Peer-graded Assignment: Segmenting and Clustering Neighborhoods in Toronto

Part 1

In [1]:
```python
import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analsysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # library to handle JSON files

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

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

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

# import k-means from clustering stage
from sklearn.cluster import KMeans

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

print('Libraries imported.')
```

```
Solving environment: done


==> WARNING: A newer version of conda exists. <==
  current version: 4.5.11
  latest version: 4.7.12

Please update conda by running

    $ conda update -n base -c defaults conda



# All requested packages already installed.

Solving environment: done


==> WARNING: A newer version of conda exists. <==
  current version: 4.5.11
  latest version: 4.7.12

Please update conda by running

    $ conda update -n base -c defaults conda



# All requested packages already installed.

Libraries imported.
```

In [1]:

```
pip install lxml
```

Requirement already satisfied: lxml in /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (4.4.1)
Note: you may need to restart the kernel to use updated packages.

```python
#Fetching the data from the web page
url = 'https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M'
toronto_data = pd.read_html(url, header = 0)
toronto_data = toronto_data[0]
toronto_data.head()
```

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

```python
#Creating the neighborhoods data with Borough Name ie, eliminating 'Not assigned observations'
neighborhoods_data = toronto_data[toronto_data.Borough != 'Not assigned']
neighborhoods_data.reset_index(drop = True, inplace = True)
neighborhoods_data.head()
```

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

In [9]:

```
#Grouping the Data by postcode, ensuring that all Neighborhoods under the same postcode appear as one observation
neighborhoods_data = neighborhoods_data.groupby(['Postcode','Borough'])['Neighbourhood'].apply(','.join)
neighborhoods_data = neighborhoods_data.reset_index(level = ['Postcode','Borough'])
neighborhoods_data.head()
```

Out[9]:

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

In [17]:

```
#Replacing the 'Neighborhood's with the observation 'Not assigned' their Borough Names
print(neighborhoods_data[neighborhoods_data.Neighbourhood == 'Not assigned'])
neighborhoods_data.loc[(neighborhoods_data.Neighbourhood == 'Not assigned'), 'Neighbourhood']=neighborhoods_data.Borough
neighborhoods_data.head()
```

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

Out[17]:

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

In [19]:

```
neighborhoods_data[neighborhoods_data.Neighbourhood == 'Not assigned']
```

Out[19]:

Postcode	Borough	Neighbourhood

The above code shows that the Neighbourhoods with 'Not assigned' Observations have been replaced with their Borough Name

```
neighborhoods_data
```

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

	Postcode	Borough	Neighbourhood
25	M3A	North York	Parkwoods
26	M3B	North York	Don Mills North
27	M3C	North York	Flemingdon Park,Don Mills South
28	M3H	North York	Bathurst Manor,Downsview North,Wilson Heights
29	M3J	North York	Northwood Park,York University
30	M3K	North York	CFB Toronto,Downsview East
31	M3L	North York	Downsview West
32	M3M	North York	Downsview Central
33	M3N	North York	Downsview Northwest
34	M4A	North York	Victoria Village
35	M4B	East York	Woodbine Gardens,Parkview Hill
36	M4C	East York	Woodbine Heights
37	M4E	East Toronto	The Beaches
38	M4G	East York	Leaside
39	M4H	East York	Thorncliffe Park
40	M4J	East York	East Toronto
41	M4K	East Toronto	The Danforth West,Riverdale
42	M4L	East Toronto	The Beaches West,India Bazaar
43	M4M	East Toronto	Studio District
44	M4N	Central Toronto	Lawrence Park
45	M4P	Central Toronto	Davisville North
46	M4R	Central Toronto	North Toronto West
47	M4S	Central Toronto	Davisville
48	M4T	Central Toronto	Moore Park,Summerhill East
49	M4V	Central Toronto	Deer Park,Forest Hill SE,Rathnelly,South Hill,...
50	M4W	Downtown Toronto	Rosedale
51	M4X	Downtown Toronto	Cabbagetown,St. James Town

	Postcode	Borough	Neighbourhood
52	M4Y	Downtown Toronto	Church and Wellesley
53	M5A	Downtown Toronto	Harbourfront
54	M5B	Downtown Toronto	Ryerson,Garden District
55	M5C	Downtown Toronto	St. James Town
56	M5E	Downtown Toronto	Berczy Park
57	M5G	Downtown Toronto	Central Bay Street
58	M5H	Downtown Toronto	Adelaide,King,Richmond
59	M5J	Downtown Toronto	Harbourfront East,Toronto Islands,Union Station
60	M5K	Downtown Toronto	Design Exchange,Toronto Dominion Centre
61	M5L	Downtown Toronto	Commerce Court,Victoria Hotel
62	M5M	North York	Bedford Park,Lawrence Manor East
63	M5N	Central Toronto	Roselawn
64	M5P	Central Toronto	Forest Hill North,Forest Hill West
65	M5R	Central Toronto	The Annex,North Midtown,Yorkville
66	M5S	Downtown Toronto	Harbord,University of Toronto
67	M5T	Downtown Toronto	Chinatown,Grange Park,Kensington Market
68	M5V	Downtown Toronto	CN Tower,Bathurst Quay,Island airport,Harbourf...
69	M5W	Downtown Toronto	Stn A PO Boxes 25 The Esplanade
70	M5X	Downtown Toronto	First Canadian Place,Underground city
71	M6A	North York	Lawrence Heights,Lawrence Manor
72	M6B	North York	Glencairn
73	M6C	York	Humewood-Cedarvale
74	M6E	York	Caledonia-Fairbanks
75	M6G	Downtown Toronto	Christie
76	M6H	West Toronto	Dovercourt Village,Dufferin
77	M6J	West Toronto	Little Portugal,Trinity
78	M6K	West Toronto	Brockton,Exhibition Place,Parkdale Village

	Postcode	Borough	Neighbourhood
79	M6L	North York	Downsview,North Park,Upwood Park
80	M6M	York	Del Ray,Keelesdale,Mount Dennis,Silverthorn
81	M6N	York	The Junction North,Runnymede
82	M6P	West Toronto	High Park,The Junction South
83	M6R	West Toronto	Parkdale,Roncesvalles
84	M6S	West Toronto	Runnymede,Swansea
85	M7A	Queen's Park	Queen's Park
86	M7R	Mississauga	Canada Post Gateway Processing Centre
87	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eastern
88	M8V	Etobicoke	Humber Bay Shores,Mimico South,New Toronto
89	M8W	Etobicoke	Alderwood,Long Branch
90	M8X	Etobicoke	The Kingsway,Montgomery Road,Old Mill North
91	M8Y	Etobicoke	Humber Bay,King's Mill Park,Kingsway Park Sout...
92	M8Z	Etobicoke	Kingsway Park South West,Mimico NW,The Queensw...
93	M9A	Queen's Park	Queen's Park
94	M9B	Etobicoke	Cloverdale,Islington,Martin Grove,Princess Gar...
95	M9C	Etobicoke	Bloordale Gardens,Eringate,Markland Wood,Old B...
96	M9L	North York	Humber Summit
97	M9M	North York	Emery,Humberlea
98	M9N	York	Weston
99	M9P	Etobicoke	Westmount
100	M9R	Etobicoke	Kingsview Village,Martin Grove Gardens,Richvie...
101	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...
102	M9W	Etobicoke	Northwest

Part 2

Downloading the Geospatial_Data

```
url = 'https://cocl.us/Geospatial_data'
Geospatial_data = pd.read_csv(url)
Geospatial_data.head()
```

	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

Renaming the Postal Code to Postcode and Merging the Geospatial_data and the neighborhoods_data by a common variable Postcode

In [28]:

```
Geospatial_data = Geospatial_data.rename(columns = {"Postal Code":"Postcode"})
Geospatial_data.head()
```

Out[28]:

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

```
combined_data = pd.merge(neighborhoods_data,Geospatial_data)
combined_data
```

	Postcode	Borough	Neighbourhood	Latitude	Longitude
0	M1B	Scarborough	Rouge,Malvern	43.806686	-79.194353
1	M1C	Scarborough	Highland Creek,Rouge Hill,Port Union	43.784535	-79.160497
2	M1E	Scarborough	Guildwood,Morningside,West Hill	43.763573	-79.188711
3	M1G	Scarborough	Woburn	43.770992	-79.216917
4	M1H	Scarborough	Cedarbrae	43.773136	-79.239476
5	M1J	Scarborough	Scarborough Village	43.744734	-79.239476
6	M1K	Scarborough	East Birchmount Park,Ionview,Kennedy Park	43.727929	-79.262029
7	M1L	Scarborough	Clairlea,Golden Mile,Oakridge	43.711112	-79.284577
8	M1M	Scarborough	Cliffcrest,Cliffside,Scarborough Village West	43.716316	-79.239476
9	M1N	Scarborough	Birch Cliff,Cliffside West	43.692657	-79.264848
10	M1P	Scarborough	Dorset Park,Scarborough Town Centre,Wexford He...	43.757410	-79.273304
11	M1R	Scarborough	Maryvale,Wexford	43.750072	-79.295849
12	M1S	Scarborough	Agincourt	43.794200	-79.262029
13	M1T	Scarborough	Clarks Corners,Sullivan,Tam O'Shanter	43.781638	-79.304302
14	M1V	Scarborough	Agincourt North,L'Amoreaux East,Milliken,Steel...	43.815252	-79.284577
15	M1W	Scarborough	L'Amoreaux West	43.799525	-79.318389
16	M1X	Scarborough	Upper Rouge	43.836125	-79.205636
17	M2H	North York	Hillcrest Village	43.803762	-79.363452
18	M2J	North York	Fairview,Henry Farm,Oriole	43.778517	-79.346556
19	M2K	North York	Bayview Village	43.786947	-79.385975
20	M2L	North York	Silver Hills,York Mills	43.757490	-79.374714
21	M2M	North York	Newtonbrook,Willowdale	43.789053	-79.408493
22	M2N	North York	Willowdale South	43.770120	-79.408493
23	M2P	North York	York Mills West	43.752758	-79.400049
24	M2R	North York	Willowdale West	43.782736	-79.442259

	Postcode	Borough	Neighbourhood	Latitude	Longitude
25	M3A	North York	Parkwoods	43.753259	-79.329656
26	M3B	North York	Don Mills North	43.745906	-79.352188
27	M3C	North York	Flemingdon Park,Don Mills South	43.725900	-79.340923
28	M3H	North York	Bathurst Manor,Downsview North,Wilson Heights	43.754328	-79.442259
29	M3J	North York	Northwood Park,York University	43.767980	-79.487262
30	M3K	North York	CFB Toronto,Downsview East	43.737473	-79.464763
31	M3L	North York	Downsview West	43.739015	-79.506944
32	M3M	North York	Downsview Central	43.728496	-79.495697
33	M3N	North York	Downsview Northwest	43.761631	-79.520999
34	M4A	North York	Victoria Village	43.725882	-79.315572
35	M4B	East York	Woodbine Gardens,Parkview Hill	43.706397	-79.309937
36	M4C	East York	Woodbine Heights	43.695344	-79.318389
37	M4E	East Toronto	The Beaches	43.676357	-79.293031
38	M4G	East York	Leaside	43.709060	-79.363452
39	M4H	East York	Thorncliffe Park	43.705369	-79.349372
40	M4J	East York	East Toronto	43.685347	-79.338106
41	M4K	East Toronto	The Danforth West,Riverdale	43.679557	-79.352188
42	M4L	East Toronto	The Beaches West,India Bazaar	43.668999	-79.315572
43	M4M	East Toronto	Studio District	43.659526	-79.340923
44	M4N	Central Toronto	Lawrence Park	43.728020	-79.388790
45	M4P	Central Toronto	Davisville North	43.712751	-79.390197
46	M4R	Central Toronto	North Toronto West	43.715383	-79.405678
47	M4S	Central Toronto	Davisville	43.704324	-79.388790
48	M4T	Central Toronto	Moore Park,Summerhill East	43.689574	-79.383160
49	M4V	Central Toronto	Deer Park,Forest Hill SE,Rathnelly,South Hill,...	43.686412	-79.400049
50	M4W	Downtown Toronto	Rosedale	43.679563	-79.377529
51	M4X	Downtown Toronto	Cabbagetown,St. James Town	43.667967	-79.367675

	Postcode	Borough	Neighbourhood	Latitude	Longitude
52	M4Y	Downtown Toronto	Church and Wellesley	43.665860	-79.383160
53	M5A	Downtown Toronto	Harbourfront	43.654260	-79.360636
54	M5B	Downtown Toronto	Ryerson,Garden District	43.657162	-79.378937
55	M5C	Downtown Toronto	St. James Town	43.651494	-79.375418
56	M5E	Downtown Toronto	Berczy Park	43.644771	-79.373306
57	M5G	Downtown Toronto	Central Bay Street	43.657952	-79.387383
58	M5H	Downtown Toronto	Adelaide,King,Richmond	43.650571	-79.384568
59	M5J	Downtown Toronto	Harbourfront East,Toronto Islands,Union Station	43.640816	-79.381752
60	M5K	Downtown Toronto	Design Exchange,Toronto Dominion Centre	43.647177	-79.381576
61	M5L	Downtown Toronto	Commerce Court,Victoria Hotel	43.648198	-79.379817
62	M5M	North York	Bedford Park,Lawrence Manor East	43.733283	-79.419750
63	M5N	Central Toronto	Roselawn	43.711695	-79.416936
64	M5P	Central Toronto	Forest Hill North,Forest Hill West	43.696948	-79.411307
65	M5R	Central Toronto	The Annex,North Midtown,Yorkville	43.672710	-79.405678
66	M5S	Downtown Toronto	Harbord,University of Toronto	43.662696	-79.400049
67	M5T	Downtown Toronto	Chinatown,Grange Park,Kensington Market	43.653206	-79.400049
68	M5V	Downtown Toronto	CN Tower,Bathurst Quay,Island airport,Harbourf...	43.628947	-79.394420
69	M5W	Downtown Toronto	Stn A PO Boxes 25 The Esplanade	43.646435	-79.374846
70	M5X	Downtown Toronto	First Canadian Place,Underground city	43.648429	-79.382280
71	M6A	North York	Lawrence Heights,Lawrence Manor	43.718518	-79.464763
72	M6B	North York	Glencairn	43.709577	-79.445073
73	M6C	York	Humewood-Cedarvale	43.693781	-79.428191
74	M6E	York	Caledonia-Fairbanks	43.689026	-79.453512
75	M6G	Downtown Toronto	Christie	43.669542	-79.422564
76	M6H	West Toronto	Dovercourt Village,Dufferin	43.669005	-79.442259
77	M6J	West Toronto	Little Portugal,Trinity	43.647927	-79.419750
78	M6K	West Toronto	Brockton,Exhibition Place,Parkdale Village	43.636847	-79.428191

	Postcode	Borough	Neighbourhood	Latitude	Longitude
79	M6L	North York	Downsview,North Park,Upwood Park	43.713756	-79.490074
80	M6M	York	Del Ray,Keelesdale,Mount Dennis,Silverthorn	43.691116	-79.476013
81	M6N	York	The Junction North,Runnymede	43.673185	-79.487262
82	M6P	West Toronto	High Park,The Junction South	43.661608	-79.464763
83	M6R	West Toronto	Parkdale,Roncesvalles	43.648960	-79.456325
84	M6S	West Toronto	Runnymede,Swansea	43.651571	-79.484450
85	M7A	Queen's Park	Queen's Park	43.662301	-79.389494
86	M7R	Mississauga	Canada Post Gateway Processing Centre	43.636966	-79.615819
87	M7Y	East Toronto	Business Reply Mail Processing Centre 969 Eastern	43.662744	-79.321558
88	M8V	Etobicoke	Humber Bay Shores,Mimico South,New Toronto	43.605647	-79.501321
89	M8W	Etobicoke	Alderwood,Long Branch	43.602414	-79.543484
90	M8X	Etobicoke	The Kingsway,Montgomery Road,Old Mill North	43.653654	-79.506944
91	M8Y	Etobicoke	Humber Bay,King's Mill Park,Kingsway Park Sout...	43.636258	-79.498509
92	M8Z	Etobicoke	Kingsway Park South West,Mimico NW,The Queensw...	43.628841	-79.520999
93	M9A	Queen's Park	Queen's Park	43.667856	-79.532242
94	M9B	Etobicoke	Cloverdale,Islington,Martin Grove,Princess Gar...	43.650943	-79.554724
95	M9C	Etobicoke	Bloordale Gardens,Eringate,Markland Wood,Old B...	43.643515	-79.577201
96	M9L	North York	Humber Summit	43.756303	-79.565963
97	M9M	North York	Emery,Humberlea	43.724766	-79.532242
98	M9N	York	Weston	43.706876	-79.518188
99	M9P	Etobicoke	Westmount	43.696319	-79.532242
100	M9R	Etobicoke	Kingsview Village,Martin Grove Gardens,Richvie...	43.688905	-79.554724
101	M9V	Etobicoke	Albion Gardens,Beaumond Heights,Humbergate,Jam...	43.739416	-79.588437
102	M9W	Etobicoke	Northwest	43.706748	-79.594054

In [ ]: