CLUSTERING NEIGHBORHOODS IN TORONTO

This notebook is divided into three sections - Section A deals with data gathering and cleaning, Section B geocodes the neighborhoods and finally Section C runs a clustering algorithm to discover similar neighborhood clusters in Toronto

In this notebook, we will explore, segment, and cluster the neighborhoods in the city of Toronto.

For the Toronto neighborhood data, a Wikipedia page exists that has all the information we need to explore and cluster the neighborhoods in Toronto. This notebook will scrape the Wikipedia page and wrangle the data, clean it, and then read it into a pandas dataframe so that it is in a structured format for applying algorithms

- BY SHUDH DATTA (@Shudh) *

In [1]:

```
### Section A - Scraping,cleaning & wrangling relevant data from Wikipedia
```

In [2]:

```python
import pandas as pd # pandas
import numpy as np

import json # library to handle JSON files

!conda install -c conda-forge geopy --yes # uncomment this line if you haven't c
ompleted the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude and lon
gitude values

import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas dat
aframe

# 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
import folium # map rendering library


print('Libraries imported.')
```

Solving environment: done

All requested packages already installed.

Solving environment: done

All requested packages already installed.

Libraries imported.

Scraping wikipedia data using pandas

In [3]:

```python
link = "https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M"

tables = pd.read_html(link,header=0)[0]

tables
```

Out[3]:

	Postcode	Borough	Neighbourhood
0	M1A	Not assigned	Not assigned
1	M2A	Not assigned	Not assigned
2	M3A	North York	Parkwoods
3	M4A	North York	Victoria Village
4	M5A	Downtown Toronto	Harbourfront
5	M6A	North York	Lawrence Heights
6	M6A	North York	Lawrence Manor
7	M7A	Downtown Toronto	Queen's Park
8	M8A	Not assigned	Not assigned
9	M9A	Queen's Park	Not assigned
10	M1B	Scarborough	Rouge
11	M1B	Scarborough	Malvern
12	M2B	Not assigned	Not assigned
13	M3B	North York	Don Mills North
14	M4B	East York	Woodbine Gardens
15	M4B	East York	Parkview Hill
16	M5B	Downtown Toronto	Ryerson
17	M5B	Downtown Toronto	Garden District
18	M6B	North York	Glencairn
19	M7B	Not assigned	Not assigned
20	M8B	Not assigned	Not assigned
21	M9B	Etobicoke	Cloverdale
22	M9B	Etobicoke	Islington
23	M9B	Etobicoke	Martin Grove
24	M9B	Etobicoke	Princess Gardens
25	M9B	Etobicoke	West Deane Park
26	M1C	Scarborough	Highland Creek
27	M1C	Scarborough	Rouge Hill
28	M1C	Scarborough	Port Union
29	M2C	Not assigned	Not assigned
...	...	...	...

	Postcode	Borough	Neighbourhood
257	M9X	Not assigned	Not assigned
258	M1Y	Not assigned	Not assigned
259	M2Y	Not assigned	Not assigned
260	M3Y	Not assigned	Not assigned
261	M4Y	Downtown Toronto	Church and Wellesley
262	M5Y	Not assigned	Not assigned
263	M6Y	Not assigned	Not assigned
264	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eastern
265	M8Y	Etobicoke	Humber Bay
266	M8Y	Etobicoke	King's Mill Park
267	M8Y	Etobicoke	Kingsway Park South East
268	M8Y	Etobicoke	Mimico NE
269	M8Y	Etobicoke	Old Mill South
270	M8Y	Etobicoke	The Queensway East
271	M8Y	Etobicoke	Royal York South East
272	M8Y	Etobicoke	Sunnylea
273	M9Y	Not assigned	Not assigned
274	M1Z	Not assigned	Not assigned
275	M2Z	Not assigned	Not assigned
276	M3Z	Not assigned	Not assigned
277	M4Z	Not assigned	Not assigned
278	M5Z	Not assigned	Not assigned
279	M6Z	Not assigned	Not assigned
280	M7Z	Not assigned	Not assigned
281	M8Z	Etobicoke	Kingsway Park South West
282	M8Z	Etobicoke	Mimico NW
283	M8Z	Etobicoke	The Queensway West
284	M8Z	Etobicoke	Royal York South West
285	M8Z	Etobicoke	South of Bloor
286	M9Z	Not assigned	Not assigned

287 rows × 3 columns

Next we will process the cells that have an assigned borough and ignore cells with a borough that is
Not assigned.

In [4]:

```python
table_cleaned = tables[~tables['Borough'].isin(['Not assigned'])]
table_cleaned.reset_index(drop=True, inplace=True)
table_cleaned
```

Out[4]:

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront
3	M6A	North York	Lawrence Heights
4	M6A	North York	Lawrence Manor
5	M7A	Downtown Toronto	Queen's Park
6	M9A	Queen's Park	Not assigned
7	M1B	Scarborough	Rouge
8	M1B	Scarborough	Malvern
9	M3B	North York	Don Mills North
10	M4B	East York	Woodbine Gardens
11	M4B	East York	Parkview Hill
12	M5B	Downtown Toronto	Ryerson
13	M5B	Downtown Toronto	Garden District
14	M6B	North York	Glencairn
15	M9B	Etobicoke	Cloverdale
16	M9B	Etobicoke	Islington
17	M9B	Etobicoke	Martin Grove
18	M9B	Etobicoke	Princess Gardens
19	M9B	Etobicoke	West Deane Park
20	M1C	Scarborough	Highland Creek
21	M1C	Scarborough	Rouge Hill
22	M1C	Scarborough	Port Union
23	M3C	North York	Flemingdon Park
24	M3C	North York	Don Mills South
25	M4C	East York	Woodbine Heights
26	M5C	Downtown Toronto	St. James Town
27	M6C	York	Humewood-Cedarvale
28	M9C	Etobicoke	Bloordale Gardens
29	M9C	Etobicoke	Eringate
...	...	...	...

	Postcode	Borough	Neighbourhood
180	M9V	Etobicoke	Thistletown
181	M1W	Scarborough	L'Amoreaux West
182	M4W	Downtown Toronto	Rosedale
183	M5W	Downtown Toronto	Stn A PO Boxes 25 The Esplanade
184	M8W	Etobicoke	Alderwood
185	M8W	Etobicoke	Long Branch
186	M9W	Etobicoke	Northwest
187	M1X	Scarborough	Upper Rouge
188	M4X	Downtown Toronto	Cabbagetown
189	M4X	Downtown Toronto	St. James Town
190	M5X	Downtown Toronto	First Canadian Place
191	M5X	Downtown Toronto	Underground city
192	M8X	Etobicoke	The Kingsway
193	M8X	Etobicoke	Montgomery Road
194	M8X	Etobicoke	Old Mill North
195	M4Y	Downtown Toronto	Church and Wellesley
196	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eastern
197	M8Y	Etobicoke	Humber Bay
198	M8Y	Etobicoke	King's Mill Park
199	M8Y	Etobicoke	Kingsway Park South East
200	M8Y	Etobicoke	Mimico NE
201	M8Y	Etobicoke	Old Mill South
202	M8Y	Etobicoke	The Queensway East
203	M8Y	Etobicoke	Royal York South East
204	M8Y	Etobicoke	Sunnylea
205	M8Z	Etobicoke	Kingsway Park South West
206	M8Z	Etobicoke	Mimico NW
207	M8Z	Etobicoke	The Queensway West
208	M8Z	Etobicoke	Royal York South West
209	M8Z	Etobicoke	South of Bloor

210 rows × 3 columns

More than one neighborhood can exist in one postal code area. If you search with M1C you will find three matches. These three rows will be combined into one row with the neighborhoods separated with a comma.

In [5]:

```python
# Group by Postcode

table_grp_by_postcode = table_cleaned.groupby('Postcode').agg({'Borough' : 'first', 'Neighbourhood' : ','.join}).reset_index().reindex(columns=table_cleaned.columns)

table_grp_by_postcode

# Just fyi below commented code was to check if M5A still had two matches

#print(table_grp_by_postcode.loc[table_grp_by_postcode['Postcode'] == 'M5A'])
#print(table_cleaned.loc[table_cleaned['Postcode'] == 'M5A'])
```

Out[5]:

	Postcode	Borough	Neighbourhood
0	M1B	Scarborough	Rouge,Malvern
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union
2	M1E	Scarborough	Guildwood,Morningside,West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae
5	M1J	Scarborough	Scarborough Village
6	M1K	Scarborough	East Birchmount Park,Ionview,Kennedy Park
7	M1L	Scarborough	Clairlea,Golden Mile,Oakridge
8	M1M	Scarborough	Cliffcrest,Cliffside,Scarborough Village West
9	M1N	Scarborough	Birch Cliff,Cliffside West
10	M1P	Scarborough	Dorset Park,Scarborough Town Centre,Wexford He...
11	M1R	Scarborough	Maryvale,Wexford
12	M1S	Scarborough	Agincourt
13	M1T	Scarborough	Clarks Corners,Sullivan,Tam O'Shanter
14	M1V	Scarborough	Agincourt North,L'Amoreaux East,Milliken,Steel...
15	M1W	Scarborough	L'Amoreaux West
16	M1X	Scarborough	Upper Rouge
17	M2H	North York	Hillcrest Village
18	M2J	North York	Fairview,Henry Farm,Oriole
19	M2K	North York	Bayview Village
20	M2L	North York	Silver Hills,York Mills
21	M2M	North York	Newtonbrook,Willowdale
22	M2N	North York	Willowdale South
23	M2P	North York	York Mills West
24	M2R	North York	Willowdale West
25	M3A	North York	Parkwoods
26	M3B	North York	Don Mills North
27	M3C	North York	Flemingdon Park,Don Mills South
28	M3H	North York	Bathurst Manor,Downsview North,Wilson Heights
29	M3J	North York	Northwood Park,York University
...	...	...	...

	Postcode	Borough	Neighbourhood
73	M6C	York	Humewood-Cedarvale
74	M6E	York	Caledonia-Fairbanks
75	M6G	Downtown Toronto	Christie
76	M6H	West Toronto	Dovercourt Village,Dufferin
77	M6J	West Toronto	Little Portugal,Trinity
78	M6K	West Toronto	Brockton,Exhibition Place,Parkdale Village
79	M6L	North York	Downsview,North Park,Upwood Park
80	M6M	York	Del Ray,Keelesdale,Mount Dennis,Silverthorn
81	M6N	York	The Junction North,Runnymede
82	M6P	West Toronto	High Park,The Junction South
83	M6R	West Toronto	Parkdale,Roncesvalles
84	M6S	West Toronto	Runnymede,Swansea
85	M7A	Downtown Toronto	Queen's Park
86	M7R	Mississauga	Canada Post Gateway Processing Centre
87	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eastern
88	M8V	Etobicoke	Humber Bay Shores,Mimico South,New Toronto
89	M8W	Etobicoke	Alderwood,Long Branch
90	M8X	Etobicoke	The Kingsway,Montgomery Road,Old Mill North
91	M8Y	Etobicoke	Humber Bay,King's Mill Park,Kingsway Park Sout...
92	M8Z	Etobicoke	Kingsway Park South West,Mimico NW,The Queensw...
93	M9A	Queen's Park	Not assigned
94	M9B	Etobicoke	Cloverdale,Islington,Martin Grove,Princess Gar...
95	M9C	Etobicoke	Bloordale Gardens,Eringate,Markland Wood,Old B...
96	M9L	North York	Humber Summit
97	M9M	North York	Emery,Humberlea
98	M9N	York	Weston
99	M9P	Etobicoke	Westmount
100	M9R	Etobicoke	Kingsview Village,Martin Grove Gardens,Richvie...
101	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...
102	M9W	Etobicoke	Northwest

103 rows × 3 columns

If a cell has a borough but a Not assigned neighborhood, then the neighborhood will be the same as the borough. We shall check values with Not assigned neigborhood

In [6]:

```
print(table_grp_by_postcode.loc[table_grp_by_postcode['Neighbourhood'] == 'Not a
ssigned'])
```

```
    Postcode      Borough Neighbourhood
93       M9A  Queen's Park  Not assigned
```

From the above print we see that there is only one Not assigned Neighbourhood. So, for simplicity we just replace that particular Neighbourhood value with the corresponding borough which is Queen's Park

In [7]:

```python
#table_grp_by_postcode_clean = table_grp_by_postcode.loc[table_grp_by_postcode
['Neighbourhood'] == 'Not assigned', 'Neighbourhood'] = 'Queen\'s Park'

table_grp_by_postcode.loc[table_grp_by_postcode['Neighbourhood'] == 'Not assigne
d', 'Neighbourhood'] = 'Queen\'s Park'

table_grp_by_postcode

print(table_grp_by_postcode.loc[table_grp_by_postcode['Neighbourhood'] == 'Not a
ssigned'])
print(table_grp_by_postcode.loc[table_grp_by_postcode['Neighbourhood'] == 'Queen
\'s Park'])
table_grp_by_postcode.head()
#print(table_grp_by_postcode_clean.loc[table_grp_by_postcode_clean['Neighbourhoo
d'] == 'Not assigned'])
```

```
Empty DataFrame
Columns: [Postcode, Borough, Neighbourhood]
Index: []
    Postcode         Borough Neighbourhood
85       M7A  Downtown Toronto   Queen's Park
93       M9A       Queen's Park   Queen's Park
```

Out[7]:

	Postcode	Borough	Neighbourhood
0	M1B	Scarborough	Rouge,Malvern
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union
2	M1E	Scarborough	Guildwood,Morningside,West Hill
3	M1G	Scarborough	Woburn
4	M1H	Scarborough	Cedarbrae

In [8]:

```python
# Checking that no rows exist with Neighbourhood as Not assigned
print(table_grp_by_postcode.loc[table_grp_by_postcode['Neighbourhood'] == 'Not a
ssigned'])
```

```
Empty DataFrame
Columns: [Postcode, Borough, Neighbourhood]
Index: []
```

In [9]:

```
table_grp_by_postcode.shape
```

Out[9]:

```
(103, 3)
```

Now that we have built a dataframe of the postal code of each neighborhood along with the borough name and neighborhood name, in order to utilize the Foursquare location data, we need to get the latitude and the longitude coordinates of each neighborhood.

SECTION B GEOCODING WITH THE GIVEN GEOLOCATION FILE

Given that geocode package can be very unreliable, we will use the link to a csv file that has the geographical coordinates of each postal code: [http://cocl.us/Geospatial_data (http://cocl.us/Geospatial_data)](http://cocl.us/Geospatial_data)

In [10]:

```
!wget -q -O 'geodata.csv' http://cocl.us/Geospatial_data
print('Data downloaded!')
```

```
Data downloaded!
```

Let's check the geodata we just downloaded

In [11]:

```
geodata_df = pd.read_csv('geodata.csv')

geodata_df.head()
```

Out[11]:

	Postal Code	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

Note that the column name is Postal Code and in our earlier frame from wiki it was Postcode. So, we will rename the column name here for both the frames to match

In [12]:

```python
geodata_df.rename( columns={'Postal Code':'Postcode'}, inplace=True )
geodata_df.head()
```

Out[12]:

	Postcode	Latitude	Longitude
0	M1B	43.806686	-79.194353
1	M1C	43.784535	-79.160497
2	M1E	43.763573	-79.188711
3	M1G	43.770992	-79.216917
4	M1H	43.773136	-79.239476

Now we will merge both dataframes on Postcode

In [13]:

```python
#merged_df = pd.merge(table_cleaned_1, geodata_df, on='Postcode')
#table_grp_by_postcode
merged_df = pd.merge(table_grp_by_postcode, geodata_df, on='Postcode')

merged_df.head()
```

Out[13]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M1B	Scarborough	Rouge,Malvern	43.806686	-79.194353
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497
2	M1E	Scarborough	Guildwood,Morningside,West Hill	43.763573	-79.188711
3	M1G	Scarborough	Woburn	43.770992	-79.216917
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476

In [14]:

```python
geodata_df.shape
```

Out[14]:

(103, 3)

SECTION C CLUSTERING

Explore and cluster the neighborhoods in Toronto.

Commented the code below that contain the word Toronto . Used a subset of data to check performance of foursquare and now we will do clustering with the full dataframe

In [15]:

```
#toronto_borough_data = merged_df[merged_df['Borough'] == 'Toronto'].reset_index
(drop=True)

# The below commented line could be used to filter Borough names that has Toront
o to limit dataset.

#toronto_borough_data = merged_df[merged_df["Borough"].str.contains("Toronto", c
ase=False)].reset_index(drop=True)

# Lets take the full dataset to cluster Toronto

toronto_borough_data = merged_df
```

We will take only one row out of the whole dataframe to see if foursquare setup is correct without overwhelming the API in loop.

In [16]:

```
# Just testing
neighborhood_latitude = toronto_borough_data.loc[0, 'Latitude'] # neighborhood l
atitude value
neighborhood_longitude = toronto_borough_data.loc[0, 'Longitude'] # neighborhood
longitude value

neighborhood_name = toronto_borough_data.loc[0, 'Neighbourhood'] # neighborhood
 name

print('Latitude and longitude values of {} are {}, {}.'.format(neighborhood_name
,
                                                               neighborhood_lati
tude,
                                                               neighborhood_long
itude))
```

```
Latitude and longitude values of Rouge,Malvern are 43.8066862999999
96, -79.19435340000001.
```

In [17]:

```
 # @hidden_cell

CLIENT_ID =  # your Foursquare ID
CLIENT_SECRET =  # your Foursquare Secret
VERSION =  # Foursquare API version

#print('Your credentails:')
#print('CLIENT_ID: ' + CLIENT_ID)
#print('CLIENT_SECRET:' + CLIENT_SECRET)
```

We will create the formatted url to the foursquare explore endpoint now

In [18]:

```
LIMIT = 100 # limit of number of venues returned by Foursquare API
radius = 500 # define radius

 # create URL
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
```

Lets hit the endpoint for only one postal code

In [19]:

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

Out[19]:

{'meta': {'code': 200, 'requestId': '5e43c649edbcad001b50bb9e'},
 'response': {'warning': {'text': "There aren't a lot of results ne
ar you. Try something more general, reset your filters, or expand t
he search area."},
  'headerLocation': 'Malvern',
  'headerFullLocation': 'Malvern, Toronto',
  'headerLocationGranularity': 'neighborhood',
  'totalResults': 2,
  'suggestedBounds': {'ne': {'lat': 43.8111863045, 'lng': -79.18812
958073042},
   'sw': {'lat': 43.80218629549999, 'lng': -79.2005772192696}},
  'groups': [{'type': 'Recommended Places',
    'name': 'recommended',
    'items': [{'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4bb6b9446edc76b0d771311c',
       'name': "Wendy's",
       'location': {'crossStreet': 'Morningside & Sheppard',
        'lat': 43.80744841934756,
        'lng': -79.19905558052072,
        'labeledLatLngs': [{'label': 'display',
          'lat': 43.80744841934756,
          'lng': -79.19905558052072}],
        'distance': 387,
        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['Toronto ON', 'Canada']},
       'categories': [{'id': '4bf58dd8d48988d16e941735',
         'name': 'Fast Food Restaurant',
         'pluralName': 'Fast Food Restaurants',
         'shortName': 'Fast Food',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v
2/food/fastfood_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4bb6b9446edc76b0d771311c-0'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '5539e7d2498edaf4b02673ca',
       'name': 'Interprovincial Group',
       'location': {'address': '1315 Morningside Avenue',
        'lat': 43.8056297,
        'lng': -79.2003784,
        'labeledLatLngs': [{'label': 'display',

```
             'lat': 43.8056297,
             'lng': -79.2003784}],
         'distance': 498,
         'postalCode': 'M1B 3C5',
         'cc': 'CA',
         'city': 'Scarborough',
         'state': 'ON',
         'country': 'Canada',
         'formattedAddress': ['1315 Morningside Avenue',
          'Scarborough ON M1B 3C5',
          'Canada']},
         'categories': [{'id': '52f2ab2ebcbc57f1066b8b28',
          'name': 'Print Shop',
          'pluralName': 'Print Shops',
          'shortName': 'Print Shop',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v
2/shops/default_',
           'suffix': '.png'},
          'primary': True}],
         'photos': {'count': 0, 'groups': []}},
        'referralId': 'e-0-5539e7d2498edaf4b02673ca-1'}]}]}}
```

Creating a function to extract the category type from the api data returned

In [20]:

```python
# 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 [21]:

```python
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[21]:

	name	categories	lat	lng
0	Wendy's	Fast Food Restaurant	43.807448	-79.199056
1	Interprovincial Group	Print Shop	43.805630	-79.200378

Looks like not many results near that area but anyway the code works fine!

In [22]:

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

2 venues were returned by Foursquare.

Ok now we are ready to create a function to repeat the same process to all the neighborhoods in Toronto

In [23]:

```python
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_list])
    nearby_venues.columns = ['Neighbourhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

Now is the time to hit the foursquare end point with all neighbourhoods in Toronto

In [24]:

```python
toronto_venues = getNearbyVenues(names=toronto_borough_data['Neighbourhood'],
                                 latitudes=toronto_borough_data['Latitude'],
                                 longitudes=toronto_borough_data['Longitude']
                                )
```

```
Rouge,Malvern
Highland Creek,Rouge Hill,Port Union
Guildwood,Morningside,West Hill
Woburn
Cedarbrae
Scarborough Village
East Birchmount Park,Ionview,Kennedy Park
Clairlea,Golden Mile,Oakridge
Cliffcrest,Cliffside,Scarborough Village West
Birch Cliff,Cliffside West
Dorset Park,Scarborough Town Centre,Wexford Heights
Maryvale,Wexford
Agincourt
Clarks Corners,Sullivan,Tam O'Shanter
Agincourt North,L'Amoreaux East,Milliken,Steeles East
L'Amoreaux West
Upper Rouge
Hillcrest Village
Fairview,Henry Farm,Oriole
Bayview Village
Silver Hills,York Mills
Newtonbrook,Willowdale
Willowdale South
York Mills West
Willowdale West
Parkwoods
Don Mills North
Flemingdon Park,Don Mills South
Bathurst Manor,Downsview North,Wilson Heights
Northwood Park,York University
CFB Toronto,Downsview East
Downsview West
Downsview Central
Downsview Northwest
Victoria Village
Woodbine Gardens,Parkview Hill
Woodbine Heights
The Beaches
Leaside
Thorncliffe Park
East Toronto
The Danforth West,Riverdale
The Beaches West,India Bazaar
Studio District
Lawrence Park
Davisville North
North Toronto West
Davisville
Moore Park,Summerhill East
Deer Park,Forest Hill SE,Rathnelly,South Hill,Summerhill West
Rosedale
Cabbagetown,St. James Town
```

Church and Wellesley
Harbourfront
Ryerson,Garden District
St. James Town
Berczy Park
Central Bay Street
Adelaide,King,Richmond
Harbourfront East,Toronto Islands,Union Station
Design Exchange,Toronto Dominion Centre
Commerce Court,Victoria Hotel
Bedford Park,Lawrence Manor East
Roselawn
Forest Hill North,Forest Hill West
The Annex,North Midtown,Yorkville
Harbord,University of Toronto
Chinatown,Grange Park,Kensington Market
CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Sp
adina,Railway Lands,South Niagara
Stn A PO Boxes 25 The Esplanade
First Canadian Place,Underground city
Lawrence Heights,Lawrence Manor
Glencairn
Humewood-Cedarvale
Caledonia-Fairbanks
Christie
Dovercourt Village,Dufferin
Little Portugal,Trinity
Brockton,Exhibition Place,Parkdale Village
Downsview,North Park,Upwood Park
Del Ray,Keelesdale,Mount Dennis,Silverthorn
The Junction North,Runnymede
High Park,The Junction South
Parkdale,Roncesvalles
Runnymede,Swansea
Queen's Park
Canada Post Gateway Processing Centre
Business Reply Mail Processing Centre 969 Eastern
Humber Bay Shores,Mimico South,New Toronto
Alderwood,Long Branch
The Kingsway,Montgomery Road,Old Mill North
Humber Bay,King's Mill Park,Kingsway Park South East,Mimico NE,Old
Mill South,The Queensway East,Royal York South East,Sunnylea
Kingsway Park South West,Mimico NW,The Queensway West,Royal York So
uth West,South of Bloor
Queen's Park
Cloverdale,Islington,Martin Grove,Princess Gardens,West Deane Park
Bloordale Gardens,Eringate,Markland Wood,Old Burnhamthorpe
Humber Summit
Emery,Humberlea
Weston
Westmount
Kingsview Village,Martin Grove Gardens,Richview Gardens,St. Phillip
s

```
Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Olive,Si
lverstone,South Steeles,Thistletown
Northwest
```

Lets see what we got back in the dataframe from Foursquare

In [25]:

```
print(toronto_venues.shape)
toronto_venues.head()
```

(2211, 7)

Out[25]:

	Neighbourhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude
0	Rouge,Malvern	43.806686	-79.194353	Wendy's	43.807448	-79.199056
1	Rouge,Malvern	43.806686	-79.194353	Interprovincial Group	43.805630	-79.200378
2	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	Chris Effects Painting	43.784343	-79.163742
3	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	Royal Canadian Legion	43.782533	-79.163085
4	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	Affordable Toronto Movers	43.787919	-79.162977

Let's check how many venues were returned for each neighborhood

In [26]:

```python
toronto_venues.groupby('Neighbourhood').count()
```

Out[26]:

Neighbourhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude
Adelaide,King,Richmond	100	100	100	100
Agincourt	5	5	5	5
Agincourt North,L'Amoreaux East,Milliken,Steeles East	2	2	2	2
Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Olive,Silverstone,South Steeles,Thistletown	10	10	10	10
Alderwood,Long Branch	9	9	9	9
Bathurst Manor,Downsview North,Wilson Heights	21	21	21	21
Bayview Village	4	4	4	4
Bedford Park,Lawrence Manor East	25	25	25	25
Berczy Park	55	55	55	55
Birch Cliff,Cliffside West	4	4	4	4
Bloordale Gardens,Eringate,Markland Wood,Old Burnhamthorpe	9	9	9	9
Brockton,Exhibition Place,Parkdale Village	24	24	24	24
Business Reply Mail Processing Centre 969 Eastern	17	17	17	17
CFB Toronto,Downsview East	4	4	4	4
CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Spadina,Railway Lands,South Niagara	16	16	16	16
Cabbagetown,St. James Town	42	42	42	42
Caledonia-Fairbanks	4	4	4	4
Canada Post Gateway Processing Centre	12	12	12	12
Cedarbrae	8	8	8	8
Central Bay Street	84	84	84	84
Chinatown,Grange Park,Kensington Market	80	80	80	80
Christie	18	18	18	18
Church and Wellesley	81	81	81	81

Neighbourhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude
Clairlea,Golden Mile,Oakridge	9	9	9	9
Clarks Corners,Sullivan,Tam O'Shanter	13	13	13	13
Cliffcrest,Cliffside,Scarborough Village West	2	2	2	2
Cloverdale,Islington,Martin Grove,Princess Gardens,West Deane Park	1	1	1	1
Commerce Court,Victoria Hotel	100	100	100	100
Davisville	35	35	35	35
Davisville North	7	7	7	7
...	...	...	...	...
Northwood Park,York University	4	4	4	4
Parkdale,Roncesvalles	14	14	14	14
Parkwoods	2	2	2	2
Queen's Park	39	39	39	39
Rosedale	4	4	4	4
Roselawn	3	3	3	3
Rouge,Malvern	2	2	2	2
Runnymede,Swansea	40	40	40	40
Ryerson,Garden District	100	100	100	100
Scarborough Village	1	1	1	1
Silver Hills,York Mills	2	2	2	2
St. James Town	100	100	100	100
Stn A PO Boxes 25 The Esplanade	94	94	94	94
Studio District	41	41	41	41
The Annex,North Midtown,Yorkville	21	21	21	21
The Beaches	4	4	4	4
The Beaches West,India Bazaar	18	18	18	18
The Danforth West,Riverdale	42	42	42	42
The Junction North,Runnymede	4	4	4	4
The Kingsway,Montgomery Road,Old Mill North	2	2	2	2
Thorncliffe Park	19	19	19	19
Victoria Village	5	5	5	5

Neighbourhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude
Westmount	6	6	6	6
Weston	2	2	2	2
Willowdale South	35	35	35	35
Willowdale West	6	6	6	6
Woburn	3	3	3	3
Woodbine Gardens,Parkview Hill	13	13	13	13
Woodbine Heights	9	9	9	9
York Mills West	4	4	4	4

101 rows × 6 columns

Let's find out how many unique categories can be curated from all the returned venues in Toronto

In [27]:

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

There are 266 uniques categories.

Now let us analyze each neighborhood

In [28]:

```
# one hot encoding
toronto_onehot = pd.get_dummies(toronto_venues[['Venue Category']], prefix="", p
refix_sep="")

# add neighborhood column back to dataframe
toronto_onehot['Neighbourhood'] = toronto_venues['Neighbourhood']

# move neighborhood column to the first column
fixed_columns = [toronto_onehot.columns[-1]] + list(toronto_onehot.columns[:-1])
toronto_onehot = toronto_onehot[fixed_columns]

toronto_onehot.head()
```

Out[28]:

	Neighbourhood	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airpc Servi
0	Rouge,Malvern	0	0	0	0	0	0	
1	Rouge,Malvern	0	0	0	0	0	0	
2	Highland Creek,Rouge Hill,Port Union	0	0	0	0	0	0	
3	Highland Creek,Rouge Hill,Port Union	0	0	0	0	0	0	
4	Highland Creek,Rouge Hill,Port Union	0	0	0	0	0	0	

5 rows × 267 columns
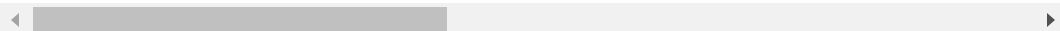
Lets get the dataframe size

In [29]:

```
toronto_onehot.shape
```

Out[29]:

```
(2211, 267)
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

In [30]:

```python
toronto_grouped = toronto_onehot.groupby('Neighbourhood').mean().reset_index()
toronto_grouped
```

Out[30]:

	Neighbourhood	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate
0	Adelaide,King,Richmond	0.0	0.000000	0.0000	0.0000	0.0000
1	Agincourt	0.0	0.000000	0.0000	0.0000	0.0000
2	Agincourt North,L'Amoreaux East,Milliken,Steel...	0.0	0.000000	0.0000	0.0000	0.0000
3	Albion Gardens,Beaumond Heights,Humbergate,Jam...	0.0	0.000000	0.0000	0.0000	0.0000
4	Alderwood,Long Branch	0.0	0.000000	0.0000	0.0000	0.0000
5	Bathurst Manor,Downsview North,Wilson Heights	0.0	0.000000	0.0000	0.0000	0.0000
6	Bayview Village	0.0	0.000000	0.0000	0.0000	0.0000
7	Bedford Park,Lawrence Manor East	0.0	0.000000	0.0000	0.0000	0.0000
8	Berczy Park	0.0	0.000000	0.0000	0.0000	0.0000
9	Birch Cliff,Cliffside West	0.0	0.000000	0.0000	0.0000	0.0000
10	Bloordale Gardens,Eringate,Markland Wood,Old B...	0.0	0.000000	0.0000	0.0000	0.0000
11	Brockton,Exhibition Place,Parkdale Village	0.0	0.000000	0.0000	0.0000	0.0000
12	Business Reply Mail Processing Centre 969 Eastern	0.0	0.000000	0.0000	0.0000	0.0000
13	CFB Toronto,Downsview East	0.0	0.000000	0.2500	0.0000	0.0000
14	CN Tower,Bathurst Quay,Island airport,Harbourf...	0.0	0.000000	0.0625	0.0625	0.0625
15	Cabbagetown,St. James Town	0.0	0.000000	0.0000	0.0000	0.0000
16	Caledonia-Fairbanks	0.0	0.000000	0.0000	0.0000	0.0000
17	Canada Post Gateway Processing Centre	0.0	0.000000	0.0000	0.0000	0.0000
18	Cedarbrae	0.0	0.000000	0.0000	0.0000	0.0000
19	Central Bay Street	0.0	0.000000	0.0000	0.0000	0.0000
20	Chinatown,Grange Park,Kensington Market	0.0	0.000000	0.0000	0.0000	0.0000
21	Christie	0.0	0.000000	0.0000	0.0000	0.0000
22	Church and Wellesley	0.0	0.012346	0.0000	0.0000	0.0000
23	Clairlea,Golden Mile,Oakridge	0.0	0.000000	0.0000	0.0000	0.0000

	Neighbourhood	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate
24	Clarks Corners,Sullivan,Tam O'Shanter	0.0	0.000000	0.0000	0.0000	0.0000
25	Cliffcrest,Cliffside,Scarborough Village West	0.0	0.000000	0.0000	0.0000	0.0000
26	Cloverdale,Islington,Martin Grove,Princess Gar...	0.0	0.000000	0.0000	0.0000	0.0000
27	Commerce Court,Victoria Hotel	0.0	0.000000	0.0000	0.0000	0.0000
28	Davisville	0.0	0.000000	0.0000	0.0000	0.0000
29	Davisville North	0.0	0.000000	0.0000	0.0000	0.0000
...	...	...	...	...	...	...
71	Northwood Park,York University	0.0	0.000000	0.0000	0.0000	0.0000
72	Parkdale,Roncesvalles	0.0	0.000000	0.0000	0.0000	0.0000
73	Parkwoods	0.0	0.000000	0.0000	0.0000	0.0000
74	Queen's Park	0.0	0.000000	0.0000	0.0000	0.0000
75	Rosedale	0.0	0.000000	0.0000	0.0000	0.0000
76	Roselawn	0.0	0.000000	0.0000	0.0000	0.0000
77	Rouge,Malvern	0.0	0.000000	0.0000	0.0000	0.0000
78	Runnymede,Swansea	0.0	0.000000	0.0000	0.0000	0.0000
79	Ryerson,Garden District	0.0	0.000000	0.0000	0.0000	0.0000
80	Scarborough Village	0.0	0.000000	0.0000	0.0000	0.0000
81	Silver Hills,York Mills	0.0	0.000000	0.0000	0.0000	0.0000
82	St. James Town	0.0	0.000000	0.0000	0.0000	0.0000
83	Stn A PO Boxes 25 The Esplanade	0.0	0.000000	0.0000	0.0000	0.0000
84	Studio District	0.0	0.000000	0.0000	0.0000	0.0000
85	The Annex,North Midtown,Yorkville	0.0	0.000000	0.0000	0.0000	0.0000
86	The Beaches	0.0	0.000000	0.0000	0.0000	0.0000
87	The Beaches West,India Bazaar	0.0	0.000000	0.0000	0.0000	0.0000
88	The Danforth West,Riverdale	0.0	0.000000	0.0000	0.0000	0.0000
89	The Junction North,Runnymede	0.0	0.000000	0.0000	0.0000	0.0000
90	The Kingsway,Montgomery Road,Old Mill North	0.0	0.000000	0.0000	0.0000	0.0000

	Neighbourhood	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate
91	Thorncliffe Park	0.0	0.000000	0.0000	0.0000	0.0000
92	Victoria Village	0.0	0.000000	0.0000	0.0000	0.0000
93	Westmount	0.0	0.000000	0.0000	0.0000	0.0000
94	Weston	0.0	0.000000	0.0000	0.0000	0.0000
95	Willowdale South	0.0	0.000000	0.0000	0.0000	0.0000
96	Willowdale West	0.0	0.000000	0.0000	0.0000	0.0000
97	Woburn	0.0	0.000000	0.0000	0.0000	0.0000
98	Woodbine Gardens,Parkview Hill	0.0	0.000000	0.0000	0.0000	0.0000
99	Woodbine Heights	0.0	0.000000	0.0000	0.0000	0.0000
100	York Mills West	0.0	0.000000	0.0000	0.0000	0.0000

101 rows × 267 columns
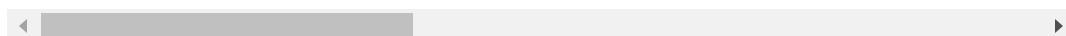
Lets find the new size

In [31]:

```
toronto_grouped.shape
```

Out[31]:

```
(101, 267)
```

Let's print each neighborhood along with the top 5 most common venues

In [32]:

```python
num_top_venues = 5

for hood in toronto_grouped['Neighbourhood']:
    print("----"+hood+"----")
    temp = toronto_grouped[toronto_grouped['Neighbourhood'] == 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')
```

```
    ----Adelaide,King,Richmond----
                    venue  freq
0          Coffee Shop  0.07
1                  Bar  0.04
2                 Café  0.04
3           Steakhouse  0.04
4      Thai Restaurant  0.04


    ----Agincourt----
                              venue  freq
0                            Lounge   0.2
1                    Breakfast Spot   0.2
2         Latin American Restaurant   0.2
3                    Clothing Store   0.2
4                      Skating Rink   0.2


    ----Agincourt North,L'Amoreaux East,Milliken,Steeles East----
                              venue  freq
0                              Park   0.5
1                        Playground   0.5
2                  Accessories Store   0.0
3                     Metro Station   0.0
4       Modern European Restaurant   0.0


    ----Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Oliv
    e,Silverstone,South Steeles,Thistletown----
                    venue  freq
0        Grocery Store   0.2
1          Pizza Place   0.1
2   Fried Chicken Joint   0.1
3          Coffee Shop   0.1
4        Sandwich Place   0.1


    ----Alderwood,Long Branch----
                    venue  freq
0        Pizza Place  0.22
1           Pharmacy  0.11
2        Coffee Shop  0.11
3     Sandwich Place  0.11
4                Pub  0.11


    ----Bathurst Manor,Downsview North,Wilson Heights----
                              venue  freq
0                       Coffee Shop  0.10
1         Middle Eastern Restaurant  0.05
2                    Ice Cream Shop  0.05
3                        Restaurant  0.05
```

```
4              Supermarket   0.05


----Bayview Village----
                  venue  freq
0                  Café  0.25
1                  Bank  0.25
2   Japanese Restaurant  0.25
3    Chinese Restaurant  0.25
4     Accessories Store  0.00


----Bedford Park,Lawrence Manor East----
                  venue  freq
0   Fast Food Restaurant  0.08
1      Italian Restaurant  0.08
2            Coffee Shop  0.08
3          Sandwich Place  0.08
4          Breakfast Spot  0.04


----Berczy Park----
                  venue  freq
0           Coffee Shop  0.07
1          Cocktail Bar  0.05
2              Beer Bar  0.04
3    Seafood Restaurant  0.04
4            Steakhouse  0.04


----Birch Cliff,Cliffside West----
                  venue  freq
0        College Stadium  0.25
1  General Entertainment  0.25
2                  Café  0.25
3          Skating Rink  0.25
4         Massage Studio  0.00


----Bloordale Gardens,Eringate,Markland Wood,Old Burnhamthorpe----
           venue  freq
0  Shopping Plaza  0.11
1  Cosmetics Shop  0.11
2      Beer Store  0.11
3    Liquor Store  0.11
4     Coffee Shop  0.11


----Brockton,Exhibition Place,Parkdale Village----
           venue  freq
0        Nightclub  0.08
1      Coffee Shop  0.08
2   Breakfast Spot  0.08
```

```
3              Café  0.08
4       Yoga Studio  0.04


----Business Reply Mail Processing Centre 969 Eastern----
                venue  freq
0          Smoke Shop  0.06
1      Auto Workshop  0.06
2            Brewery  0.06
3               Park  0.06
4  Fast Food Restaurant  0.06


----CFB Toronto,Downsview East----
                        venue  freq
0                Snack Place  0.25
1                    Airport  0.25
2                       Park  0.25
3  Construction & Landscaping  0.25
4              Metro Station  0.00


----CN Tower,Bathurst Quay,Island airport,Harbourfront West,King an
d Spadina,Railway Lands,South Niagara----
                venue  freq
0   Airport Service  0.19
1    Airport Lounge  0.12
2   Airport Terminal  0.12
3   Sculpture Garden  0.06
4            Airport  0.06


----Cabbagetown,St. James Town----
                venue  freq
0        Restaurant  0.07
1        Coffee Shop  0.07
2            Bakery  0.05
3  Italian Restaurant  0.05
4              Café  0.05


----Caledonia-Fairbanks----
                venue  freq
0               Park  0.50
1     Women's Store  0.25
2            Market  0.25
3  Accessories Store  0.00
4     Metro Station  0.00


----Canada Post Gateway Processing Centre----
                venue  freq
0              Hotel  0.17
```

```
1             Coffee Shop  0.17
2           Burrito Place  0.08
3 Mediterranean Restaurant  0.08
4                     Gym  0.08
```

----Cedarbrae----
```
               venue  freq
0              Bakery  0.12
1         Gas Station  0.12
2 Caribbean Restaurant  0.12
3      Thai Restaurant  0.12
4   Athletics & Sports  0.12
```

----Central Bay Street----
```
               venue  freq
0         Coffee Shop  0.17
1   Italian Restaurant  0.05
2                Café  0.05
3       Sandwich Place  0.05
4      Ice Cream Shop  0.05
```

----Chinatown,Grange Park,Kensington Market----
```
               venue  freq
0                 Bar  0.08
1                Café  0.06
2         Coffee Shop  0.05
3  Dumpling Restaurant  0.05
4   Chinese Restaurant  0.05
```

----Christie----
```
            venue  freq
0  Grocery Store  0.22
1           Café  0.17
2           Park  0.11
3     Restaurant  0.06
4      Nightclub  0.06
```

----Church and Wellesley----
```
               venue  freq
0         Coffee Shop  0.07
1 Japanese Restaurant  0.05
2             Gay Bar  0.05
3   Sushi Restaurant  0.05
4          Restaurant  0.04
```

----Clairlea,Golden Mile,Oakridge----
```
         venue   freq
```

```
0           Bakery   0.22
1         Bus Line   0.22
2     Soccer Field   0.11
3      Bus Station   0.11
4     Intersection   0.11
```

----Clarks Corners,Sullivan,Tam O'Shanter----

```
                venue   freq
0         Pizza Place   0.15
1            Pharmacy   0.08
2   Chinese Restaurant   0.08
3       Shopping Mall   0.08
4  Fried Chicken Joint   0.08
```

----Cliffcrest,Cliffside,Scarborough Village West----

```
                            venue   freq
0              American Restaurant   0.5
1                            Motel   0.5
2                    Metro Station   0.0
3   Molecular Gastronomy Restaurant   0.0
4        Modern European Restaurant   0.0
```

----Cloverdale,Islington,Martin Grove,Princess Gardens,West Deane P
ark----

```
                            venue   freq
0                      Golf Course   1.0
1                 Accessories Store   0.0
2                    Metro Station   0.0
3   Molecular Gastronomy Restaurant   0.0
4        Modern European Restaurant   0.0
```

----Commerce Court,Victoria Hotel----

```
                venue   freq
0          Coffee Shop   0.12
1                 Café   0.07
2                Hotel   0.06
3           Restaurant   0.05
4   Italian Restaurant   0.03
```

----Davisville----

```
              venue   freq
0     Sandwich Place   0.09
1       Dessert Shop   0.09
2        Pizza Place   0.06
3                Gym   0.06
4               Café   0.06
```

```
----Davisville North----
                 venue  freq
0                 Park  0.14
1       Breakfast Spot  0.14
2                  Gym  0.14
3     Department Store  0.14
4     Food & Drink Shop  0.14


----Deer Park,Forest Hill SE,Rathnelly,South Hill,Summerhill West--
--
                 venue  freq
0          Coffee Shop  0.14
1                  Pub  0.14
2          Pizza Place  0.07
3    Light Rail Station  0.07
4           Sports Bar  0.07


----Del Ray,Keelesdale,Mount Dennis,Silverthorn----
                 venue  freq
0           Restaurant  0.25
1         Skating Rink  0.25
2                  Bar  0.25
3       Sandwich Place  0.25
4    Mexican Restaurant  0.00


----Design Exchange,Toronto Dominion Centre----
          venue  freq
0   Coffee Shop  0.12
1          Café  0.08
2         Hotel  0.07
3     Steakhouse  0.04
4     Restaurant  0.04


----Don Mills North----
                   venue  freq
0                   Café  0.2
1        Gym / Fitness Center  0.2
2     Caribbean Restaurant  0.2
3      Japanese Restaurant  0.2
4         Basketball Court  0.2


----Dorset Park,Scarborough Town Centre,Wexford Heights----
                      venue  freq
0           Indian Restaurant   0.4
1                  Pet Store   0.2
2        Vietnamese Restaurant   0.2
3          Chinese Restaurant   0.2
4    Middle Eastern Restaurant   0.0
```

```
----Dovercourt Village,Dufferin----
         venue  freq
0     Pharmacy  0.11
1       Bakery  0.11
2  Pizza Place  0.05
3         Park  0.05
4  Coffee Shop  0.05


----Downsview Central----
                        venue  freq
0                Home Service  0.33
1               Baseball Field  0.33
2                   Food Truck  0.33
3           Monument / Landmark  0.00
4  Modern European Restaurant  0.00


----Downsview Northwest----
                 venue  freq
0  Gym / Fitness Center  0.25
1         Liquor Store  0.25
2         Grocery Store  0.25
3     Athletics & Sports  0.25
4      Accessories Store  0.00


----Downsview West----
           venue  freq
0           Bank  0.25
1           Park  0.25
2  Grocery Store  0.25
3  Shopping Mall  0.25
4  Metro Station  0.00


----Downsview,North Park,Upwood Park----
                        venue  freq
0                         Park  0.25
1  Construction & Landscaping  0.25
2             Basketball Court  0.25
3                       Bakery  0.25
4            Accessories Store  0.00


----East Birchmount Park,Ionview,Kennedy Park----
               venue  freq
0    Department Store  0.25
1  Chinese Restaurant  0.25
2         Hobby Shop  0.25
3        Coffee Shop  0.25
```

```
4  Miscellaneous Shop  0.00


----East Toronto----
                 venue  freq
0                 Park  0.33
1          Coffee Shop  0.33
2    Convenience Store  0.33
3    Accessories Store  0.00
4   Mexican Restaurant  0.00


----Emery,Humberlea----
                        venue  freq
0  Construction & Landscaping   0.5
1              Baseball Field   0.5
2           Accessories Store   0.0
3               Metro Station   0.0
4  Modern European Restaurant   0.0


----Fairview,Henry Farm,Oriole----
                 venue  freq
0       Clothing Store  0.13
1          Coffee Shop  0.08
2  Fast Food Restaurant  0.08
3           Shoe Store  0.05
4        Women's Store  0.03


----First Canadian Place,Underground city----
               venue  freq
0        Coffee Shop  0.13
1               Café  0.07
2         Steakhouse  0.04
3         Restaurant  0.04
4   Asian Restaurant  0.03


----Flemingdon Park,Don Mills South----
                 venue  freq
0     Asian Restaurant  0.10
1           Beer Store  0.10
2                  Gym  0.10
3          Coffee Shop  0.10
4   Dim Sum Restaurant  0.05


----Forest Hill North,Forest Hill West----
               venue  freq
0           Bus Line  0.25
1    Sushi Restaurant  0.25
2              Trail  0.25
```

```
3          Jewelry Store  0.25
4    Accessories Store  0.00


----Glencairn----
                  venue  freq
0           Pizza Place  0.25
1                   Pub  0.25
2   Japanese Restaurant  0.25
3                Bakery  0.25
4        Medical Center  0.00


----Guildwood,Morningside,West Hill----
                  venue  freq
0           Pizza Place  0.14
1        Breakfast Spot  0.14
2        Medical Center  0.14
3   Rental Car Location  0.14
4          Intersection  0.14


----Harbord,University of Toronto----
                  venue  freq
0                  Café  0.14
1   Japanese Restaurant  0.06
2        Sandwich Place  0.06
3              Bookstore  0.06
4            Restaurant  0.06


----Harbourfront----
          venue  freq
0   Coffee Shop  0.17
1        Bakery  0.07
2           Pub  0.07
3          Park  0.07
4          Café  0.07


----Harbourfront East,Toronto Islands,Union Station----
                  venue  freq
0           Coffee Shop  0.12
1              Aquarium  0.05
2                  Café  0.04
3    Italian Restaurant  0.04
4                 Hotel  0.04


----High Park,The Junction South----
                  venue  freq
0       Thai Restaurant  0.08
1                  Café  0.08
```

```
2  Mexican Restaurant  0.08
3                 Bar  0.08
4                Park  0.04
```

```
----Highland Creek,Rouge Hill,Port Union----
                           venue  freq
0                   Moving Target  0.33
1   Construction & Landscaping     0.33
2                             Bar  0.33
3               Accessories Store  0.00
4              Mexican Restaurant  0.00
```

```
----Hillcrest Village----
                            venue  freq
0                         Dog Run  0.25
1                            Pool  0.25
2                     Golf Course  0.25
3         Mediterranean Restaurant  0.25
4               Accessories Store  0.00
```

```
----Humber Bay Shores,Mimico South,New Toronto----
          venue  freq
0   Pizza Place  0.08
1        Bakery  0.08
2      Pharmacy  0.08
3    Restaurant  0.08
4          Café  0.08
```

```
----Humber Bay,King's Mill Park,Kingsway Park South East,Mimico NE,
Old Mill South,The Queensway East,Royal York South East,Sunnylea---
-
                                venue  freq
0                        Home Service   0.5
1                      Baseball Field   0.5
2                   Accessories Store   0.0
3   Molecular Gastronomy Restaurant    0.0
4        Modern European Restaurant    0.0
```

```
----Humber Summit----
                           venue  freq
0                     Pizza Place  0.33
1           Empanada Restaurant   0.33
2                  Shopping Mall  0.33
3             Accessories Store  0.00
4                  Metro Station  0.00
```

```
----Humewood-Cedarvale----
```

```
                      venue  freq
0                     Field  0.33
1                     Trail  0.33
2              Hockey Arena  0.33
3             Metro Station  0.00
4  Modern European Restaurant  0.00
```

```
----Kingsview Village,Martin Grove Gardens,Richview Gardens,St. Phi
llips----
                   venue  freq
0            Pizza Place  0.25
1               Bus Line  0.25
2          Sandwich Place  0.25
3        Mobile Phone Shop  0.25
4      Monument / Landmark  0.00
```

```
----Kingsway Park South West,Mimico NW,The Queensway West,Royal Yor
k South West,South of Bloor----
                venue  freq
0      Grocery Store  0.07
1                Gym  0.07
2      Discount Store  0.07
3         Kids Store  0.07
4      Sandwich Place  0.07
```

```
----L'Amoreaux West----
                    venue  freq
0      Fast Food Restaurant  0.17
1        Chinese Restaurant  0.17
2                 Gym Pool  0.08
3              Pizza Place  0.08
4              Coffee Shop  0.08
```

```
----Lawrence Heights,Lawrence Manor----
                    venue  freq
0      Furniture / Home Store  0.25
1            Clothing Store  0.25
2      Vietnamese Restaurant  0.08
3                 Boutique  0.08
4        Miscellaneous Shop  0.08
```

```
----Lawrence Park----
                venue  freq
0                Park  0.25
1         Swim School  0.25
2                Lake  0.25
3            Bus Line  0.25
4      Accessories Store  0.00
```

```
    ----Leaside----
                      venue  freq
0       Sporting Goods Shop  0.09
1               Coffee Shop  0.09
2     Furniture / Home Store  0.06
3              Burger Joint  0.06
4           Sushi Restaurant  0.06


    ----Little Portugal,Trinity----
                    venue  freq
0                     Bar  0.12
1              Restaurant  0.06
2         Asian Restaurant  0.06
3              Coffee Shop  0.04
4               Pizza Place  0.04


    ----Maryvale,Wexford----
                            venue  freq
0                       Smoke Shop  0.25
1                   Breakfast Spot  0.25
2                           Bakery  0.25
3       Middle Eastern Restaurant  0.25
4               Accessories Store  0.00


    ----Moore Park,Summerhill East----
                      venue  freq
0                      Park  0.25
1              Tennis Court  0.25
2                Playground  0.25
3                Restaurant  0.25
4         Mexican Restaurant  0.00


    ----Newtonbrook,Willowdale----
                                venue  freq
0                                 Gym  1.0
1                   Accessories Store  0.0
2                       Metro Station  0.0
3     Molecular Gastronomy Restaurant  0.0
4         Modern European Restaurant  0.0


    ----North Toronto West----
                      venue  freq
0             Clothing Store  0.13
1                Coffee Shop  0.09
2                Yoga Studio  0.04
3     Furniture / Home Store  0.04
```

```
4          Dessert Shop   0.04


----Northwest----
                      venue   freq
0        Rental Car Location   0.33
1                        Bar   0.33
2                  Drugstore   0.33
3          Accessories Store   0.00
4   Middle Eastern Restaurant   0.00


----Northwood Park,York University----
                     venue   freq
0          Massage Studio   0.25
1                     Bar   0.25
2     Caribbean Restaurant   0.25
3             Coffee Shop   0.25
4        Accessories Store   0.00


----Parkdale,Roncesvalles----
                          venue   freq
0                Breakfast Spot   0.14
1                     Gift Shop   0.14
2                   Coffee Shop   0.07
3    Eastern European Restaurant   0.07
4                 Movie Theater   0.07


----Parkwoods----
                          venue   freq
0              Food & Drink Shop   0.5
1                           Park   0.5
2                    Men's Store   0.0
3    Modern European Restaurant   0.0
4              Mobile Phone Shop   0.0


----Queen's Park----
                    venue   freq
0            Coffee Shop   0.26
1                    Gym   0.05
2                   Park   0.05
3            Yoga Studio   0.03
4      College Auditorium   0.03


----Rosedale----
                    venue   freq
0                    Park   0.50
1              Playground   0.25
2                   Trail   0.25
```

```
3               Metro Station  0.00
4  Modern European Restaurant  0.00


----Roselawn----
                    venue  freq
0                  Garden  0.33
1  Health & Beauty Service  0.33
2                    Pool  0.33
3        Accessories Store  0.00
4       Mexican Restaurant  0.00


----Rouge,Malvern----
                          venue  freq
0            Fast Food Restaurant   0.5
1                     Print Shop   0.5
2              Mexican Restaurant   0.0
3  Molecular Gastronomy Restaurant   0.0
4       Modern European Restaurant   0.0


----Runnymede,Swansea----
                 venue  freq
0                 Café  0.08
1          Coffee Shop  0.08
2          Pizza Place  0.08
3      Sushi Restaurant  0.05
4     Italian Restaurant  0.05


----Ryerson,Garden District----
                  venue  freq
0           Coffee Shop  0.09
1         Clothing Store  0.08
2                   Café  0.03
3    Japanese Restaurant  0.03
4         Cosmetics Shop  0.03


----Scarborough Village----
                          venue  freq
0                     Playground   1.0
1              Accessories Store   0.0
2                  Metro Station   0.0
3  Molecular Gastronomy Restaurant   0.0
4       Modern European Restaurant   0.0


----Silver Hills,York Mills----
                venue  freq
0    Martial Arts Dojo   0.5
1            Cafeteria   0.5
```

```
2  Accessories Store    0.0
3              Motel    0.0
4      Massage Studio    0.0


----St. James Town----
          venue   freq
0    Coffee Shop   0.08
1           Café   0.06
2     Restaurant   0.05
3   Cocktail Bar   0.04
4          Hotel   0.03


----Stn A PO Boxes 25 The Esplanade----
                venue   freq
0         Coffee Shop   0.12
1                Café   0.04
2  Seafood Restaurant   0.03
3               Hotel   0.03
4          Restaurant   0.03


----Studio District----
              venue   freq
0              Café   0.10
1       Coffee Shop   0.07
2            Bakery   0.05
3  Italian Restaurant   0.05
4           Brewery   0.05


----The Annex,North Midtown,Yorkville----
                           venue   freq
0                           Café   0.14
1                Sandwich Place   0.14
2                   Coffee Shop   0.10
3                Cosmetics Shop   0.05
4  Vegetarian / Vegan Restaurant   0.05


----The Beaches----
              venue   freq
0  Health Food Store   0.25
1                Pub   0.25
2       Neighborhood   0.25
3              Trail   0.25
4  Accessories Store   0.00


----The Beaches West,India Bazaar----
          venue   freq
0           Park   0.11
```

```
1          Pet Store  0.06
2    Ice Cream Shop  0.06
3           Brewery  0.06
4      Burger Joint  0.06
```

```
----The Danforth West,Riverdale----
                    venue  freq
0        Greek Restaurant  0.24
1             Coffee Shop  0.10
2      Italian Restaurant  0.07
3   Furniture / Home Store  0.05
4              Restaurant  0.05
```

```
----The Junction North,Runnymede----
                      venue  freq
0              Pizza Place  0.25
1     Caribbean Restaurant  0.25
2           Grocery Store  0.25
3                 Brewery  0.25
4  Middle Eastern Restaurant  0.00
```

```
----The Kingsway,Montgomery Road,Old Mill North----
                            venue  freq
0                            Park  0.5
1                           River  0.5
2               Accessories Store  0.0
3               Mexican Restaurant  0.0
4  Molecular Gastronomy Restaurant  0.0
```

```
----Thorncliffe Park----
              venue  freq
0  Indian Restaurant  0.11
1       Yoga Studio  0.05
2              Bank  0.05
3               Gym  0.05
4      Grocery Store  0.05
```

```
----Victoria Village----
                    venue  freq
0             Pizza Place  0.2
1            Intersection  0.2
2             Coffee Shop  0.2
3    Portuguese Restaurant  0.2
4            Hockey Arena  0.2
```

```
----Westmount----
                venue  freq
```

```
0        Pizza Place  0.17
1        Coffee Shop  0.17
2       Intersection  0.17
3  Chinese Restaurant  0.17
4      Sandwich Place  0.17
```

```
----Weston----
                         venue  freq
0                         Park   0.5
1            Convenience Store   0.5
2            Accessories Store   0.0
3                Metro Station   0.0
4  Modern European Restaurant   0.0
```

```
----Willowdale South----
                  venue  freq
0      Ramen Restaurant  0.09
1   Japanese Restaurant  0.06
2      Sushi Restaurant  0.06
3           Pizza Place  0.06
4        Sandwich Place  0.06
```

```
----Willowdale West----
           venue  freq
0     Pizza Place  0.17
1   Grocery Store  0.17
2     Coffee Shop  0.17
3  Discount Store  0.17
4         Butcher  0.17
```

```
----Woburn----
                            venue  freq
0                     Coffee Shop  0.67
1               Korean Restaurant  0.33
2               Accessories Store  0.00
3               Mexican Restaurant  0.00
4  Molecular Gastronomy Restaurant  0.00
```

```
----Woodbine Gardens,Parkview Hill----
                  venue  freq
0           Pizza Place  0.15
1   Fast Food Restaurant  0.15
2              Pharmacy  0.08
3     Athletics & Sports  0.08
4                  Bank  0.08
```

```
----Woodbine Heights----
```

```
            venue  freq
0            Park  0.11
1     Video Store  0.11
2 Asian Restaurant  0.11
3    Dance Studio  0.11
4     Curling Ice  0.11


----York Mills West----
                venue  freq
0                Park  0.50
1                Bank  0.25
2   Convenience Store  0.25
3   Accessories Store  0.00
4       Metro Station  0.00
```

First, let's write a function to sort the venues in descending order.

In [33]:

```python
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]
```

Now let's create the new dataframe and display the top 10 venues for each neighborhood.

In [34]:

```python
#import numpy as np

num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighbourhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighbourhood'] = toronto_grouped['Neighbourhood']

for ind in np.arange(toronto_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(toront
o_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

Out[34]:

	Neighbourhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Adelaide,King,Richmond	Coffee Shop	Steakhouse	Thai Restaurant	Café	Bar
1	Agincourt	Latin American Restaurant	Skating Rink	Lounge	Clothing Store	Breakfast Spot
2	Agincourt North,L'Amoreaux East,Milliken,Steel...	Park	Playground	Drugstore	Dim Sum Restaurant	Diner
3	Albion Gardens,Beaumond Heights,Humbergate,Jam...	Grocery Store	Fried Chicken Joint	Pizza Place	Fast Food Restaurant	Beer Store
4	Alderwood,Long Branch	Pizza Place	Sandwich Place	Gym	Coffee Shop	Skating Rink

Run k-means to cluster the neighborhood into 5 clusters.

In [35]:

```python
# set number of clusters
kclusters = 5

toronto_grouped_clustering = toronto_grouped.drop('Neighbourhood', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(toronto_grouped_cluste
ring)

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

Out[35]:

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

Let's create a new dataframe that includes the cluster as well as the top 10 venues for each neighborhood.

In [36]:

```python
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

toronto_merged = toronto_borough_data

# merge toronto_grouped with toronto_data to add latitude/longitude for each nei
ghborhood
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.set_index('Neig
hbourhood'), on='Neighbourhood')

toronto_merged.head() # check the last columns!
```

Out[36]:

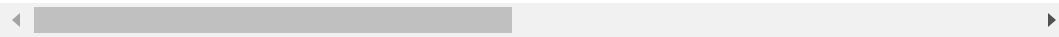|	Postcode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels
0	M1B	Scarborough	Rouge,Malvern	43.806686	-79.194353	0.0
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	0.0
2	M1E	Scarborough	Guildwood,Morningside,West Hill	43.763573	-79.188711	0.0
3	M1G	Scarborough	Woburn	43.770992	-79.216917	0.0
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476	0.0
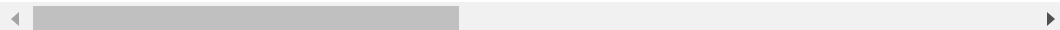
Now is the time ..Lets see how our cluster looks like. We take an approximate central lat long in toronto to initialize our folium map

In [37]:

```
toronto_merged[toronto_merged.isnull().any(axis=1)]
```

Out[37]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue
16	M1X	Scarborough	Upper Rouge	43.836125	-79.205636	NaN	NaN

Remove all null values

In [38]:

```
toronto_merged = toronto_merged.dropna()
```

In [39]:

```
toronto_merged[toronto_merged.isnull().any(axis=1)]
```

Out[39]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	M Comn Ve

Finally let us visualize our Toronto cluster

In [40]:

```python
# create map
latitude = 43.65426
longitude = -79.360636
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(toronto_merged['Latitude'], toronto_merged['Lo
ngitude'], toronto_merged['Neighbourhood'], toronto_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    #print(cluster)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[int(cluster)-1],
        fill=True,
        fill_color=rainbow[int(cluster)-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```
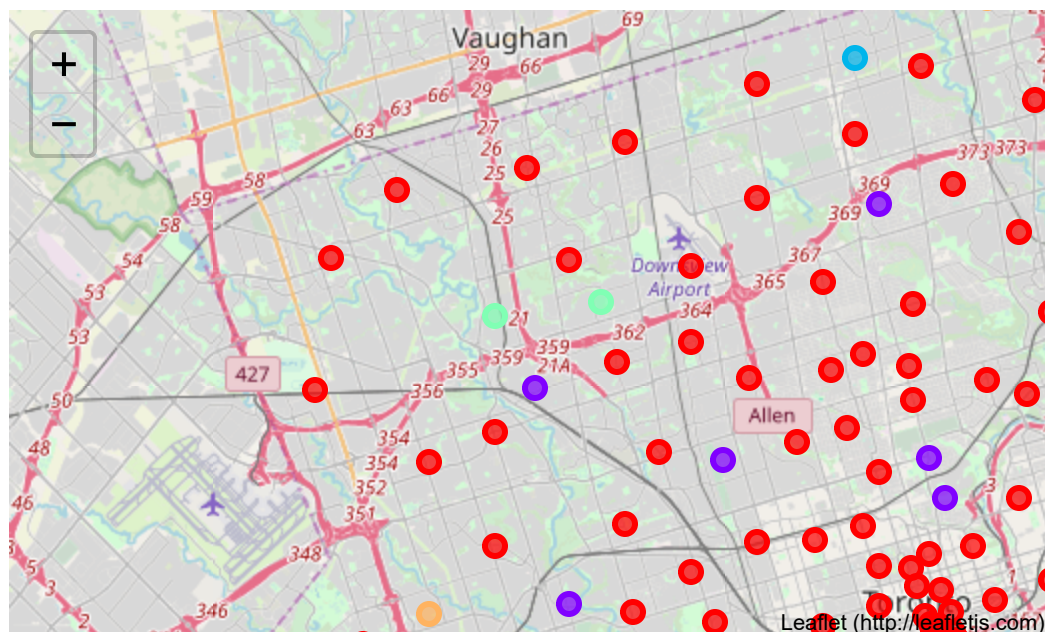
Out[40]:

Analyzing each Toronto cluster

In [41]:

```python
toronto_merged.loc[toronto_merged['Cluster Labels'] == 0, toronto_merged.columns
[[1] + list(range(5, toronto_merged.shape[1]))]]
```

Out[41]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	
0	Scarborough	0.0	Fast Food Restaurant	Print Shop	Yoga Studio	Donut Shop	R
1	Scarborough	0.0	Bar	Moving Target	Construction & Landscaping	Yoga Studio	Do
2	Scarborough	0.0	Medical Center	Intersection	Electronics Store	Breakfast Spot	Piz
3	Scarborough	0.0	Coffee Shop	Korean Restaurant	Yoga Studio	Drugstore	
4	Scarborough	0.0	Bakery	Hakka Restaurant	Fried Chicken Joint	Caribbean Restaurant	A
6	Scarborough	0.0	Hobby Shop	Coffee Shop	Chinese Restaurant	Department Store	R
7	Scarborough	0.0	Bakery	Bus Line	Park	Ice Cream Shop	Soc
8	Scarborough	0.0	American Restaurant	Motel	Department Store	Dim Sum Restaurant	
9	Scarborough	0.0	College Stadium	Café	General Entertainment	Skating Rink	R
10	Scarborough	0.0	Indian Restaurant	Chinese Restaurant	Pet Store	Vietnamese Restaurant	Yog
11	Scarborough	0.0	Middle Eastern Restaurant	Bakery	Breakfast Spot	Smoke Shop	Yog
12	Scarborough	0.0	Latin American Restaurant	Skating Rink	Lounge	Clothing Store	
13	Scarborough	0.0	Pizza Place	Italian Restaurant	Bank	Noodle House	F
15	Scarborough	0.0	Fast Food Restaurant	Chinese Restaurant	Burger Joint	Breakfast Spot	C
18	North York	0.0	Clothing Store	Coffee Shop	Fast Food Restaurant	Shoe Store	
19	North York	0.0	Café	Chinese Restaurant	Bank	Japanese Restaurant	E R

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	C
20	North York	0.0	Cafeteria	Martial Arts Dojo	Yoga Studio	Ethiopian Restaurant	Er R
22	North York	0.0	Ramen Restaurant	Sandwich Place	Coffee Shop	Pizza Place	
24	North York	0.0	Grocery Store	Pizza Place	Discount Store	Coffee Shop	
26	North York	0.0	Gym / Fitness Center	Caribbean Restaurant	Japanese Restaurant	Basketball Court	
27	North York	0.0	Gym	Beer Store	Asian Restaurant	Coffee Shop	
28	North York	0.0	Coffee Shop	Sushi Restaurant	Ice Cream Shop	Deli / Bodega	
29	North York	0.0	Bar	Coffee Shop	Massage Studio	Caribbean Restaurant	Yog
30	North York	0.0	Snack Place	Airport	Construction & Landscaping	Park	C R
31	North York	0.0	Grocery Store	Bank	Shopping Mall	Park	Com R
33	North York	0.0	Gym / Fitness Center	Athletics & Sports	Liquor Store	Grocery Store	Airp
34	North York	0.0	Coffee Shop	Pizza Place	Intersection	Hockey Arena	Pc R
35	East York	0.0	Fast Food Restaurant	Pizza Place	Gym / Fitness Center	Gastropub	
36	East York	0.0	Dance Studio	Video Store	Beer Store	Curling Ice	R
37	East Toronto	0.0	Neighborhood	Trail	Pub	Health Food Store	R
...	...	...	...	...	...	...	
67	Downtown Toronto	0.0	Bar	Café	Coffee Shop	Vietnamese Restaurant	R
68	Downtown Toronto	0.0	Airport Service	Airport Terminal	Airport Lounge	Sculpture Garden	
69	Downtown Toronto	0.0	Coffee Shop	Café	Beer Bar	Restaurant	R
70	Downtown Toronto	0.0	Coffee Shop	Café	Steakhouse	Restaurant	R

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	
71	North York	0.0	Furniture / Home Store	Clothing Store	Coffee Shop	Boutique	Misce
72	North York	0.0	Japanese Restaurant	Pizza Place	Pub	Bakery	E R
73	York	0.0	Field	Hockey Arena	Trail	Department Store	Ro
75	Downtown Toronto	0.0	Grocery Store	Café	Park	Baby Store	Ro
76	West Toronto	0.0	Bakery	Pharmacy	Gym / Fitness Center	Grocery Store	F R
77	West Toronto	0.0	Bar	Asian Restaurant	Restaurant	Pizza Place	Me
78	West Toronto	0.0	Café	Coffee Shop	Breakfast Spot	Nightclub	
79	North York	0.0	Park	Bakery	Construction & Landscaping	Basketball Court	Yog
80	York	0.0	Skating Rink	Sandwich Place	Bar	Restaurant	El
81	York	0.0	Grocery Store	Pizza Place	Caribbean Restaurant	Brewery	Do
82	West Toronto	0.0	Thai Restaurant	Bar	Mexican Restaurant	Café	
83	West Toronto	0.0	Breakfast Spot	Gift Shop	Dessert Shop	Cuban Restaurant	
84	West Toronto	0.0	Coffee Shop	Pizza Place	Café	Italian Restaurant	Ro
85	Downtown Toronto	0.0	Coffee Shop	Park	Gym	Yoga Studio	
86	Mississauga	0.0	Hotel	Coffee Shop	Fried Chicken Joint	Gym	Ro
87	East Toronto	0.0	Park	Garden Center	Light Rail Station	Restaurant	Bur
88	Etobicoke	0.0	Fast Food Restaurant	Pharmacy	Bakery	Restaurant	Fried
89	Etobicoke	0.0	Pizza Place	Sandwich Place	Gym	Coffee Shop	Ska

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	
92	Etobicoke	0.0	Fast Food Restaurant	Hardware Store	Supplement Shop	Discount Store	Tanni
93	Queen's Park	0.0	Coffee Shop	Park	Gym	Yoga Studio	
95	Etobicoke	0.0	Cosmetics Shop	Park	Shopping Plaza	Liquor Store	Cof
96	North York	0.0	Empanada Restaurant	Pizza Place	Shopping Mall	Yoga Studio	Do
99	Etobicoke	0.0	Chinese Restaurant	Middle Eastern Restaurant	Coffee Shop	Pizza Place	Int
100	Etobicoke	0.0	Bus Line	Pizza Place	Sandwich Place	Mobile Phone Shop	Yog
101	Etobicoke	0.0	Grocery Store	Fried Chicken Joint	Pizza Place	Fast Food Restaurant	B
102	Etobicoke	0.0	Drugstore	Bar	Rental Car Location	Ethiopian Restaurant	Ei R

86 rows × 12 columns

In [42]:

```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 1, toronto_merged.columns
[[1] + list(range(5, toronto_merged.shape[1]))]]
```

Out[42]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
5	Scarborough	1.0	Playground	Yoga Studio	Donut Shop	Dessert Shop	Dim Sum Restaurant
14	Scarborough	1.0	Park	Playground	Drugstore	Dim Sum Restaurant	Diner
23	North York	1.0	Park	Bank	Convenience Store	Ethiopian Restaurant	Empanad Restaurant
25	North York	1.0	Park	Food & Drink Shop	Department Store	Ethiopian Restaurant	Empanad Restaurant
40	East York	1.0	Park	Convenience Store	Coffee Shop	Dim Sum Restaurant	Diner
48	Central Toronto	1.0	Park	Playground	Tennis Court	Restaurant	Easter European Restaurant
50	Downtown Toronto	1.0	Park	Trail	Playground	Dessert Shop	Dim Sum Restaurant
74	York	1.0	Park	Market	Women's Store	Gourmet Shop	Go Cours
90	Etobicoke	1.0	Park	River	Event Space	Ethiopian Restaurant	Empanad Restaurant
98	York	1.0	Park	Convenience Store	Event Space	Ethiopian Restaurant	Empanad Restaurant

In [43]:

```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 2, toronto_merged.columns
[[1] + list(range(5, toronto_merged.shape[1]))]]
```

Out[43]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Mo Comm Ven
21	North York	2.0	Gym	Dessert Shop	Falafel Restaurant	Event Space	Ethiopian Restaurant	Empana Restaura

In [44]:

```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 3, toronto_merged.columns
[[1] + list(range(5, toronto_merged.shape[1]))]]
```

Out[44]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th M Comm Ve
32	North York	3.0	Baseball Field	Food Truck	Home Service	Yoga Studio	Dessert Shop	Di
91	Etobicoke	3.0	Baseball Field	Home Service	Yoga Studio	Donut Shop	Diner	Disco St
97	North York	3.0	Baseball Field	Construction & Landscaping	Yoga Studio	Dumpling Restaurant	Discount Store	Dog F

In [45]:

```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 4, toronto_merged.columns
[[1] + list(range(5, toronto_merged.shape[1]))]]
```

Out[45]:

	Borough	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Co
17	North York	4.0	Mediterranean Restaurant	Golf Course	Dog Run	Pool	Yoga Studio	Dir Rest
94	Etobicoke	4.0	Golf Course	Yoga Studio	Drugstore	Dim Sum Restaurant	Diner	Di

Conclusion

Toronto is predominantly has a homogenous structure . Most of the neighborhood belong to the first cluster which appears to be a nice place to live in with bar , pizza shops and bakeries bustling the place. It looks like a bit congested for playground. The third cluster has a lot of breathing space with playgrounds and parks. Maybe kids and active folks would love to stay here. The fourth cluster us catagorized by Business Services and more like commercial area.

In [ ]: