First import all necessary packages for the activities. We will be using BeautifulSoup to scrape the website, requests package to get the website data and pandas for creating dataframes

```
In [269]: !pip install bs4
          !pip install geocoder
          from bs4 import BeautifulSoup
          import requests
          import pandas as pd
```

Requirement already satisfied: bs4 in /home/jupyterlab/conda/envs/python/lib/
python3.6/site-packages (0.0.1)
Requirement already satisfied: beautifulsoup4 in /home/jupyterlab/conda/envs/
python/lib/python3.6/site-packages (from bs4) (4.9.3)
Requirement already satisfied: soupsieve>1.2; python_version >= "3.0" in /hom
e/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from beautifulsou
p4->bs4) (2.2.1)
Requirement already satisfied: geocoder in /home/jupyterlab/conda/envs/pytho
n/lib/python3.6/site-packages (1.38.1)
Requirement already satisfied: click in /home/jupyterlab/conda/envs/python/li
b/python3.6/site-packages (from geocoder) (8.0.1)
Requirement already satisfied: requests in /home/jupyterlab/conda/envs/pytho
n/lib/python3.6/site-packages (from geocoder) (2.25.1)
Requirement already satisfied: six in /home/jupyterlab/conda/envs/python/lib/
python3.6/site-packages (from geocoder) (1.15.0)
Requirement already satisfied: ratelim in /home/jupyterlab/conda/envs/python/
lib/python3.6/site-packages (from geocoder) (0.1.6)
Requirement already satisfied: future in /home/jupyterlab/conda/envs/python/l
ib/python3.6/site-packages (from geocoder) (0.18.2)
Requirement already satisfied: importlib-metadata; python_version < "3.8" in
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from click->g
eocoder) (4.6.1)
Requirement already satisfied: idna<3,>=2.5 in /home/jupyterlab/conda/envs/py
thon/lib/python3.6/site-packages (from requests->geocoder) (2.10)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /home/jupyterlab/cond
a/envs/python/lib/python3.6/site-packages (from requests->geocoder) (1.26.6)
Requirement already satisfied: certifi>=2017.4.17 in /home/jupyterlab/conda/e
nvs/python/lib/python3.6/site-packages (from requests->geocoder) (2021.5.30)
Requirement already satisfied: chardet<5,>=3.0.2 in /home/jupyterlab/conda/en
vs/python/lib/python3.6/site-packages (from requests->geocoder) (4.0.0)
Requirement already satisfied: decorator in /home/jupyterlab/conda/envs/pytho
n/lib/python3.6/site-packages (from ratelim->geocoder) (4.4.2)
Requirement already satisfied: zipp>=0.5 in /home/jupyterlab/conda/envs/pytho
n/lib/python3.6/site-packages (from importlib-metadata; python_version < "3.
8"->click->geocoder) (3.5.0)
Requirement already satisfied: typing-extensions>=3.6.4; python_version < "3.
8" in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from im
portlib-metadata; python_version < "3.8"->click->geocoder) (3.10.0.0)

Use wikipedia postal of codes for Canada to get the data

```
In [270]: url='https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
```

```
In [271]: data    = requests.get(url).text
```

```
In [272]: soup = BeautifulSoup(data, 'html5lib')
```

Later after finding the table and table data create a dictionary called cell having 3 keys PostalCode, Borough and Neighborhood.

As postal code contains upto 3 characters extract that using tablerow.p.text

Next use split ,strip and replace functions for getting Borough and Neighborhood information..

Append to the list
Create a dataframe with list

```
In [273]:  table_contents=[]
           table=soup.find('table')
           for row in table.findAll('td'):
               cell = {}
               if row.span.text=='Not assigned':
                   pass
               else:
                   cell['PostalCode'] = row.p.text[:3]
                   cell['Borough'] = (row.span.text).split('(')[0]
                   cell['Neighborhood'] = (((((row.span.text).split('(')[1]).strip(')')).
           replace(' /',',')).replace(')',' ')).strip(' ')
                   table_contents.append(cell)

           print(table_contents)
           df=pd.DataFrame(table_contents)
           df['Borough']=df['Borough'].replace({'Downtown TorontoStn A PO Boxes25 The Esp
           lanade':'Downtown Toronto Stn A',
                                                 'East TorontoBusiness reply mail
           Processing Centre969 Eastern':'East Toronto Business',
                                                 'EtobicokeNorthwest':'Etobicoke
            Northwest','East YorkEast Toronto':'East York/East Toronto',
                                                 'MississaugaCanada Post Gateway
            Processing Centre':'Mississauga'})
```

[{'PostalCode': 'M3A', 'Borough': 'North York', 'Neighborhood': 'Parkwoods'}, {'PostalCode': 'M4A', 'Borough': 'North York', 'Neighborhood': 'Victoria Village'}, {'PostalCode': 'M5A', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Regent Park, Harbourfront'}, {'PostalCode': 'M6A', 'Borough': 'North York', 'Neighborhood': 'Lawrence Manor, Lawrence Heights'}, {'PostalCode': 'M7A', 'Borough': "Queen's Park", 'Neighborhood': 'Ontario Provincial Government'}, {'PostalCode': 'M9A', 'Borough': 'Etobicoke', 'Neighborhood': 'Islington Avenue'}, {'PostalCode': 'M1B', 'Borough': 'Scarborough', 'Neighborhood': 'Malvern, Rouge'}, {'PostalCode': 'M3B', 'Borough': 'North York', 'Neighborhood': 'Don Mills North'}, {'PostalCode': 'M4B', 'Borough': 'East York', 'Neighborhood': 'Parkview Hill, Woodbine Gardens'}, {'PostalCode': 'M5B', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Garden District, Ryerson'}, {'PostalCode': 'M6B', 'Borough': 'North York', 'Neighborhood': 'Glencairn'}, {'PostalCode': 'M9B', 'Borough': 'Etobicoke', 'Neighborhood': 'West Deane Park, Princess Gardens, Martin Grove, Islington, Cloverdale'}, {'PostalCode': 'M1C', 'Borough': 'Scarborough', 'Neighborhood': 'Rouge Hill, Port Union, Highland Creek'}, {'PostalCode': 'M3C', 'Borough': 'North York', 'Neighborhood': 'Don Mills South'}, {'PostalCode': 'M4C', 'Borough': 'East York', 'Neighborhood': 'Woodbine Heights'}, {'PostalCode': 'M5C', 'Borough': 'Downtown Toronto', 'Neighborhood': 'St. James Town'}, {'PostalCode': 'M6C', 'Borough': 'York', 'Neighborhood': 'Humewood-Cedarvale'}, {'PostalCode': 'M9C', 'Borough': 'Etobicoke', 'Neighborhood': 'Eringate, Bloordale Gardens, Old Burnhamthorpe, Markland Wood'}, {'PostalCode': 'M1E', 'Borough': 'Scarborough', 'Neighborhood': 'Guildwood, Morningside, West Hill'}, {'PostalCode': 'M4E', 'Borough': 'East Toronto', 'Neighborhood': 'The Beaches'}, {'PostalCode': 'M5E', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Berczy Park'}, {'PostalCode': 'M6E', 'Borough': 'York', 'Neighborhood': 'Caledonia-Fairbanks'}, {'PostalCode': 'M1G', 'Borough': 'Scarborough', 'Neighborhood': 'Woburn'}, {'PostalCode': 'M4G', 'Borough': 'East York', 'Neighborhood': 'Leaside'}, {'PostalCode': 'M5G', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Central Bay Street'}, {'PostalCode': 'M6G', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Christie'}, {'PostalCode': 'M1H', 'Borough': 'Scarborough', 'Neighborhood': 'Cedarbrae'}, {'PostalCode': 'M2H', 'Borough': 'North York', 'Neighborhood': 'Hillcrest Village'}, {'PostalCode': 'M3H', 'Borough': 'North York', 'Neighborhood': 'Bathurst Manor, Wilson Heights, Downsview North'}, {'PostalCode': 'M4H', 'Borough': 'East York', 'Neighborhood': 'Thorncliffe Park'}, {'PostalCode': 'M5H', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Richmond, Adelaide, King'}, {'PostalCode': 'M6H', 'Borough': 'West Toronto', 'Neighborhood': 'Dufferin, Dovercourt Village'}, {'PostalCode': 'M1J', 'Borough': 'Scarborough', 'Neighborhood': 'Scarborough Village'}, {'PostalCode': 'M2J', 'Borough': 'North York', 'Neighborhood': 'Fairview, Henry Farm, Oriole'}, {'PostalCode': 'M3J', 'Borough': 'North York', 'Neighborhood': 'Northwood Park, York University'}, {'PostalCode': 'M4J', 'Borough': 'East YorkEast Toronto', 'Neighborhood': 'The Danforth East'}, {'PostalCode': 'M5J', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Harbourfront East, Union Station, Toronto Islands'}, {'PostalCode': 'M6J', 'Borough': 'West Toronto', 'Neighborhood': 'Little Portugal, Trinity'}, {'PostalCode': 'M1K', 'Borough': 'Scarborough', 'Neighborhood': 'Kennedy Park, Ionview, East Birchmount Park'}, {'PostalCode': 'M2K', 'Borough': 'North York', 'Neighborhood': 'Bayview Village'}, {'PostalCode': 'M3K', 'Borough': 'North York', 'Neighborhood': 'Downsview East'}, {'PostalCode': 'M4K', 'Borough': 'East Toronto', 'Neighborhood': 'The Danforth West, Riverdale'}, {'PostalCode': 'M5K', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Toronto Dominion Centre, Design Exchange'}, {'PostalCode': 'M6K', 'Borough': 'West Toronto', 'Neighborhood': 'Brockton, Parkdale Village, Exhibition Place'}, {'PostalCode': 'M1L', 'Borough': 'Scarborough', 'Neighborhood': 'Golden Mile, Clairlea, Oakridge'}, {'PostalCode': 'M2L', 'Borough': 'North York', 'Neighborhood': 'York Mills, Silver Hills'}, {'PostalCode': 'M3L', 'Borough': 'North York', 'Neighborhood': 'Downsvie

w West'}, {'PostalCode': 'M4L', 'Borough': 'East Toronto', 'Neighborhood': 'India Bazaar, The Beaches West'}, {'PostalCode': 'M5L', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Commerce Court, Victoria Hotel'}, {'PostalCode': 'M6L', 'Borough': 'North York', 'Neighborhood': 'North Park, Maple Leaf Park, Upwood Park'}, {'PostalCode': 'M9L', 'Borough': 'North York', 'Neighborhood': 'Humber Summit'}, {'PostalCode': 'M1M', 'Borough': 'Scarborough', 'Neighborhood': 'Cliffside, Cliffcrest, Scarborough Village West'}, {'PostalCode': 'M2M', 'Borough': 'North York', 'Neighborhood': 'Willowdale, Newtonbrook'}, {'PostalCode': 'M3M', 'Borough': 'North York', 'Neighborhood': 'Downsview Central'}, {'PostalCode': 'M4M', 'Borough': 'East Toronto', 'Neighborhood': 'Studio District'}, {'PostalCode': 'M5M', 'Borough': 'North York', 'Neighborhood': 'Bedford Park, Lawrence Manor East'}, {'PostalCode': 'M6M', 'Borough': 'York', 'Neighborhood': 'Del Ray, Mount Dennis, Keelsdale and Silverthorn'}, {'PostalCode': 'M9M', 'Borough': 'North York', 'Neighborhood': 'Humberlea, Emery'}, {'PostalCode': 'M1N', 'Borough': 'Scarborough', 'Neighborhood': 'Birch Cliff, Cliffside West'}, {'PostalCode': 'M2N', 'Borough': 'North York', 'Neighborhood': 'Willowdale South'}, {'PostalCode': 'M3N', 'Borough': 'North York', 'Neighborhood': 'Downsview Northwest'}, {'PostalCode': 'M4N', 'Borough': 'Central Toronto', 'Neighborhood': 'Lawrence Park'}, {'PostalCode': 'M5N', 'Borough': 'Central Toronto', 'Neighborhood': 'Roselawn'}, {'PostalCode': 'M6N', 'Borough': 'York', 'Neighborhood': 'Runnymede, The Junction North'}, {'PostalCode': 'M9N', 'Borough': 'York', 'Neighborhood': 'Weston'}, {'PostalCode': 'M1P', 'Borough': 'Scarborough', 'Neighborhood': 'Dorset Park, Wexford Heights, Scarborough Town Centre'}, {'PostalCode': 'M2P', 'Borough': 'North York', 'Neighborhood': 'York Mills West'}, {'PostalCode': 'M4P', 'Borough': 'Central Toronto', 'Neighborhood': 'Davisville North'}, {'PostalCode': 'M5P', 'Borough': 'Central Toronto', 'Neighborhood': 'Forest Hill North & West'}, {'PostalCode': 'M6P', 'Borough': 'West Toronto', 'Neighborhood': 'High Park, The Junction South'}, {'PostalCode': 'M9P', 'Borough': 'Etobicoke', 'Neighborhood': 'Westmount'}, {'PostalCode': 'M1R', 'Borough': 'Scarborough', 'Neighborhood': 'Wexford, Maryvale'}, {'PostalCode': 'M2R', 'Borough': 'North York', 'Neighborhood': 'Willowdale West'}, {'PostalCode': 'M4R', 'Borough': 'Central Toronto', 'Neighborhood': 'North Toronto West'}, {'PostalCode': 'M5R', 'Borough': 'Central Toronto', 'Neighborhood': 'The Annex, North Midtown, Yorkville'}, {'PostalCode': 'M6R', 'Borough': 'West Toronto', 'Neighborhood': 'Parkdale, Roncesvalles'}, {'PostalCode': 'M7R', 'Borough': 'MississaugaCanada Post Gateway Processing Centre', 'Neighborhood': 'Enclave of L4W'}, {'PostalCode': 'M9R', 'Borough': 'Etobicoke', 'Neighborhood': 'Kingsview Village, St. Phillips, Martin Grove Gardens, Richview Gardens'}, {'PostalCode': 'M1S', 'Borough': 'Scarborough', 'Neighborhood': 'Agincourt'}, {'PostalCode': 'M4S', 'Borough': 'Central Toronto', 'Neighborhood': 'Davisville'}, {'PostalCode': 'M5S', 'Borough': 'Downtown Toronto', 'Neighborhood': 'University of Toronto, Harbord'}, {'PostalCode': 'M6S', 'Borough': 'West Toronto', 'Neighborhood': 'Runnymede, Swansea'}, {'PostalCode': 'M1T', 'Borough': 'Scarborough', 'Neighborhood': "Clarks Corners, Tam O'Shanter, Sullivan"}, {'PostalCode': 'M4T', 'Borough': 'Central Toronto', 'Neighborhood': 'Moore Park, Summerhill East'}, {'PostalCode': 'M5T', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Kensington Market, Chinatown, Grange Park'}, {'PostalCode': 'M1V', 'Borough': 'Scarborough', 'Neighborhood': "Milliken, Agincourt North, Steeles East, L'Amoreaux East"}, {'PostalCode': 'M4V', 'Borough': 'Central Toronto', 'Neighborhood': 'Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park'}, {'PostalCode': 'M5V', 'Borough': 'Downtown Toronto', 'Neighborhood': 'CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Quay, South Niagara, Island airport'}, {'PostalCode': 'M8V', 'Borough': 'Etobicoke', 'Neighborhood': 'New Toronto, Mimico South, Humber Bay Shores'}, {'PostalCode': 'M9V', 'Borough': 'Etobicoke', 'Neighborhood': 'South Steeles, Silverstone, Humbergate, Jamestown, Mount Olive, Beaumond Heights, Thistletown, Albion Gardens'}, {'PostalCode': 'M1W',

```
      'Borough': 'Scarborough', 'Neighborhood': "Steeles West, L'Amoreaux West"},
      {'PostalCode': 'M4W', 'Borough': 'Downtown Toronto', 'Neighborhood': 'Rosedal
      e'}, {'PostalCode': 'M5W', 'Borough': 'Downtown TorontoStn A PO Boxes25 The E
      splanade', 'Neighborhood': 'Enclave of M5E'}, {'PostalCode': 'M8W', 'Boroug
      h': 'Etobicoke', 'Neighborhood': 'Alderwood, Long Branch'}, {'PostalCode': 'M
      9W', 'Borough': 'EtobicokeNorthwest', 'Neighborhood': 'Clairville, Humberwoo
      d, Woodbine Downs, West Humber, Kipling Heights, Rexdale, Elms, Tandridge, Ol
      d Rexdale'}, {'PostalCode': 'M1X', 'Borough': 'Scarborough', 'Neighborhood':
      'Upper Rouge'}, {'PostalCode': 'M4X', 'Borough': 'Downtown Toronto', 'Neighbo
      rhood': 'St. James Town, Cabbagetown'}, {'PostalCode': 'M5X', 'Borough': 'Dow
      ntown Toronto', 'Neighborhood': 'First Canadian Place, Underground city'},
      {'PostalCode': 'M8X', 'Borough': 'Etobicoke', 'Neighborhood': 'The Kingsway,
      Montgomery Road, Old Mill North'}, {'PostalCode': 'M4Y', 'Borough': 'Downtown
      Toronto', 'Neighborhood': 'Church and Wellesley'}, {'PostalCode': 'M7Y', 'Bor
      ough': 'East TorontoBusiness reply mail Processing Centre969 Eastern', 'Neigh
      borhood': 'Enclave of M4L'}, {'PostalCode': 'M8Y', 'Borough': 'Etobicoke', 'N
      eighborhood': "Old Mill South, King's Mill Park, Sunnylea, Humber Bay, Mimico
      NE, The Queensway East, Royal York South East, Kingsway Park South East"},
      {'PostalCode': 'M8Z', 'Borough': 'Etobicoke', 'Neighborhood': 'Mimico NW, The
      Queensway West, South of Bloor, Kingsway Park South West, Royal York South We
      st'}]
```

In [274]: `df.shape`

Out[274]: `(103, 3)`

In [275]:
```python
import geocoder # import geocoder
```

In [276]: `df['PostalCode']`

Out[276]:
```
0        M3A
1        M4A
2        M5A
3        M6A
4        M7A
        ...
98       M8X
99       M4Y
100      M7Y
101      M8Y
102      M8Z
Name: PostalCode, Length: 103, dtype: object
```

In [277]:
```python
url2='https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBMDe
veloperSkillsNetwork-DS0701EN-SkillsNetwork/labs_v1/Geospatial_Coordinates.cs
v'
```

```
In [278]: df2=pd.read_csv(url2)
          df2.head()
```

Out[278]:

	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 [279]: df2 = df2.rename(columns={"Postal Code":"PostalCode"})
```

```
In [280]: df2.head()
```

Out[280]:

	PostalCode	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 [281]: df.head()
```

Out[281]:

	PostalCode	Borough	Neighborhood
0	M3A	North York	Parkwoods
1	M4A	North York	Victoria Village
2	M5A	Downtown Toronto	Regent Park, Harbourfront
3	M6A	North York	Lawrence Manor, Lawrence Heights
4	M7A	Queen's Park	Ontario Provincial Government

```
In [282]: df.set_index('PostalCode', inplace=True)
```

```
In [283]: df2.set_index('PostalCode', inplace=True)
```

```
In [284]: df_merged = df.join(df2, how='left')
```

```
In [285]: df_merged.head()
```

Out[285]:

PostalCode	Borough	Neighborhood	Latitude	Longitude
M3A	North York	Parkwoods	43.753259	-79.329656
M4A	North York	Victoria Village	43.725882	-79.315572
M5A	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
M6A	North York	Lawrence Manor, Lawrence Heights	43.718518	-79.464763
M7A	Queen's Park	Ontario Provincial Government	43.662301	-79.389494

```
In [286]: neighborhoods=df_merged
```

```
In [287]: print('The dataframe has {} boroughs and {} neighborhoods.'.format(
              len(neighborhoods['Borough'].unique()),
              neighborhoods.shape[0]
          )
          )
```

```
The dataframe has 15 boroughs and 103 neighborhoods.
```

```
In [288]: import folium
          from geopy.geocoders import Nominatim
```

```
In [289]: address = 'Toronto, CA'

          geolocator = Nominatim(user_agent="toronto_expoler")
          location = geolocator.geocode(address)
          latitude = location.latitude
          longitude = location.longitude
          print('The geograpical coordinate of Toronto are {}, {}.'.format(latitude, lon
          gitude))
```

```
The geograpical coordinate of Toronto are 43.6534817, -79.3839347.
```

```
In [290]:   # create map of New York using latitude and longitude values
            map_toronto = folium.Map(location=[latitude, longitude], zoom_start=10)

            # add markers to map
            for lat, lng, borough, neighborhood in zip(neighborhoods['Latitude'], neighbor
            hoods['Longitude'], neighborhoods['Borough'], neighborhoods['Neighborhood']):
                label = '{}, {}'.format(neighborhood, borough)
                label = folium.Popup(label, parse_html=True)
                folium.CircleMarker(
                    [lat, lng],
                    radius=5,
                    popup=label,
                    color='blue',
                    fill=True,
                    fill_color='#3186cc',
                    fill_opacity=0.7,
                    parse_html=False).add_to(map_toronto)

            map_toronto
```

Out[290]:
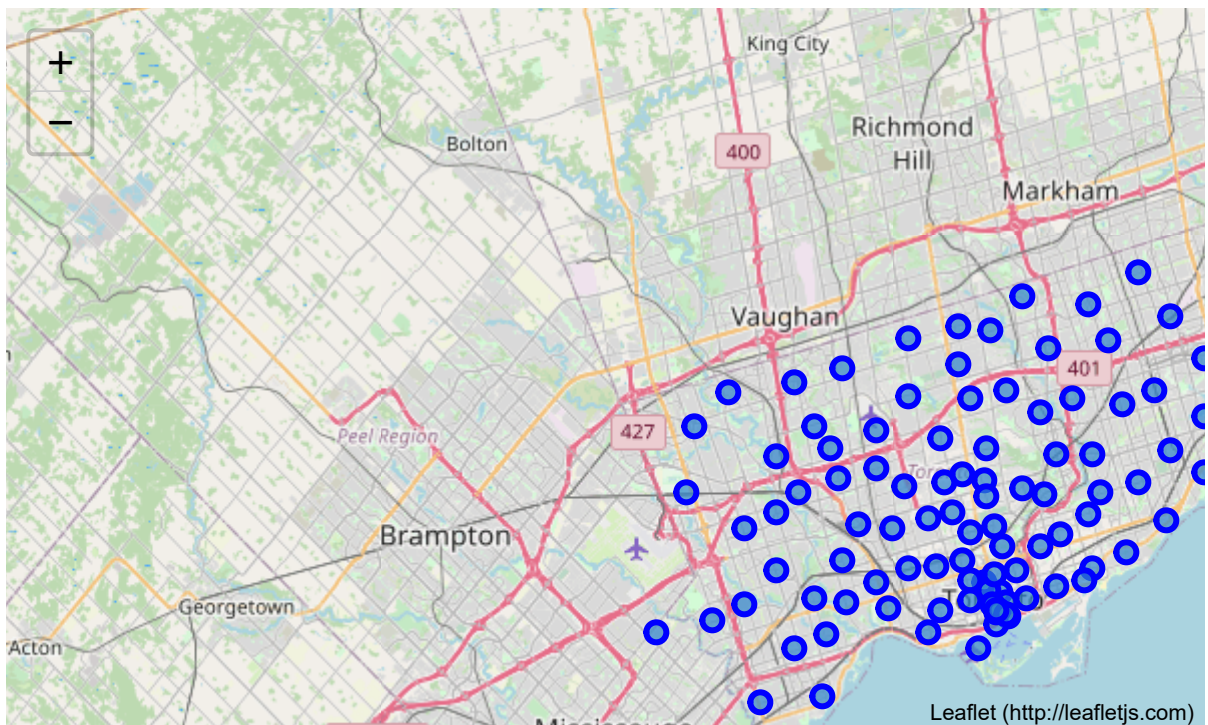
```
In [291]: toronto_data = neighborhoods[neighborhoods['Borough'].str.contains('Toronto')]
          .reset_index(drop=True)
          toronto_data.head()
```

Out[291]:

	Borough	Neighborhood	Latitude	Longitude
0	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636
1	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937
2	Downtown Toronto	St. James Town	43.651494	-79.375418
3	East Toronto	The Beaches	43.676357	-79.293031
4	Downtown Toronto	Berczy Park	43.644771	-79.373306

```
In [292]: toronto_data.shape
```

Out[292]: (39, 4)

```
In [293]: address = 'Toronto, CA'

          geolocator = Nominatim(user_agent="toronto_explorer")
          location = geolocator.geocode(address)
          latitude = location.latitude
          longitude = location.longitude
          print('The geograpical coordinate of Toronto are {}, {}.'.format(latitude, lon
          gitude))
```

The geograpical coordinate of Toronto are 43.6534817, -79.3839347.

```
In [294]:  # create map of Manhattan using latitude and longitude values
           map_toronto2 = folium.Map(location=[latitude, longitude], zoom_start=11)

           # add markers to map
           for lat, lng, label in zip(toronto_data['Latitude'], toronto_data['Longitude'
           ], toronto_data['Neighborhood']):
               label = folium.Popup(label, parse_html=True)
               folium.CircleMarker(
                   [lat, lng],
                   radius=5,
                   popup=label,
                   color='blue',
                   fill=True,
                   fill_color='#3186cc',
                   fill_opacity=0.7,
                   parse_html=False).add_to(map_toronto2)

           map_toronto2
```
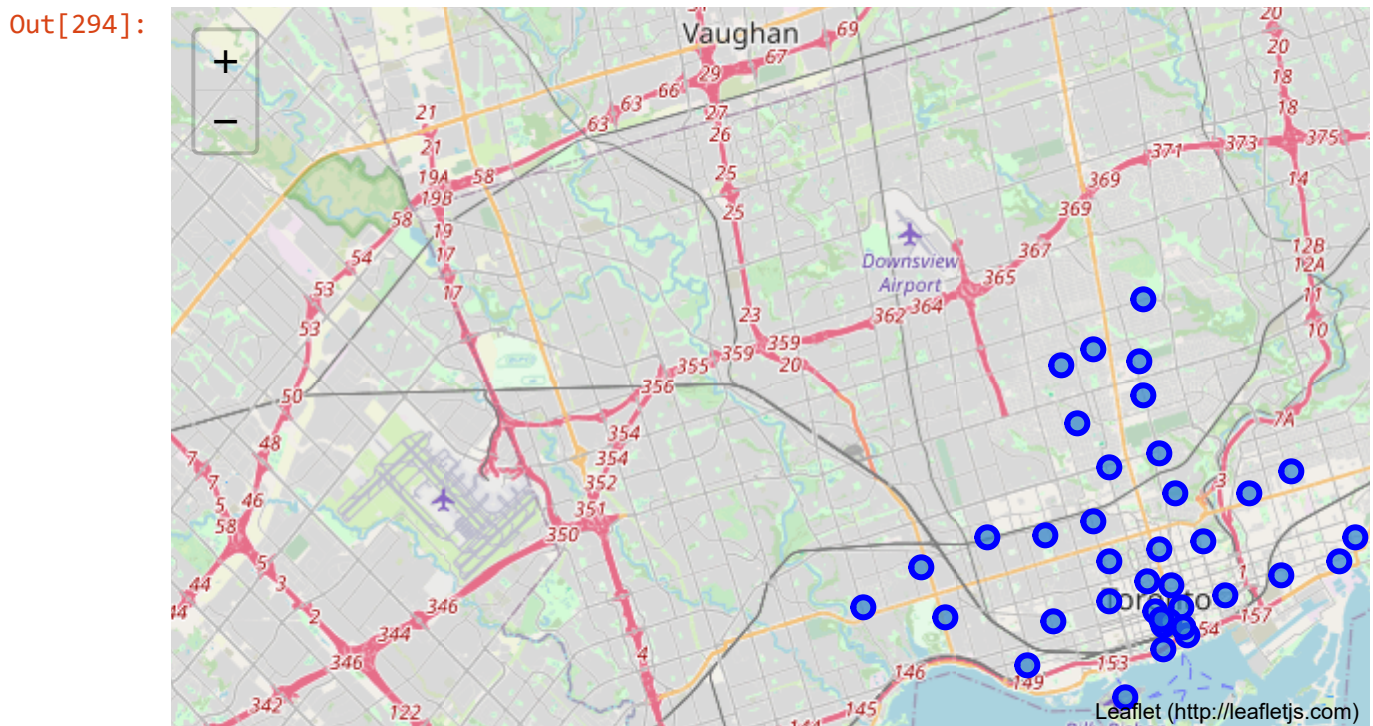
Out[294]:


```
In [295]:  toronto_data.loc[0, 'Neighborhood']
```

Out[295]: 'Regent Park, Harbourfront'

In [296]:
```python
neighborhood_latitude = toronto_data.loc[0, 'Latitude'] # neighborhood latitude value
neighborhood_longitude = toronto_data.loc[0, 'Longitude'] # neighborhood longitude value

neighborhood_name = toronto_data.loc[0, 'Neighborhood'] # neighborhood name

print('Latitude and longitude values of {} are {}, {}.'.format(neighborhood_name,
                                                                neighborhood_latitude,
                                                                neighborhood_longitude))
```

Latitude and longitude values of Regent Park, Harbourfront are 43.6542599, -79.3606359.

In [297]:
```python
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
```

Out[297]: 'https://api.foursquare.com/v2/venues/explore?&client_id=U15IH31SPJWMOVTCUXZ4EDSNQDLYBQJKQVJ13MLJXPGVLISQ&client_secret=NPRYGUQVHRM0TH5JA2DNLQS1YEOVUFHFHML4ZQUN0G54GZ4P&v=20180605&ll=43.6542599,-79.3606359&radius=500&limit=100'

```
In [298]:  results = requests.get(url).json()
           results
```

Out[298]: {'meta': {'code': 200, 'requestId': '610080bf4102f778eaff4b0f'},
          'response': {'suggestedFilters': {'header': 'Tap to show:',
            'filters': [{'name': 'Open now', 'key': 'openNow'}]},
           'headerLocation': 'Corktown',
           'headerFullLocation': 'Corktown, Toronto',
           'headerLocationGranularity': 'neighborhood',
           'totalResults': 44,
           'suggestedBounds': {'ne': {'lat': 43.6587599045, 'lng': -79.3544279001486},
            'sw': {'lat': 43.6497598955, 'lng': -79.36684389985142}},
           'groups': [{'type': 'Recommended Places',
             'name': 'recommended',
             'items': [{'reasons': {'count': 0,
                'items': [{'summary': 'This spot is popular',
                  'type': 'general',
                  'reasonName': 'globalInteractionReason'}]},
               'venue': {'id': '54ea41ad498e9a11e9e13308',
                'name': 'Roselle Desserts',
                'location': {'address': '362 King St E',
                 'crossStreet': 'Trinity St',
                 'lat': 43.653446723052674,
                 'lng': -79.3620167174383,
                 'labeledLatLngs': [{'label': 'display',
                   'lat': 43.653446723052674,
                   'lng': -79.3620167174383}],
                 'distance': 143,
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                'reasonName': 'globalInteractionReason'}]},
             'venue': {'id': '4ad8d551f964a5201f1521e3',
              'name': 'Vistek',
              'location': {'address': '496 Queen St E',

                    'crossStreet': 'at Sumach',
                    'lat': 43.65704640025721,
                    'lng': -79.35966695607046,
                    'labeledLatLngs': [{'label': 'display',
                      'lat': 43.65704640025721,
                      'lng': -79.35966695607046}],
                    'distance': 319,
                    'cc': 'CA',
                    'city': 'Toronto',
                    'state': 'ON',
                    'country': 'Canada',
                    'formattedAddress': ['496 Queen St E (at Sumach)',
                     'Toronto ON',
                     'Canada']},
                   'categories': [{'id': '4bf58dd8d48988d122951735',
                     'name': 'Electronics Store',
                     'pluralName': 'Electronics Stores',
                     'shortName': 'Electronics',
                     'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/tec
hnology_',
                      'suffix': '.png'},
                     'primary': True}],
                   'photos': {'count': 0, 'groups': []}},
                  'referralId': 'e-0-4ad8d551f964a5201f1521e3-36'},
                 {'reasons': {'count': 0,
                   'items': [{'summary': 'This spot is popular',
                     'type': 'general',
                     'reasonName': 'globalInteractionReason'}]},
                  'venue': {'id': '4af21e78f964a520fae521e3',
                   'name': 'Arta Gallery',
                   'location': {'address': '14 Distillery Lane',
                    'crossStreet': 'Distillery District',
                    'lat': 43.650022181882065,
                    'lng': -79.36122168476822,
                    'labeledLatLngs': [{'label': 'display',
                      'lat': 43.650022181882065,
                      'lng': -79.36122168476822}],
                    'distance': 474,
                    'postalCode': 'M5A 3C4',
                    'cc': 'CA',
                    'city': 'Toronto',
                    'state': 'ON',
                    'country': 'Canada',
                    'formattedAddress': ['14 Distillery Lane (Distillery District)',
                     'Toronto ON M5A 3C4',
                     'Canada']},
                   'categories': [{'id': '4bf58dd8d48988d1e2931735',
                     'name': 'Art Gallery',
                     'pluralName': 'Art Galleries',
                     'shortName': 'Art Gallery',
                     'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/arts_ente
rtainment/artgallery_',
                      'suffix': '.png'},
                     'primary': True}],
                   'photos': {'count': 0, 'groups': []}},
                  'referralId': 'e-0-4af21e78f964a520fae521e3-37'},
                 {'reasons': {'count': 0,

        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4d126fd3d1848cfad5cfbb71',
       'name': 'TD Canada Trust',
       'location': {'address': '457 Front Street East',
        'lat': 43.652779762702764,
        'lng': -79.3563362625656,
        'labeledLatLngs': [{'label': 'display',
          'lat': 43.652779762702764,
          'lng': -79.3563362625656}],
        'distance': 383,
        'postalCode': 'M5A 0J2',
        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['457 Front Street East',
         'Toronto ON M5A 0J2',
         'Canada']},
       'categories': [{'id': '4bf58dd8d48988d10a951735',
         'name': 'Bank',
         'pluralName': 'Banks',
         'shortName': 'Bank',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fin
ancial_',
          'suffix': '.png'},
         'primary': True}],
       'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4d126fd3d1848cfad5cfbb71-38'},
     {'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4b2cf78cf964a52077cb24e3',
       'name': 'Savoury Grounds',
       'location': {'address': '481 Queen St. East',
        'crossStreet': 'Sumach St',
        'lat': 43.656820970004496,
        'lng': -79.3589698353747,
        'labeledLatLngs': [{'label': 'display',
          'lat': 43.656820970004496,
          'lng': -79.3589698353747}],
        'distance': 315,
        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['481 Queen St. East (Sumach St)',
         'Toronto ON',
         'Canada']},
       'categories': [{'id': '4bf58dd8d48988d1e0931735',
         'name': 'Coffee Shop',
         'pluralName': 'Coffee Shops',
         'shortName': 'Coffee Shop',
         'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/coff
eeshop_',

                       'suffix': '.png'},
                      'primary': True}],
                  'photos': {'count': 0, 'groups': []}},
                'referralId': 'e-0-4b2cf78cf964a52077cb24e3-39'},
             {'reasons': {'count': 0,
                'items': [{'summary': 'This spot is popular',
                   'type': 'general',
                   'reasonName': 'globalInteractionReason'}]},
              'venue': {'id': '4b8acdfdf964a520378232e3',
                 'name': 'The Beer Store',
                 'location': {'address': '28 River Street',
                  'crossStreet': 'Queen St E',
                  'lat': 43.657773,
                  'lng': -79.3574632,
                  'labeledLatLngs': [{'label': 'display',
                     'lat': 43.657773,
                     'lng': -79.3574632}],
                  'distance': 467,
                  'postalCode': 'M5A 3N9',
                  'cc': 'CA',
                  'city': 'Toronto',
                  'state': 'ON',
                  'country': 'Canada',
                  'formattedAddress': ['28 River Street (Queen St E)',
                   'Toronto ON M5A 3N9',
                   'Canada']},
                 'categories': [{'id': '5370f356bcbc57f1066c94c2',
                    'name': 'Beer Store',
                    'pluralName': 'Beer Stores',
                    'shortName': 'Beer Store',
                    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/nightlif
       e/beergarden_',
                     'suffix': '.png'},
                    'primary': True}],
                  'photos': {'count': 0, 'groups': []}},
                'referralId': 'e-0-4b8acdfdf964a520378232e3-40'},
             {'reasons': {'count': 0,
                'items': [{'summary': 'This spot is popular',
                   'type': 'general',
                   'reasonName': 'globalInteractionReason'}]},
              'venue': {'id': '5f5e9e92fd233501367b169c',
                 'name': 'Kibo Sushi House 希',
                 'location': {'address': 'Unit 3, 146 Sumach St',
                  'crossStreet': 'at Shuter St',
                  'lat': 43.658522,
                  'lng': -79.359717,
                  'labeledLatLngs': [{'label': 'display',
                     'lat': 43.658522,
                     'lng': -79.359717}],
                  'distance': 480,
                  'postalCode': 'M5A 0P7',
                  'cc': 'CA',
                  'city': 'Toronto',
                  'state': 'ON',
                  'country': 'Canada',
                  'formattedAddress': ['Unit 3, 146 Sumach St (at Shuter St)',
                   'Toronto ON M5A 0P7',

              'Canada']},
            'categories': [{'id': '4bf58dd8d48988d1d2941735',
              'name': 'Sushi Restaurant',
              'pluralName': 'Sushi Restaurants',
              'shortName': 'Sushi',
              'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/sush
i_',
              'suffix': '.png'},
              'primary': True}],
            'photos': {'count': 0, 'groups': []}},
          'referralId': 'e-0-5f5e9e92fd233501367b169c-41'},
        {'reasons': {'count': 0,
          'items': [{'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]},
         'venue': {'id': '579cc5f2498e0fe8397deebb',
          'name': 'GW General',
          'location': {'lat': 43.650495,
           'lng': -79.357538,
           'labeledLatLngs': [{'label': 'display',
             'lat': 43.650495,
             'lng': -79.357538}],
           'distance': 487,
           'cc': 'CA',
           'country': 'Canada',
           'formattedAddress': ['Canada']},
          'categories': [{'id': '4bf58dd8d48988d116951735',
            'name': 'Antique Shop',
            'pluralName': 'Antique Shops',
            'shortName': 'Antiques',
            'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/ant
ique_',
            'suffix': '.png'},
            'primary': True}],
          'photos': {'count': 0, 'groups': []}},
         'referralId': 'e-0-579cc5f2498e0fe8397deebb-42'},
        {'reasons': {'count': 0,
          'items': [{'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]},
         'venue': {'id': '4dffdf2152b10e7477991327',
          'name': 'Sumach-Shuter Parkette',
          'location': {'address': '48 Shuter St.',
           'crossStreet': 'at River St.',
           'lat': 43.65848972987893,
           'lng': -79.35869192148257,
           'labeledLatLngs': [{'label': 'display',
             'lat': 43.65848972987893,
             'lng': -79.35869192148257}],
           'distance': 496,
           'postalCode': 'M5A 1X9',
           'cc': 'CA',
           'city': 'Toronto',
           'state': 'ON',
           'country': 'Canada',
           'formattedAddress': ['48 Shuter St. (at River St.)',
            'Toronto ON M5A 1X9',

```
            'Canada']},
         'categories': [{'id': '4bf58dd8d48988d1e7941735',
          'name': 'Playground',
          'pluralName': 'Playgrounds',
          'shortName': 'Playground',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/parks_out
    doors/playground_',
            'suffix': '.png'},
          'primary': True}],
         'photos': {'count': 0, 'groups': []}},
         'referralId': 'e-0-4dffdf2152b10e7477991327-43'}]}]}}
```

In [299]:
```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 [300]:
```python
from pandas.io.json import json_normalize # tranform JSON file into a pandas d
ataframe

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

```
In [301]:  venues = results['response']['groups'][0]['items']

           nearby_venues = json_normalize(venues) # flatten JSON

           # filter columns
           filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'v
           enue.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, axi
           s=1)

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

           nearby_venues.head()
```

```
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages/ipykernel_laun
cher.py:3: FutureWarning: pandas.io.json.json_normalize is deprecated, use pa
ndas.json_normalize instead
  This is separate from the ipykernel package so we can avoid doing imports u
ntil
```

Out[301]:

	name	categories	lat	lng
0	Roselle Desserts	Bakery	43.653447	-79.362017
1	Tandem Coffee	Coffee Shop	43.653559	-79.361809
2	Cooper Koo Family YMCA	Distribution Center	43.653249	-79.358008
3	Impact Kitchen	Restaurant	43.656369	-79.356980
4	Body Blitz Spa East	Spa	43.654735	-79.359874

```
In [302]:  print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))
```

```
44 venues were returned by Foursquare.
```

```
In [303]: 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={}&clie
          nt_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 = ['Neighborhood',
                            'Neighborhood Latitude',
                            'Neighborhood Longitude',
                            'Venue',
                            'Venue Latitude',
                            'Venue Longitude',
                            'Venue Category']
              return(nearby_venues)
```

```
In [304]:  toronto_venues = getNearbyVenues(names=toronto_data['Neighborhood'],
                                             latitudes=toronto_data['Latitude'],
                                             longitudes=toronto_data['Longitude']
                                             )
```

Regent Park, Harbourfront
Garden District, Ryerson
St. James Town
The Beaches
Berczy Park
Central Bay Street
Christie
Richmond, Adelaide, King
Dufferin, Dovercourt Village
The Danforth East
Harbourfront East, Union Station, Toronto Islands
Little Portugal, Trinity
The Danforth West, Riverdale
Toronto Dominion Centre, Design Exchange
Brockton, Parkdale Village, Exhibition Place
India Bazaar, The Beaches West
Commerce Court, Victoria Hotel
Studio District
Lawrence Park
Roselawn
Davisville North
Forest Hill North & West
High Park, The Junction South
North Toronto West
The Annex, North Midtown, Yorkville
Parkdale, Roncesvalles
Davisville
University of Toronto, Harbord
Runnymede, Swansea
Moore Park, Summerhill East
Kensington Market, Chinatown, Grange Park
Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park
CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Quay,
South Niagara, Island airport
Rosedale
Enclave of M5E
St. James Town, Cabbagetown
First Canadian Place, Underground city
Church and Wellesley
Enclave of M4L
```

```
In [306]: print(toronto_venues.shape)
          toronto_venues.head()
```

(1601, 7)

Out[306]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Regent Park, Harbourfront	43.65426	-79.360636	Roselle Desserts	43.653447	-79.362017	Bakery
1	Regent Park, Harbourfront	43.65426	-79.360636	Tandem Coffee	43.653559	-79.361809	Coffee Shop
2	Regent Park, Harbourfront	43.65426	-79.360636	Cooper Koo Family YMCA	43.653249	-79.358008	Distribution Center
3	Regent Park, Harbourfront	43.65426	-79.360636	Impact Kitchen	43.656369	-79.356980	Restaurant
4	Regent Park, Harbourfront	43.65426	-79.360636	Body Blitz Spa East	43.654735	-79.359874	Spa

```
In [307]: toronto_venues.groupby('Neighborhood').count()
```

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Berczy Park	57	57	57	57	57	57
Brockton, Parkdale Village, Exhibition Place	23	23	23	23	23	23
CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Quay, South Niagara, Island airport	14	14	14	14	14	14
Central Bay Street	69	69	69	69	69	69
Christie	16	16	16	16	16	16
Church and Wellesley	80	80	80	80	80	80
Commerce Court, Victoria Hotel	100	100	100	100	100	100
Davisville	35	35	35	35	35	35
Davisville North	9	9	9	9	9	9
Dufferin, Dovercourt Village	16	16	16	16	16	16
Enclave of M4L	16	16	16	16	16	16
Enclave of M5E	97	97	97	97	97	97
First Canadian Place, Underground city	100	100	100	100	100	100
Forest Hill North & West	4	4	4	4	4	4
Garden District, Ryerson	100	100	100	100	100	100
Harbourfront East, Union Station, Toronto Islands	100	100	100	100	100	100
High Park, The Junction South	25	25	25	25	25	25
India Bazaar, The Beaches West	19	19	19	19	19	19
Kensington Market, Chinatown, Grange Park	65	65	65	65	65	65
Lawrence Park	5	5	5	5	5	5
Little Portugal, Trinity	42	42	42	42	42	42
Moore Park, Summerhill East	3	3	3	3	3	3
North Toronto West	22	22	22	22	22	22
Parkdale, Roncesvalles	14	14	14	14	14	14
Regent Park, Harbourfront	44	44	44	44	44	44
Richmond, Adelaide, King	100	100	100	100	100	100
Rosedale	4	4	4	4	4	4

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Roselawn	2	2	2	2	2	2
Runnymede, Swansea	32	32	32	32	32	32
St. James Town	87	87	87	87	87	87
St. James Town, Cabbagetown	47	47	47	47	47	47
Studio District	36	36	36	36	36	36
Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park	14	14	14	14	14	14
The Annex, North Midtown, Yorkville	21	21	21	21	21	21
The Beaches	4	4	4	4	4	4
The Danforth East	4	4	4	4	4	4
The Danforth West, Riverdale	42	42	42	42	42	42
Toronto Dominion Centre, Design Exchange	100	100	100	100	100	100
University of Toronto, Harbord	33	33	33	33	33	33

In [308]:
```python
print('There are {} uniques categories.'.format(len(toronto_venues['Venue Category'].unique())))
```

There are 237 uniques categories.

```
In [309]:   # 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[309]:

	Yoga Studio	Adult Boutique	Airport	Airport Food Court	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Antique Shop	Aquarium
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0

5 rows × 237 columns

```
In [310]:   toronto_onehot.shape
```

Out[310]:   (1601, 237)

```
In [311]: toronto_grouped = toronto_onehot.groupby('Neighborhood').mean().reset_index()
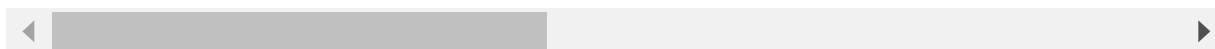          toronto_grouped
```

Out[311]:

	Neighborhood	Yoga Studio	Adult Boutique	Airport	Airport Food Court	Airport Lounge	Airport Service	Airport Terminal	Amer Restau
0	Berczy Park	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
1	Brockton, Parkdale Village, Exhibition Place	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
2	CN Tower, King and Spadina, Railway Lands, Har...	0.000000	0.0000	0.071429	0.071429	0.142857	0.071429	0.142857	0.00
3	Central Bay Street	0.014493	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
4	Christie	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
5	Church and Wellesley	0.025000	0.0125	0.000000	0.000000	0.000000	0.000000	0.000000	0.01
6	Commerce Court, Victoria Hotel	0.010000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.03
7	Davisville	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
8	Davisville North	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
9	Dufferin, Dovercourt Village	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
10	Enclave of M4L	0.062500	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
11	Enclave of M5E	0.010309	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.01
12	First Canadian Place, Underground city	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.03
13	Forest Hill North & West	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
14	Garden District, Ryerson	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
15	Harbourfront East, Union Station, Toronto Islands	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
16	High Park, The Junction South	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
17	India Bazaar, The Beaches West	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00

	Neighborhood	Yoga Studio	Adult Boutique	Airport	Airport Food Court	Airport Lounge	Airport Service	Airport Terminal	Amei Restat
18	Kensington Market, Chinatown, Grange Park	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
19	Lawrence Park	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
20	Little Portugal, Trinity	0.023810	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
21	Moore Park, Summerhill East	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
22	North Toronto West	0.045455	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
23	Parkdale, Roncesvalles	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
24	Regent Park, Harbourfront	0.022727	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
25	Richmond, Adelaide, King	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.02
26	Rosedale	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
27	Roselawn	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
28	Runnymede, Swansea	0.031250	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
29	St. James Town	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.02
30	St. James Town, Cabbagetown	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
31	Studio District	0.027778	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.05
32	Summerhill West, Rathnelly, South Hill, Forest...	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.07
33	The Annex, North Midtown, Yorkville	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
34	The Beaches	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
35	The Danforth East	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00
36	The Danforth West, Riverdale	0.023810	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.02
37	Toronto Dominion Centre, Design Exchange	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.02

	Neighborhood	Yoga Studio	Adult Boutique	Airport	Airport Food Court	Airport Lounge	Airport Service	Airport Terminal	Amer Restau
38	University of Toronto, Harbord	0.030303	0.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00

39 rows × 237 columns

```
In [312]:    num_top_venues = 5

             for hood in toronto_grouped['Neighborhood']:
                 print("----"+hood+"----")
                 temp = toronto_grouped[toronto_grouped['Neighborhood'] == hood].T.reset_in
             dex()
                 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).hea
             d(num_top_venues))
                 print('\n')
```

```
        ----Berczy Park----
            venue  freq
0   Cocktail Bar  0.05
1    Coffee Shop  0.05
2         Bakery  0.05
3    Cheese Shop  0.04
4     Restaurant  0.04


----Brockton, Parkdale Village, Exhibition Place----
            venue  freq
0            Café  0.13
1     Coffee Shop  0.09
2  Breakfast Spot  0.09
3       Pet Store  0.04
4   Burrito Place  0.04


----CN Tower, King and Spadina, Railway Lands, Harbourfront West, Bathurst Qu
ay, South Niagara, Island airport----
             venue  freq
0   Airport Lounge  0.14
1  Airport Terminal  0.14
2            Plane  0.07
3   Harbor / Marina  0.07
4     Boat or Ferry  0.07


----Central Bay Street----
                venue  freq
0         Coffee Shop  0.16
1      Sandwich Place  0.06
2                Café  0.06
3   Italian Restaurant  0.04
4  Japanese Restaurant  0.03


----Christie----
           venue  freq
0  Grocery Store  0.25
1           Café  0.19
2           Park  0.12
3      Nightclub  0.06
4    Coffee Shop  0.06


----Church and Wellesley----
                 venue  freq
0          Coffee Shop  0.08
1      Sushi Restaurant  0.06
2  Japanese Restaurant  0.06
3              Gay Bar  0.04
4           Restaurant  0.04


----Commerce Court, Victoria Hotel----
         venue   freq
```

```
0    Coffee Shop  0.14
1     Restaurant  0.07
2           Café  0.06
3          Hotel  0.06
4            Gym  0.04


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


    ----Davisville North----
                 venue  freq
0  Gym / Fitness Center  0.11
1      Food & Drink Shop  0.11
2         Sandwich Place  0.11
3       Department Store  0.11
4           Dance Studio  0.11


    ----Dufferin, Dovercourt Village----
                 venue  freq
0                Bakery  0.12
1              Pharmacy  0.12
2  Gym / Fitness Center  0.06
3                   Bar  0.06
4               Brewery  0.06


    ----Enclave of M4L----
             venue  freq
0     Yoga Studio  0.06
1  Auto Workshop  0.06
2     Skate Park  0.06
3     Restaurant  0.06
4    Pizza Place  0.06


    ----Enclave of M5E----
                 venue  freq
0           Coffee Shop  0.09
1     Italian Restaurant  0.04
2     Seafood Restaurant  0.04
3  Japanese Restaurant  0.03
4                 Hotel  0.03


    ----First Canadian Place, Underground city----
          venue  freq
0  Coffee Shop  0.10
1         Café  0.07
2        Hotel  0.06
```

```
3         Restaurant  0.04
4               Gym  0.04


    ----Forest Hill North & West----
                venue  freq
0               Trail  0.25
1       Jewelry Store  0.25
2            Bus Line  0.25
3     Sushi Restaurant  0.25
4        Yoga Studio  0.00


    ----Garden District, Ryerson----
                venue  freq
0         Coffee Shop  0.11
1      Clothing Store  0.09
2               Hotel  0.03
3      Cosmetics Shop  0.03
4     Bubble Tea Shop  0.03


    ----Harbourfront East, Union Station, Toronto Islands----
            venue  freq
0     Coffee Shop  0.13
1        Aquarium  0.05
2            Café  0.04
3           Hotel  0.04
4      Restaurant  0.03


    ----High Park, The Junction South----
                  venue  freq
0                  Café  0.08
1     Mexican Restaurant  0.08
2     Arts & Crafts Store  0.08
3        Thai Restaurant  0.08
4             Speakeasy  0.04


    ----India Bazaar, The Beaches West----
                venue  freq
0     Sushi Restaurant  0.05
1                  Pub  0.05
2              Brewery  0.05
3        Burrito Place  0.05
4      Fish & Chips Shop  0.05


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

```
        ----Lawrence Park----
                   venue  freq
0                   Park   0.2
1                   Lake   0.2
2  Dim Sum Restaurant   0.2
3               Bus Line   0.2
4            Swim School   0.2


        ----Little Portugal, Trinity----
                       venue  freq
0                       Bar   0.12
1  Vietnamese Restaurant   0.05
2                      Café   0.05
3                Restaurant   0.05
4              Men's Store   0.05


        ----Moore Park, Summerhill East----
                       venue  freq
0                      Park   0.33
1              Summer Camp   0.33
2              Tennis Court   0.33
3              Yoga Studio   0.00
4  Moroccan Restaurant   0.00


        ----North Toronto West----
                   venue  freq
0  Clothing Store   0.09
1      Coffee Shop   0.09
2      Yoga Studio   0.05
3             Café   0.05
4            Diner   0.05


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


        ----Regent Park, Harbourfront----
                   venue  freq
0      Coffee Shop   0.16
1            Bakery   0.07
2               Pub   0.07
3              Park   0.07
4  Breakfast Spot   0.05


        ----Richmond, Adelaide, King----
                   venue  freq
```

```
0        Coffee Shop  0.09
1              Café  0.05
2    Clothing Store  0.05
3             Hotel  0.04
4   Thai Restaurant  0.04


----Rosedale----
            venue  freq
0            Park  0.50
1      Playground  0.25
2           Trail  0.25
3     Yoga Studio  0.00
4   Movie Theater  0.00


----Roselawn----
                 venue  freq
0         Home Service   0.5
1               Garden   0.5
2          Yoga Studio   0.0
3          Music Venue   0.0
4   Martial Arts School   0.0


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


----St. James Town----
             venue  freq
0       Coffee Shop  0.07
1              Café  0.06
2    Clothing Store  0.03
3      Cocktail Bar  0.03
4            Bakery  0.03


----St. James Town, Cabbagetown----
                venue  freq
0         Coffee Shop  0.09
1          Restaurant  0.06
2                Café  0.06
3   Italian Restaurant  0.04
4         Pizza Place  0.04


----Studio District----
         venue  freq
0   Coffee Shop  0.08
1       Brewery  0.06
2     Gastropub  0.06
```

```
3          Café  0.06
4        Bakery  0.06



----Summerhill West, Rathnelly, South Hill, Forest Hill SE, Deer Park----
              venue  freq
0        Coffee Shop  0.14
1         Bagel Shop  0.07
2  Light Rail Station  0.07
3               Bank  0.07
4         Restaurant  0.07



----The Annex, North Midtown, Yorkville----
            venue  freq
0  Sandwich Place  0.14
1            Café  0.14
2     Coffee Shop  0.10
3  History Museum  0.05
4       BBQ Joint  0.05



----The Beaches----
               venue  freq
0   Health Food Store  0.25
1               Trail  0.25
2                 Pub  0.25
3         Yoga Studio  0.00
4  Miscellaneous Shop  0.00



----The Danforth  East----
                      venue  freq
0              Intersection  0.25
1          Convenience Store  0.25
2                       Park  0.25
3        Rental Car Location  0.25
4  Modern European Restaurant  0.00



----The Danforth West, Riverdale----
                 venue  freq
0      Greek Restaurant  0.17
1           Coffee Shop  0.07
2     Italian Restaurant  0.07
3  Furniture / Home Store  0.05
4        Ice Cream Shop  0.05



----Toronto Dominion Centre, Design Exchange----
              venue  freq
0        Coffee Shop  0.11
1              Hotel  0.07
2               Café  0.05
3         Restaurant  0.04
4  Seafood Restaurant  0.03
```

```
----University of Toronto, Harbord----
                  venue  freq
0                  Café  0.15
1        Sandwich Place  0.06
2                   Bar  0.06
3  Japanese Restaurant  0.06
4             Bookstore  0.06
```

In [313]:
```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]
```

In [314]:
```python
import numpy as np
```

```
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(toro
nto_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

Out[315]:

	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	8 C
0	Berczy Park	Bakery	Coffee Shop	Cocktail Bar	Seafood Restaurant	Beer Bar	Pharmacy	Restaurant	
1	Brockton, Parkdale Village, Exhibition Place	Café	Breakfast Spot	Coffee Shop	Gym	Bakery	Stadium	Burrito Place	Re
2	CN Tower, King and Spadina, Railway Lands, Har...	Airport Lounge	Airport Terminal	Boat or Ferry	Sculpture Garden	Airport	Airport Food Court	Airport Service	
3	Central Bay Street	Coffee Shop	Sandwich Place	Café	Italian Restaurant	Salad Place	Deli / Bodega	Restaurant	T
4	Christie	Grocery Store	Café	Park	Baby Store	Coffee Shop	Restaurant	Italian Restaurant	Atl

Cluster Neighborhoods

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

In [316]:
```python
# import k-means from clustering stage
from sklearn.cluster import KMeans
```

In [317]:
```python
# 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_clus
tering)

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

Out[317]: `array([2, 2, 2, 2, 2, 2, 2, 2, 2, 2], dtype=int32)`

In [318]:
```python
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

toronto_merged = toronto_data

# merge manhattan_grouped with manhattan_data to add latitude/longitude for ea
ch neighborhood
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.set_index('Ne
ighborhood'), on='Neighborhood')

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

Out[318]:

	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Co
0	Downtown Toronto	Regent Park, Harbourfront	43.654260	-79.360636	2	Coffee Shop	Park	Pub	
1	Downtown Toronto	Garden District, Ryerson	43.657162	-79.378937	2	Coffee Shop	Clothing Store	Hotel	Te
2	Downtown Toronto	St. James Town	43.651494	-79.375418	2	Coffee Shop	Café	Restaurant	
3	East Toronto	The Beaches	43.676357	-79.293031	2	Pub	Trail	Health Food Store	W
4	Downtown Toronto	Berczy Park	43.644771	-79.373306	2	Bakery	Coffee Shop	Cocktail Bar	S Res

In [319]:
```python
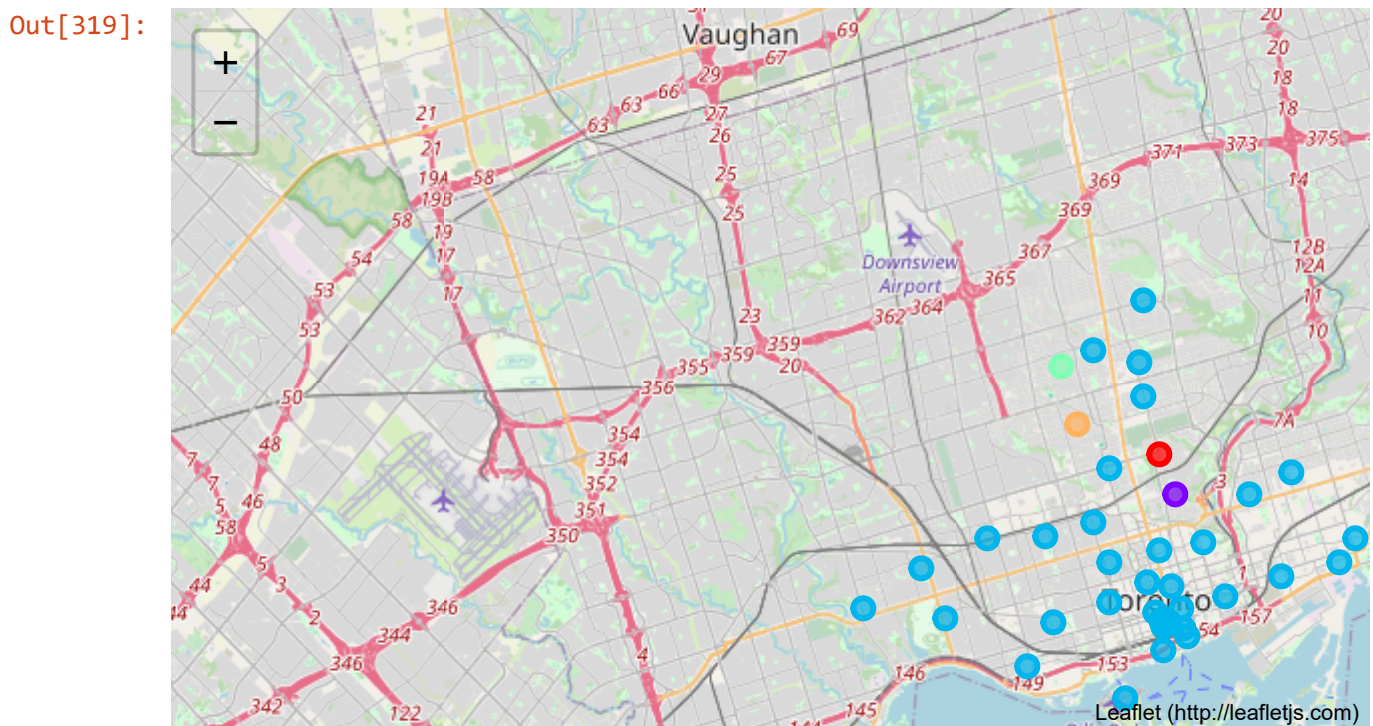# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# 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'], toronto_merged['Neighborhood'], toronto_merged['Cluster Labels'
]):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=Tru
e)
    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[319]:

In [ ]:

In [ ]: