Cafe in Queens

Introduction

In this project, we will how convert addresses into their equivalent latitude and longitude values. Also, we will use the Foursquare API to explore neighborhoods in New York City. We will use the explore function to get the most common venue categories in each neighborhood, and then use this feature to group the neighborhoods into clusters. Then we will use the k-means clustering algorithm to complete this task. Finally, we will use the Folium library to visualize the neighborhoods in New York City and their emerging clusters.

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1. Importing Libraries:

In [4]:

```
!conda install -c conda-forge beautifulsoup4 --yes
!conda install -c conda-forge folium=0.5.0 --yes
print('Libraries installed!')
```

```
Collecting package metadata: done
```

Solving environment: done

==> WARNING: A newer version of conda exists. <==

current version: 4.6.14 latest version: 4.7.5

Please update conda by running

\$ conda update -n base -c defaults conda

Package Plan

environment location: /srv/conda/envs/notebook

added / updated specs:

beautifulsoup4

The following packages will be downloaded:

package	build		
beautifulsoup4-4.7.1 openssl-1.1.1c soupsieve-1.9.2	py37_1001 h516909a_0 py37_0	2.1 MB	conda-forge conda-forge conda-forge
	Total:	2.3 MB	

The following NEW packages will be INSTALLED:

beautifulsoup4 conda-forge/linux-64::beautifulsoup4-4.7.1-py37_1001 soupsieve conda-forge/linux-64::soupsieve-1.9.2-py37 0

The following packages will be UPDATED:

Downloading and Extracting Packages

beautifulsoup4-4.7.1 | 140 KB | ################################ | 10 0%

Preparing transaction: done Verifying transaction: done Executing transaction: done

Collecting package metadata: done

Solving environment: done

==> WARNING: A newer version of conda exists. <==

current version: 4.6.14 latest version: 4.7.5

Please update conda by running

\$ conda update -n base -c defaults conda

Package Plan

environment location: /srv/conda/envs/notebook

added / updated specs:

- folium=0.5.0

The following packages will be downloaded:

package	build		
asn1crypto-0.24.0 cffi-1.12.3 chardet-3.0.4 cryptography-2.7 folium-0.5.0 idna-2.8 pycparser-2.19 pyopenssl-19.0.0 pysocks-1.7.0	py37_1003 py37h8022711_0 py37_1003 py37h72c5cf5_0 py_0 py37_1000 py37_1 py37_0 py37_0 py37_0	154 KB 218 KB 167 KB 610 KB 45 KB 100 KB 171 KB 81 KB 26 KB	conda-forge conda-forge conda-forge conda-forge conda-forge conda-forge conda-forge conda-forge
requests-2.22.0 urllib3-1.25.3 vincent-0.4.4	py37_1 py37_0 py_1	84 KB 187 KB 28 KB	conda-forge conda-forge conda-forge
vincenc-0.4.4			conda-ronge
	Total:	1.8 MB	

The following NEW packages will be INSTALLED:

```
conda-forge/linux-64::asn1crypto-0.24.0-py37 1003
asn1crypto
                   conda-forge/linux-64::cffi-1.12.3-py37h8022711 0
cffi
chardet
                   conda-forge/linux-64::chardet-3.0.4-py37 1003
cryptography
                   conda-forge/linux-64::cryptography-2.7-py37h72c5cf5 0
folium
                   conda-forge/noarch::folium-0.5.0-py 0
                   conda-forge/linux-64::idna-2.8-py37 1000
idna
                   conda-forge/linux-64::pycparser-2.19-py37_1
pycparser
                   conda-forge/linux-64::pyopenssl-19.0.0-py37 0
pyopenssl
                   conda-forge/linux-64::pysocks-1.7.0-py37_0
pysocks
requests
                   conda-forge/linux-64::requests-2.22.0-py37_1
                   conda-forge/linux-64::urllib3-1.25.3-py37 0
urllib3
vincent
                   conda-forge/noarch::vincent-0.4.4-py 1
```

Downloading and Extracting Packages

pvcparser-2.19 | 171 KB

0%					
requests-2.22.0 0%	1	84 KB		#######################################	10
pyopenssl-19.0.0 0%	1	81 KB	l	#######################################	10
folium-0.5.0 0%		45 KB		***************************************	10
asn1crypto-0.24.0 0%		154 KB		***************************************	10
pysocks-1.7.0 0%		26 KB		***************************************	10
urllib3-1.25.3 0%		187 KB		***************************************	10
idna-2.8 0%		100 KB		***************************************	10
chardet-3.0.4 0%		167 KB		***************************************	10
cffi-1.12.3 0%		218 KB		***************************************	10
cryptography-2.7 0%		610 KB		***************************************	10
vincent-0.4.4 0%		28 KB		***************************************	10

Preparing transaction: done Verifying transaction: done Executing transaction: done

Libraries installed!

In [5]:

```
pip install geocoder
Collecting geocoder
  Downloading https://files.pythonhosted.org/packages/4f/6b/13166c909ad2f2d76
b929a4227c952630ebaf0d729f6317eb09cbceccbab/geocoder-1.38.1-py2.py3-none-any.
wh1 (98kB)
                                 102kB 4.5MB/s ta 0:00:01
Collecting ratelim (from geocoder)
  Downloading https://files.pythonhosted.org/packages/f2/98/7e6d147fd16a10a5f
821db6e25f192265d6ecca3d82957a4fdd592cad49c/ratelim-0.1.6-py2.py3-none-any.wh
Requirement already satisfied: six in /srv/conda/envs/notebook/lib/python3.7/
site-packages (from geocoder) (1.12.0)
Requirement already satisfied: requests in /srv/conda/envs/notebook/lib/pytho
n3.7/site-packages (from geocoder) (2.22.0)
Requirement already satisfied: click in /srv/conda/envs/notebook/lib/python3.
7/site-packages (from geocoder) (7.0)
Collecting future (from geocoder)
  Downloading https://files.pythonhosted.org/packages/90/52/e20466b85000a181e
1e144fd8305caf2cf475e2f9674e797b222f8105f5f/future-0.17.1.tar.gz (829kB)
                                    829kB 14.8MB/s eta 0:00:01
Requirement already satisfied: decorator in /srv/conda/envs/notebook/lib/pyth
on3.7/site-packages (from ratelim->geocoder) (4.4.0)
Requirement already satisfied: chardet<3.1.0,>=3.0.2 in /srv/conda/envs/noteb
ook/lib/python3.7/site-packages (from requests->geocoder) (3.0.4)
Requirement already satisfied: idna<2.9,>=2.5 in /srv/conda/envs/notebook/li
b/python3.7/site-packages (from requests->geocoder) (2.8)
Requirement already satisfied: certifi>=2017.4.17 in /srv/conda/envs/noteboo
k/lib/python3.7/site-packages (from requests->geocoder) (2019.6.16)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /sr
v/conda/envs/notebook/lib/python3.7/site-packages (from requests->geocoder)
(1.25.3)
Building wheels for collected packages: future
  Building wheel for future (setup.py) ... done
  Stored in directory: /home/jovyan/.cache/pip/wheels/0c/61/d2/d6b7317325828f
bb39ee6ad559dbe4664d0896da4721bf379e
Successfully built future
Installing collected packages: ratelim, future, geocoder
Successfully installed future-0.17.1 geocoder-1.38.1 ratelim-0.1.6
Note: you may need to restart the kernel to use updated packages.
```

In [6]:

```
# use the inline backend to generate the plots within the browser
%matplotlib inline
import matplotlib as mpl
import matplotlib.pyplot as plt
mpl.style.use('ggplot') # optional: for ggplot-like style
# check for latest version of Matplotlib
print ('Matplotlib version: ', mpl.__version__) # >= 2.0.0
```

Matplotlib version: 3.1.1

In [14]:

```
import numpy as np # library to handle data in a vectorized manner
import pandas as pd # library for data analsysis
pd.set_option('display.max_columns', None)
pd.set option('display.max rows', None)
import json # library to handle JSON files
!conda install -c conda-forge geopy --yes # uncomment this line if you haven to completed t
he Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into Latitude and Longitude val
ues
import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas dataframe
# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors
# import k-means from clustering stage
from sklearn.cluster import KMeans
!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you haven't
leted the Foursquare API lab
import folium # map rendering library
print('Libraries imported.')
```

```
Collecting package metadata: done
Solving environment: done
==> WARNING: A newer version of conda exists. <==
  current version: 4.6.14
  latest version: 4.7.5
Please update conda by running
    $ conda update -n base -c defaults conda
# All requested packages already installed.
Collecting package metadata: done
Solving environment: done
==> WARNING: A newer version of conda exists. <==
  current version: 4.6.14
 latest version: 4.7.5
Please update conda by running
    $ conda update -n base -c defaults conda
# All requested packages already installed.
Libraries imported.
```

2.Data Understanding and Preparation

```
In [35]:
```

```
!wget -q -0 'newyork_data.json' https://cocl.us/new_york_dataset
print('Data downloaded!')
```

Data downloaded!

```
In [36]:
```

```
with open('newyork_data.json') as json_data:
   newyork_data = json.load(json_data)
```

In [37]:

newyork_data

Out[37]:

```
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   'geometry': { 'type': 'Point',
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   'geometry name': 'geom',
   'properties': {'name': 'Wakefield',
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   'properties': {'name': 'Co-op City',
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    'annoline2': 'City',
    'annoline3': None,
    'annoangle': 0.0,
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   'properties': {'name': 'Eastchester',
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  'annoangle': 0.0,
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  'annoline3': None,
  'annoangle': 0.0,
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   -73.90281798724604,
   40.88168737120521]}},
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  'bbox': [-73.91065965862981,
   40.87655077879964,
```

```
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   40.87655077879964]}},
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  'annoangle': 0.0,
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  'annoline3': None,
  'annoangle': 0.0,
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  'stacked': 1,
  'annoline1': 'Williamsbridge',
  'annoline2': None,
  'annoline3': None,
  'annoangle': 0.0,
  'borough': 'Bronx',
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   -73.85744642974207,
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 'geometry_name': 'geom',
 'properties': {'name': 'Baychester',
  'stacked': 1,
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```
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  'annoline3': None,
  'annoangle': 0.0,
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```

```
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  'annoline3': None,
  'annoangle': 0.0,
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```

```
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  'annoangle': 0.0,
  'borough': 'Bronx',
  'bbox': [-73.91609987487575,
  40.80623874935177,
   -73.91609987487575,
  40.80623874935177]}},
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  'annoangle': 0.0,
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    'annoangle': 0.0,
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    'annoline3': None,
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In [47]:
neighborhoods_data = newyork_data['features']
In [48]:
neighborhoods_data[0]
Out[48]:
{ 'type': 'Feature',
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   -73.84720052054902,
  40.89470517661]}}
In [49]:
# define the dataframe columns
column_names = ['Borough', 'Neighborhood', 'Latitude', 'Longitude']
# instantiate the dataframe
neighborhoods = pd.DataFrame(columns=column names)
In [50]:
neighborhoods
Out[50]:
```

Borough Neighborhood Latitude Longitude

In [51]:

In [52]:

neighborhoods

Out[52]:

	Borough	Neighborhood	Latitude	Longitude
0	Bronx	Wakefield	40.894705	-73.847201
1	Bronx	Co-op City	40.874294	-73.829939
2	Bronx	Eastchester	40.887556	-73.827806
3	Bronx	Fieldston	40.895437	-73.905643
4	Bronx	Riverdale	40.890834	-73.912585
5	Bronx	Kingsbridge	40.881687	-73.902818
6	Manhattan	Marble Hill	40.876551	-73.910660
7	Bronx	Woodlawn	40.898273	-73.867315
8	Bronx	Norwood	40.877224	-73.879391
9	Bronx	Williamsbridge	40.881039	-73.857446
10	Bronx	Baychester	40.866858	-73.835798
11	Bronx	Pelham Parkway	40.857413	-73.854756
12	Bronx	City Island	40.847247	-73.786488
13	Bronx	Bedford Park	40.870185	-73.885512
14	Bronx	University Heights	40.855727	-73.910416
15	Bronx	Morris Heights	40.847898	-73.919672
16	Bronx	Fordham	40.860997	-73.896427
17	Bronx	East Tremont	40.842696	-73.887356
18	Bronx	West Farms	40.839475	-73.877745
19	Bronx	High Bridge	40.836623	-73.926102
20	Bronx	Melrose	40.819754	-73.909422
21	Bronx	Mott Haven	40.806239	-73.916100
22	Bronx	Port Morris	40.801664	-73.913221
23	Bronx	Longwood	40.815099	-73.895788
24	Bronx	Hunts Point	40.809730	-73.883315
25	Bronx	Morrisania	40.823592	-73.901506
26	Bronx	Soundview	40.821012	-73.865746
27	Bronx	Clason Point	40.806551	-73.854144
28	Bronx	Throgs Neck	40.815109	-73.816350
29	Bronx	Country Club	40.844246	-73.824099
30	Bronx	Parkchester	40.837938	-73.856003
31	Bronx	Westchester Square	40.840619	-73.842194
32	Bronx	Van Nest	40.843608	-73.866299
33	Bronx	Morris Park	40.847549	-73.850402

	Borough	Neighborhood	Latitude	Longitude
34	Bronx	Belmont	40.857277	-73.888452
35	Bronx	Spuyten Duyvil	40.881395	-73.917190
36	Bronx	North Riverdale	40.908543	-73.904531
37	Bronx	Pelham Bay	40.850641	-73.832074
38	Bronx	Schuylerville	40.826580	-73.826203
39	Bronx	Edgewater Park	40.821986	-73.813885
40	Bronx	Castle Hill	40.819014	-73.848027
41	Bronx	Olinville	40.871371	-73.863324
42	Bronx	Pelham Gardens	40.862966	-73.841612
43	Bronx	Concourse	40.834284	-73.915589
44	Bronx	Unionport	40.829774	-73.850535
45	Bronx	Edenwald	40.884561	-73.848083
46	Brooklyn	Bay Ridge	40.625801	-74.030621
47	Brooklyn	Bensonhurst	40.611009	-73.995180
48	Brooklyn	Sunset Park	40.645103	-74.010316
49	Brooklyn	Greenpoint	40.730201	-73.954241
50	Brooklyn	Gravesend	40.595260	-73.973471
51	Brooklyn	Brighton Beach	40.576825	-73.965094
52	Brooklyn	Sheepshead Bay	40.586890	-73.943186
53	Brooklyn	Manhattan Terrace	40.614433	-73.957438
54	Brooklyn	Flatbush	40.636326	-73.958401
55	Brooklyn	Crown Heights	40.670829	-73.943291
56	Brooklyn	East Flatbush	40.641718	-73.936103
57	Brooklyn	Kensington	40.642382	-73.980421
58	Brooklyn	Windsor Terrace	40.656946	-73.980073
59	Brooklyn	Prospect Heights	40.676822	-73.964859
60	Brooklyn	Brownsville	40.663950	-73.910235
61	Brooklyn	Williamsburg	40.707144	-73.958115
62	Brooklyn	Bushwick	40.698116	-73.925258
63	Brooklyn	Bedford Stuyvesant	40.687232	-73.941785
64	Brooklyn	Brooklyn Heights	40.695864	-73.993782
65	Brooklyn	Cobble Hill	40.687920	-73.998561
66	Brooklyn	Carroll Gardens	40.680540	-73.994654
67	Brooklyn	Red Hook	40.676253	-74.012759
68	Brooklyn	Gowanus	40.673931	-73.994441
69	Brooklyn	Fort Greene	40.688527	-73.972906

	Borough	Neighborhood	Latitude	Longitude
70	Brooklyn	Park Slope	40.672321	-73.977050
71	Brooklyn	Cypress Hills	40.682391	-73.876616
72	Brooklyn	East New York	40.669926	-73.880699
73	Brooklyn	Starrett City	40.647589	-73.879370
74	Brooklyn	Canarsie	40.635564	-73.902093
75	Brooklyn	Flatlands	40.630446	-73.929113
76	Brooklyn	Mill Island	40.606336	-73.908186
77	Brooklyn	Manhattan Beach	40.577914	-73.943537
78	Brooklyn	Coney Island	40.574293	-73.988683
79	Brooklyn	Bath Beach	40.599519	-73.998752
80	Brooklyn	Borough Park	40.633131	-73.990498
81	Brooklyn	Dyker Heights	40.619219	-74.019314
82	Brooklyn	Gerritsen Beach	40.590848	-73.930102
83	Brooklyn	Marine Park	40.609748	-73.931344
84	Brooklyn	Clinton Hill	40.693229	-73.967843
85	Brooklyn	Sea Gate	40.576375	-74.007873
86	Brooklyn	Downtown	40.690844	-73.983463
87	Brooklyn	Boerum Hill	40.685683	-73.983748
88	Brooklyn	Prospect Lefferts Gardens	40.658420	-73.954899
89	Brooklyn	Ocean Hill	40.678403	-73.913068
90	Brooklyn	City Line	40.678570	-73.867976
91	Brooklyn	Bergen Beach	40.615150	-73.898556
92	Brooklyn	Midwood	40.625596	-73.957595
93	Brooklyn	Prospect Park South	40.647009	-73.962613
94	Brooklyn	Georgetown	40.623845	-73.916075
95	Brooklyn	East Williamsburg	40.708492	-73.938858
96	Brooklyn	North Side	40.714823	-73.958809
97	Brooklyn	South Side	40.710861	-73.958001
98	Brooklyn	Ocean Parkway	40.613060	-73.968367
99	Brooklyn	Fort Hamilton	40.614768	-74.031979
100	Manhattan	Chinatown	40.715618	-73.994279
101	Manhattan	Washington Heights	40.851903	-73.936900
102	Manhattan	Inwood	40.867684	-73.921210
103	Manhattan	Hamilton Heights	40.823604	-73.949688
104	Manhattan	Manhattanville	40.816934	-73.957385
105	Manhattan	Central Harlem	40.815976	-73.943211

	Borough	Neighborhood	Latitude	Longitude
106	Manhattan	East Harlem	40.792249	-73.944182
107	Manhattan	Upper East Side	40.775639	-73.960508
108	Manhattan	Yorkville	40.775930	-73.947118
109	Manhattan	Lenox Hill	40.768113	-73.958860
110	Manhattan	Roosevelt Island	40.762160	-73.949168
111	Manhattan	Upper West Side	40.787658	-73.977059
112	Manhattan	Lincoln Square	40.773529	-73.985338
113	Manhattan	Clinton	40.759101	-73.996119
114	Manhattan	Midtown	40.754691	-73.981669
115	Manhattan	Murray Hill	40.748303	-73.978332
116	Manhattan	Chelsea	40.744035	-74.003116
117	Manhattan	Greenwich Village	40.726933	-73.999914
118	Manhattan	East Village	40.727847	-73.982226
119	Manhattan	Lower East Side	40.717807	-73.980890
120	Manhattan	Tribeca	40.721522	-74.010683
121	Manhattan	Little Italy	40.719324	-73.997305
122	Manhattan	Soho	40.722184	-74.000657
123	Manhattan	West Village	40.734434	-74.006180
124	Manhattan	Manhattan Valley	40.797307	-73.964286
125	Manhattan	Morningside Heights	40.808000	-73.963896
126	Manhattan	Gramercy	40.737210	-73.981376
127	Manhattan	Battery Park City	40.711932	-74.016869
128	Manhattan	Financial District	40.707107	-74.010665
129	Queens	Astoria	40.768509	-73.915654
130	Queens	Woodside	40.746349	-73.901842
131	Queens	Jackson Heights	40.751981	-73.882821
132	Queens	Elmhurst	40.744049	-73.881656
133	Queens	Howard Beach	40.654225	-73.838138
134	Queens	Corona	40.742382	-73.856825
135	Queens	Forest Hills	40.725264	-73.844475
136	Queens	Kew Gardens	40.705179	-73.829819
137	Queens	Richmond Hill	40.697947	-73.831833
138	Queens	Flushing	40.764454	-73.831773
139	Queens	Long Island City	40.750217	-73.939202
140	Queens	Sunnyside	40.740176	-73.926916
141	Queens	East Elmhurst	40.764073	-73.867041

	Borough	Neighborhood	Latitude	Longitude
142	Queens	Maspeth	40.725427	-73.896217
143	Queens	Ridgewood	40.708323	-73.901435
144	Queens	Glendale	40.702762	-73.870742
145	Queens	Rego Park	40.728974	-73.857827
146	Queens	Woodhaven	40.689887	-73.858110
147	Queens	Ozone Park	40.680708	-73.843203
148	Queens	South Ozone Park	40.668550	-73.809865
149	Queens	College Point	40.784903	-73.843045
150	Queens	Whitestone	40.781291	-73.814202
151	Queens	Bayside	40.766041	-73.774274
152	Queens	Auburndale	40.761730	-73.791762
153	Queens	Little Neck	40.770826	-73.738898
154	Queens	Douglaston	40.766846	-73.742498
155	Queens	Glen Oaks	40.749441	-73.715481
156	Queens	Bellerose	40.728573	-73.720128
157	Queens	Kew Gardens Hills	40.722578	-73.820878
158	Queens	Fresh Meadows	40.734394	-73.782713
159	Queens	Briarwood	40.710935	-73.811748
160	Queens	Jamaica Center	40.704657	-73.796902
161	Queens	Oakland Gardens	40.745619	-73.754950
162	Queens	Queens Village	40.718893	-73.738715
163	Queens	Hollis	40.711243	-73.759250
164	Queens	South Jamaica	40.696911	-73.790426
165	Queens	St. Albans	40.694445	-73.758676
166	Queens	Rochdale	40.675211	-73.772588
167	Queens	Springfield Gardens	40.666230	-73.760421
168	Queens	Cambria Heights	40.692775	-73.735269
169	Queens	Rosedale	40.659816	-73.735261
170	Queens	Far Rockaway	40.603134	-73.754980
171	Queens	Broad Channel	40.603027	-73.820055
172	Queens	Breezy Point	40.557401	-73.925512
173	Queens	Steinway	40.775923	-73.902290
174	Queens	Beechhurst	40.792781	-73.804365
175	Queens	Bay Terrace	40.782843	-73.776802
176	Queens	Edgemere	40.595642	-73.776133
177	Queens	Arverne	40.589144	-73.791992

	Borough	Neighborhood	Latitude	Longitude
178	Queens	Rockaway Beach	40.582802	-73.822361
179	Queens	Neponsit	40.572037	-73.857547
180	Queens	Murray Hill	40.764126	-73.812763
181	Queens	Floral Park	40.741378	-73.708847
182	Queens	Holliswood	40.720957	-73.767142
183	Queens	Jamaica Estates	40.716805	-73.787227
184	Queens	Queensboro Hill	40.744572	-73.825809
185	Queens	Hillcrest	40.723825	-73.797603
186	Queens	Ravenswood	40.761705	-73.931575
187	Queens	Lindenwood	40.663918	-73.849638
188	Queens	Laurelton	40.667884	-73.740256
189	Queens	Lefrak City	40.736075	-73.862525
190	Queens	Belle Harbor	40.576156	-73.854018
191	Queens	Rockaway Park	40.580343	-73.841534
192	Queens	Somerville	40.597711	-73.796648
193	Queens	Brookville	40.660003	-73.751753
194	Queens	Bellaire	40.733014	-73.738892
195	Queens	North Corona	40.754071	-73.857518
196	Queens	Forest Hills Gardens	40.714611	-73.841022
197	Staten Island	St. George	40.644982	-74.079353
198	Staten Island	New Brighton	40.640615	-74.087017
199	Staten Island	Stapleton	40.626928	-74.077902
200	Staten Island	Rosebank	40.615305	-74.069805
201	Staten Island	West Brighton	40.631879	-74.107182
202	Staten Island	Grymes Hill	40.624185	-74.087248
203	Staten Island	Todt Hill	40.597069	-74.111329
204	Staten Island	South Beach	40.580247	-74.079553
205	Staten Island	Port Richmond	40.633669	-74.129434
206	Staten Island	Mariner's Harbor	40.632546	-74.150085
207	Staten Island	Port Ivory	40.639683	-74.174645
208	Staten Island	Castleton Corners	40.613336	-74.119181
209	Staten Island	New Springville	40.594252	-74.164960
210	Staten Island	Travis	40.586314	-74.190737
211	Staten Island	New Dorp	40.572572	-74.116479
212	Staten Island	Oakwood	40.558462	-74.121566
213	Staten Island	Great Kills	40.549480	-74.149324

	Borough	Neighborhood	Latitude	Longitude
214	Staten Island	Eltingville	40.542231	-74.164331
215	Staten Island	Annadale	40.538114	-74.178549
216	Staten Island	Woodrow	40.541968	-74.205246
217	Staten Island	Tottenville	40.505334	-74.246569
218	Staten Island	Tompkinsville	40.637316	-74.080554
219	Staten Island	Silver Lake	40.619193	-74.096290
220	Staten Island	Sunnyside	40.612760	-74.097126
221	Brooklyn	Ditmas Park	40.643675	-73.961013
222	Brooklyn	Wingate	40.660947	-73.937187
223	Brooklyn	Rugby	40.655572	-73.926882
224	Staten Island	Park Hill	40.609190	-74.080157
225	Staten Island	Westerleigh	40.621090	-74.133041
226	Staten Island	Graniteville	40.620172	-74.153152
227	Staten Island	Arlington	40.635325	-74.165104
228	Staten Island	Arrochar	40.596313	-74.067124
229	Staten Island	Grasmere	40.598268	-74.076674
230	Staten Island	Old Town	40.596329	-74.087511
231	Staten Island	Dongan Hills	40.588673	-74.096399
232	Staten Island	Midland Beach	40.573527	-74.093483
233	Staten Island	Grant City	40.576216	-74.105856
234	Staten Island	New Dorp Beach	40.564255	-74.104327
235	Staten Island	Bay Terrace	40.553988	-74.139166
236	Staten Island	Huguenot	40.531912	-74.191741
237	Staten Island	Pleasant Plains	40.524699	-74.219831
238	Staten Island	Butler Manor	40.506082	-74.229504
239	Staten Island	Charleston	40.530531	-74.232158
240	Staten Island	Rossville	40.549404	-74.215729
241	Staten Island	Arden Heights	40.549286	-74.185887
242	Staten Island	Greenridge	40.555295	-74.170794
243	Staten Island	Heartland Village	40.589139	-74.159022
244	Staten Island	Chelsea	40.594726	-74.189560
245	Staten Island	Bloomfield	40.605779	-74.187256
246	Staten Island	Bulls Head	40.609592	-74.159409
247	Manhattan	Carnegie Hill	40.782683	-73.953256
248	Manhattan	Noho	40.723259	-73.988434
249	Manhattan	Civic Center	40.715229	-74.005415

	Borough	Neighborhood	Latitude	Longitude
250	Manhattan	Midtown South	40.748510	-73.988713
251	Staten Island	Richmond Town	40.569606	-74.134057
252	Staten Island	Shore Acres	40.609719	-74.066678
253	Staten Island	Clifton	40.619178	-74.072642
254	Staten Island	Concord	40.604473	-74.084024
255	Staten Island	Emerson Hill	40.606794	-74.097762
256	Staten Island	Randall Manor	40.635630	-74.098051
257	Staten Island	Howland Hook	40.638433	-74.186223
258	Staten Island	Elm Park	40.630147	-74.141817
259	Brooklyn	Remsen Village	40.652117	-73.916653
260	Brooklyn	New Lots	40.662744	-73.885118
261	Brooklyn	Paerdegat Basin	40.631318	-73.902335
262	Brooklyn	Mill Basin	40.615974	-73.915154
263	Queens	Jamaica Hills	40.711460	-73.796465
264	Queens	Utopia	40.733500	-73.796717
265	Queens	Pomonok	40.734936	-73.804861
266	Queens	Astoria Heights	40.770317	-73.894680
267	Bronx	Claremont Village	40.831428	-73.901199
268	Bronx	Concourse Village	40.824780	-73.915847
269	Bronx	Mount Eden	40.843826	-73.916556
270	Bronx	Mount Hope	40.848842	-73.908299
271	Manhattan	Sutton Place	40.760280	-73.963556
272	Queens	Hunters Point	40.743414	-73.953868
273	Manhattan	Turtle Bay	40.752042	-73.967708
274	Manhattan	Tudor City	40.746917	-73.971219
275	Manhattan	Stuyvesant Town	40.731000	-73.974052
276	Manhattan	Flatiron	40.739673	-73.990947
277	Queens	Sunnyside Gardens	40.745652	-73.918193
278	Queens	Blissville	40.737251	-73.932442
279	Brooklyn	Fulton Ferry	40.703281	-73.995508
280	Brooklyn	Vinegar Hill	40.703321	-73.981116
281	Brooklyn	Weeksville	40.675040	-73.930531
282	Brooklyn	Broadway Junction	40.677861	-73.903317
283	Brooklyn	Dumbo	40.703176	-73.988753
284	Staten Island	Manor Heights	40.601810	-74.120594
285	Staten Island	Willowbrook	40.603707	-74.132084

	Borough	Neighborhood	Latitude	Longitude
286	Staten Island	Sandy Ground	40.541140	-74.217766
287	Staten Island	Egbertville	40.579119	-74.127272
288	Queens	Roxbury	40.567376	-73.892138
289	Brooklyn	Homecrest	40.598525	-73.959185
290	Queens	Middle Village	40.716415	-73.881143
291	Staten Island	Prince's Bay	40.526264	-74.201526
292	Staten Island	Lighthouse Hill	40.576506	-74.137927
293	Staten Island	Richmond Valley	40.519541	-74.229571
294	Queens	Malba	40.790602	-73.826678
295	Brooklyn	Highland Park	40.681999	-73.890346
296	Brooklyn	Madison	40.609378	-73.948415
297	Bronx	Bronxdale	40.852723	-73.861726
298	Bronx	Allerton	40.865788	-73.859319
299	Bronx	Kingsbridge Heights	40.870392	-73.901523
300	Brooklyn	Erasmus	40.646926	-73.948177
301	Manhattan	Hudson Yards	40.756658	-74.000111
302	Queens	Hammels	40.587338	-73.805530
303	Queens	Bayswater	40.611322	-73.765968
304	Queens	Queensbridge	40.756091	-73.945631
305	Staten Island	Fox Hills	40.617311	-74.081740

In [53]:

The dataframe has 5 boroughs and 306 neighborhoods.

In [54]:

```
address = 'New York City, NY'

geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of New York City are {}, {}.'.format(latitude, longitude))
```

The geograpical coordinate of New York City are 40.7127281, -74.0060152.

Create a map of New York with neighborhoods superimposed on top.

In [55]:

```
# create map of New York using latitude and longitude values
map newyork = folium.Map(location=[latitude, longitude], zoom start=10)
# add markers to map
for lat, lng, borough, neighborhood in zip(neighborhoods['Latitude'], neighborhoods['Longi
tude'], neighborhoods['Borough'], neighborhoods['Neighborhood']):
    label = '{}, {}'.format(neighborhood, borough)
    label = folium.Popup(label, parse html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill color='#3186cc',
        fill opacity=0.7,
        parse html=False).add to(map newyork)
map_newyork
```

Out[55]:

Let's simplify the above map and segment and cluster only the neighborhoods in Queens. So let's slice the original dataframe and create a new dataframe of the Queens data.

In [56]:

```
Queens_data = neighborhoods[neighborhoods['Borough'] == 'Queens'].reset_index(drop=True)
Queens_data.head()
```

Out[56]:

	Borough	Neighborhood	Latitude	Longitude
0	Queens	Astoria	40.768509	-73.915654
1	Queens	Woodside	40.746349	-73.901842
2	Queens	Jackson Heights	40.751981	-73.882821
3	Queens	Elmhurst	40.744049	-73.881656
4	Queens	Howard Beach	40.654225	-73.838138

In [57]:

```
address = 'Queens, NY'
geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate of Queens are {}, {}.'.format(latitude, longitude))
```

The geograpical coordinate of Queens are 40.6524927, -73.7914214158161.

In [58]:

```
# create map of Queens using latitude and longitude values
map_Queens = folium.Map(location=[latitude, longitude], zoom_start=11)
# add markers to map
for lat, lng, label in zip(Queens data['Latitude'], Queens data['Longitude'], Queens data[
'Neighborhood']):
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_Queens)
map Queens
```

Out[58]:

4.Data Modelling

Define Foursquare Credentials and Version

In [59]:

```
CLIENT_ID = 'HZWQATJKJFBOW35GMHRSYLLJ5UG4HHYVT0NINAR4VFASGSY0' # your Foursquare ID
CLIENT_SECRET = '0Q0E2DPPCVSYUBN1UN3J0MHNHGP5EUKXP3PQHBV534DWDKKO' # your Foursquare Secre
t
VERSION = '20180605' # Foursquare API version
print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

Your credentails:

CLIENT_ID: HZWQATJKJFBOW35GMHRSYLLJ5UG4HHYVT0NINAR4VFASGSY0 CLIENT SECRET:0Q0E2DPPCVSYUBN1UN3J0MHNHGP5EUKXP3PQHBV534DWDKK0

In [60]:

```
Queens_data.loc[0, 'Neighborhood']
```

Out[60]:

'Astoria'

In [61]:

Latitude and longitude values of Astoria are 40.76850859335492, -73.915653743 04234.

In [62]:

```
LIMIT = 100 # limit of number of venues returned by Foursquare API
radius = 500 # define radius
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll
={},{}&radius={}&limit={}'.format(
CLIENT_ID,
CLIENT_SECRET,
VERSION,
neighborhood_latitude,
neighborhood_longitude,
radius,
LIMIT)
url # display URL
```

Out[62]:

'https://api.foursquare.com/v2/venues/explore?&client_id=HZWQATJKJFBOW35GMHRS YLLJ5UG4HHYVT0NINAR4VFASGSY0&client_secret=0Q0E2DPPCVSYUBN1UN3J0MHNHGP5EUKXP3 PQHBV534DWDKK0&v=20180605&ll=40.76850859335492,-73.91565374304234&radius=500&limit=100'

In [63]:

results = requests.get(url).json()
results

Out[63]:

```
{'meta': {'code': 200, 'requestId': '5d2c62c7bf7dde002c2021bb'},
 'response': {'suggestedFilters': {'header': 'Tap to show:',
   'filters': [{'name': '$-$$$$', 'key': 'price'},
    {'name': 'Open now', 'key': 'openNow'}]},
  'headerLocation': 'Astoria',
  'headerFullLocation': 'Astoria, Queens',
  'headerLocationGranularity': 'neighborhood',
  'totalResults': 109,
  'suggestedBounds': {'ne': {'lat': 40.773008597854925,
    'lng': -73.90972309237958},
   'sw': {'lat': 40.76400858885492, 'lng': -73.9215843937051}},
  'groups': [{'type': 'Recommended Places',
    'name': 'recommended',
    'items': [{'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4bdf502a89ca76b062b75d5e',
       'name': 'Favela Grill',
       'location': {'address': '33-18 28th Ave',
        'crossStreet': 'btwn 33rd & 34th St.',
        'lat': 40.76734843380796,
        'lng': -73.91789747356819,
        'labeledLatLngs': [{'label': 'display',
          'lat': 40.76734843380796,
          'lng': -73.91789747356819}],
        'distance': 229,
        'postalCode': '11103',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['33-18 28th Ave (btwn 33rd & 34th St.)',
         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d16b941735',
         'name': 'Brazilian Restaurant',
         'pluralName': 'Brazilian Restaurants',
         'shortName': 'Brazilian',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/food/arge
ntinian_',
          'suffix': '.png'},
         'primary': True}],
       'delivery': {'id': '289413',
        'url': 'https://www.seamless.com/menu/favela-brazilian-cuisine-33-18-
28th-ave-astoria/289413?affiliate=1131&utm source=foursquare-affiliate-networ
k&utm medium=affiliate&utm campaign=1131&utm content=289413',
        'provider': {'name': 'seamless',
         'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
          'sizes': [40, 50],
          'name': '/delivery_provider_seamless_20180129.png'}}},
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4bdf502a89ca76b062b75d5e-0'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
```

```
'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4c94d26d58d4b60c40fc2b29',
       'name': 'CrossFit Queens',
       'location': {'address': '25-50 31st St',
        'crossStreet': 'Astoria Blvd',
        'lat': 40.76940404539832,
        'lng': -73.91897736979166,
        'labeledLatLngs': [{'label': 'display',
          'lat': 40.76940404539832,
          'lng': -73.91897736979166}],
        'distance': 297,
        'postalCode': '11102',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['25-50 31st St (Astoria Blvd)',
         'Astoria, NY 11102',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d176941735',
         'name': 'Gym',
         'pluralName': 'Gyms',
         'shortName': 'Gym',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/building/
gym_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4c94d26d58d4b60c40fc2b29-1'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4a9c0105f964a520b03520e3',
       'name': 'Titan Foods Inc.',
       'location': {'address': '25-56 31st St',
        'crossStreet': 'btwn 28th Rd. & Newtown Ave.',
        'lat': 40.76919777900986,
        'lng': -73.9192530467441,
        'labeledLatLngs': [{'label': 'display',
          'lat': 40.76919777900986,
          'lng': -73.9192530467441}],
        'distance': 312,
        'postalCode': '11102',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['25-56 31st St (btwn 28th Rd. & Newtown Ave.)',
         'Astoria, NY 11102',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d1f5941735',
         'name': 'Gourmet Shop',
         'pluralName': 'Gourmet Shops',
         'shortName': 'Gourmet',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/shops/foo
```

```
d_gourmet_',
           suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []},
       'venuePage': {'id': '68301435'}},
      'referralId': 'e-0-4a9c0105f964a520b03520e3-2'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '52c580e8498eddd52d925dd9',
       'name': 'Orange Blossom',
       'location': {'lat': 40.76985614579503,
        'lng': -73.9170119137407,
        'labeledLatLngs': [{'label': 'display',
          'lat': 40.76985614579503,
          'lng': -73.9170119137407}],
        'distance': 188,
        'cc': 'US',
        'city': 'Queens',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['Queens, NY', 'United States']},
       'categories': [{'id': '4bf58dd8d48988d1f5941735',
         'name': 'Gourmet Shop',
         'pluralName': 'Gourmet Shops',
         'shortName': 'Gourmet',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/foo
d gourmet_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-52c580e8498eddd52d925dd9-3'},
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       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4d7ce85486cfa14365a2d2a0',
       'name': 'Simply Fit Astoria',
       'location': {'address': '37-16 Astoria Blvd',
        'crossStreet': 'at 25 Ave',
        'lat': 40.76911377971976,
        'lng': -73.91240303580314,
        'labeledLatLngs': [{'label': 'display',
          'lat': 40.76911377971976,
          'lng': -73.91240303580314}],
        'distance': 282,
        'postalCode': '11103',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['37-16 Astoria Blvd (at 25 Ave)',
         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d176941735',
         'name': 'Gym',
```

```
'pluralName': 'Gyms',
         'shortName': 'Gym',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/building/
gym_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
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         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
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       'name': 'Off The Hook',
       'location': {'address': '28-08 34th St',
        'crossStreet': 'btwn 28th & 30th Ave.',
        'lat': 40.76720036066658,
        'lng': -73.91810419486981,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -73.91810419486981}],
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        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
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         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d1ce941735',
         'name': 'Seafood Restaurant',
         'pluralName': 'Seafood Restaurants',
         'shortName': 'Seafood',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/food/seaf
ood_',
          'suffix': '.png'},
         'primary': True}],
       'delivery': {'id': '299409',
        'url': 'https://www.seamless.com/menu/off-the-hook-raw-bar--grill-28-
08-34th-st-astoria/299409?affiliate=1131&utm source=foursquare-affiliate-netw
ork&utm medium=affiliate&utm campaign=1131&utm content=299409',
        'provider': {'name': 'seamless',
         'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
          'sizes': [40, 50],
          'name': '/delivery_provider_seamless_20180129.png'}}},
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       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5208fbc011d228eef0972843',
       'name': 'Sitan Muay Thai',
       'location': {'address': '25-73 Steinway St',
        'lat': 40.76610776852132,
```

```
'lng': -73.9132238599876,
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        'cc': 'US',
        'city': 'Astoria',
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        'country': 'United States',
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         'United States']},
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         'pluralName': 'Martial Arts Dojos',
         'shortName': 'Martial Arts',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/gym
martialarts ',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []},
       'venuePage': {'id': '83742041'}},
      'referralId': 'e-0-5208fbc011d228eef0972843-6'},
     {'reasons': {'count': 0,
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         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4ba58abaf964a520d01039e3',
       'name': 'Al-sham Sweets and Pastries',
       'location': {'address': '24-39 Steinway St',
        'crossStreet': 'Astoria Boulevard & 25th Avenue',
        'lat': 40.768076961690774,
        'lng': -73.91156100683968,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -73.91156100683968}],
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        'postalCode': '11103',
        'cc': 'US',
        'neighborhood': 'Astoria',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['24-39 Steinway St (Astoria Boulevard & 25th Ave
nue)',
         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d115941735',
         'name': 'Middle Eastern Restaurant',
         'pluralName': 'Middle Eastern Restaurants',
         'shortName': 'Middle Eastern',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/midd
leeastern_',
           'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
```

```
'referralId': 'e-0-4ba58abaf964a520d01039e3-7'},
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         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
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       'name': 'Irish Rover',
       'location': {'address': '3718 28th Ave',
        'crossStreet': 'at 38th St.',
        'lat': 40.76583545894952,
        'lng': -73.91464727517706,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -73.91464727517706}],
        'distance': 309,
        'postalCode': '11103',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['3718 28th Ave (at 38th St.)',
         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d11b941735',
         'name': 'Pub',
         'pluralName': 'Pubs',
         'shortName': 'Pub',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/nightlif
e/pub_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4176fc00f964a520b61d1fe3-8'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4adc66a6f964a520122c21e3',
       'name': 'El Cafetal',
       'location': {'address': '3019 Astoria Blvd',
        'lat': 40.77015319512015,
        'lng': -73.91821410404256,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -73.91821410404256}],
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        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['3019 Astoria Blvd',
         'Astoria, NY 11102',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d1c1941735',
         'name': 'Mexican Restaurant',
         'pluralName': 'Mexican Restaurants',
```

```
'shortName': 'Mexican',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/food/mexi
can_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4adc66a6f964a520122c21e3-9'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4ff0ec8ee4b08cbcb87a4e6b',
       'name': 'Noisette',
       'location': {'address': '24-21 Steinway St',
        'lat': 40.768543965185785,
        'lng': -73.91124779846233,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -73.91124779846233}],
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        'postalCode': '11103',
        'cc': 'US',
        'city': 'Astoria',
        'state': 'NY',
        'country': 'United States',
        'formattedAddress': ['24-21 Steinway St',
         'Astoria, NY 11103',
         'United States']},
       'categories': [{'id': '4bf58dd8d48988d1d0941735',
         'name': 'Dessert Shop',
         'pluralName': 'Dessert Shops',
         'shortName': 'Desserts',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/food/dess
ert_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4ff0ec8ee4b08cbcb87a4e6b-10'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
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          'suffix': '.png'},
         'primary': True}],
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filiate&utm campaign=1131&utm content=288747',
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gym_',
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         'primary': True}],
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         'United States']},
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           'suffix': '.png'},
         'primary': True}],
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        'url': 'https://www.seamless.com/menu/layali-dubai-restaurant-2417-st
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rk&utm medium=affiliate&utm campaign=1131&utm content=966639',
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         'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
          'sizes': [40, 50],
          'name': '/delivery_provider_seamless_20180129.png'}}},
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```

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danddrink_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
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         'reasonName': 'globalInteractionReason'}]},
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          'lng': -73.92044142362329}],
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        'country': 'United States',
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         'United States']},
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         'pluralName': 'Cafés',
         'shortName': 'Café',
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```
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          'suffix': '.png'},
         'primary': True}],
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        'url': 'https://www.seamless.com/menu/cafe-to-go-31-19-30th-ave-astor
ia/300470?affiliate=1131&utm source=foursquare-affiliate-network&utm medium=a
ffiliate&utm campaign=1131&utm content=300470',
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          'sizes': [40, 50],
          'name': '/delivery_provider_seamless_20180129.png'}}},
       'photos': {'count': 0, 'groups': []},
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          'suffix': '.png'},
         'primary': True}],
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```

```
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         'United States']},
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         'pluralName': 'Chinese Restaurants',
         'shortName': 'Chinese',
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n_',
          'suffix': '.png'},
         'primary': True}],
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steinway-st-astoria/338402?affiliate=1131&utm source=foursquare-affiliate-net
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          'sizes': [40, 50],
          'name': '/delivery_provider_seamless_20180129.png'}}},
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       'location': {'address': '37-04 30th Ave',
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         'United States' 1},
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eeshop ',
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'suffix': '.png'},
         'primary': True}],
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         'reasonName': 'globalInteractionReason'}]},
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       'name': 'Smart Choice Convenience Store',
       'location': {'address': '34-12 30th Ave',
        'lat': 40.765585377317976,
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         'United States']},
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         'shortName': 'Deli / Bodega',
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_',
          'suffix': '.png'},
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       'name': 'Jannah Charcoal & Grill',
       'location': {'address': '30th Avenue',
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        'lat': 40.7640867218297,
        'lng': -73.91558201721965,
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         'United States']},
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etfood_',
          'suffix': '.png'},
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        'lat': 40.76557301229827,
        'lng': -73.91846405194195,
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d wineshop_',
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        'lng': -73.91857219992431,
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         'primary': True}],
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         'shortName': 'Salon / Barbershop',
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'primary': True}],
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         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
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       'name': 'Aden Restaurant',
       'location': {'address': '24-42 Steinway St',
        'lat': 40.768233,
        'lng': -73.911779,
```

```
'labeledLatLngs': [{'label': 'display',
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         'United States']},
       'categories': [{'id': '4bf58dd8d48988d115941735',
         'name': 'Middle Eastern Restaurant',
         'pluralName': 'Middle Eastern Restaurants',
         'shortName': 'Middle Eastern',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories v2/food/midd
leeastern_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-50e8c2c7e4b0688e455b3e52-99'}]}]}}
```

In [64]:

```
# function that extracts the category of the venue
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

if len(categories_list) == 0:
    return None
else:
    return categories_list[0]['name']
```

In [65]:

```
venues = results['response']['groups'][0]['items']
nearby_venues = json_normalize(venues) # flatten JSON

# filter columns
filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venue.location.lng']
nearby_venues = nearby_venues.loc[:, filtered_columns]

# filter the category for each row
nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type, axis=1)

# clean columns
nearby_venues.columns = [col.split(".")[-1] for col in nearby_venues.columns]
nearby_venues.head()
```

Out[65]:

	name	categories	lat	Ing
0	Favela Grill	Brazilian Restaurant	40.767348	-73.917897
1	CrossFit Queens	Gym	40.769404	-73.918977
2	Titan Foods Inc.	Gourmet Shop	40.769198	-73.919253
3	Orange Blossom	Gourmet Shop	40.769856	-73.917012
4	Simply Fit Astoria	Gym	40.769114	-73.912403

In [66]:

```
print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))
```

100 venues were returned by Foursquare.

5. Explore Neighborhoods in Queens

In [68]:

```
def getNearbyVenues(names, latitudes, longitudes, radius=500):
    venues list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)
        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client id={}&client secret={}
&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT ID,
            CLIENT SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)
        # make the GET request
        results = requests.get(url).json()["response"]['groups'][0]['items']
        # return only relevant information for each nearby venue
        venues list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])
    nearby venues = pd.DataFrame([item for venue list in venues list for item in venue lis
t])
    nearby venues.columns = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category'
    return(nearby_venues)
```

In [69]:

Astoria

Woodside

Jackson Heights

Elmhurst

Howard Beach

Corona

Forest Hills

Kew Gardens

Richmond Hill

Flushing

Long Island City

Sunnyside

East Elmhurst

Maspeth

Ridgewood

Glendale

Rego Park

Woodhaven

Ozone Park

South Ozone Park

College Point

Whitestone

Bayside

Auburndale

Little Neck

Douglaston

Glen Oaks

Bellerose

Kew Gardens Hills

Fresh Meadows

Briarwood

Jamaica Center

Oakland Gardens

Queens Village

Hollis

South Jamaica

St. Albans

Rochdale

Springfield Gardens

Cambria Heights

Rosedale

Far Rockaway

Broad Channel

Breezy Point

Steinway

Beechhurst

Bay Terrace

Edgemere

Arverne

Rockaway Beach

Neponsit

Murray Hill

Floral Park

Holliswood

Jamaica Estates

Queensboro Hill

Hillcrest

Ravenswood Lindenwood Laurelton Lefrak City Belle Harbor Rockaway Park Somerville Brookville Bellaire North Corona Forest Hills Gardens Jamaica Hills Utopia Pomonok Astoria Heights Hunters Point Sunnyside Gardens Blissville Roxbury Middle Village Malba Hammels Bayswater Queensbridge

In [70]:

print(Queens_venues.shape)
Queens_venues.head()

(2180, 7)

Out[70]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Astoria	40.768509	-73.915654	Favela Grill	40.767348	-73.917897	Brazilian Restaurant
1	Astoria	40.768509	-73.915654	CrossFit Queens	40.769404	-73.918977	Gym
2	Astoria	40.768509	-73.915654	Titan Foods Inc.	40.769198	-73.919253	Gourmet Shop
3	Astoria	40.768509	-73.915654	Orange Blossom	40.769856	-73.917012	Gourmet Shop
4	Astoria	40.768509	-73.915654	Simply Fit Astoria	40.769114	-73.912403	Gym

In [71]:

Queens_venues.groupby('Neighborhood').count()

Out[71]:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Arverne	18	18	18	18	18	18
Astoria	100	100	100	100	100	100
Astoria Heights	13	13	13	13	13	13
Auburndale	18	18	18	18	18	18
Bay Terrace	40	40	40	40	40	40
Bayside	70	70	70	70	70	70
Bayswater	2	2	2	2	2	2
Beechhurst	16	16	16	16	16	16
Bellaire	12	12	12	12	12	12
Belle Harbor	18	18	18	18	18	18
Bellerose	23	23	23	23	23	23
Blissville	22	22	22	22	22	22
Breezy Point	4	4	4	4	4	4
Briarwood	14	14	14	14	14	14
Broad Channel	6	6	6	6	6	6
Brookville	1	1	1	1	1	1
Cambria Heights	17	17	17	17	17	17
College Point	41	41	41	41	41	41
Corona	22	22	22	22	22	22
Douglaston	22	22	22	22	22	22
East Elmhurst	11	11	11	11	11	11
Edgemere	14	14	14	14	14	14
Elmhurst	42	42	42	42	42	42
Far Rockaway	31	31	31	31	31	31
Floral Park	4	4	4	4	4	4
Flushing	58	58	58	58	58	58
Forest Hills	39	39	39	39	39	39
Forest Hills Gardens	21	21	21	21	21	21
Fresh Meadows	15	15	15	15	15	15
Glen Oaks	21	21	21	21	21	21
Glendale	4	4	4	4	4	4

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Hammels	19	19	19	19	19	19
Hillcrest	21	21	21	21	21	21
Hollis	20	20	20	20	20	20
Holliswood	4	4	4	4	4	4
Howard Beach	52	52	52	52	52	52
Hunters Point	72	72	72	72	72	72
Jackson Heights	80	80	80	80	80	80
Jamaica Center	46	46	46	46	46	46
Jamaica Estates	4	4	4	4	4	4
Jamaica Hills	25	25	25	25	25	25
Kew Gardens	48	48	48	48	48	48
Kew Gardens Hills	20	20	20	20	20	20
Laurelton	6	6	6	6	6	6
Lefrak City	28	28	28	28	28	28
Lindenwood	12	12	12	12	12	12
Little Neck	46	46	46	46	46	46
Long Island City	78	78	78	78	78	78
Malba	3	3	3	3	3	3
Maspeth	31	31	31	31	31	31
Middle Village	18	18	18	18	18	18
Murray Hill	46	46	46	46	46	46
Neponsit	5	5	5	5	5	5
North Corona	25	25	25	25	25	25
Oakland Gardens	24	24	24	24	24	24
Ozone Park	33	33	33	33	33	33
Pomonok	11	11	11	11	11	11
Queens Village	17	17	17	17	17	17
Queensboro Hill	25	25	25	25	25	25
Queensbridge	15	15	15	15	15	15
Ravenswood	26	26	26	26	26	26
Rego Park	46	46	46	46	46	46

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Richmond Hill	26	26	26	26	26	26
Ridgewood	36	36	36	36	36	36
Rochdale	23	23	23	23	23	23
Rockaway Beach	58	58	58	58	58	58
Rockaway Park	27	27	27	27	27	27
Rosedale	15	15	15	15	15	15
Roxbury	10	10	10	10	10	10
Somerville	1	1	1	1	1	1
South Jamaica	7	7	7	7	7	7
South Ozone Park	13	13	13	13	13	13
Springfield Gardens	16	16	16	16	16	16
St. Albans	16	16	16	16	16	16
Steinway	25	25	25	25	25	25
Sunnyside	40	40	40	40	40	40
Sunnyside Gardens	100	100	100	100	100	100
Utopia	17	17	17	17	17	17
Whitestone	6	6	6	6	6	6
Woodhaven	24	24	24	24	24	24
Woodside	75	75	75	75	75	75

In [72]:

print('There are {} uniques categories.'.format(len(Queens_venues['Venue Category'].unique
())))

There are 273 uniques categories.

6. Analyze Each Neighborhood

In [73]:

```
# one hot encoding
Queens_onehot = pd.get_dummies(Queens_venues[['Venue Category']], prefix="", prefix_sep="")
# add neighborhood column back to dataframe
Queens_onehot['Neighborhood'] = Queens_venues['Neighborhood']
# move neighborhood column to the first column
fixed_columns = [Queens_onehot.columns[-1]] + list(Queens_onehot.columns[:-1])
Queens_onehot = Queens_onehot[fixed_columns]
Queens_onehot.head()
```

Out[73]:

	Yoga Studio	Accessories Store	Afghan Restaurant		American Restaurant		Argentinian Restaurant	Art Gallery	Mus€
0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	
4									•

In [74]:

Queens_onehot.shape

Out[74]:

(2180, 273)

In [75]:

```
Queens_grouped = Queens_onehot.groupby('Neighborhood').mean().reset_index()
Queens_grouped
print(Queens_grouped .shape)
Queens_grouped .head(10)
```

(81, 273)

Out[75]:

	Neighborhood	Yoga Studio	Accessories Store	Afghan Restaurant	Airport Terminal	American Restaurant	Arepa Restaurant	Argentini Restaura
0	Arverne	0.000000	0.000	0.0	0.0	0.000000	0.0	(
1	Astoria	0.000000	0.000	0.0	0.0	0.000000	0.0	(
2	Astoria Heights	0.000000	0.000	0.0	0.0	0.000000	0.0	(
3	Auburndale	0.000000	0.000	0.0	0.0	0.055556	0.0	(
4	Bay Terrace	0.000000	0.025	0.0	0.0	0.050000	0.0	(
5	Bayside	0.014286	0.000	0.0	0.0	0.042857	0.0	(
6	Bayswater	0.000000	0.000	0.0	0.0	0.000000	0.0	(
7	Beechhurst	0.062500	0.000	0.0	0.0	0.000000	0.0	(
8	Bellaire	0.000000	0.000	0.0	0.0	0.000000	0.0	(
9	Belle Harbor	0.000000	0.000	0.0	0.0	0.000000	0.0	(

Let us assume our customer wants to open either an Italian Restaurant or an Indian Restaurant

In [78]:

```
print(len(Queens_grouped[Queens_grouped["Italian Restaurant"] > 0]))
print(len(Queens_grouped[Queens_grouped["Indian Restaurant"] > 0]))
```

25

13

In [89]:

```
Queens_grouped = Queens_grouped[["Neighborhood","Italian Restaurant", "Indian Restaurant"]]
```

In [90]:

Queens_grouped.head()

Out[90]:

	Neighborhood	Italian Restaurant	Indian Restaurant
0	Arverne	0.000000	0.00
1	Astoria	0.020000	0.02
2	Astoria Heights	0.153846	0.00
3	Auburndale	0.055556	0.00
4	Bay Terrace	0.000000	0.00

In []:

In [91]:

```
num_top_venues = 5
for hood in Queens_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = Queens_grouped[Queens_grouped['Neighborhood'] == hood].T.reset_index()
    temp.columns = ['venue','freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_top_venues))
    print('\n')
```

	Ληνοηη	2	
	Arverne	venue	fred
0	Ttalian	Restaurant	•
1		Restaurant	
_	11101011	neseaur ane	0.0
	Astoria	a	
		venue	
0		Restaurant	
1	Indian	Restaurant	0.02
	Actoni:	. Woights	
	ASCOLT	a Heights venue	
0	Ttalian	Restaurant	
1		Restaurant	
_			
	Auburno	dale	
		venue	
0		Restaurant	0.06
1	Indian	Restaurant	0.00
	Pay To	rrace	
	вау гег	venue	fred
0	Ttalian	Restaurant	
1		Restaurant	0.0
	Bayside	2	
		venue	freq
0		Restaurant	0.04
1	Italian	Restaurant	0.03
	Bayswat	tar	
	Dayswa	venue	frea
0	Italian	Restaurant	
1		Restaurant	
	Beechhi	urst	
		venue	
0		Restaurant	0.06
1	Indian	Restaurant	0.00
	Bellaiı	^	
	DCTTGI	venue	freq
0	Italian	Restaurant	
1		Restaurant	
	Belle H	Harbor	
0		venue Restaurant	freq 0.06

Indian Restaurant 0.00 1 ----Bellerose---venue freq Italian Restaurant 0.09 Indian Restaurant 0.00 1 ----Blissville---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Breezy Point---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Briarwood---venue freq Indian Restaurant 0.07 Italian Restaurant 0.00 ----Broad Channel---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Brookville---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Cambria Heights---venue freq Italian Restaurant 0 0.0 Indian Restaurant 0.0 ----College Point---venue freq Italian Restaurant 0 0.0 Indian Restaurant 0.0 ----Corona---venue freq Italian Restaurant 0.05 Indian Restaurant 0.00

	-Douglas	ston	
		venue	freq
0]	[talian	Restaurant	0.05
1	Indian	Restaurant	0.00
	-East E	lmhurst	_
	- .	venue	
		Restaurant	0.0
1	Indian	Restaurant	0.0
	-Edgemer	20	
	Lugemei	venue	fred
a 1	[talian	Restaurant	
1		Restaurant	0.0
_	Indian	Nescaul alle	0.0
	-Elmhurs	st	
		venue	freq
0]	[talian	Restaurant	0.0
1	Indian	Restaurant	0.0
	-Far Roo	ckaway	
		venue	freq
0]	[talian	Restaurant	0.0
1	Indian	Restaurant	0.0
	-1 1	DI-	
	-FIORAL	Park	C
0	T	venue	
		Restaurant Restaurant	0.25 0.00
т .	LCallan	Restaurant	0.00
	-Flushir	າg	
		venue	frea
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1		Restaurant	
	Forest	Hills	
		venue	freq
0]	[talian	Restaurant	0.03
1	Indian	Restaurant	0.00
	Forest	Hills Garde	
_	- •	venue	
		Restaurant	
1	ındıan	Restaurant	0.0
=	.Enach M	Meadows	
	i i CSII I	venue	frea
0 1	[talian	Restaurant	•

Indian Restaurant 1 0.0 ----Glen Oaks---venue freq Indian Restaurant 0.05 Italian Restaurant 0.00 ----Glendale---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Hammels---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Hillcrest---venue freq Italian Restaurant 0.05 1 Indian Restaurant 0.00 ----Hollis---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Holliswood---venue freq Italian Restaurant 0.0 Indian Restaurant 0.0 ----Howard Beach---freq venue 0 Italian Restaurant 0.08 Indian Restaurant 0.00 ----Hunters Point---venue freq Italian Restaurant 0.06 0 Indian Restaurant 0.00 ----Jackson Heights---venue freq Italian Restaurant 0.01 Indian Restaurant 0.00

Jamaica Center	_
	freq
0 Italian Restaurant	•
1 Indian Restaurant	
Jamaica Estates	
	freq
0 Italian Restaurant	
1 Indian Restaurant	0.0
Jamaica Hills	C
venue	
0 Indian Restaurant	
1 Italian Restaurant	0.00
Kew Gardens	
venue	freq
0 Indian Restaurant	•
1 Italian Restaurant	0.02
Kew Gardens Hills	
	freq
0 Italian Restaurant	0.0
1 Indian Restaurant	0.0
l avealtae	
Laurelton venue	fnog
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1 Indian Restaurant	
i indian Kestadi ane	0.0
Lefrak City	
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1 Indian Restaurant	0.0
Lindenwood	_
	freq
0 Italian Restaurant	
1 Indian Restaurant	0.0
Little Neck	
venue	freq
0 Italian Restaurant	
1 Indian Restaurant	
	3.30
Long Island City-	
-	_
venue 0 Italian Restaurant	freq

1	Indian	Restaurant	0.01
	Malba-		
		venue	fred
0	Italian	Restaurant	
1	Indian	Restaurant	0.6
	Maspet	h	
	-	venue	
0	Italian	Restaurant	0.6
1	Indian	Restaurant Restaurant	0.6
	Middle	Village	
_		venue	
		Restaurant	
1	Indian	Restaurant	0.00
	Murray	Hill	
	Mui i ay	venue	frec
a	Ttalian	Restaurant	
		Restaurant	
	Nepons		
		venue	fred
0	Italian	Restaurant	0.6
1	Indian	Restaurant	0.6
	North	Corona	_
_	T4-13	venue	
0 1		Restaurant	
1	Inulan	Restaurant	0.0
	Oaklan	d Gardens	
	Uakian	venue	
а	T+alian	Restaurant	
1		Restaurant	
_			
	Ozone	Park	
		venue	
0	Italian	Restaurant	0.0
1	Indian	Restaurant	0.6
	Domono	k	
	Pomono		fnac
а	Ttalian	venue Restaurant	
		Restaurant	

	Queens	Village	
		venue	
0	Italian	Restaurant	0.0
		Restaurant	
_			
	Oueensl	ooro Hill	_
	C	venue	
a	Indian	Restaurant	0 01
1	T+alian	Restaurant	0.04
_	Italian	Nescaul alle	0.00
	Oueensl	oridge	
	C	venue	frea
a	T+alian	Restaurant	
1	Indian	Restaurant	0.0
_	Illutali	Nescaul alle	0.0
	Ravensı	wood	
		venue	frea
a	Ttalian	Restaurant	
1		Restaurant	
1	Illutali	Restaurant	0.04
	Rego Pa	ark	
		venue	frea
a	T+alian	Restaurant	
1	Inutan	Restaurant	0.00
	Richmo	nd Hill	
		venue	fred
a	Indian		
		Restaurant	
1	italian	Restaurant	0.00
	Ridgewo	nod	
	Kiugew		£
_	T. 3.	venue	
		Restaurant	
1	Indian	Restaurant	0.03
	Rochda	10	
	-Nociiua.	venue	£na-
_	T. 3.		-
		Restaurant	
1	Indian	Restaurant	0.0
	Rockaw	ay Beach	
	- NOCKAW	venue	fnoc
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		Restaurant	
1	Indian	Restaurant	0.0
	Rockawa	ay Park	
	NOCKAW	venue	fnag
Ω	T+01:00		-
О	ıcaılan	Restaurant	0.0

1	Indian	Restaurant	0.0
	Roseda	le	
		venue	freq
0	Italian	Restaurant	•
1		Restaurant	
	Roxbur		
		venue	freq
		Restaurant	
1	Indian	Restaurant	0.0
	Somerv	ille	
	Joiner V.	venue	frea
a	Ttalian	Restaurant	
1		Restaurant	
_	Inatan	Kestaal alle	0.0
	South	Jamaica	
		venue	freq
0	Italian	Restaurant	0.0
1	Indian	Restaurant	0.0
	South	Ozone Park	
	Journ	venue	
а	Ttalian	Restaurant	
		Restaurant	
_	Indian	Reseaul alle	0.0
	Spring	field Garden	ıs
		venue	
0	Italian	Restaurant	0.0
1	Indian	Restaurant	0.0
	St. Al	bans	
		venue	
0		Restaurant	0.0
1	Indian	Restaurant	0.0
	Steinw	av	
	CCTIIW	venue	frec
0	Ttalian	Restaurant	
1		Restaurant	
1	THUTAIL	nescaul ailt	0.00
	Sunnys	ide	
	-	venue	freq
0	Italian	Restaurant	
1	Indian	Restaurant	0.00

```
----Sunnyside Gardens----
                venue freq
    Indian Restaurant 0.01
  Italian Restaurant 0.00
1
----Utopia----
                venue frea
  Italian Restaurant
                        0.0
   Indian Restaurant
                        0.0
----Whitestone----
                venue freq
  Italian Restaurant
                        0.0
1
    Indian Restaurant
                        0.0
----Woodhaven----
                venue freq
  Italian Restaurant
                        0.0
1
    Indian Restaurant
                        0.0
----Woodside----
                venue frea
  Italian Restaurant
                        0.0
   Indian Restaurant
                        0.0
```

In [97]:

```
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)
    return row_categories_sorted.index.values[0:num_top_venues]
```

7. Cluster Neighborhoods

In [104]:

```
# set number of clusters
kclusters = 5
Queens_grouped_clustering = Queens_grouped.drop('Neighborhood', 1)
# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(Queens_grouped_clustering)
# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

Out[104]:

```
array([0, 0, 1, 4, 0, 2, 0, 4, 4, 4], dtype=int32)
```

In [114]:

```
# create a new dataframe that includes the cluster as well as the top 10 venues for each n
eighborhood.
Queens_merged = Queens_grouped.copy()

# add clustering labels
Queens_merged["Cluster Labels"] = kmeans.labels_
```

In [116]:

Queens_merged.head()

Out[116]:

	Neighborhood	Italian Restaurant	Indian Restaurant	Cluster Labels
0	Arverne	0.000000	0.00	0
1	Astoria	0.020000	0.02	0
2	Astoria Heights	0.153846	0.00	1
3	Auburndale	0.055556	0.00	4
4	Bay Terrace	0.000000	0.00	0

In []:

8. Examine Clusters

Cluster 1

```
In [136]:
```

Queens_merged.loc[Queens_merged['Cluster Labels'] == 0]

Out[136]:

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
0	Arverne	0.000000	0.000000	0
1	Astoria	0.020000	0.020000	0
4	Bay Terrace	0.000000	0.000000	0
6	Bayswater	0.000000	0.000000	0
11	Blissville	0.000000	0.000000	0
12	Breezy Point	0.000000	0.000000	0
14	Broad Channel	0.000000	0.000000	0
15	Brookville	0.000000	0.000000	0
16	Cambria Heights	0.000000	0.000000	0
17	College Point	0.000000	0.000000	0
20	East Elmhurst	0.000000	0.000000	0
21	Edgemere	0.000000	0.000000	0
22	Elmhurst	0.000000	0.000000	0
23	Far Rockaway	0.000000	0.000000	0
25	Flushing	0.017241	0.000000	0
26	Forest Hills	0.025641	0.000000	0
27	Forest Hills Gardens	0.000000	0.000000	0
28	Fresh Meadows	0.000000	0.000000	0
30	Glendale	0.000000	0.000000	0
31	Hammels	0.000000	0.000000	0
33	Hollis	0.000000	0.000000	0
34	Holliswood	0.000000	0.000000	0
37	Jackson Heights	0.012500	0.000000	0
38	Jamaica Center	0.000000	0.000000	0
39	Jamaica Estates	0.000000	0.000000	0
42	Kew Gardens Hills	0.000000	0.000000	0
43	Laurelton	0.000000	0.000000	0
44	Lefrak City	0.000000	0.000000	0
45	Lindenwood	0.000000	0.000000	0
47	Long Island City	0.012821	0.012821	0
48	Malba	0.000000	0.000000	0
49	Maspeth	0.000000	0.000000	0
51	Murray Hill	0.000000	0.000000	0
52	Neponsit	0.000000	0.000000	0

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
53	North Corona	0.000000	0.000000	0
54	Oakland Gardens	0.000000	0.000000	0
55	Ozone Park	0.000000	0.000000	0
56	Pomonok	0.000000	0.000000	0
57	Queens Village	0.000000	0.000000	0
59	Queensbridge	0.000000	0.000000	0
61	Rego Park	0.021739	0.000000	0
64	Rochdale	0.000000	0.000000	0
65	Rockaway Beach	0.000000	0.000000	0
66	Rockaway Park	0.000000	0.000000	0
67	Rosedale	0.000000	0.000000	0
68	Roxbury	0.000000	0.000000	0
69	Somerville	0.000000	0.000000	0
70	South Jamaica	0.000000	0.000000	0
71	South Ozone Park	0.000000	0.000000	0
72	Springfield Gardens	0.000000	0.000000	0
73	St. Albans	0.000000	0.000000	0
76	Sunnyside Gardens	0.000000	0.010000	0
77	Utopia	0.000000	0.000000	0
78	Whitestone	0.000000	0.000000	0
79	Woodhaven	0.000000	0.000000	0
80	Woodside	0.000000	0.000000	0

Cluster 2

In [137]:

```
Queens_merged.loc[Queens_merged['Cluster Labels'] == 1]
```

Out[137]:

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
2	Astoria Heights	0.153846	0.0	1

Cluster 3

In [138]:

```
Queens_merged.loc[Queens_merged['Cluster Labels'] == 2]
```

Out[138]:

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
5	Bayside	0.028571	0.042857	2
13	Briarwood	0.000000	0.071429	2
29	Glen Oaks	0.000000	0.047619	2
40	Jamaica Hills	0.000000	0.120000	2
41	Kew Gardens	0.020833	0.041667	2
58	Queensboro Hill	0.000000	0.040000	2
62	Richmond Hill	0.000000	0.038462	2
63	Ridgewood	0.027778	0.027778	2

Cluster 4

In [139]:

```
Queens_merged.loc[Queens_merged['Cluster Labels'] == 3]
```

Out[139]:

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
24	Floral Park	0.0	0.25	3

Cluster 5

In [140]:

```
Queens_merged.loc[Queens_merged['Cluster Labels'] == 4]
```

Out[140]:

	Restaurant_Location	Italian Restaurant	Indian Restaurant	Cluster Labels
3	Auburndale	0.055556	0.000000	4
7	Beechhurst	0.062500	0.000000	4
8	Bellaire	0.083333	0.000000	4
9	Belle Harbor	0.055556	0.000000	4
10	Bellerose	0.086957	0.000000	4
18	Corona	0.045455	0.000000	4
19	Douglaston	0.045455	0.000000	4
32	Hillcrest	0.047619	0.000000	4
35	Howard Beach	0.076923	0.000000	4
36	Hunters Point	0.055556	0.000000	4
46	Little Neck	0.065217	0.000000	4
50	Middle Village	0.055556	0.000000	4
60	Ravenswood	0.076923	0.038462	4
74	Steinway	0.080000	0.000000	4
75	Sunnyside	0.075000	0.000000	4

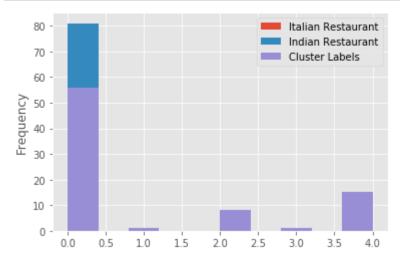
From the clustered data, we can see that for both Italian and Indian Restaurants, cluster 3 seems to be the best choice. There would be less or very little competition from existing restaurants.

In [141]:

```
import matplotlib as mpl
import matplotlib.pyplot as plt
import numpy as np
```

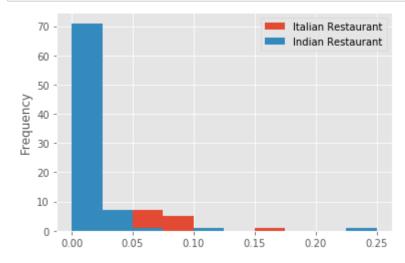
In [146]:

```
Queens_merged.plot(kind='hist')
plt.show()
```



In [147]:

Queens_grouped.plot(kind='hist')
plt.show()



In []: