Segmenting and Clustering Neighborhoods in Toronto

IBM Data Science Professional Certificate

Capstone Week 3 Part 1

In [1]:
```
import pandas as pd
website_url = 'https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
table =pd.read_html(website_url)
table=table[0]
table.head()
```

Out[1]:

	0	1	2
0	Postcode	Borough	Neighbourhood
1	M1A	Not assigned	Not assigned
2	M2A	Not assigned	Not assigned
3	M3A	North York	Parkwoods
4	M4A	North York	Victoria Village

In [2]:
```
table.columns = table.iloc[0]
table = table.reindex(table.index.drop(0))
table.head()
```

Out[2]:

	Postcode	Borough	Neighbourhood
1	M1A	Not assigned	Not assigned
2	M2A	Not assigned	Not assigned
3	M3A	North York	Parkwoods
4	M4A	North York	Victoria Village
5	M5A	Downtown Toronto	Harbourfront

In [3]:
```
import numpy as np

table['Borough'].replace('Not assigned',np.nan,inplace=True)
table.head()
```

Out[3]:

	Postcode	Borough	Neighbourhood
1	M1A	NaN	Not assigned
2	M2A	NaN	Not assigned
3	M3A	North York	Parkwoods
4	M4A	North York	Victoria Village
5	M5A	Downtown Toronto	Harbourfront

In [4]:
```
# simply drop whole row with NaN in "Borough" column
table.dropna(subset=["Borough"], axis=0, inplace=True)

# reset index, because we droped rows
table.reset_index(drop=True, inplace=True)

table.head()
```

Out[4]:

	Postcode	Borough	Neighbourhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Harbourfront
3	M5A	Downtown Toronto	Regent Park
4	M6A	North York	Lawrence Heights

Combine Postcode rows

More than one neighborhood can exist in one postal code area. For example, in the table on the Wikipedia page, you will notice that M5A is listed twice and has two neighborhoods: Harbourfront and Regent Park. These two rows will be combined into one row with the neighborhoods separated with a comma as shown in row 11 in the above table.

In [5]:
```
table2= table.groupby(by=['Postcode','Borough']).agg(lambda x: ','.join(x))

table2.reset_index(level=['Postcode','Borough'], inplace=True)
table2.head()
```

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

Fill not assigned neighborhood with borough

If a cell has a borough but a Not assigned neighborhood, then the neighborhood will be the same as the borough. So for the 9th cell in the table on the Wikipedia page, the value of the Borough and the Neighborhood columns will be Queen's Park.

In [6]:
```
table2['Neighbourhood'].replace('Not assigned',table2['Borough'],inplace=True)

# test if the code above works
table2.loc[table2['Postcode']=='M7A',]
```

Out[6]:

	Postcode	Borough	Neighbourhood
85	M7A	Queen's Park	Queen's Park

Number of rows of my dataframe

In the last cell of your notebook, use the .shape method to print the number of rows of your dataframe.

```
In [7]: print('My datafram has {} rows'.format(table2.shape[0]))
        My datafram has 103 rows
```

Capstone Week 3 Part 2

Get the latitude and the longitude coordinates of each neighborhood.

In [8]:
```
! pip install geocoder
```

```
Requirement already satisfied: geocoder in /Users/jacquelinewong/anaconda3/lib/python3.6/site-p
ackages (1.38.1)
Requirement already satisfied: requests in /Users/jacquelinewong/anaconda3/lib/python3.6/site-p
ackages (from geocoder) (2.18.4)
Requirement already satisfied: click in /Users/jacquelinewong/anaconda3/lib/python3.6/site-pack
ages (from geocoder) (6.7)
Requirement already satisfied: ratelim in /Users/jacquelinewong/anaconda3/lib/python3.6/site-pa
ckages (from geocoder) (0.1.6)
Requirement already satisfied: six in /Users/jacquelinewong/anaconda3/lib/python3.6/site-packag
es (from geocoder) (1.11.0)
Requirement already satisfied: future in /Users/jacquelinewong/anaconda3/lib/python3.6/site-pac
kages (from geocoder) (0.17.1)
Requirement already satisfied: chardet<3.1.0,>=3.0.2 in /Users/jacquelinewong/anaconda3/lib/pyt
hon3.6/site-packages (from requests->geocoder) (3.0.4)
Requirement already satisfied: idna<2.7,>=2.5 in /Users/jacquelinewong/anaconda3/lib/python3.6/
site-packages (from requests->geocoder) (2.6)
Requirement already satisfied: urllib3<1.23,>=1.21.1 in /Users/jacquelinewong/anaconda3/lib/pyt
hon3.6/site-packages (from requests->geocoder) (1.22)
Requirement already satisfied: certifi>=2017.4.17 in /Users/jacquelinewong/anaconda3/lib/python
3.6/site-packages (from requests->geocoder) (2018.4.16)
Requirement already satisfied: decorator in /Users/jacquelinewong/anaconda3/lib/python3.6/site-
packages (from ratelim->geocoder) (4.3.0)
```

In [9]:
```
import geocoder # import geocoder

# initialize your variable to None
lat_lng_coords = None

postal_code = 'M5A'

# loop until you get the coordinates
while(lat_lng_coords is None):
  g = geocoder.arcgis('{}, Toronto, Ontario'.format(postal_code))
  lat_lng_coords = g.latlng

latitude = lat_lng_coords[0]
longitude = lat_lng_coords[1]
```

In [10]:
```
print(latitude)
print(longitude)
```

```
43.65512000000007
-79.36263979699999
```

In [11]:
```
coordinates= pd.read_csv('Geospatial_Coordinates.csv')
coordinates.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

In [12]:
```
table3=pd.merge(table2,coordinates,left_on='Postcode', right_on='Postal Code')
table3.drop(columns='Postal Code', inplace=True)
table3.head()
```

Out[12]:

	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 [13]:
```
table3.shape
```

Out[13]: (103, 5)

Capstone Week 3 Part 3

Explore and cluster the neighborhoods in Toronto. You can decide to work with only boroughs that contain the word Toronto and then replicate the same analysis we did to the New York City data. It is up to you.

Just make sure:

to add enough Markdown cells to explain what you decided to do and to report any observations you make. to generate maps to visualize your neighborhoods and how they cluster together. Once you are happy with your analysis, submit a link to the new Notebook on your Github repository. (3 marks)

Explore Neighborhoods in Toronto

In [14]:
```
CLIENT_ID = 'HMJSQ3GVV5LKNSTVIMD1DZYOS1E2WPOYUF43FCPWX4QNKLFW' # your Foursquare ID
CLIENT_SECRET = 'PWDCF25ERDO4YXDNO4IINJGEKEOBCJO2P0WSGINATUEJWIGR' # your Foursquare Secret
VERSION = '20180605' # Foursquare API version
LIMIT = 100 # limit of number of venues returned by Foursquare API
```

In [15]:
```
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={}&l
l={},{}&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 = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

Now write the code to run the above function on each neighborhood and create a new dataframe called *toronto_venues*.

In [16]:
```
import requests # library to handle requests
```

In [17]:
```
toronto_venues = getNearbyVenues(names=table3['Neighbourhood'],
                                 latitudes=table3['Latitude'],
                                 longitudes=table3['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,Regent Park
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 Spadina,Railway Lands,South Ni
agara
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 Eas
t,Royal York South East,Sunnylea
Kingsway Park South West,Mimico NW,The Queensway West,Royal York South West,South of Bloor
Islington Avenue
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. Phillips
Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Olive,Silverstone,South Steeles,This
tletown
```

```
Northwest
```

Let's check the size of the resulting dataframe

In [18]:
```
print(toronto_venues.shape)
toronto_venues.head()
```

```
(2253, 7)
```

Out[18]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Rouge,Malvern	43.806686	-79.194353	Wendy's	43.807448	-79.199056	Fast Food Restaurant
1	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	Royal Canadian Legion	43.782533	-79.163085	Bar
2	Guildwood,Morningside,West Hill	43.763573	-79.188711	Swiss Chalet Rotisserie & Grill	43.767697	-79.189914	Pizza Place
3	Guildwood,Morningside,West Hill	43.763573	-79.188711	G & G Electronics	43.765309	-79.191537	Electronics Store
4	Guildwood,Morningside,West Hill	43.763573	-79.188711	Big Bite Burrito	43.766299	-79.190720	Mexican Restaurant

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

In [19]:
```
toronto_venues.groupby('Neighborhood').count()
```

Out[19]:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Adelaide,King,Richmond	100	100	100	100	100	100
Agincourt	4	4	4	4	4	4
Agincourt North,L'Amoreaux East,Milliken,Steeles East	2	2	2	2	2	2
Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Olive,Silverstone,South Steeles,Thistletown	9	9	9	9	9	9
Alderwood,Long Branch	9	9	9	9	9	9
Bathurst Manor,Downsview North,Wilson Heights	20	20	20	20	20	20
Bayview Village	4	4	4	4	4	4
Bedford Park,Lawrence Manor East	24	24	24	24	24	24
Berczy Park	57	57	57	57	57	57
Birch Cliff,Cliffside West	4	4	4	4	4	4
Bloordale Gardens,Eringate,Markland Wood,Old Burnhamthorpe	8	8	8	8	8	8
Brockton,Exhibition Place,Parkdale Village	21	21	21	21	21	21
Business Reply Mail Processing Centre 969 Eastern	17	17	17	17	17	17
CFB Toronto,Downsview East	2	2	2	2	2	2
CN Tower,Bathurst Quay,Island						

airport,Harbourfront West,King and Spadina,Railway Lands,South Niagara	17	17	17	17	17	17
Cabbagetown,St. James Town	45	45	45	45	45	45
Caledonia-Fairbanks	5	5	5	5	5	5
Canada Post Gateway Processing Centre	11	11	11	11	11	11
Cedarbrae	7	7	7	7	7	7
Central Bay Street	82	82	82	82	82	82
Chinatown,Grange Park,Kensington Market	100	100	100	100	100	100
Christie	16	16	16	16	16	16
Church and Wellesley	84	84	84	84	84	84
Clairlea,Golden Mile,Oakridge	10	10	10	10	10	10
Clarks Corners,Sullivan,Tam O'Shanter	11	11	11	11	11	11
Cliffcrest,Cliffside,Scarborough Village West	2	2	2	2	2	2
Cloverdale,Islington,Martin Grove,Princess Gardens,West Deane Park	1	1	1	1	1	1
Commerce Court,Victoria Hotel	100	100	100	100	100	100
Davisville	33	33	33	33	33	33
Davisville North	7	7	7	7	7	7
...	...	...	...	...	...	...
Northwood Park,York University	6	6	6	6	6	6
Parkdale,Roncesvalles	15	15	15	15	15	15
Parkwoods	4	4	4	4	4	4

Queen's Park	41	41	41	41	41	41
Rosedale	5	5	5	5	5	5
Roselawn	4	4	4	4	4	4
Rouge,Malvern	1	1	1	1	1	1
Runnymede,Swansea	35	35	35	35	35	35
Ryerson,Garden District	100	100	100	100	100	100
Scarborough Village	2	2	2	2	2	2
Silver Hills,York Mills	1	1	1	1	1	1
St. James Town	100	100	100	100	100	100
Stn A PO Boxes 25 The Esplanade	96	96	96	96	96	96
Studio District	41	41	41	41	41	41
The Annex,North Midtown,Yorkville	23	23	23	23	23	23
The Beaches	5	5	5	5	5	5
The Beaches West,India Bazaar	19	19	19	19	19	19
The Danforth West,Riverdale	42	42	42	42	42	42
The Junction North,Runnymede	4	4	4	4	4	4
The Kingsway,Montgomery Road,Old Mill North	2	2	2	2	2	2
Thorncliffe Park	18	18	18	18	18	18
Victoria Village	5	5	5	5	5	5
Westmount	7	7	7	7	7	7
Weston	1	1	1	1	1	1
Willowdale South	36	36	36	36	36	36

Willowdale West	5	5	5	5	5	5
Woburn	4	4	4	4	4	4
Woodbine Gardens,Parkview Hill	11	11	11	11	11	11
Woodbine Heights	9	9	9	9	9	9
York Mills West	4	4	4	4	4	4

100 rows × 6 columns

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

In [20]:
```
print('There are {} uniques categories.'.format(len(toronto_venues['Venue Category'].unique())))
```

```
There are 277 uniques categories.
```

Analyze Each Neighborhood

In [21]:
```
# one hot encoding
toronto_onehot = pd.get_dummies(toronto_venues[['Venue Category']], prefix="", prefix_sep="")

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

# 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[21]:

	Yoga Studio	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	...	Train Station	Turk Restaur
0	0	0	0	0	0	0	0	0	0	0	...	0	0
1	0	0	0	0	0	0	0	0	0	0	...	0	0
2	0	0	0	0	0	0	0	0	0	0	...	0	0
3	0	0	0	0	0	0	0	0	0	0	...	0	0
4	0	0	0	0	0	0	0	0	0	0	...	0	0

5 rows × 277 columns

And let's examine the new dataframe size.

In [22]:
```
toronto_onehot.shape
```

Out[22]: (2253, 277)

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

In [23]:
```
toronto_grouped = toronto_onehot.groupby('Neighborhood').mean().reset_index()
toronto_grouped
```

Out[23]:

	Neighborhood	Yoga Studio	Accessories Store	Afghan Restaurant	Airport	Airport Food Court	Airport Gate	Airport Lounge	Airport Service
0	Adelaide,King,Richmond	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
1	Agincourt	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	Agincourt North,L'Amoreaux East,Milliken,Steel...	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	Albion Gardens,Beaumond Heights,Humbergate,Jam...	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
4	Alderwood,Long Branch	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	Bathurst Manor,Downsview North,Wilson Heights	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	Bayview Village	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	Bedford Park,Lawrence Manor East	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
8	Berczy Park	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
9	Birch Cliff,Cliffside West	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
10	Bloordale Gardens,Eringate,Markland	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

	Wood,Old B...								
11	Brockton,Exhibition Place,Parkdale Village	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	Business Reply Mail Processing Centre 969 Eastern	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
13	CFB Toronto,Downsview East	0.000000	0.0	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000
14	CN Tower,Bathurst Quay,Island airport,Harbourf...	0.000000	0.0	0.000000	0.058824	0.058824	0.058824	0.117647	0.176471
15	Cabbagetown,St. James Town	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
16	Caledonia-Fairbanks	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
17	Canada Post Gateway Processing Centre	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
18	Cedarbrae	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
19	Central Bay Street	0.012195	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
20	Chinatown,Grange Park,Kensington Market	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
21	Christie	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
22	Church and Wellesley	0.011905	0.0	0.011905	0.000000	0.000000	0.000000	0.000000	0.000000
23	Clairlea,Golden Mile,Oakridge	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
24	Clarks Corners,Sullivan,Tam O'Shanter	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25	Cliffcrest,Cliffside,Scarborough Village West	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
26	Cloverdale,Islington,Martin	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

	Grove,Princess Gar...								
27	Commerce Court,Victoria Hotel	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
28	Davisville	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
29	Davisville North	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
...	...	...	...	...	...	...	...	...	...
70	Northwood Park,York University	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
71	Parkdale,Roncesvalles	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
72	Parkwoods	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
73	Queen's Park	0.024390	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
74	Rosedale	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75	Roselawn	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
76	Rouge,Malvern	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
77	Runnymede,Swansea	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
78	Ryerson,Garden District	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
79	Scarborough Village	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
80	Silver Hills,York Mills	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
81	St. James Town	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
82	Stn A PO Boxes 25 The Esplanade	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
83	Studio District	0.024390	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	The Annex,North								

84	Midtown,Yorkville	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
85	The Beaches	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
86	The Beaches West,India Bazaar	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
87	The Danforth West,Riverdale	0.023810	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
88	The Junction North,Runnymede	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
89	The Kingsway,Montgomery Road,Old Mill North	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
90	Thorncliffe Park	0.055556	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
91	Victoria Village	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
92	Westmount	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
93	Weston	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
94	Willowdale South	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
95	Willowdale West	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
96	Woburn	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
97	Woodbine Gardens,Parkview Hill	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
98	Woodbine Heights	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
99	York Mills West	0.000000	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

100 rows × 277 columns

Let's confirm the new size

In [24]:
```
toronto_grouped.shape
```

Out[24]: (100, 277)

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

In [25]:
```
num_top_venues = 5

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

```
----Adelaide,King,Richmond----
             venue  freq
0      Coffee Shop  0.07
1             Café  0.05
2  Thai Restaurant  0.04
3       Steakhouse  0.04
4              Bar  0.04


----Agincourt----
               venue  freq
0       Skating Rink  0.25
```

```
1     Breakfast Spot  0.25
2             Lounge  0.25
3     Clothing Store  0.25
4  Mobile Phone Shop  0.00


----Agincourt North,L'Amoreaux East,Milliken,Steeles East----
                venue  freq
0          Playground   0.5
1                Park   0.5
2  Miscellaneous Shop   0.0
3       Movie Theater   0.0
4               Motel   0.0


----Albion Gardens,Beaumond Heights,Humbergate,Jamestown,Mount Olive,Silverstone,South Steeles,
Thistletown----
                  venue  freq
0         Grocery Store  0.22
1            Beer Store  0.11
2  Fried Chicken Joint  0.11
3       Sandwich Place  0.11
4          Coffee Shop  0.11


----Alderwood,Long Branch----
                venue  freq
0         Pizza Place  0.22
1                 Gym  0.11
2  Athletics & Sports  0.11
3         Coffee Shop  0.11
4                 Pub  0.11


----Bathurst Manor,Downsview North,Wilson Heights----
         venue  freq
0  Coffee Shop  0.10
```

```
1     Pharmacy  0.05
2        Diner  0.05
3  Supermarket  0.05
4         Bank  0.05


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


----Bedford Park,Lawrence Manor East----
                     venue  freq
0       Italian Restaurant  0.08
1              Coffee Shop  0.08
2                Juice Bar  0.08
3           Breakfast Spot  0.04
4  Comfort Food Restaurant  0.04


----Berczy Park----
            venue  freq
0     Coffee Shop  0.11
1    Cocktail Bar  0.05
2          Bakery  0.05
3  Farmers Market  0.04
4     Cheese Shop  0.04


----Birch Cliff,Cliffside West----
                   venue  freq
0  General Entertainment  0.25
1        College Stadium  0.25
```

```
2                   Café  0.25
3           Skating Rink  0.25
4            Yoga Studio  0.00


----Bloordale Gardens,Eringate,Markland Wood,Old Burnhamthorpe----
                venue  freq
0  Convenience Store  0.12
1         Beer Store  0.12
2               Café  0.12
3       Liquor Store  0.12
4     Shopping Plaza  0.12


----Brockton,Exhibition Place,Parkdale Village----
                    venue  freq
0          Breakfast Spot  0.10
1             Coffee Shop  0.10
2                   Café  0.10
3      Italian Restaurant  0.05
4  Furniture / Home Store  0.05


----Business Reply Mail Processing Centre 969 Eastern----
           venue  freq
0        Butcher  0.06
1     Skate Park  0.06
2         Garden  0.06
3  Auto Workshop  0.06
4     Restaurant  0.06


----CFB Toronto,Downsview East----
                venue  freq
0             Airport   0.5
1                Park   0.5
2         Yoga Studio   0.0
```

```
3  Miscellaneous Shop   0.0
4       Movie Theater   0.0


----CN Tower,Bathurst Quay,Island airport,Harbourfront West,King and Spadina,Railway Lands,Sout
h Niagara----
              venue  freq
0   Airport Service  0.18
1    Airport Lounge  0.12
2  Airport Terminal  0.12
3             Plane  0.06
4               Bar  0.06


----Cabbagetown,St. James Town----
         venue  freq
0         Café  0.07
1  Coffee Shop  0.07
2  Pizza Place  0.04
3       Bakery  0.04
4    Pet Store  0.04


----Caledonia-Fairbanks----
                  venue  freq
0                  Park   0.4
1         Women's Store   0.2
2                Market   0.2
3  Fast Food Restaurant   0.2
4     Mobile Phone Shop   0.0


----Canada Post Gateway Processing Centre----
                       venue  freq
0                      Hotel  0.18
1                Coffee Shop  0.18
2        Fried Chicken Joint  0.09
```

```
3   Mediterranean Restaurant  0.09
4  Middle Eastern Restaurant  0.09


----Cedarbrae----
                 venue  freq
0                 Bank  0.14
1  Caribbean Restaurant  0.14
2       Thai Restaurant  0.14
3    Athletics & Sports  0.14
4   Fried Chicken Joint  0.14


----Central Bay Street----
                venue  freq
0         Coffee Shop  0.15
1      Ice Cream Shop  0.05
2  Italian Restaurant  0.05
3        Burger Joint  0.04
4                Café  0.04


----Chinatown,Grange Park,Kensington Market----
                          venue  freq
0                         Café  0.08
1  Vegetarian / Vegan Restaurant  0.06
2            Chinese Restaurant  0.05
3                           Bar  0.05
4          Vietnamese Restaurant  0.04


----Christie----
          venue  freq
0  Grocery Store  0.19
1           Café  0.19
2           Park  0.12
3          Diner  0.06
```

```
4     Restaurant  0.06


----Church and Wellesley----
                 venue  freq
0          Coffee Shop  0.07
1  Japanese Restaurant  0.06
2              Gay Bar  0.05
3     Sushi Restaurant  0.05
4           Restaurant  0.04


----Clairlea,Golden Mile,Oakridge----
           venue  freq
0       Bus Line   0.2
1         Bakery   0.2
2  Metro Station   0.1
3           Park   0.1
4   Intersection   0.1


----Clarks Corners,Sullivan,Tam O'Shanter----
                venue  freq
0         Pizza Place  0.18
1                Bank  0.09
2  Chinese Restaurant  0.09
3     Thai Restaurant  0.09
4  Italian Restaurant  0.09


----Cliffcrest,Cliffside,Scarborough Village West----
                 venue  freq
0  American Restaurant   0.5
1               Motel   0.5
2         Music Store   0.0
3        Moving Target   0.0
4        Movie Theater   0.0
```

```
----Cloverdale,Islington,Martin Grove,Princess Gardens,West Deane Park----
               venue  freq
0               Bank   1.0
1        Yoga Studio   0.0
2  Mobile Phone Shop   0.0
3      Movie Theater   0.0
4              Motel   0.0


----Commerce Court,Victoria Hotel----
                 venue  freq
0          Coffee Shop  0.09
1                 Café  0.06
2                Hotel  0.06
3           Restaurant  0.04
4  American Restaurant  0.04


----Davisville----
                venue  freq
0      Sandwich Place  0.09
1        Dessert Shop  0.09
2  Italian Restaurant  0.06
3          Restaurant  0.06
4         Pizza Place  0.06


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

```
----Deer Park,Forest Hill SE,Rathnelly,South Hill,Summerhill West----
              venue  freq
0               Pub  0.12
1       Coffee Shop  0.12
2        Sports Bar  0.06
3  Sushi Restaurant  0.06
4        Bagel Shop  0.06


----Del Ray,Keelesdale,Mount Dennis,Silverthorn----
                venue  freq
0  Turkish Restaurant  0.25
1        Skating Rink  0.25
2      Discount Store  0.25
3      Sandwich Place  0.25
4       Metro Station  0.00


----Design Exchange,Toronto Dominion Centre----
                venue  freq
0         Coffee Shop  0.15
1                Café  0.08
2               Hotel  0.06
3  Italian Restaurant  0.04
4          Restaurant  0.04


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

```
----Dorset Park,Scarborough Town Centre,Wexford Heights----
                   venue  freq
0       Indian Restaurant  0.29
1              Pet Store  0.14
2  Furniture / Home Store  0.14
3   Vietnamese Restaurant  0.14
4      Chinese Restaurant  0.14


----Dovercourt Village,Dufferin----
         venue  freq
0       Bakery  0.11
1  Supermarket  0.11
2     Pharmacy  0.11
3  Art Gallery  0.05
4         Café  0.05


----Downsview Central----
               venue  freq
0         Food Truck   0.5
1     Baseball Field   0.5
2        Yoga Studio   0.0
3  Mobile Phone Shop   0.0
4      Movie Theater   0.0


----Downsview Northwest----
                  venue  freq
0        Discount Store   0.2
1  Gym / Fitness Center   0.2
2    Athletics & Sports   0.2
3          Liquor Store   0.2
4         Grocery Store   0.2


----Downsview West----
```

```
           venue  freq
0  Grocery Store  0.33
1           Bank  0.17
2           Park  0.17
3          Hotel  0.17
4  Shopping Mall  0.17


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


----East Birchmount Park,Ionview,Kennedy Park----
               venue  freq
0  Convenience Store  0.25
1     Discount Store  0.25
2        Coffee Shop  0.25
3   Department Store  0.25
4        Yoga Studio  0.00


----East Toronto----
                        venue  freq
0                        Park  0.50
1           Convenience Store  0.25
2               Metro Station  0.25
3                Yoga Studio  0.00
4  Modern European Restaurant  0.00


----Emery,Humberlea----
               venue  freq
```

```
0     Baseball Field   1.0
1        Yoga Studio   0.0
2  Mobile Phone Shop   0.0
3      Movie Theater   0.0
4              Motel   0.0
```

```
----Fairview,Henry Farm,Oriole----
                 venue  freq
0        Clothing Store  0.12
1           Coffee Shop  0.07
2  Fast Food Restaurant  0.07
3         Women's Store  0.03
4      Asian Restaurant  0.03
```

```
----First Canadian Place,Underground city----
         venue  freq
0  Coffee Shop  0.09
1         Café  0.07
2   Steakhouse  0.04
3        Hotel  0.04
4   Restaurant  0.04
```

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

```
----Forest Hill North,Forest Hill West----
             venue  freq
0     Jewelry Store  0.25
```

```
1              Park  0.25
2  Sushi Restaurant  0.25
3             Trail  0.25
4       Yoga Studio  0.00
```

```
----Glencairn----
                        venue  freq
0                  Playground  0.25
1         Japanese Restaurant  0.25
2                      Bakery  0.25
3                         Pub  0.25
4  Modern European Restaurant  0.00
```

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

```
----Harbord,University of Toronto----
                 venue  freq
0                Café  0.12
1                 Bar  0.06
2           Bookstore  0.06
3  Japanese Restaurant  0.06
4          Restaurant  0.06
```

```
----Harbourfront East,Toronto Islands,Union Station----
                venue  freq
0         Coffee Shop  0.11
1               Hotel  0.05
```

```
2            Aquarium  0.05
3  Italian Restaurant  0.04
4               Café  0.04


----Harbourfront,Regent Park----
         venue  freq
0  Coffee Shop  0.19
1          Pub  0.06
2       Bakery  0.06
3         Café  0.06
4         Park  0.06


----High Park,The Junction South----
                venue  freq
0  Mexican Restaurant  0.09
1               Café  0.09
2                Bar  0.09
3       Grocery Store  0.04
4         Flea Market  0.04


----Highland Creek,Rouge Hill,Port Union----
              venue  freq
0               Bar   1.0
1       Yoga Studio   0.0
2  Mobile Phone Shop   0.0
3      Movie Theater   0.0
4             Motel   0.0


----Hillcrest Village----
                     venue  freq
0  Mediterranean Restaurant  0.17
1      Fast Food Restaurant  0.17
2                      Pool  0.17
```

```
3        Athletics & Sports  0.17
4               Golf Course  0.17


----Humber Bay Shores,Mimico South,New Toronto----
                  venue  freq
0           Pizza Place  0.07
1                   Gym  0.07
2  Fast Food Restaurant  0.07
3   Fried Chicken Joint  0.07
4                 Café  0.07


----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                   Locksmith  0.25
1  Construction & Landscaping  0.25
2              Baseball Field  0.25
3                        Park  0.25
4           Mobile Phone Shop  0.00


----Humber Summit----
                 venue  freq
0  Empanada Restaurant   0.5
1          Pizza Place   0.5
2          Yoga Studio   0.0
3        Movie Theater   0.0
4                Motel   0.0


----Humewood-Cedarvale----
                venue  freq
0         Playground  0.25
1       Hockey Arena  0.25
2              Field  0.25
```

```
3              Trail  0.25
4  Mobile Phone Shop  0.00


----Kingsview Village,Martin Grove Gardens,Richview Gardens,St. Phillips----
                venue  freq
0         Pizza Place  0.33
1                Park  0.33
2   Mobile Phone Shop  0.33
3         Yoga Studio  0.00
4  Miscellaneous Shop  0.00


----Kingsway Park South West,Mimico NW,The Queensway West,Royal York South West,South of Bloor-
---
                  venue  freq
0          Burger Joint  0.07
1  Fast Food Restaurant  0.07
2       Supplement Shop  0.07
3                Bakery  0.07
4        Sandwich Place  0.07


----L'Amoreaux West----
                  venue  freq
0    Chinese Restaurant  0.17
1  Fast Food Restaurant  0.17
2           Pizza Place  0.08
3         Grocery Store  0.08
4        Breakfast Spot  0.08


----Lawrence Heights,Lawrence Manor----
                    venue  freq
0  Furniture / Home Store  0.23
1          Clothing Store  0.15
2                Boutique  0.08
```

```
3             Coffee Shop  0.08
4       Accessories Store  0.08


----Lawrence Park----
           venue  freq
0       Bus Line  0.33
1    Swim School  0.33
2           Park  0.33
3    Yoga Studio  0.00
4  Movie Theater  0.00


----Leaside----
                    venue  freq
0             Coffee Shop  0.11
1     Sporting Goods Shop  0.08
2  Furniture / Home Store  0.06
3          Sandwich Place  0.06
4            Burger Joint  0.06


----Little Portugal,Trinity----
              venue  freq
0               Bar  0.11
1       Coffee Shop  0.06
2  Asian Restaurant  0.05
3       Pizza Place  0.03
4             Café  0.03


----Maryvale,Wexford----
                        venue  freq
0             Breakfast Spot  0.14
1                    Bakery  0.14
2               Auto Garage  0.14
3  Middle Eastern Restaurant  0.14
```

```
4                 Smoke Shop  0.14


----Moore Park,Summerhill East----
          venue  freq
0  Tennis Court  0.25
1          Park  0.25
2           Gym  0.25
3    Restaurant  0.25
4   Yoga Studio  0.00


----North Toronto West----
                 venue  freq
0          Coffee Shop  0.10
1       Clothing Store  0.10
2  Sporting Goods Shop  0.10
3          Yoga Studio  0.05
4            Gift Shop  0.05


----Northwest----
                        venue  freq
0                   Drugstore   0.5
1         Rental Car Location   0.5
2                 Yoga Studio   0.0
3  Modern European Restaurant   0.0
4               Movie Theater   0.0


----Northwood Park,York University----
                    venue  freq
0          Massage Studio  0.17
1      Miscellaneous Shop  0.17
2    Caribbean Restaurant  0.17
3                     Bar  0.17
4  Furniture / Home Store  0.17
```

```
----Parkdale,Roncesvalles----
                venue  freq
0      Breakfast Spot  0.13
1           Gift Shop  0.13
2  Italian Restaurant  0.07
3         Coffee Shop  0.07
4                 Bar  0.07


----Parkwoods----
                  venue  freq
0  Fast Food Restaurant  0.25
1     Food & Drink Shop  0.25
2                  Park  0.25
3             Bus Stop  0.25
4           Yoga Studio  0.00


----Queen's Park----
         venue  freq
0  Coffee Shop  0.22
1          Gym  0.05
2         Park  0.05
3        Diner  0.05
4  Yoga Studio  0.02


----Rosedale----
           venue  freq
0           Park   0.4
1     Playground   0.2
2          Trail   0.2
3       Building   0.2
4  Movie Theater   0.0
```

```
----Roselawn----
                     venue  freq
0                   Garden  0.25
1             Music Venue  0.25
2  Health & Beauty Service  0.25
3            Home Service  0.25
4        Mobile Phone Shop  0.00


----Rouge,Malvern----
                  venue  freq
0  Fast Food Restaurant   1.0
1          Yoga Studio   0.0
2     Mobile Phone Shop   0.0
3         Moving Target   0.0
4         Movie Theater   0.0


----Runnymede,Swansea----
                venue  freq
0         Pizza Place  0.09
1               Café  0.09
2         Coffee Shop  0.09
3    Sushi Restaurant  0.06
4  Italian Restaurant  0.06


----Ryerson,Garden District----
                       venue  freq
0               Coffee Shop  0.09
1            Clothing Store  0.06
2            Cosmetics Shop  0.04
3  Middle Eastern Restaurant  0.03
4                      Café  0.03
```

```
----Scarborough Village----
                venue  freq
0          Playground   0.5
1          Smoke Shop   0.5
2  Miscellaneous Shop   0.0
3       Movie Theater   0.0
4               Motel   0.0


----Silver Hills,York Mills----
                        venue  freq
0                   Cafeteria   1.0
1                 Yoga Studio   0.0
2  Modern European Restaurant   0.0
3               Moving Target   0.0
4               Movie Theater   0.0


----St. James Town----
                venue  freq
0         Coffee Shop  0.07
1               Café  0.05
2  Italian Restaurant  0.05
3          Restaurant  0.05
4               Hotel  0.04


----Stn A PO Boxes 25 The Esplanade----
                venue  freq
0         Coffee Shop  0.09
1          Restaurant  0.04
2               Café  0.04
3  Italian Restaurant  0.03
4            Beer Bar  0.03


----Studio District----
```

```
                venue  freq
0                Café  0.10
1         Coffee Shop  0.07
2  Italian Restaurant  0.05
3              Bakery  0.05
4           Gastropub  0.05


----The Annex,North Midtown,Yorkville----
            venue  freq
0            Café  0.13
1     Coffee Shop  0.13
2  Sandwich Place  0.13
3     Pizza Place  0.09
4  Cosmetics Shop  0.04


----The Beaches----
                  venue  freq
0     Health Food Store   0.2
1                 Trail   0.2
2  Other Great Outdoors   0.2
3                   Pub   0.2
4         Movie Theater   0.0


----The Beaches West,India Bazaar----
            venue  freq
0    Burger Joint  0.05
1             Gym  0.05
2  Sandwich Place  0.05
3   Movie Theater  0.05
4      Steakhouse  0.05


----The Danforth West,Riverdale----
                   venue  freq
```

```
0        Greek Restaurant  0.21
1             Coffee Shop  0.10
2      Italian Restaurant  0.07
3          Ice Cream Shop  0.07
4  Furniture / Home Store  0.05


----The Junction North,Runnymede----
                        venue  freq
0               Grocery Store  0.25
1                 Pizza Place  0.25
2           Convenience Store  0.25
3                    Bus Line  0.25
4  Modern European Restaurant  0.00


----The Kingsway,Montgomery Road,Old Mill North----
               venue  freq
0              River   0.5
1               Park   0.5
2       Yoga Studio   0.0
3  Mobile Phone Shop   0.0
4      Movie Theater   0.0


----Thorncliffe Park----
               venue  freq
0  Indian Restaurant  0.11
1        Yoga Studio  0.06
2       Intersection  0.06
3               Park  0.06
4        Coffee Shop  0.06


----Victoria Village----
                  venue  freq
0          Hockey Arena   0.2
```

```
1            Pizza Place   0.2
2  Portuguese Restaurant   0.2
3            Coffee Shop   0.2
4           Intersection   0.2


----Westmount----
                      venue  freq
0                Pizza Place  0.29
1             Sandwich Place  0.14
2         Chinese Restaurant  0.14
3  Middle Eastern Restaurant  0.14
4               Intersection  0.14


----Weston----
                venue  freq
0                Park   1.0
1         Yoga Studio   0.0
2  Miscellaneous Shop   0.0
3       Movie Theater   0.0
4               Motel   0.0


----Willowdale South----
                  venue  freq
0     Ramen Restaurant  0.08
1          Coffee Shop  0.08
2  Japanese Restaurant  0.06
3          Pizza Place  0.06
4                Café   0.06


----Willowdale West----
             venue  freq
0     Pizza Place   0.2
1        Pharmacy   0.2
```

```
2         Butcher   0.2
3  Discount Store   0.2
4     Coffee Shop   0.2


----Woburn----
                        venue  freq
0                 Coffee Shop  0.50
1                Soccer Field  0.25
2           Korean Restaurant  0.25
3                 Yoga Studio  0.00
4  Modern European Restaurant  0.00


----Woodbine Gardens,Parkview Hill----
                  venue  freq
0  Fast Food Restaurant  0.18
1           Pizza Place  0.18
2         Breakfast Spot  0.09
3    Athletics & Sports  0.09
4          Intersection  0.09


----Woodbine Heights----
              venue  freq
0    Cosmetics Shop  0.11
1  Asian Restaurant  0.11
2          Pharmacy  0.11
3       Video Store  0.11
4       Curling Ice  0.11


----York Mills West----
               venue  freq
0  Convenience Store  0.25
1               Bank  0.25
2                Bar  0.25
```

```
3                Park  0.25
4         Yoga Studio  0.00
```

Let's put that into a *pandas* dataframe

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

In [26]:
```
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 [27]:
```
num_top_venues = 10

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

# create columns according to number of top venues
columns = ['Neighborhood']
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['Neighborhood'] = toronto_grouped['Neighborhood']

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

neighborhoods_venues_sorted.head()
```

Out[27]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Mos Commor Venue
0	Adelaide,King,Richmond	Coffee Shop	Café	Steakhouse	Bar	Thai Restaurant	Gym	Asian Restaurant	Burger Joint
1	Agincourt	Clothing Store	Breakfast Spot	Lounge	Skating Rink	Electronics Store	Doner Restaurant	Donut Shop	Drugstore
2	Agincourt North,L'Amoreaux East,Milliken,Steel...	Playground	Park	Women's Store	Eastern European Restaurant	Dive Bar	Dog Run	Doner Restaurant	Donut Shop
3	Albion Gardens,Beaumond Heights,Humbergate,Jam...	Grocery Store	Fast Food Restaurant	Fried Chicken Joint	Pizza Place	Coffee Shop	Sandwich Place	Beer Store	Pharmacy
4	Alderwood,Long Branch	Pizza Place	Pub	Pharmacy	Gym	Skating Rink	Sandwich Place	Coffee Shop	Athletics & Sports

4. Cluster Neighborhoods

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

In [28]:
```
# import k-means from clustering stage
from sklearn.cluster import KMeans
```

In [29]:
```
# set number of clusters
kclusters = 5
toronto_grouped_clustering = toronto_grouped.drop('Neighborhood', 1)

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

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

Out[29]:
```
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 [30]:
```
# Note that the Neighborhood column in table3 is spelled as 'Neighbourhood'
table3.head(1)
```

Out[30]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M1B	Scarborough	Rouge,Malvern	43.806686	-79.194353

In [31]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

toronto_merged = table3

# merge toronto_grouped with toronto_data to add latitude/longitude for each neighborhood
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), on='N
eighbourhood',how = 'right')

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

Out[31]:

	Postcode	Borough	Neighbourhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
0	M1B	Scarborough	Rouge,Malvern	43.806686	-79.194353	3	Fast Food Restaurant	Women's Store	Eastern European Restaurant
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497	0	Bar	Women's Store	Electronics Store
2	M1E	Scarborough	Guildwood,Morningside,West Hill	43.763573	-79.188711	0	Pizza Place	Rental Car Location	Breakfast Spot
3	M1G	Scarborough	Woburn	43.770992	-79.216917	0	Coffee Shop	Soccer Field	Korean Restaurant
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476	0	Bakery	Hakka Restaurant	Caribbean Restaurant

Finally, let's visualize the resulting clusters

In [32]:
```
#!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you haven't completed the Foursquare API lab
import folium # map rendering library

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors
```

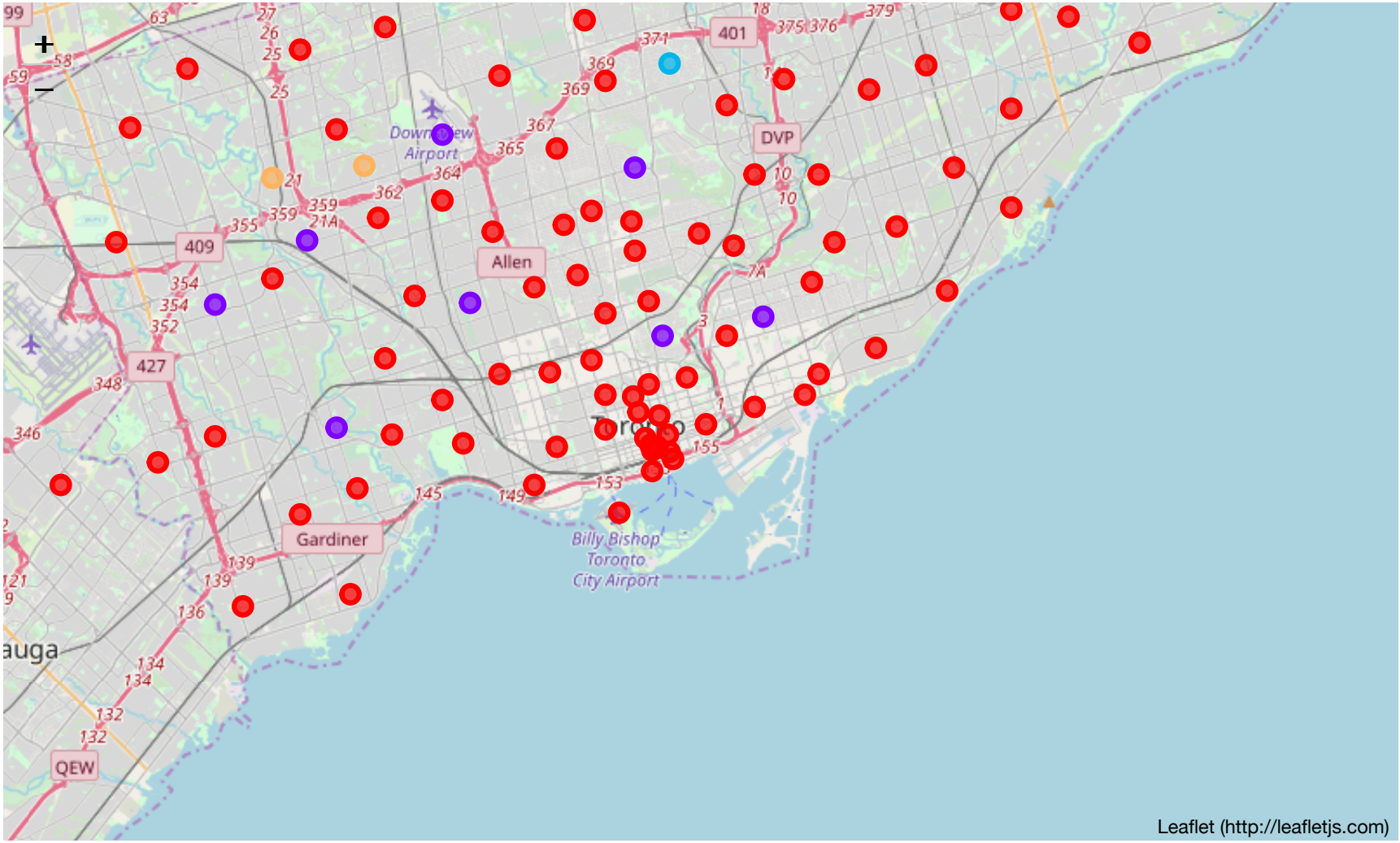
In [33]:
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# 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['Longitude'], toront
o_merged['Neighbourhood'], toronto_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```

Out[33]:



5. Examine Clusters

Now, you can examine each cluster and determine the discriminating venue categories that distinguish each cluster.

Cluster 0

City cluster

This cluster is indicated by red dots in the map

In [34]:
```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 0, toronto_merged.columns[[2] + list(range
(5, toronto_merged.shape[1]))]]
```

Out[34]:

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Cor
1	Highland Creek,Rouge Hill,Port Union	0	Bar	Women's Store	Electronics Store	Doner Restaurant	Donut Shop	Drugstor
2	Guildwood,Morningside,West Hill	0	Pizza Place	Rental Car Location	Breakfast Spot	Medical Center	Electronics Store	Mexican Restaura
3	Woburn	0	Coffee Shop	Soccer Field	Korean Restaurant	Women's Store	Eastern European Restaurant	Dog Run
4	Cedarbrae	0	Bakery	Hakka Restaurant	Caribbean Restaurant	Athletics & Sports	Bank	Thai Restaura
5	Scarborough Village	0	Playground	Smoke Shop	Women's Store	Eastern European Restaurant	Dive Bar	Dog Run
	East Birchmount		Discount	Convenience		Department	Eastern	

6	Park,Ionview,Kennedy Park	0	Store	Store	Coffee Shop	Store	European Restaurant	Dog Run
7	Clairlea,Golden Mile,Oakridge	0	Bus Line	Bakery	Intersection	Fast Food Restaurant	Metro Station	Bus Stat
8	Cliffcrest,Cliffside,Scarborough Village West	0	Motel	American Restaurant	Women's Store	Discount Store	Dog Run	Doner Restaura
9	Birch Cliff,Cliffside West	0	College Stadium	Skating Rink	General Entertainment	Café	Ethiopian Restaurant	Empana Restaura
10	Dorset Park,Scarborough Town Centre,Wexford He...	0	Indian Restaurant	Pet Store	Latin American Restaurant	Chinese Restaurant	Furniture / Home Store	Vietnam Restaura
11	Maryvale,Wexford	0	Breakfast Spot	Auto Garage	Smoke Shop	Bakery	Shopping Mall	Middle Eastern Restaura
12	Agincourt	0	Clothing Store	Breakfast Spot	Lounge	Skating Rink	Electronics Store	Doner Restaura
13	Clarks Corners,Sullivan,Tam O'Shanter	0	Pizza Place	Shopping Mall	Bank	Thai Restaurant	Chinese Restaurant	Italian Restaura
15	L'Amoreaux West	0	Fast Food Restaurant	Chinese Restaurant	Thrift / Vintage Store	Pharmacy	Coffee Shop	Sandwic Place
17	Hillcrest Village	0	Fast Food Restaurant	Mediterranean Restaurant	Dog Run	Athletics & Sports	Pool	Golf Cou
			Clothing	Fast Food		Women's		Japanes

18	Fairview,Henry Farm,Oriole	0	Store	Restaurant	Coffee Shop	Store	Food Court	Restaura
19	Bayview Village	0	Café	Japanese Restaurant	Bank	Chinese Restaurant	Dog Run	Doner Restaura
22	Willowdale South	0	Coffee Shop	Ramen Restaurant	Japanese Restaurant	Sushi Restaurant	Pizza Place	Café
23	York Mills West	0	Convenience Store	Park	Bank	Bar	Women's Store	Eastern Europea Restaura
24	Willowdale West	0	Pizza Place	Coffee Shop	Butcher	Discount Store	Pharmacy	Construc & Landsca
25	Parkwoods	0	Fast Food Restaurant	Bus Stop	Park	Food & Drink Shop	Eastern European Restaurant	Dog Run
26	Don Mills North	0	Café	Caribbean Restaurant	Gym / Fitness Center	Japanese Restaurant	Basketball Court	Women's Store
27	Flemingdon Park,Don Mills South	0	Gym	Beer Store	Coffee Shop	Asian Restaurant	Italian Restaurant	General Entertair
28	Bathurst Manor,Downsview North,Wilson Heights	0	Coffee Shop	Pharmacy	Frozen Yogurt Shop	Shopping Mall	Fast Food Restaurant	Sandwic Place
29	Northwood Park,York University	0	Furniture / Home Store	Massage Studio	Caribbean Restaurant	Bar	Coffee Shop	Miscella Shop
31	Downsview West	0	Grocery Store	Shopping Mall	Bank	Park	Hotel	Women's Store
			Athletics &	Gym / Fitness			Discount	Women's

33	Downsview Northwest	0	Sports	Center	Grocery Store	Liquor Store	Store	Store
34	Victoria Village	0	Pizza Place	Hockey Arena	Portuguese Restaurant	Coffee Shop	Intersection	Conveni Store
35	Woodbine Gardens,Parkview Hill	0	Fast Food Restaurant	Pizza Place	Gastropub	Bank	Breakfast Spot	Intersect
36	Woodbine Heights	0	Pharmacy	Park	Video Store	Skating Rink	Cosmetics Shop	Beer Sto
...	...	...	...	...	...	...	...	...
67	Chinatown,Grange Park,Kensington Market	0	Café	Vegetarian / Vegan Restaurant	Chinese Restaurant	Bar	Mexican Restaurant	Vietnam Restaura
68	CN Tower,Bathurst Quay,Island airport,Harbourf...	0	Airport Service	Airport Terminal	Airport Lounge	Plane	Coffee Shop	Sculptur Garden
69	Stn A PO Boxes 25 The Esplanade	0	Coffee Shop	Restaurant	Café	Seafood Restaurant	Fast Food Restaurant	Hotel
70	First Canadian Place,Underground city	0	Coffee Shop	Café	Restaurant	Steakhouse	Hotel	Bar
71	Lawrence Heights,Lawrence Manor	0	Furniture / Home Store	Clothing Store	Accessories Store	Coffee Shop	Boutique	Miscella Shop
72	Glencairn	0	Japanese Restaurant	Pub	Playground	Bakery	Discount Store	Dive Bar
73	Humewood-Cedarvale	0	Trail	Playground	Field	Hockey Arena	Eastern European Restaurant	Dive Bar

75	Christie	0	Café	Grocery Store	Park	Convenience Store	Italian Restaurant	Diner
76	Dovercourt Village,Dufferin	0	Bakery	Pharmacy	Supermarket	Gym / Fitness Center	Music Venue	Discount Store
77	Little Portugal,Trinity	0	Bar	Coffee Shop	Asian Restaurant	New American Restaurant	Men's Store	Cocktail
78	Brockton,Exhibition Place,Parkdale Village	0	Coffee Shop	Breakfast Spot	Café	Italian Restaurant	Burrito Place	Stadium
79	Downsview,North Park,Upwood Park	0	Basketball Court	Construction & Landscaping	Bakery	Park	Women's Store	Doner Restaura
80	Del Ray,Keelesdale,Mount Dennis,Silverthorn	0	Discount Store	Sandwich Place	Skating Rink	Turkish Restaurant	Dumpling Restaurant	Dive Bar
81	The Junction North,Runnymede	0	Pizza Place	Convenience Store	Grocery Store	Bus Line	Eastern European Restaurant	Dog Run
82	High Park,The Junction South	0	Bar	Café	Mexican Restaurant	Arts & Crafts Store	Flea Market	Italian Restaura
83	Parkdale,Roncesvalles	0	Breakfast Spot	Gift Shop	Eastern European Restaurant	Bar	Bank	Dog Run
84	Runnymede,Swansea	0	Coffee Shop	Café	Pizza Place	Italian Restaurant	Sushi Restaurant	Gym
							Yoga	Smoothi

85	Queen's Park	0	Coffee Shop	Gym	Diner	Park	Studio	Shop
86	Canada Post Gateway Processing Centre	0	Coffee Shop	Hotel	American Restaurant	Middle Eastern Restaurant	Gym / Fitness Center	Fried Ch Joint
87	Business Reply Mail Processing Centre 969 Eastern	0	Park	Garden Center	Skate Park	Farmers Market	Fast Food Restaurant	Spa
88	Humber Bay Shores,Mimico South,New Toronto	0	Pharmacy	American Restaurant	Bakery	Fried Chicken Joint	Café	Sandwic Place
89	Alderwood,Long Branch	0	Pizza Place	Pub	Pharmacy	Gym	Skating Rink	Sandwic Place
91	Humber Bay,King's Mill Park,Kingsway Park Sout...	0	Construction & Landscaping	Park	Locksmith	Baseball Field	Women's Store	Electroni Store
92	Kingsway Park South West,Mimico NW,The Queensw...	0	Hardware Store	Thrift / Vintage Store	Convenience Store	Discount Store	Sandwich Place	Burrito F
94	Cloverdale,Islington,Martin Grove,Princess Gar...	0	Bank	Women's Store	Electronics Store	Doner Restaurant	Donut Shop	Drugstor
95	Bloordale Gardens,Eringate,Markland Wood,Old B...	0	Pizza Place	Beer Store	Convenience Store	Coffee Shop	Café	Shoppin Plaza
96	Humber Summit	0	Pizza Place	Empanada Restaurant	Dumpling Restaurant	Discount Store	Dive Bar	Dog Rur

99	Westmount	0	Pizza Place	Coffee Shop	Middle Eastern Restaurant	Sandwich Place	Chinese Restaurant	Intersect
101	Albion Gardens,Beaumond Heights,Humbergate,Jam...	0	Grocery Store	Fast Food Restaurant	Fried Chicken Joint	Pizza Place	Coffee Shop	Sandwic Place
102	Northwest	0	Rental Car Location	Drugstore	Women's Store	Dumpling Restaurant	Dive Bar	Dog Rur

87 rows × 12 columns

Cluster 1

Park cluster

This cluster is indicated by purple dots in the map

In [35]:
```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 1, toronto_merged.columns[[2] + list(range
(5, toronto_merged.shape[1]))]]
```

Out[35]:

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Commor Venue
14	Agincourt North,L'Amoreaux East,Milliken,Steel...	1	Playground	Park	Women's Store	Eastern European Restaurant	Dive Bar	Dog Run	Doner Restaurant
	CFB								

30	Toronto,Downsview East	1	Airport	Park	Women's Store	Electronics Store	Dog Run	Doner Restaurant	Donut Shop
40	East Toronto	1	Park	Metro Station	Convenience Store	Electronics Store	Dog Run	Doner Restaurant	Donut Shop
44	Lawrence Park	1	Park	Swim School	Bus Line	Women's Store	Dumpling Restaurant	Dog Run	Doner Restauran
50	Rosedale	1	Park	Building	Playground	Trail	Women's Store	Dive Bar	Dog Run
74	Caledonia-Fairbanks	1	Park	Women's Store	Fast Food Restaurant	Market	Convenience Store	Construction & Landscaping	Concert Hall
90	The Kingsway,Montgomery Road,Old Mill North	1	River	Park	Women's Store	Dumpling Restaurant	Dive Bar	Dog Run	Doner Restauran
98	Weston	1	Park	Women's Store	Eastern European Restaurant	Dive Bar	Dog Run	Doner Restaurant	Donut Shop
100	Kingsview Village,Martin Grove Gardens,Richvie...	1	Pizza Place	Park	Mobile Phone Shop	Dumpling Restaurant	Dive Bar	Dog Run	Doner Restauran

Cluster 2

Cafeteria cluster

This cluster is indicated by a blue dot in the map

In [36]:
```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 2, toronto_merged.columns[[2] + list(range
(5, toronto_merged.shape[1]))]]
```

Out[36]:

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Co
20	Silver Hills,York Mills	2	Cafeteria	Women's Store	Eastern European Restaurant	Dog Run	Doner Restaurant	Donut Shop	Drugstore	Dumpling Restaurant	Elec Stor

Cluster 3

Fast food cluster

This cluster is indicated by a green dot in the map

In [37]:
```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 3, toronto_merged.columns[[2] + list(range
(5, toronto_merged.shape[1]))]]
```

Out[37]:

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Com V
0	Rouge,Malvern	3	Fast Food Restaurant	Women's Store	Eastern European Restaurant	Dive Bar	Dog Run	Doner Restaurant	Donut Shop	Drugstore	Dump Resta

Cluster 4

Sports cluster

This cluster is indicated by orange dots in the map

In [38]:
```
toronto_merged.loc[toronto_merged['Cluster Labels'] == 4, toronto_merged.columns[[2] + list(range
(5, toronto_merged.shape[1]))]]
```

Out[38]:

	Neighbourhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	
32	Downsview Central	4	Food Truck	Baseball Field	Women's Store	Electronics Store	Doner Restaurant	Donut Shop	Drugstore	Dumpling Restaurant	E E F
97	Emery,Humberlea	4	Baseball Field	Women's Store	Electronics Store	Doner Restaurant	Donut Shop	Drugstore	Dumpling Restaurant	Eastern European Restaurant	E F