Project 1 Customer Service Request Analysis

DESCRIPTION

Background of Problem Statement :

NYC 311's mission is to provide the public with quick and easy access to all New York City government services and information while offering the best customer service. Each day, NYC311 receives thousands of requests related to several hundred types of non-emergency services, including noise complaints, plumbing issues, and illegally parked cars. These requests are received by NYC311 and forwarded to the relevant agencies such as the police, buildings, or transportation. The agency responds to the request, addresses it, and then closes it.

Problem Objective :

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

Analysis Tasks to be performed:

(Perform a service request data analysis of New York City 311 calls)

1. Import a 311 NYC service request.
2. 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)
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.
4. Order the complaint types based on the average 'Request_Closing_Time', grouping them for different locations.
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'.

a. Whether the average response time across complaint types is similar or not (overall)

b. Are the type of complaint or service requested and location related?

In [1]:

```
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
```

In [2]:

```
# Load libraries
import numpy as np
import pandas as pd
import nltk
import random
import re
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

Task-1 Read the data file

In [3]:

```
data = pd.read_csv('311_Service_Requests_from_2010_to_Present.csv')
```

```
/Applications/anaconda3/lib/python3.8/site-packages/IPython/core/interactiveshell.py:3146: DtypeWarning: Columns (48,49) have mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [4]:

```
# Check if the data has been ingested properly

data.head()
data.describe
data.shape
data.isna().sum()
```

Out[4]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Name	Bridge Highway Direction	Road Ramp	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	Location
0	32310363	12/31/2015 11:59:45 PM	01-01-1600:55	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	71 VERMILYEA AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.865682	-73.923501	(40.86568153763367, -73.92350955717444)
1	32309934	12/31/2015 11:59:44	01-01-161	NYPD	New York City Po	Blocked Driveway	No Access	Street/Sidewalk	11105.0	27-07 23 AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.775945	-73.915094	(40.77594533121032, -73.91509394

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Name	Bridge Highway Direction	Road Ramp	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	Location
		PM	:26		liceDepartment																98605)
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/ Sidewalk	10458.0	2897 VALENTINE AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.870325	-73.88525	(40.87032 4522 1114 24, -73.88852 4644 1864 6)
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Dep artm	Illegal Parking	Commercial Overnight Parking	Street/ Sidewalk	10461.0	2940 BAISLEY AVENUE	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.835994	-73.82879	(40.83599 4046 8308 3, -73.82837 9395 8420 6)

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Incident Address	...	Bridge Highway Name	Bridge Highway Direction	Road Ramp	Bridge Highway Segment	Garage Lot Name	Ferry Direction	Ferry Terminal Name	Latitude	Longitude	Location
4	32306529	12/31/2015 11:56:58 PM	01-01-16 3:24	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	87-1457 ROAD	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	40.730060	-73.874170	(40.73305961895685, -73.87416975810375)

5 rows × 53 columns

Out[4]:

```
<bound method NDFrame.describe of         Unique Key            Created Date  \
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]>
```

Out[4]:

```
(300698, 53)
```

Out[4]:

```
Unique Key                          0
Created Date                        0
Closed Date                      2164
Agency                              0
Agency Name                         0
Complaint Type                      0
Descriptor                       5914
Location Type                     131
Incident Zip                     2615
Incident Address                44410
Street Name                     44410
Cross Street 1                  49279
Cross Street 2                  49779
Intersection Street 1          256840
Intersection Street 2          257336
Address Type                      2815
City                              2614
Landmark                        300349
Facility Type                     2171
Status                              0
Due Date                            3
Resolution Description              0
Resolution Action Updated Date   2187
Community Board                     0
Borough                             0
X Coordinate (State Plane)       3540
Y Coordinate (State Plane)       3540
Park Facility Name                  0
Park Borough                        0
School Name                         0
School Number                       0
School Region                       1
School Code                         1
School Phone Number                 0
School Address                      0
School City                         0
School State                        0
School Zip                          1
School Not Found                    0
School or Citywide Complaint   300698
Vehicle Type                   300698
Taxi Company Borough           300698
Taxi Pick Up Location          300698
Bridge Highway Name            300455
```

```
Bridge Highway Direction          300455
Road Ramp                         300485
Bridge Highway Segment            300485
Garage Lot Name                   300698
Ferry Direction                   300697
Ferry Terminal Name               300696
Latitude                            3540
Longitude                           3540
Location                            3540
dtype: int64
```

Data Preparation in the next few steps as explained below

Drop the columns with max NaN values

In [5]:

```
data_ac = data.drop(columns =['Incident Address','Street Name','Cross
Street 1','Cross Street 2','Intersection Street 1','Intersection Street
2','Landmark','X Coordinate (State Plane)','Y Coordinate (State
Plane)','School or Citywide Complaint','Vehicle Type','Taxi Company
Borough','Taxi Pick Up Location','Bridge Highway Name','Bridge Highway
Direction','Bridge Highway Direction','Road Ramp','Bridge Highway
Segment','Garage Lot Name','Ferry Direction','Ferry Terminal
Name','Latitude','Longitude'])
data_ac.shape
data_ac.head()
data_ac.isna().sum()
```

Out[5]:

```
(300698, 31)
```

Out[5]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	School Number	School Region	School Code	School Phone Number	School Address	School City	School State	School Zip	School Not Found	Location
0	32310363	12/31/2015 11:59:44	01-01-16 0:55	NYPD	New York City Police D	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	ADDRESS	...	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	N	(40.865681536337 67, -73.9235009557174 4)

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	School Number	School Region	School Code	School Phone Number	School Address	School City	School State	School Zip	School Not Found	Location
		5 PM			epartment																
1	32309934	12/31/2015 11:59:44 PM	01-01-16 1:26	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	N	(40.775945312321085, -73.9150939389860 5)
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	N	(40.870324522111424, -73.8852464418646)

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	School Number	School Region	School Code	School Phone Number	School Address	School City	School State	School Zip	School Not Found	Location
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Department	Illegal Parking	Commercial Overnight Parking	Street/Sidewalk	10461.0	ADDRESS	...	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	N	(40.835994046830 83, -73.8283793958420 6)
4	32306529	12/31/2015 11:56:58 PM	01-01-16 3:24	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	ADDRESS	...	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	Unspecified	N	(40.733059618956 815, -73.8741697581037 5)

5 rows × 31 columns

Out[5]:

```
Unique Key                        0
Created Date                      0
Closed Date                    2164
Agency                            0
```

```
Agency Name                          0
Complaint Type                       0
Descriptor                        5914
Location Type                      131
Incident Zip                      2615
Address Type                      2815
City                              2614
Facility Type                     2171
Status                               0
Due Date                             3
Resolution Description               0
Resolution Action Updated Date    2187
Community Board                      0
Borough                              0
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
Location                          3540
dtype: int64
```

Drop columns related to School which have unspecified data

In [6]:

```
data_bc = data_ac.drop(columns=['School Name','School Number','School
Region','School Code','School Phone Number','School Address','School
City','School Zip','School Not Found'])
data_bc.head()
data_bc.shape
data_bc.isna().sum()
```

Out[6]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
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	ADDRESS	...	Closed	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 0:55	12 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.86568153633767, -73.92350095577444)
1	32309934	12/31/2015 11:59:44	01-01-16 1:26	NYPD	New York City Police Depart	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	Closed	01-01-16 7:59	The Police Department respon	01-01-16 1:26	01 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.77594531232108 5, -73.91509393898605)

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
		PM			ment									ded to the compl ai...							
2	32309159	12/31/2015 11:59:29 PM	01-01-16 4:51	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	Closed	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 4:51	07 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.870324522111424, -73.88524644186466)
3	32301	12/31/	01-0	NY	NewY	Illegal Pa	Comm	Street/Side	1046	ADDR	...	Clos	01-0	The Pol	01-01-	10 BRO	BRO	Unspeci	BRO	Unspeci	(40.835994046

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
	50988	2015 11:57:46 PM	1-167:43	PD	ork City Police Department	rking	ercial Overnight Parking	walk	1.0	ESS		ed	1-167:57	ice Department responded to the complai...	167:43	NX	NX	fied	NX	fied	83083, -73.8283793958420 6)
4	32306529	12/31/2015 11:56:58 PM	01-01-163:24	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	ADDRESS	...	Closed	01-01-167:56	The Police Department responded and	01-01-163:24	04 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.733059618956815, -73.8741697581037 5)

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
													upon arriv...							

5 rows × 22 columns

Out[6]:

```
(300698, 22)
```

Out[6]:

```
Unique Key                            0
Created Date                          0
Closed Date                        2164
Agency                                0
Agency Name                           0
Complaint Type                        0
Descriptor                         5914
Location Type                       131
Incident Zip                       2615
Address Type                       2815
City                               2614
Facility Type                      2171
Status                                0
Due Date                              3
Resolution Description                0
Resolution Action Updated Date     2187
Community Board                       0
Borough                               0
Park Facility Name                    0
Park Borough                          0
School State                          0
Location                           3540
dtype: int64
```

Drop rows with Nan values

In [7]:

```
data_clean = data_bc.dropna()
data_clean.head()
data_clean.shape
data_clean.isna().sum()
```

Out[7]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
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	ADDRESS	...	Closed	01-01-16 7:59	The Police Department responded and upon ariv...	01-01-16 0:55	12 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.865681536337 67, -73.9235009557174 4)
1	32309934	12/31/2015 11:	01-01-16 :	NYPD	New York City Pol	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	Closed	01-01-16 7:	The Police Depart	01-01-16 1:26	01 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.775945312321 085, -73.9150939

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
		59:44 PM	26		ice Department								59	ment responded to the complai...							3898605)
2	32309159	12/31/2015 11:59:29 PM	01-01-164:51	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	Closed	01-01-167:59	The Police Department responded and upon ari	01-01-164:51	07 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.870324522111424, -73.88852464418646)

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
														v...							
3	32305098	12/31/2015 11:57:46 PM	01-01-16 7:43	NYPD	New York City Police Department	Illegal Parking	Commercial Overnight Parking	Street/Sidewalk	10461.0	ADDRESS	...	Closed	01-01-16 7:57	The Police Department responded to the compl ai...	01-01-16 7:43	10 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.835994046830 83, -73.8283793958420 6)
4	32306529	12/31/2015 11:56:	01-01-16 3:	NYPD	New York City Police	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	ADDRESS	...	Closed	01-01-16 7:	The Police Departmen	01-01-16 3:24	04 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.733059618956 815, -73.8741697581

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Status	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location
58PM	24		Department									56	tresponded and upon arriv...							0375)

5 rows × 22 columns

Out[7]:

```
(290881, 22)
```

Out[7]:

```
Unique Key                        0
Created Date                      0
Closed Date                       0
Agency                            0
Agency Name                       0
Complaint Type                    0
Descriptor                        0
Location Type                     0
Incident Zip                      0
Address Type                      0
City                              0
Facility Type                     0
Status                            0
Due Date                          0
Resolution Description            0
Resolution Action Updated Date    0
Community Board                   0
Borough                           0
Park Facility Name                0
Park Borough                      0
School State                      0
```

```
Location                          0
dtype: int64
```

Task-2 Converted the Create Date and Closed date to Date-time format

In [8]:

```
data_clean['Created Date'] =  pd.to_datetime(data_clean['Created Date'])
data_clean['Closed Date'] =  pd.to_datetime(data_clean['Closed Date'])
<ipython-input-8-978dffa2a24b>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs
/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_clean['Created Date'] =  pd.to_datetime(data_clean['Created Date'])
<ipython-input-8-978dffa2a24b>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs
/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_clean['Closed Date'] =  pd.to_datetime(data_clean['Closed Date'])
```

Task-2 Created a new column with Resolution Time which is the time difference between Complaint registration and Complaint closure

In [9]:

```
data_clean['Resolution Time'] = data_clean['Closed Date'] -
data_clean['Created Date']
<ipython-input-9-2d271178dbca>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs
/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_clean['Resolution Time'] = data_clean['Closed Date'] - data_clean['C
reated Date']
```

In [10]:

```
data_clean.head()
```

Out[10]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolution Time
0	32310363	2015-12-31 23:59:45	2016-01-00 00:55:00	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	ADDRESS	...	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 0:55	12 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.865681536337 67, -73.9235009557174 4)	0 days 00:55:15
1	32309934	2015-12-31 23:59:	2016-01-01 0:26:	NYPD	New York City Police Depart	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	01-01-16 7:59	The Police Department respon	01-01-16 1:26	01 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.775945312321 085, -73.9150939389860 5)	0 days 01:26:16

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolution Time
		44	00		ment								ded to the complai...								
2	32309159	2015-12-31 23:59:29	2016-01-01 04:51:00	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 4:51	07 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.870324522111424, -73.88524644186466)	0 days 04:51:31
3	32302	2015	2016	NY	New Y	Illegal Pa	Comm	Street/Side	1046	ADDR	...	01-0	The Pol	01-01-	10 BRO	BRO	Unspeci	BRO	Unspeci	(40.835994046	0 days 0

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolution Time
	50988	-12-31 23:57:46	-01-01 07:43:00	PD	ork City Police Department	rking	ercial Overnight Parking	walk	1.0	ESS		1-16 7:57	ice Department responded to the complai...	16 7:43	NX	NX	fied	NX	fied	83083, -73.8283 793958 4206)	7:45:14
4	32306529	2015-12-31 23:56:58	2016-01-01 03:24:00	NYPD	New York City Police Department	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	ADDRESS	...	01-01-16 7:56	The Police Department responded and	01-01-16 3:24	04 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.733 059618 956815, -73.8741 697581 0375)	0days 03:27:02

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolution Time
												upon arriv...								

5 rows × 23 columns

Task-3 Exploratory Data Analysis (EDA)

Insight - 1 "Blocked Driveway" is the No-1 complaint made, followed by "Illegal Parking", "Noise - Street/Sidewalk" and Noise - Commercial"

In [11]:

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

Out[11]:

```
Blocked Driveway            76675
Illegal Parking             74020
Noise - Street/Sidewalk     47745
Noise - Commercial          35144
Derelict Vehicle            17496
Noise - Vehicle             16867
Animal Abuse                 7743
Traffic                      4256
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
```

Insight - 2 " 33 percent of the Complaint types cause ----> 86 percent of the Total Complaints"

In [12]:

```
data_clean['Complaint Type'].value_counts(normalize=True)
```

Out[12]:

```
Blocked Driveway            0.263596
Illegal Parking             0.254468
Noise - Street/Sidewalk     0.164139
Noise - Commercial          0.120819
Derelict Vehicle            0.060148
Noise - Vehicle             0.057986
Animal Abuse                0.026619
Traffic                     0.014631
Noise - Park                0.013500
Vending                     0.012971
Drinking                    0.004366
Noise - House of Worship    0.003163
Posting Advertisement       0.002224
Disorderly Youth            0.000980
Graffiti                    0.000388
Name: Complaint Type, dtype: float64
```

If NYPD can come up with a strategy to "SOLVE" the top 5 Complaint types it will help them reduce the number of Complaints by 86%

1.Blocked Driveway - 26.35%

2.Illegal Parking - 25.44%

3.Noise - Street/Sidewalk - 16.41%

4.Noise - Commercial - 12.08%

5.Derelict Vehicle - 6.01%

Total = 86.29%

Insight-3 "BROOKLYN" Borough generates maximum complaints followed by "QUEENS" and "MANHATTAN"

In [13]:

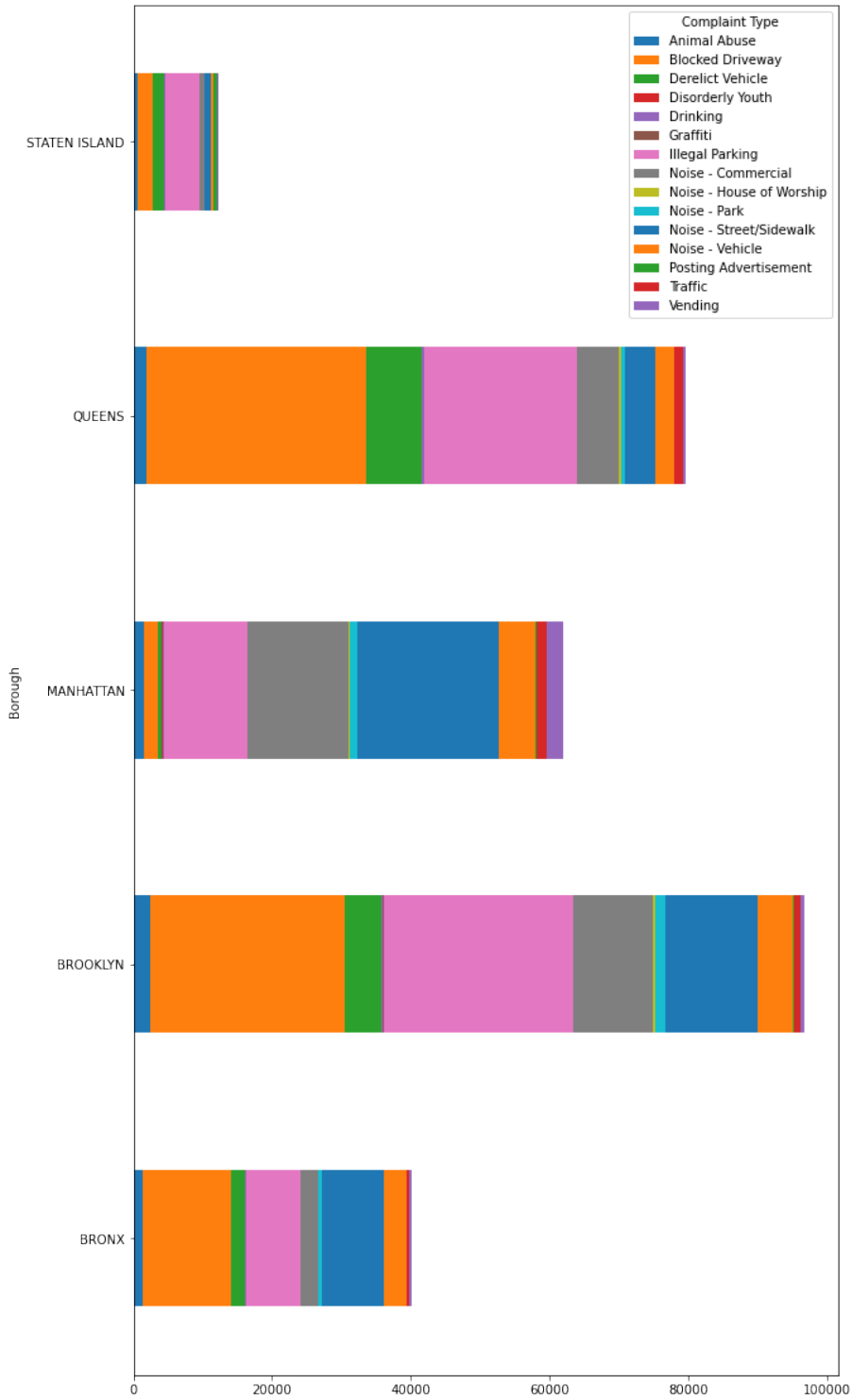
```
complaints_bor = data_clean.groupby(["Borough","Complaint
Type"]).size().unstack()

complaints_bor

complaints_bor.plot(kind="barh", figsize=(10,20), stacked=True)
```

Out[13]:

Complaint Type	Animal Abuse	Blocked Driveway	Derelict Vehicle	Disorderly Youth	Drinking	Graffiti	Illegal Parking	Noise - Commercial	Noise - House of Worship	Noise - Park	Noise - Street/ Sidewalk	Noise - Vehicle	Posting Advertisement	Traffic	Vending
Borough															
BRONX	1411	12740	1947	63	187	9	7829	2431	79	522	8864	3385	16	321	377
BROOKLYN	2390	28119	5161	72	257	43	27386	11451	338	1537	13315	5145	45	1040	514
MANHATTAN	1511	2055	528	68	294	22	11980	14528	189	1167	20360	5374	41	1468	2380
QUEENS	1874	31620	8098	59	357	37	21944	6057	297	634	4391	2607	30	1254	477
STATEN ISLAND	557	2141	1762	23	175	2	4881	677	17	67	815	356	515	173	25

Out[13]:

```
<AxesSubplot:ylabel='Borough'>
```



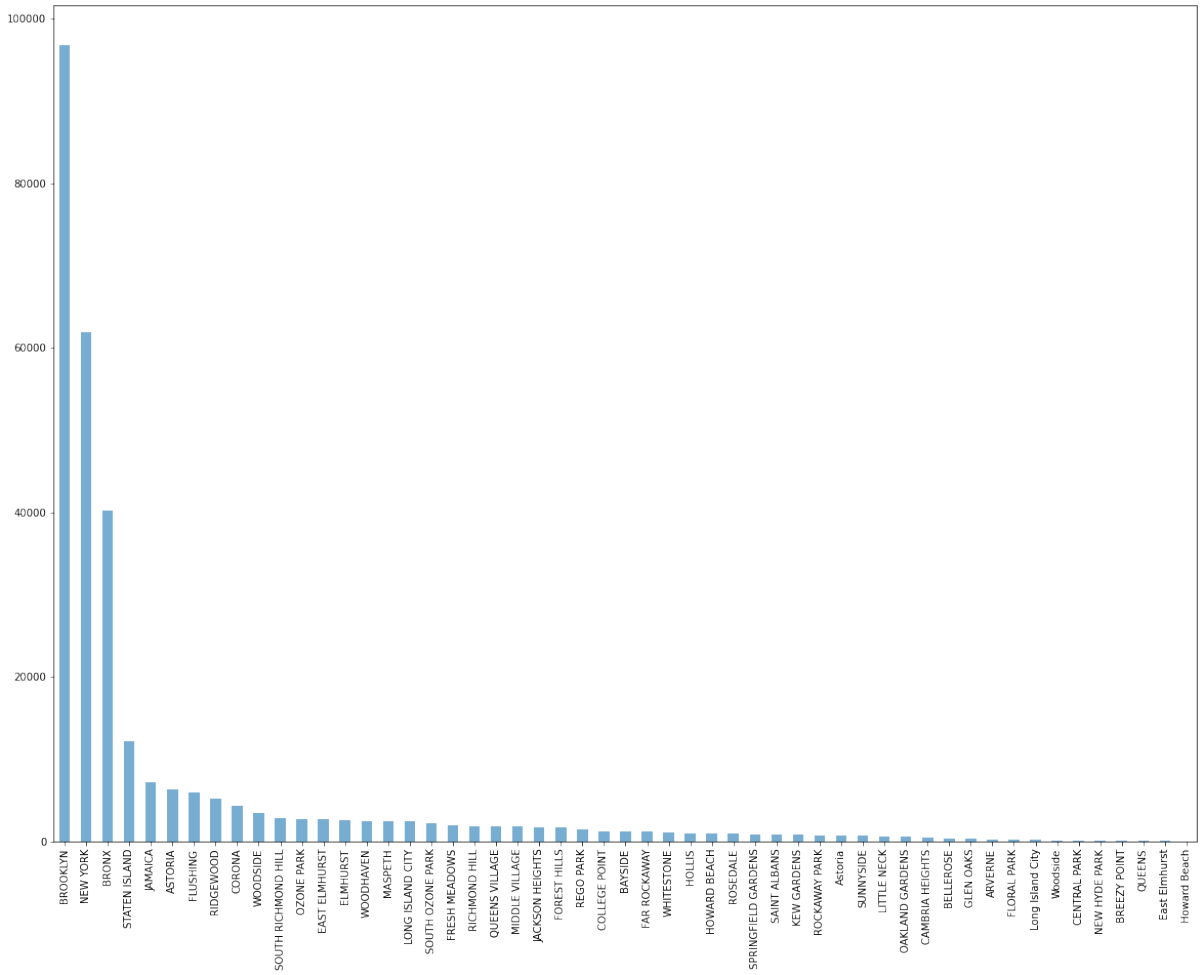
Insight-4 The City of BROOKLYN generates the largest number of Complaints followed by NEW YORK and BRONX, these three cities among them have a total of 200,000 complaints.

In [14]:

```
data_clean['City'].value_counts().plot(kind='bar', alpha=0.6,
figsize=(20,15))
plt.show()
```

Out[14]:

```
<AxesSubplot:>
```



Insight-5 Complaints with description of "LOUD MUSIC/PARTY" and "NO ACCESS" together total to 100,000

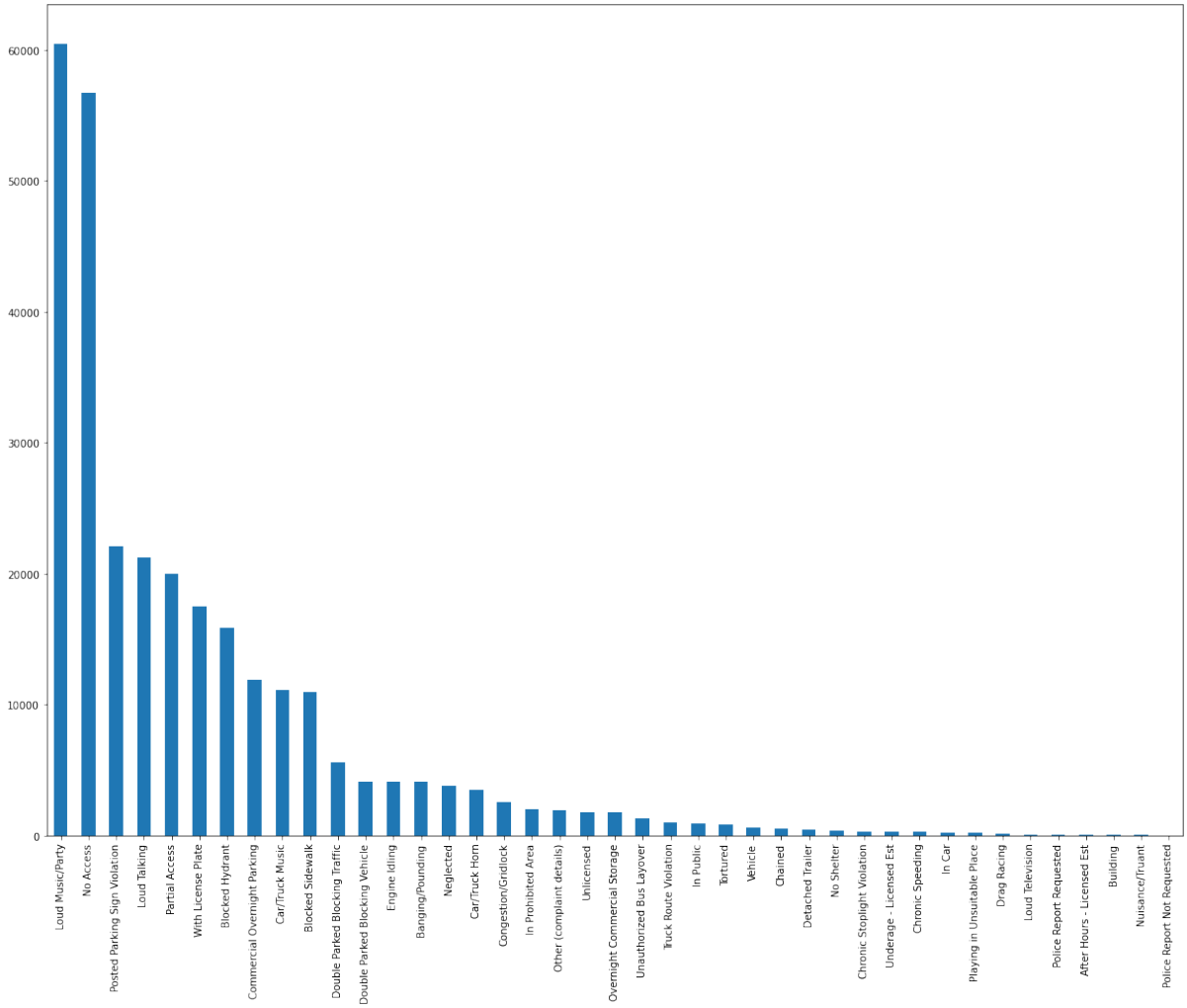
These type of offences can be dealt with relative ease by educating the residents and later levying heavy fines

In [15]:

```
data_clean['Descriptor'].value_counts().plot(kind='bar', figsize=(20,15))
plt.show()
```

Out[15]:

```
<AxesSubplot:>
```



Insight-6 Around 240,000 complaints come "from Street/Sidewalk" as Location Type

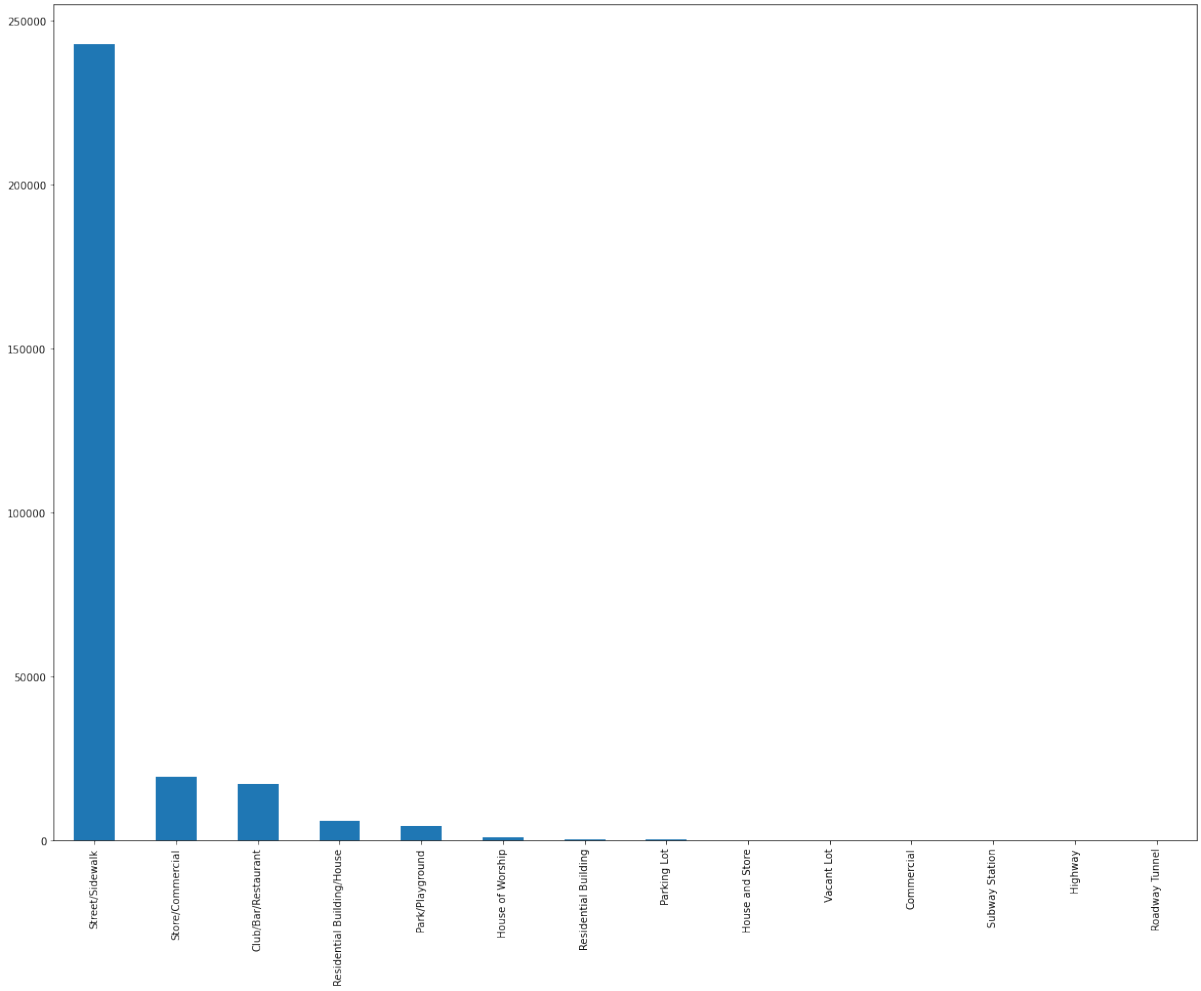
This is a clear indication the Administration has to look at "SMART PARKING SOLUTIONS" for these Location Type to resolve these type of complaints

In [16]:

```
data_clean['Location Type'].value_counts().plot(kind='bar',
figsize=(20,15))
plt.show()
```

Out[16]:

```
<AxesSubplot:>
```



In [17]:

```
dfnew = data_clean.rename(columns={'Resolution Time': 'Resolved_t'})

dfnew.head()

dfnew.tail()
```

Out[17]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
0	32310363	2015-12-31 23:59:45	2016-01-01 00:55:00	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	ADDRESS	...	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 0:55	12 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.865681536337 67, -73.9235009557174 4)	0 days 00:55:15
1	32309934	2015-12-31 23:59:	2016-01-01 1:26:	NYPD	New York City Police Depart	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	01-01-16 7:59	The Police Department respon	01-01-16 1:26	01 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.775945312321 085, -73.9150939389860 5)	0 days 01:26:16

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
		44	00		ment								ded to the complai...								
2	32309159	2015-12-31 23:59:29	2016-01-01 04:51:00	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	01-01-16 7:59	The Police Department responded and upon arriv...	01-01-16 4:51	07 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.870324522111424, -73.88524644186466)	0days 04:51:31
3	32309	2015	2016	NY	New Y	Illegal Pa	Comm	Street/Side	1046	ADDR	...	01-0	The Pol	01-01-	10 BRO	BRO	Unspeci	BRO	Unspeci	(40.835994046	0days 0

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
	50988	-12-3123:57:46	-01-0107:43:00	PD	orkCityPoliceDepartment	rking	ercialOvernightParking	walk	1.0	ESS		1-167:57	iceDepartmentrespondedtothecomplai..	167:43	NX	NX	fied	NX	fied	83083, -73.8283793958420 6)	7:45:14
4	32306529	2015-12-3123:56:58	2016-01-0103:24:00	NYPD	NewYorkCityPoliceDepartment	IllegalParking	BlockedSidewalk	Street/Sidewalk	11373.0	ADDRESS	...	01-01-167:56	ThePoliceDepartmentrespondedand	01-01-163:24	04QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.733059618956815, -73.8741697581037 5)	0days03:27:02

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
												upon arriv...									

5 rows × 23 columns

Out[17]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
30092	30281370	2015-03-29 0	2015-03-29 0	NYPD	New York City Pol	Noise - Commer	Loud Music/Party	Store/Commercial	10002.0	ADDRESS	...	03/29/2015 08:3	The Police Department	03/29/2015 01:1	03 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.716052907898855, -73.991378503	0 days 00:38:29

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
		0:34:32	1:13:01		ice Department	cial						4:32 AM	ent responded to the complai...	3:01 AM						70803)	
300694	30281230	2015-03-29 00:33:28	2015-03-29 02:33:59	NYPD	New York City Police Department	Blocked Driveway	Partial Access	Street/Sidewalk	11418.0	ADDRESS	...	03/29/2015 08:33:28 AM	The Police Department responded and upon ar	03/29/2015 02:33:59 AM	09 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.69407728322387, -73.8460866160573)	0 days 02:00:31

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
30069695	30283424	2015-03-29 00:33:03	2015-03-29 03:40:20	NYPD	New York City Police Department	Noise - Commercial	Loud Music/Party	Club/Bar/Restaurant	11206.0	ADDRESS	...	03/29/2015 08:33:03 AM	The Police Department responded to the complai...	03/29/2015 03:40:20 AM	03 BROOKLYN	BROOKLYN	Unspecified	BROOKLYN	Unspecified	(40.699590353009 27, -73.944233771441 69)	0days 03:07:17
30069696	30280004	2015-03-29	2015-03-29	NYPD	New York City P	Noise - Commer	Loud Music/P	Club/Bar/Restaurant	10461.0	ADDRESS	...	03/29/2015 08:	The Police Depart	03/29/2015 04:	10 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.837707585420 6, -73.834587310	0days 04:05:

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
	00:33:02	04:38:35		olic Department	cial	arty					33:02 AM	ment responded to the complai...	38:35 AM						19586)	33
30069 7	30281825	2015-03-29 00:33:01	2015-03-29 04:41:50	NYPD	New York City Police Department	Noise - Commercial	Loud Music/Party	Store/Commercial	10036.0	ADDRESS	...	03/29/2015 08:33:01 AM	The Police Department responded to the compl	03/29/2015 04:41:50 AM	05 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.760583229501 15, -73.985922043923 92)	0 days 04:08:49

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Due Date	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t
ai. ..																				

5 rows × 23 columns

Converting the Resolved time column to seconds

In [18]:

```
dfnew['Resolved_t'].dtype
```

Out[18]:

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

In [19]:

```
dfnew['R_t'] = dfnew["Resolved_t"].dt.seconds
dfnew
```

Out[19]:

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
0	32310363	2015-12-31 23:59:45	2016-01-01 00:55:00	NYPD	New York City Police Department	Noise - Street/Sidewalk	Loud Music/Party	Street/Sidewalk	10034.0	ADDRESS	...	The Police Department responded and upon arriv...	01-01-16 0:55	12 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.865681536337 67, -73.9235009557174 4)	0days 00:55:15	3315
1	32309934	2015-12-31 23:	2016-01-01 01:	NYPD	New York City Police	Blocked Driveway	No Access	Street/Sidewalk	11105.0	ADDRESS	...	The Police Department	01-01-16 1:26	01 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.775945312321 085, -73.9150939389	0days 01:26:16	5176

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
		59:44	26:00		Department							responded to the compl ai..							8605)		
2	32309159	2015-12-31 23:59:29	2016-01-01 04:51:00	NYPD	New York City Police Department	Blocked Driveway	No Access	Street/Sidewalk	10458.0	ADDRESS	...	The Police Department responded and upon ari	01-01-16 4:51	07 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.870324522111424, -73.88524644186466)	0days04:51:31	17491

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
												v..									
3	32305098	2015-12-31 23:57:46	2016-01-07 43:00	NYPD	New York City Police Department	Illegal Parking	Commercial Overnight Parking	Street/Sidewalk	10461.0	ADDRESS	...	The Police Department responded to the compl ai..	01-01-67:43	10 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.835994046830 83, -73.8283793958420 6)	0 days 07:45:14	27914
4	32306529	2015-12-31 2	2016-01-0 1 0	NYPD	New York City Pol	Illegal Parking	Blocked Sidewalk	Street/Sidewalk	11373.0	ADDRESS	...	The Police Departm	01-01-63:24	04 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.733059618956 815, -73.8741697581	0 days 03:27:02	12422

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
		3:56:58	3:24:00		icDepartment							entrespondedandupponarriv..							0375)		
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
30092	30281370	2015-03-29 00:34:32	2015-03-29 01:13:01	NYPD	NewYorkCityPoliceDepartm	Noise - Commercial	Loud Music/Party	Store/Commercial	10002.0	ADDRESS	...	ThePoliceDepartmentresponded	03/29/2015 01:13:01 AM	03MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.716052907898 55, -73.9913785037080 3)	0days 00:38:29	2309

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
30069 4	30281230	2015-03-29 00:33:28	2015-03-29 02:33:59	NYPD	New York City Police Department	Blocked Driveway	Partial Access	Street/Sidewalk	11418.0	ADDRESS	...	The Police Department responded and upon arriv...	03/29/2015 02:33:59 AM	09 QUEENS	QUEENS	Unspecified	QUEENS	Unspecified	(40.694077283223 87, -73.8460866160573)	0days 02:00:31	7231
				ent							to the compl ai..									

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
30069	30283424	2015-03-29 00:33:03	2015-03-29 03:40:20	NYPD	New York City Police Department	Noise - Commercial	Loud Music/Party	Club/Bar/Restaurant	11206.0	ADDRESS	...	The Police Department responded to the compl...	03/29/2015 03:40:20 AM	03 BROOKLYN	BROOKLYN	Unspecified	BROOKLYN	Unspecified	(40.699590353009027, -73.94423377144169)	0days 03:07:17	11237
30096	30280004	2015-03-29 00:33:33	2015-03-29 04:38	NYPD	New York City Police De	Noise - Commercial	Loud Music/Party	Club/Bar/Restaurant	10461.0	ADDRESS	...	The Police Department resp	03/29/2015 04:38:35	10 BRONX	BRONX	Unspecified	BRONX	Unspecified	(40.83770758542006, -73.83458731019586)	0days 04:05:33	14733

	Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type	Descriptor	Location Type	Incident Zip	Address Type	...	Resolution Description	Resolution Action Updated Date	Community Board	Borough	Park Facility Name	Park Borough	School State	Location	Resolved_t	R_t
		:02	:35		partment							onded to the compl ai..	AM								
30097	30281825	2015-03-29 00:33:01	2015-03-29 04:41:50	NYPD	New York City Police Department	Noise - Commercial	Loud Music/Party	Store/Commercial	10036.0	ADDRESS	...	The Police Department responded to the compl ai..	03/29/2015 04:41:50 AM	05 MANHATTAN	MANHATTAN	Unspecified	MANHATTAN	Unspecified	(40.760583229501 15, -73.985922043923 92)	0 days 04:08:49	14929

290881 rows × 24 columns

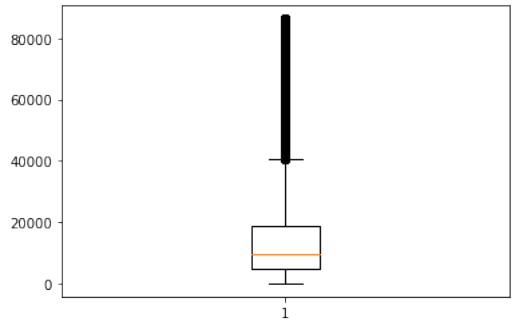
Checking the distribution of the Resolution time using boxplot, value_counts() and distribution plot

In [20]:

```
plt.boxplot(dfnew['R_t'])
```

Out[20]:

```
{'whiskers': [<matplotlib.lines.Line2D at 0x7ff94b67c5b0>,
  <matplotlib.lines.Line2D at 0x7ff94b67c910>],
 'caps': [<matplotlib.lines.Line2D at 0x7ff94b67cc70>,
  <matplotlib.lines.Line2D at 0x7ff94b67cfd0>],
 'boxes': [<matplotlib.lines.Line2D at 0x7ff94b67c250>],
 'medians': [<matplotlib.lines.Line2D at 0x7ff94b688370>],
 'fliers': [<matplotlib.lines.Line2D at 0x7ff94b6886d0>],
 'means': []}
```



In [21]:

```
dfnew['R_t'].value_counts()
```

Out[21]:

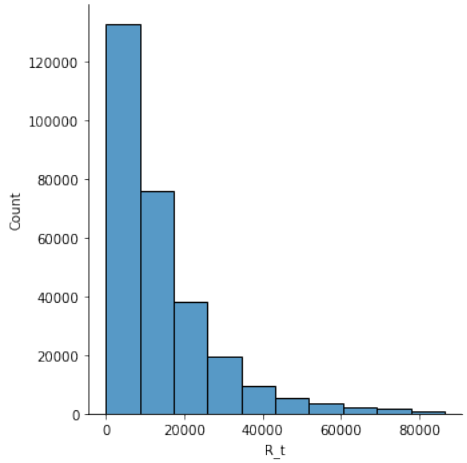
```
2160     480
2640     464
3060     464
2760     456
3180     456
        ...
48681      1
58914      1
63008      1
77339      1
85197      1
Name: R_t, Length: 44617, dtype: int64
```

In [22]:

```
sns.displot(dfnew, x="R_t", bins=10)
```

Out[22]:

```
<seaborn.axisgrid.FacetGrid at 0x7ff94b688b80>
```



In [23]:

```
dfnew['R_t'].dtype
```

Out[23]:

```
dtype('int64')
```

Addding a Resolution time category with ELEVEN levels for better analysis

In [24]:

```
# create a list of our conditions
conditions = [
    (dfnew['R_t'] >36000 ),
    (dfnew['R_t'] > 32400) & (dfnew['R_t'] <= 36000),
    (dfnew['R_t'] > 28800) & (dfnew['R_t'] <= 32400),
    (dfnew['R_t'] > 25200) & (dfnew['R_t'] <= 28800),
    (dfnew['R_t'] > 21600) & (dfnew['R_t'] <= 25200),
    (dfnew['R_t'] > 18000) & (dfnew['R_t'] <= 21600),
    (dfnew['R_t'] > 14400) & (dfnew['R_t'] <= 18000),
    (dfnew['R_t'] > 10800) & (dfnew['R_t'] <= 14400),
    (dfnew['R_t'] >  7200) & (dfnew['R_t'] <= 10800),
    (dfnew['R_t'] > 3600) & (dfnew['R_t'] <= 7200),
    (dfnew['R_t'] >= 0) & (dfnew['R_t'] <= 3600),
]

# create a list of the values we want to assign for each condition
values = [11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1]

# create a new column and use np.select to assign values to it using our
lists as arguments
dfnew['res_cat'] = np.select(conditions, values)
```

In [25]:

```
dfnew['res_cat'].value_counts()
```

Out[25]:

```
2     57507
1     56320
3     43654
4     31998
5     23776
11    21868
6     17861
7     13772
```

```
8      10615
9       7708
10      5802
Name: res_cat, dtype: int64
```

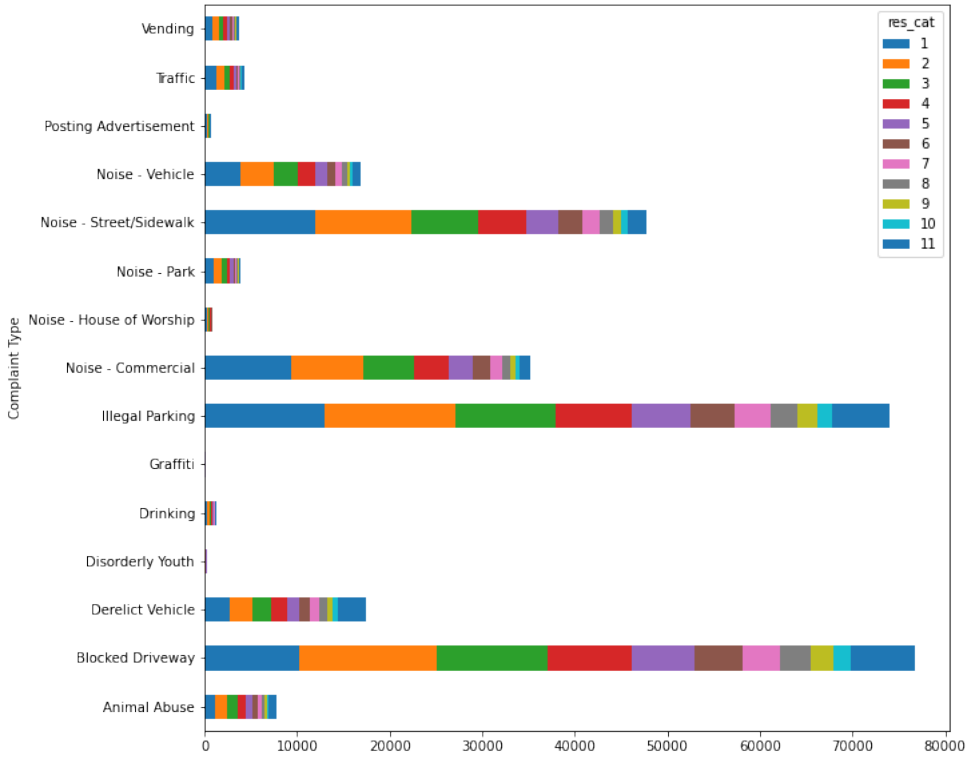
Task-4 Complaint Types grouped with Resolution Time Categories

In [26]:

```
complaints_t = dfnew.groupby(["Complaint Type","res_cat"]).size().unstack()

complaints_t.plot(kind="barh", figsize=(10,10), stacked=True)
```

Out[26]:

```
<AxesSubplot:ylabel='Complaint Type'>
```



Converting Dataframes to numpy arrays for Statistical Calculations

In [27]:

```
num_arrb = pd.DataFrame(complaints_bor).to_numpy()

num_arrt = pd.DataFrame(complaints_t).to_numpy()
```

In [28]:

```
num_arrb
num_arrt
```

Out[28]:

```
array([[ 1411, 12740,  1947,    63,   187,     9,  7829,  2431,    79,
          522,  8864,  3385,    16,   321,   377],
       [ 2390, 28119,  5161,    72,   257,    43, 27386, 11451,   338,
         1537, 13315,  5145,    45,  1040,   514],
       [ 1511,  2055,   528,    68,   294,    22, 11980, 14528,   189,
         1167, 20360,  5374,    41,  1468,  2380],
       [ 1874, 31620,  8098,    59,   357,    37, 21944,  6057,   297,
          634,  4391,  2607,    30,  1254,   477],
```

```
       [  557,  2141,  1762,    23,   175,     2,  4881,   677,    17,
          67,   815,   356,   515,   173,    25]])
```

Out[28]:

```
array([[ 1082,  1348,  1183,   888,   669,   519,   443,   325,   261,
         200,   825],
       [10260, 14793, 12030,  9023,  6840,  5231,  3985,  3299,  2481,
        1851,  6882],
       [ 2721,  2457,  2021,  1678,  1414,  1158,   986,   828,   611,
         535,  3087],
       [   57,    64,    40,    36,    28,    17,    16,     5,     4,
           5,    13],
       [  255,   262,   200,   143,   109,    76,    62,    46,    24,
          23,    70],
       [   12,    13,    15,    12,    13,     8,     9,     6,     3,
           4,    18],
       [12989, 14114, 10892,  8196,  6247,  4882,  3802,  2890,  2142,
        1686,  6180],
       [ 9328,  7810,  5539,  3720,  2626,  1812,  1328,   896,   572,
         362,  1151],
       [  278,   204,   126,    96,    62,    30,    28,    30,    11,
          11,    44],
       [ 1044,   805,   537,   400,   315,   213,   173,   123,    73,
          60,   184],
       [12034, 10280,  7323,  5082,  3493,  2561,  1878,  1418,   976,
         633,  2067],
       [ 3849,  3663,  2564,  1861,  1334,   896,   731,   513,   356,
         263,   837],
       [  304,   135,    86,    34,    25,    30,     7,     8,     5,
           3,    10],
       [ 1318,   819,   556,   405,   301,   211,   144,   106,    77,
          75,   244],
       [  789,   740,   542,   424,   300,   217,   180,   122,   112,
          91,   256]])
```

Task-5.b Applying Chi square test to check the independency of Complaint types and Borough Location both are categorical variables

Assuming a NULL Hypothesis H0 - The 2 variables Complaint Type and Borough Location are INDEPENDENT

In [29]:

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

stat, p, dof, expected = chi2_contingency(num_arrb)

prob = 0.95
# interpret p-value
alpha = 1.0 - prob
if p <= alpha:
    print('Dependent (reject H0)')
else:
    print('Independent (fail to reject H0)')

critical = chi2.ppf(prob, dof)
print('probability=%.3f, critical=%.3f, stat=%.3f' % (prob, critical,
stat))
```

```
print('significance=%.3f, p=%.3f' % (alpha, p))
Dependent (reject H0)
probability=0.950, critical=74.468, stat=73285.413
significance=0.050, p=0.000
```

Statistical test gives us evidence to reject the null hypothesis as the 2 categorical variables are dependent.

The Borough location has an affect on the Complaint Type registered with a confidence interval of 95%

Task-5.a Applying Chi square test to check the independency of Complaint types and Resolution Time Category both are categorical variables

Assuming a NULL Hypothesis H0 - The 2 variables Complaint Type and Resolution Time Category are INDEPENDENT

In [30]:

```
stat, p, dof, expected = chi2_contingency(num_arrt)

prob = 0.95
# interpret p-value
alpha = 1.0 - prob
if p <= alpha:
    print('Dependent (reject H0)')
else:
    print('Independent (fail to reject H0)')

critical = chi2.ppf(prob, dof)
print('probability=%.3f, critical=%.3f, stat=%.3f' % (prob, critical,
stat))

print('significance=%.3f, p=%.3f' % (alpha, p))
Dependent (reject H0)
probability=0.950, critical=168.613, stat=11849.127
significance=0.050, p=0.000
```

Statistical test gives us evidence to reject the null hypothesis as the 2 categorical variables are dependent.

The Complaint Type has an affect on the Resoltuion Time Category with a confidence interval of 95%

Task-5.a By Plotting the Average resolution time required for different complaints type in number of hours we can reinforce the previous statistical test results that the Resolution Time is dependent on the Complaint Type

In [31]:

```
complaints_tt = dfnew.groupby("Complaint Type")["R_t"].mean()/3600
```

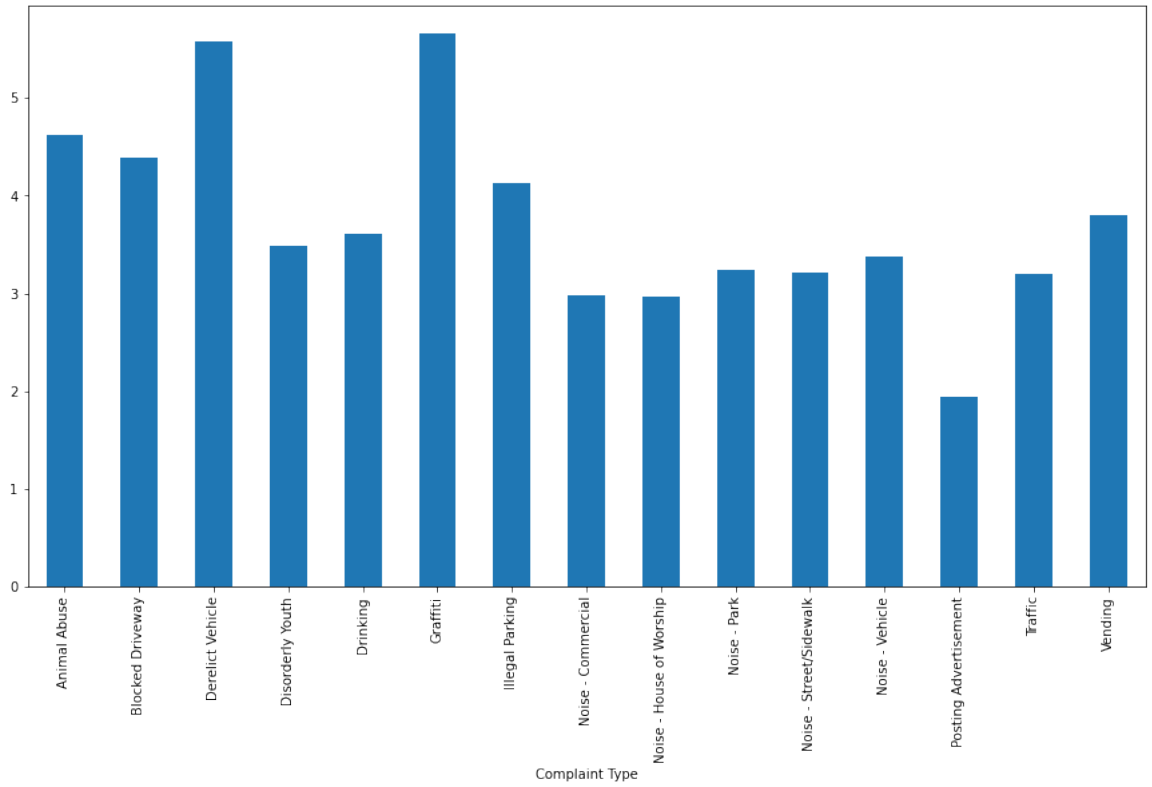
```
complaints_tt

complaints_tt.plot(kind="bar", figsize=(15,8), stacked=True)

print("The Average Resolution time for complaints in hours : ",
complaints_tt.mean())

print("The Minimum Average Resolution time for complaints in hours : ",
complaints_tt.min())

print("The Maximum Average Resolution time for complaints in hours : ",
complaints_tt.max())
```

Out[31]:

```
Complaint Type
Animal Abuse                4.627397
Blocked Driveway            4.382400
Derelict Vehicle            5.582929
Disorderly Youth            3.484604
Drinking                    3.611536
Graffiti                    5.664526
Illegal Parking             4.132335
Noise - Commercial          2.982225
Noise - House of Worship    2.964972
Noise - Park                3.243770
Noise - Street/Sidewalk     3.217912
Noise - Vehicle             3.383090
Posting Advertisement       1.938901
Traffic                     3.202991
Vending                     3.801838
Name: R_t, dtype: float64
```

Out[31]:

```
<AxesSubplot:xlabel='Complaint Type'>
The Average Resolution time for complaints in hours :  3.748094968845405
The Minimum Average Resolution time for complaints in hours :  1.9389009101
837542
The Maximum Average Resolution time for complaints in hours :  5.6645255653
88397
```


0
1
2
3
4
5
Animal Abuse
Blocked Driveway
Derelict Vehicle
Disorderly Youth
Drinking
Graffiti
Illegal Parking
Noise - Commercial
Noise - House of Worship
Noise - Park
Noise - Street/Sidewalk
Noise - Vehicle
Posting Advertisement
Traffic
Vending
Complaint Type