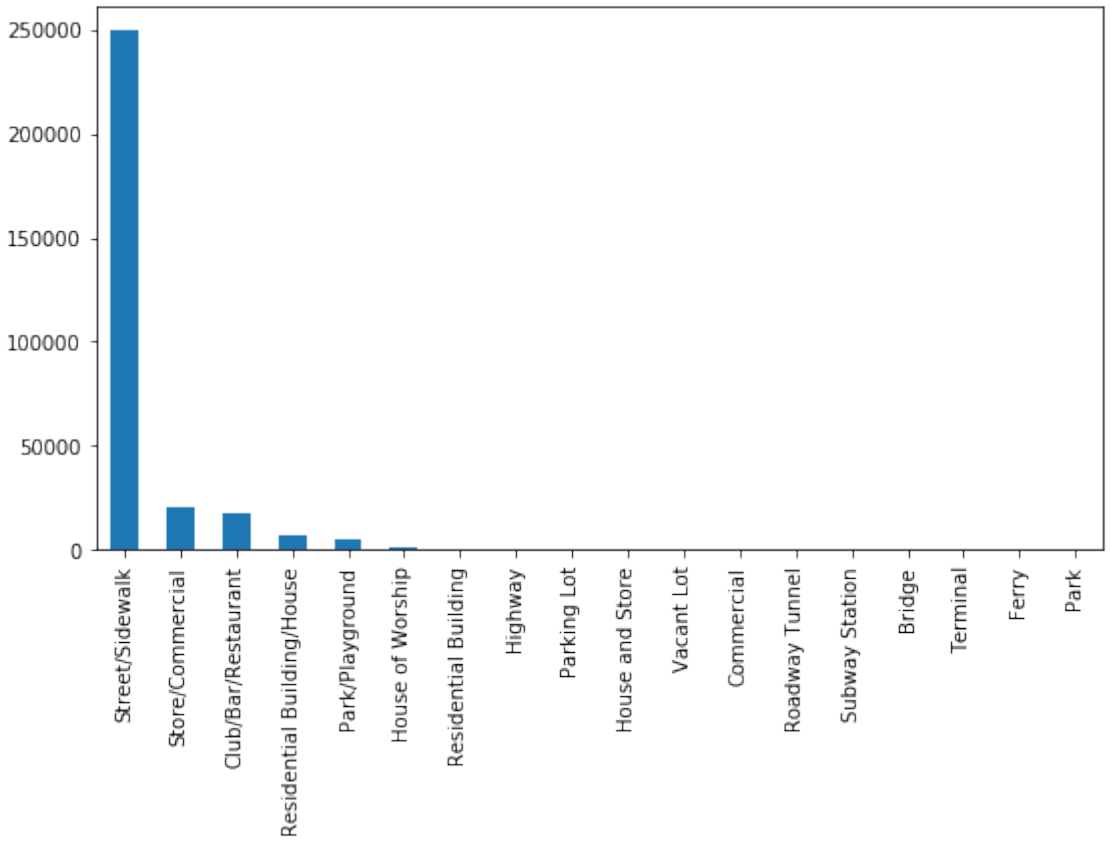
[9]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1add4df4e48>
```



Insight 1 So most of the people call 311 to complain about Blocked Driveway, followed by Illegal Parking and so on.

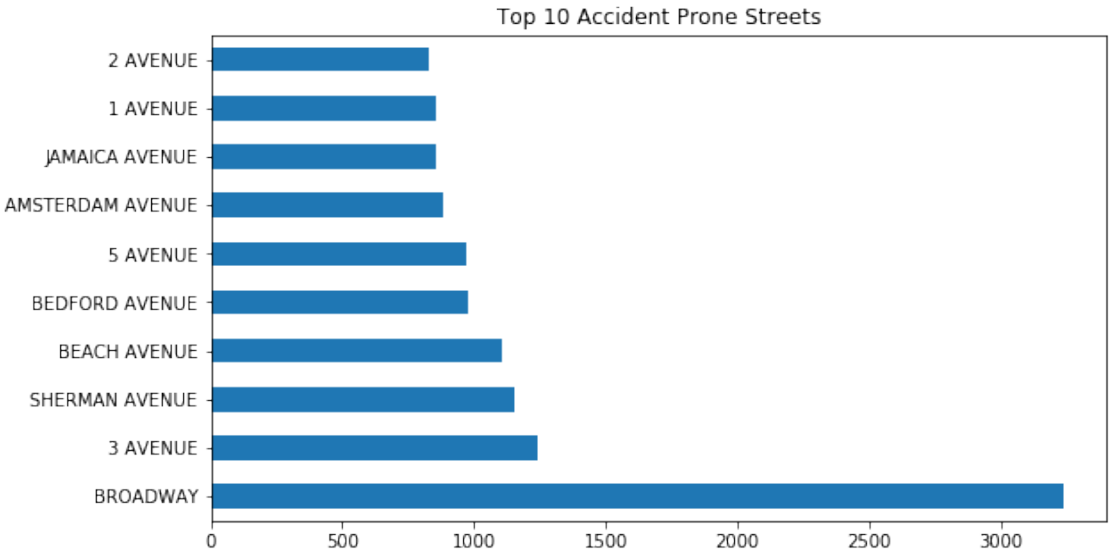
[10]:
```
(customer_dataframe['Location Type'].value_counts()).plot(kind='bar',
                    figsize=(9,5), title = '')
```

[10]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1add7621c48>
```



[11]:
```
(customer_dataframe['Street Name'].value_counts().head(10)).plot(kind='barh',
                    figsize=(9,5), title = 'Top 10 Accident Prone Streets')
```

[11]: <matplotlib.axes._subplots.AxesSubplot at 0x1add73f82c8>



Insight 2 Broadway witnesses the most accidents

[12]:
```
#Categorise the complaint service time based on the data of Request_Closing_Time
#Below 2 hours - Fast,
#Between 2 to 4 hours - Acceptable,
#Between 4 to 6 - Slow,
#More than 6 hours - Very Slow

customer_dataframe['Request_Closing_Time'].dtype
```

[12]:
```
dtype('<m8[ns]')
```

[13]:
```
#testing the data
customer_dataframe['Request_Closing_Time'].iloc[247].days
```

[13]:
```
0
```

[14]:
```
def toHrs(timeDel):
    days = timeDel.days
    hrs = round(timeDel.seconds/3600, 2)
    res = (days*24)+hrs
    return res
```

[15]:
```
customer_dataframe['Request_Closing_Time'] =␣
↪customer_dataframe['Request_Closing_Time'].apply(toHrs)
```

[16]:
```
customer_dataframe['Request_Closing_Time'].head()
```

[16]:
```
0    0.92
1    1.44
2    4.86
3    7.75
4    3.45
Name: Request_Closing_Time, dtype: float64
```

[17]:
```
#making a function to categorise the Request_Closing_Time
def Response_Time(time_hrs):
    if (time_hrs < 2):
        return 'Fast'
    elif (time_hrs >2 and time_hrs < 4 ):
        return 'Average'
    elif (time_hrs >4 and time_hrs < 6 ):
        return 'Slow'
    else:
```

```
        return 'Very Slow'
```

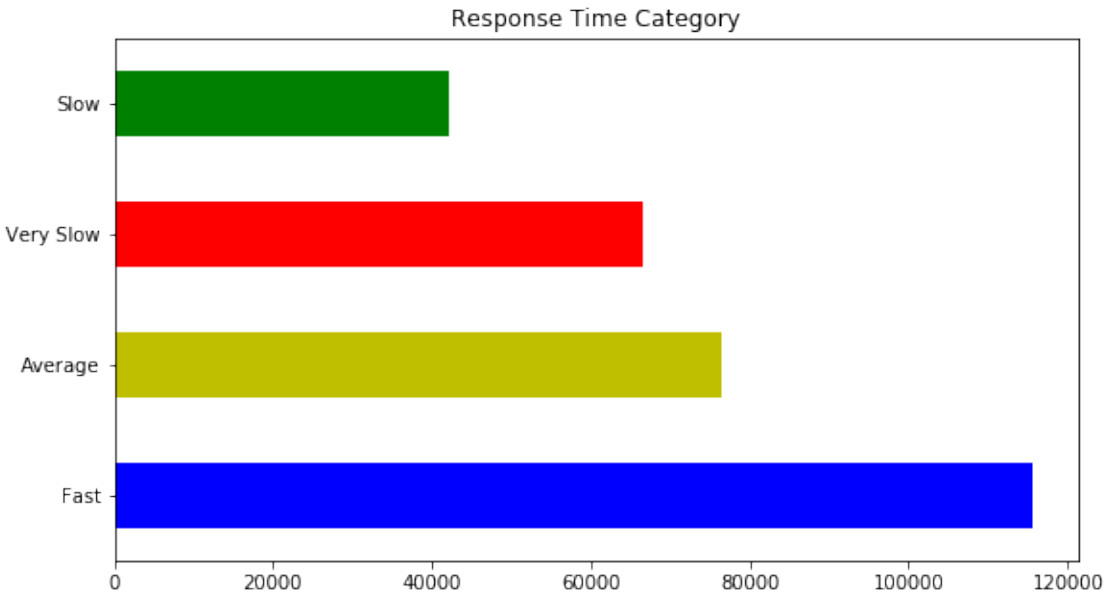
[18]:
```
#creating a new column Response_time_category to store the categories of␣
↪Request_Closing_Time
customer_dataframe['Response_time_category'] =␣
↪customer_dataframe['Request_Closing_Time'].apply(Response_Time)
```

[19]:
```
customer_dataframe['Response_time_category'].head(10)
```

[19]:
```
0         Fast
1         Fast
2         Slow
3    Very Slow
4      Average
5         Fast
6         Fast
7         Fast
8    Very Slow
9         Fast
Name: Response_time_category, dtype: object
```

[20]:
```
(customer_dataframe['Response_time_category'].value_counts()).
↪plot(kind='barh',figsize=(9,5), color=list('byrg'), title = 'Response Time␣
↪Category')
```

[20]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1add73c0488>
```



[21]:
```
customer_dataframe['Response_time_category'].value_counts()
```

[21]:
```
Fast         115550
Average       76539
Very Slow     66557
Slow          42052
Name: Response_time_category, dtype: int64
```

Insight 3 So, it is seen that the NYC is able to sove most of the received complaints within 2 hours

[22]:
```
#Finding on which months most complaints were received
customer_dataframe['Created Date'].dtype
```

[22]:
```
dtype('<M8[ns]')
```

[23]:
```
#testing the data
customer_dataframe['Created Date'].iloc[247].month
```

[23]:
```
12
```

[24]:
```
#a function to return month name from the month number
monthName = pd.Series({1:'Jan', 2:'Feb',3:'Mar', 4:'Apr', 5:'May', 6:'Jun',
                       7:'Jul', 8:'Aug', 9:'Sep', 10:'Oct', 11:'Nov', 12:'Dec'})
def getMonth(timeDel):
    month = timeDel.month
    return monthName[month]
```

[25]:
```
#testing the function
print(getMonth(customer_dataframe['Created Date'].iloc[247]))
```

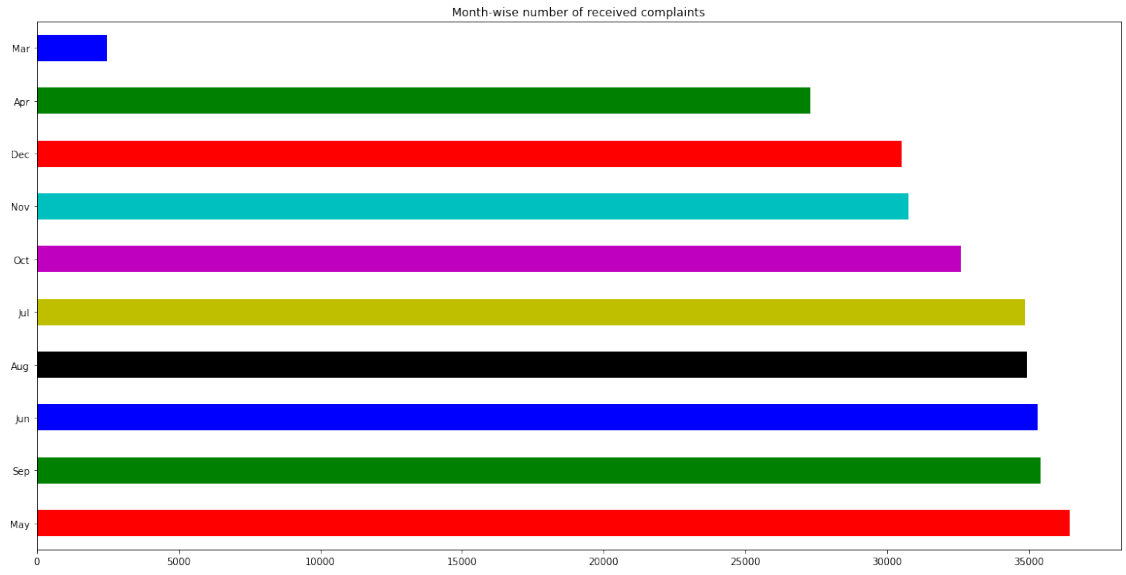
```
Dec
```

[26]:
```
#applying the function to the entire column and storing the values in a new␣
↪column Created_Month
customer_dataframe['Created_Month'] = customer_dataframe['Created Date'].
↪apply(getMonth)
customer_dataframe['Created_Month'].head()
```

[26]:
```
0    Dec
1    Dec
2    Dec
3    Dec
4    Dec
Name: Created_Month, dtype: object
```

[27]:
```
(customer_dataframe['Created_Month'].value_counts()).plot(kind='barh',␣
↪figsize=(20,10), color=list('rgbkymc'), title = 'Month-wise number of␣
↪received complaints')
```

[27]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1ade7ebf648>
```



Insight 4 The month of May has received the highest number of complaints according to this database in the year 2015

[28]:
```
#Order the complaint types based on the average 'Request_Closing_Time',␣
↪grouping them for different locations.
#grouping the data city wise
customer_dataframe['City'].head()
```

[28]:
```
0    NEW YORK
1     ASTORIA
2       BRONX
3       BRONX
4    ELMHURST
Name: City, dtype: object
```

[29]:
```
#checking null values
customer_dataframe['City'].isnull().sum()
```

[29]:
```
2614
```

[30]:
```
customer_dataframe['City'].fillna('Not Available')
```

[30]:
```
0              NEW YORK
1               ASTORIA
2                 BRONX
3                 BRONX
4              ELMHURST
               ...
300693    Not Available
300694    RICHMOND HILL
300695         BROOKLYN
300696            BRONX
300697         NEW YORK
Name: City, Length: 300698, dtype: object
```

[31]:
```
#grouping the dataom
df_grouped_data = customer_dataframe[['City', 'Complaint␣
↪Type','Request_Closing_Time']].groupby(['City', 'Complaint Type']).mean()
```

[32]:
```
df_grouped_data
```

[32]:

City	Complaint Type	Request_Closing_Time
ARVERNE	Animal Abuse	2.153158
	Blocked Driveway	2.526000
	Derelict Vehicle	2.968889
	Disorderly Youth	3.595000
	Drinking	0.240000
...		...
Woodside	Blocked Driveway	6.405455
	Derelict Vehicle	4.965000
	Illegal Parking	5.219500
	Noise - Commercial	2.390000
	Noise - Street/Sidewalk	3.410000

[764 rows x 1 columns]

[33]:
```
#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?
```

[34]:
```
import scipy.stats as stats
from math import sqrt
```

[35]:
```
#Performing ANOVA test for the first one

# H0 : All Complaint Type average response time is similar
# H1 : Not similar

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

[35]:
```
Blocked Driveway            77044
Illegal Parking             75361
Noise - Street/Sidewalk     48612
Noise - Commercial          35577
Derelict Vehicle            17718
Noise - Vehicle             17083
Animal Abuse                 7778
Traffic                      4498
Homeless Encampment          4416
Noise - Park                 4042
Vending                      3802
Drinking                     1280
Noise - House of Worship      931
Posting Advertisement         650
Urinating in Public           592
Bike/Roller/Skate Chronic     427
Panhandling                   307
Disorderly Youth              286
Illegal Fireworks             168
Graffiti                      113
Agency Issues                   6
Squeegee                        4
Ferry Complaint                 2
Animal in a Park                1
Name: Complaint Type, dtype: int64
```

[36]:
```
top5_complaints_type = customer_dataframe['Complaint Type'].value_counts()[:5]
top5_complaints_type
```

[36]:
```
Blocked Driveway          77044
Illegal Parking           75361
Noise - Street/Sidewalk   48612
Noise - Commercial        35577
Derelict Vehicle          17718
Name: Complaint Type, dtype: int64
```

[37]:
```
top5_complaints_type_names = top5_complaints_type.index
top5_complaints_type_names
```

[37]:
```
Index(['Blocked Driveway', 'Illegal Parking', 'Noise - Street/Sidewalk',
       'Noise - Commercial', 'Derelict Vehicle'],
      dtype='object')
```

[38]:
```
complaint_wise_response_time = customer_dataframe[['Complaint Type',␣
↪'Request_Closing_Time']].groupby(['Complaint Type']).mean()
complaint_wise_response_time
```

[38]:

Complaint Type	Request_Closing_Time
Agency Issues	5.258333
Animal Abuse	5.213240
Animal in a Park	336.830000
Bike/Roller/Skate Chronic	3.766486
Blocked Driveway	4.740904
Derelict Vehicle	7.364152
Disorderly Youth	3.558846
Drinking	3.861859
Ferry Complaint	NaN
Graffiti	7.151062
Homeless Encampment	4.365609
Illegal Fireworks	2.761190
Illegal Parking	4.501152
Noise - Commercial	3.147167
Noise - House of Worship	3.193283
Noise - Park	3.410721
Noise - Street/Sidewalk	3.445222
Noise - Vehicle	3.588984
Panhandling	4.372820
Posting Advertisement	1.975941
Squeegee	4.047500
Traffic	3.448645
Urinating in Public	3.626503
Vending	4.013897

[39]:
```
customer_dataframe[customer_dataframe['Complaint Type'] == 'Ferry Complaint']
```

[39]:

	Unique Key	Created Date	Closed Date	Request_Closing_Time	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	…	Road Ramp
161610	31227876	2015-08-03 08:28:00	NaT	NaN	NYPD	New York City Police Department	Ferry Complaint	Homeless Issue	Terminal	NaN	…	NaN
192974	31015799	2015-07-06 09:12:00	NaT	NaN	NYPD	New York City Police Department	Ferry Complaint					

```
192974  Disruptive Passenger         Ferry           NaN  …       NaN

       Bridge Highway Segment Garage Lot Name  Ferry Direction  \
161610                    NaN             NaN              NaN
192974                    NaN             NaN  Manhattan Bound

                        Ferry Terminal Name Latitude Longitude Location  \
161610  St. George Terminal (Staten Island)      NaN       NaN      NaN
192974                              Barberi      NaN       NaN      NaN

       Response_time_category Created_Month
161610              Very Slow           Aug
192974              Very Slow           Jul

[2 rows x 56 columns]
```

[40]:
```
complaint_wise_response_time.dropna(inplace =True)
complaint_wise_response_time
```

[40]:

Complaint Type	Request_Closing_Time
Agency Issues	5.258333
Animal Abuse	5.213240
Animal in a Park	336.830000
Bike/Roller/Skate Chronic	3.766486
Blocked Driveway	4.740904
Derelict Vehicle	7.364152
Disorderly Youth	3.558846
Drinking	3.861859
Graffiti	7.151062
Homeless Encampment	4.365609
Illegal Fireworks	2.761190
Illegal Parking	4.501152
Noise - Commercial	3.147167
Noise - House of Worship	3.193283
Noise - Park	3.410721
Noise - Street/Sidewalk	3.445222
Noise - Vehicle	3.588984
Panhandling	4.372820
Posting Advertisement	1.975941
Squeegee	4.047500
Traffic	3.448645
Urinating in Public	3.626503
Vending	4.013897

[41]:

```
sample_data = customer_dataframe.loc[customer_dataframe['Complaint Type'].
 ↪isin(top5_complaints_type_names), ['Complaint Type', 'Request_Closing_Time']]
sample_data
```

[41]:

	Complaint Type	Request_Closing_Time
0	Noise - Street/Sidewalk	0.92
1	Blocked Driveway	1.44
2	Blocked Driveway	4.86
3	Illegal Parking	7.75
4	Illegal Parking	3.45
…	…	…
300693	Noise - Commercial	NaN
300694	Blocked Driveway	2.01
300695	Noise - Commercial	3.12
300696	Noise - Commercial	4.09
300697	Noise - Commercial	4.15

[254312 rows x 2 columns]

[42]:
```
sample_data.isnull().sum()
```

[42]:
```
Complaint Type             0
Request_Closing_Time    2059
dtype: int64
```

[43]:
```
sample_data.dropna(how='any', inplace=True)
sample_data.isnull().sum()
```

[43]:
```
Complaint Type          0
Request_Closing_Time    0
dtype: int64
```

[44]:
```
sample_data.shape
```

[44]:
```
(252253, 2)
```

[45]:
```
s1 = sample_data[sample_data['Complaint Type'] ==␣
 ↪top5_complaints_type_names[0]].Request_Closing_Time
s2 = sample_data[sample_data['Complaint Type'] ==␣
 ↪top5_complaints_type_names[1]].Request_Closing_Time
s3 = sample_data[sample_data['Complaint Type'] ==␣
 ↪top5_complaints_type_names[2]].Request_Closing_Time
s4 = sample_data[sample_data['Complaint Type'] ==␣
 ↪top5_complaints_type_names[3]].Request_Closing_Time
s5 = sample_data[sample_data['Complaint Type'] ==␣
 ↪top5_complaints_type_names[4]].Request_Closing_Time
s1.head()
```

[45]:
```
1     1.44
2     4.86
7     1.80
9     1.38
10    7.80
Name: Request_Closing_Time, dtype: float64
```

[46]:
```
print(s1.isnull().sum())
print(s2.isnull().sum())
print(s3.isnull().sum())
print(s4.isnull().sum())
print(s5.isnull().sum())
```

```
0
0
0
0
0
```

[47]:
```
stats.f_oneway(s1, s2, s3, s4, s5)
```

[47]:
```
F_onewayResult(statistic=1799.598683238952, pvalue=0.0)
```

We can see pvalue is less than 0.05 so we reject null hypothesis and so all complaint types average response time is not similar.

[48]:
```
# Trying ChiSquare Test for second one :-
#Are the type of complaint or service requested and location related?

# H0 : 2 categories - Complain Type and Location is independent means not␣
 ↪related
# Ha : 2 categories - Complain Type and Location is dependent means related
```

[49]:
```
top5_location = customer_dataframe['City'].value_counts()[:5]
top5_location
```

[49]:
```
BROOKLYN         98307
NEW YORK         65994
BRONX            40702
STATEN ISLAND    12343
JAMAICA           7296
Name: City, dtype: int64
```

[50]:
```
top5_location_names = top5_location.index
top5_location_names
```

[50]:
```
Index(['BROOKLYN', 'NEW YORK', 'BRONX', 'STATEN ISLAND', 'JAMAICA'],
dtype='object')
```

[51]:
```
sample_data_location_c_type = customer_dataframe.
↪loc[(customer_dataframe['Complaint Type'].isin(top5_complaints_type_names))␣
↪& (customer_dataframe['City'].isin(top5_location_names)), ['Complaint Type',␣
↪'City']]
sample_data_location_c_type.head()
```

[51]:

	Complaint Type	City
0	Noise - Street/Sidewalk	NEW YORK
2	Blocked Driveway	BRONX
3	Illegal Parking	BRONX
5	Illegal Parking	BROOKLYN
6	Illegal Parking	NEW YORK

[52]:
```
ch2, p_value, df, exp_frq = stats.chi2_contingency(pd.
↪crosstab(sample_data_location_c_type['Complaint Type'],␣
↪sample_data_location_c_type['City']))
```

[53]:
```
print(ch2)
print(p_value)
```

```
40522.79928349593
0.0
```

We can see that the pvalue is less than 0.05, so we reject the null hypothesis. That means the complaint type and location are not independent.

THE END! THANK YOU!