

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
nv/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': 'Thornccliffe 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 York/East 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': 'Downsview'}]

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, Uppwood 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, Beaumont 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]: `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]: `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]:

	Borough	Neighborhood	Latitude	Longitude
PostalCode				
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_explorer")
          location = geolocator.geocode(address)
          latitude = location.latitude
          longitude = location.longitude
          print('The geographical coordinate of Toronto are {}, {}'.format(latitude, longitude))
```

The geographical coordinate of Toronto are 43.6534817, -79.3839347.


```

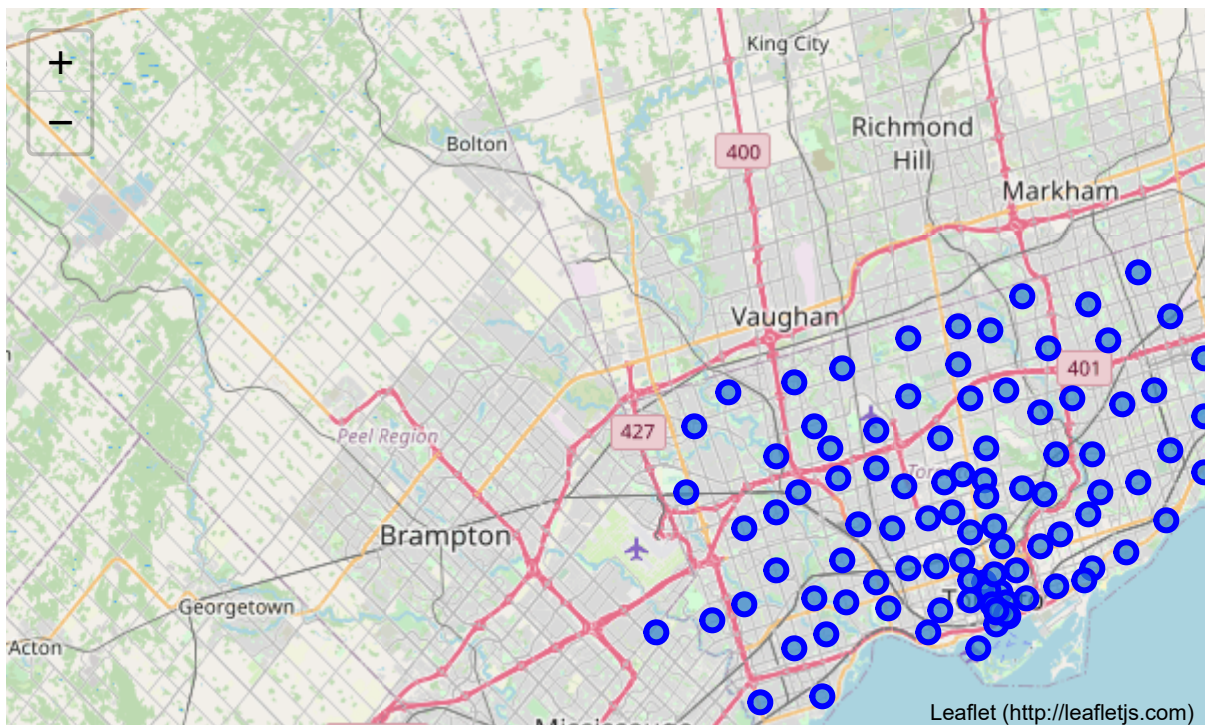
In [290]: # create map of New York using Latitude and Longitude values
map_toronto = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, neighborhood in zip(neighborhoods['Latitude'], neighborhoods['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, longitude))
```

The geograpical coordinate of Toronto are 43.6534817, -79.3839347.

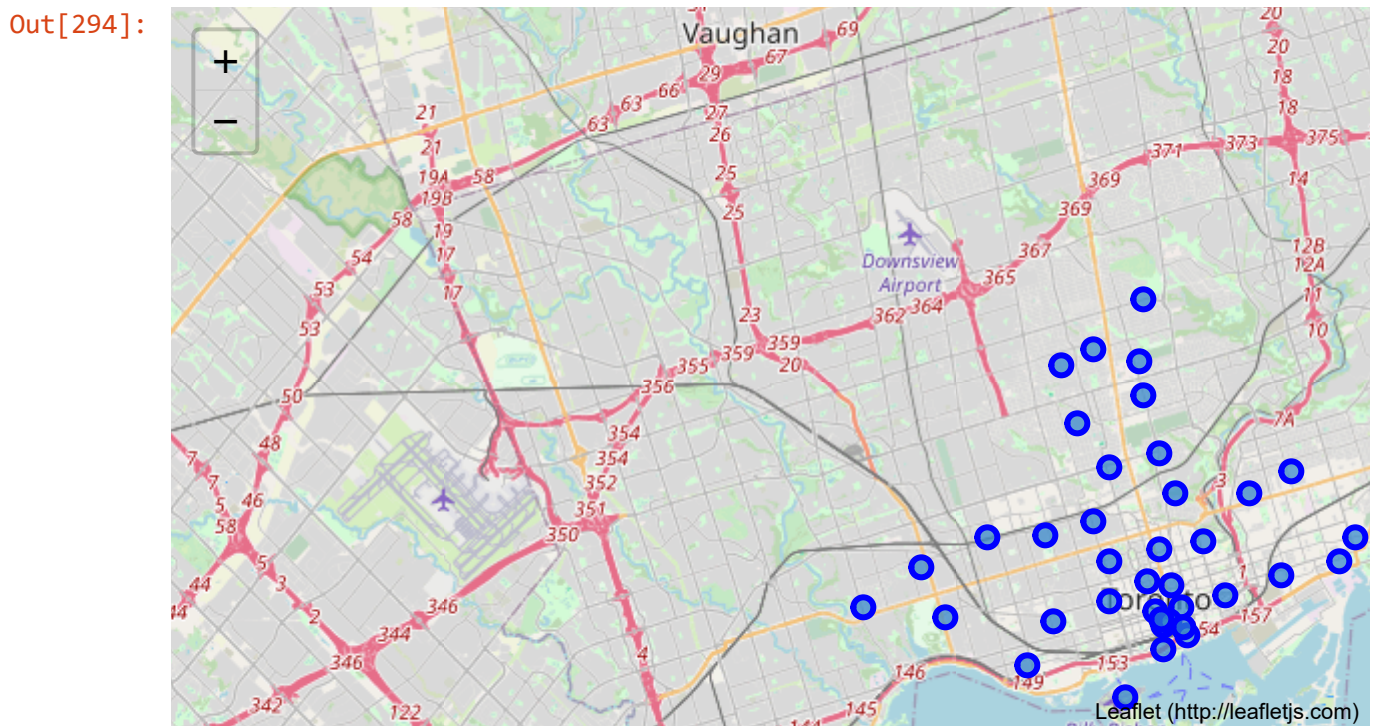
```

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

```



```

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

```

Out[295]: 'Regent Park, Harbourfront'

```
In [296]: 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]: 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=U15IH31SPJWMOVTCUXZ4EDSNQDLBYBQJKQVJ13MLJXPGVLISQ&client_secret=NPRYGUQVHRM0TH5JA2DNLQS1YE0VUFHFM L4ZQUN0G54GZ4P&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,
        'postalCode': 'M5A 1K9',
        'cc': 'CA',
        'city': 'Toronto',
        'state': 'ON',
        'country': 'Canada',
        'formattedAddress': ['362 King St E (Trinity St)',
          'Toronto ON M5A 1K9',
          'Canada']},
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                        'Canada' ]},
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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}],
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'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': []},
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{ 'reasons': { 'count': 0,
  'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason' } ]},
  'venue': { 'id': '4af21e78f964a520fae521e3',
    'name': 'Arta Gallery',
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      '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' } ] ],
'venu': { 'id': '4d126fd3d1848cfad5cfbb71',
  'name': 'TD Canada Trust',
  'location': { 'address': '457 Front Street East',
    'lat': 43.652779762702764,
    'lng': -79.3563362625656,
    'labeledLatLngs': [ { 'label': 'display',
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      'lng': -79.3563362625656 } ],
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    'cc': 'CA',
    'city': 'Toronto',
    'state': 'ON',
    'country': 'Canada',
    'formattedAddress': [ '457 Front Street East',
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      'Canada' ] },
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    'name': 'Bank',
    'pluralName': 'Banks',
    'shortName': 'Bank',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/financial_',
      'suffix': '.png' },
    'primary': True } ],
  'photos': { 'count': 0, 'groups': [ ] },
  'referralId': 'e-0-4d126fd3d1848cfad5cfbb71-38' },
{ 'reasons': { 'count': 0,
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    'reasonName': 'globalInteractionReason' } ] },
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  '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/coffee_shop_' }
```

```
'suffix': '.png'},
'primary': True]],
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'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']},
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'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'},
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'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',
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'lng': -79.359717}]},
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'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',
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                    'lng': -79.357538 } ],
                'distance': 487,
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                '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 } ]},
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            '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]: *# 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]: *from pandas.io.json import json_normalize # tranform JSON file into a pandas dataframe*

```

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

```

```
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', 'venue.location.lng']
nearby_venues = nearby_venues.loc[:, filtered_columns]

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

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

nearby_venues.head()
```

/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages/ipykernel_launcher.py:3: FutureWarning: pandas.io.json.json_normalize is deprecated, use pandas.json_normalize instead

This is separate from the ipykernel package so we can avoid doing imports until

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={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)
        # make the GET request
        results = requests.get(url).json()["response"]["groups"][0]["items"]
        # return only relevant information for each nearby venue
        venues_list.append([
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item
in venue_list])
    nearby_venues.columns = ['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()
```

Out[307]:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
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]: 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
```

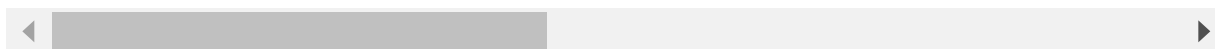
Out[311]:

	Neighborhood	Yoga Studio	Adult Boutique	Airport	Airport Food Court	Airport Lounge	Airport Service	Airport Terminal	Amei Restai
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 Restai
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_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')
```

----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 Quay, 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]: 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]: import numpy as np
```

```

In [315]: 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
0	Berczy Park	Bakery	Coffee Shop	Cocktail Bar	Seafood Restaurant	Beer Bar	Pharmacy	Restaurant	C
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	Ti
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]: # import k-means from clustering stage
from sklearn.cluster import KMeans
```

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

```
In [318]: # 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 each neighborhood
toronto_merged = toronto_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), 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 Most Common Venue
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

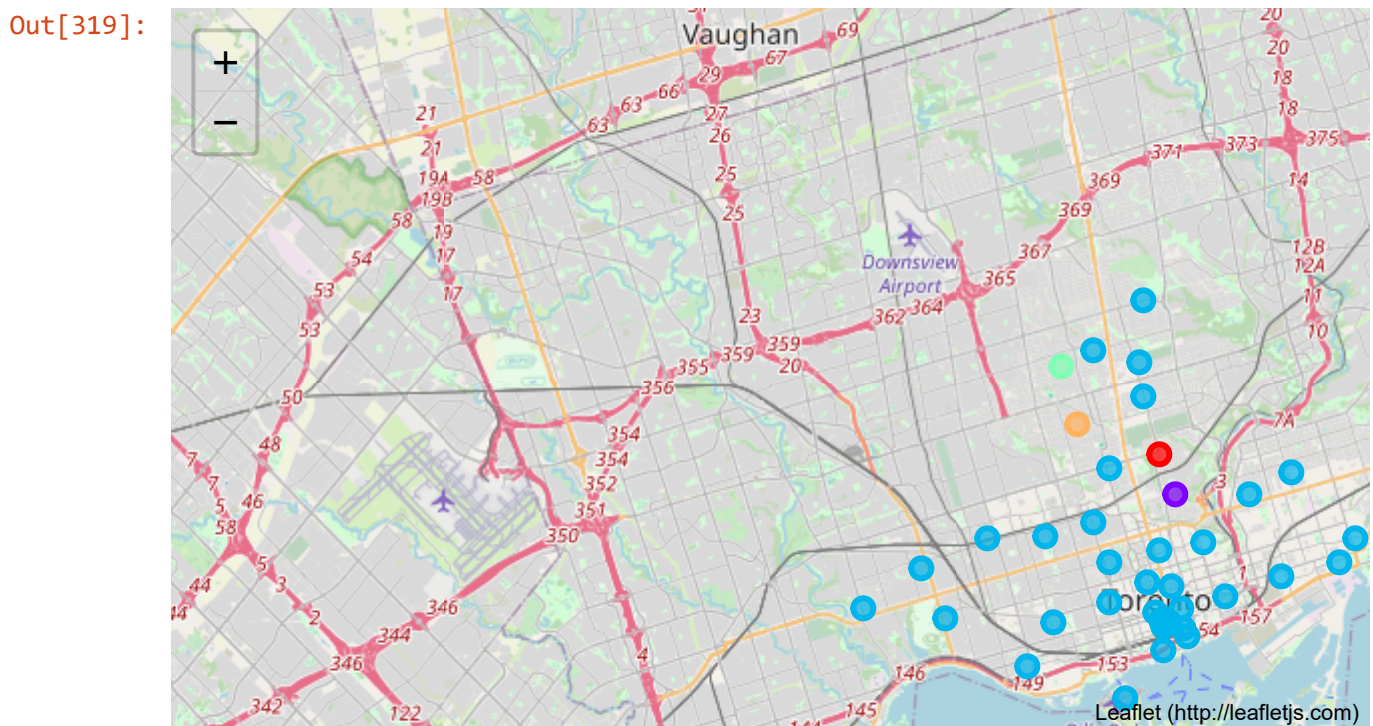
```

In [319]: # 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=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

```



In []:

In []: