

# toronto

September 14, 2018

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

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

import json # library to handle JSON files

get_ipython().system("conda install -c conda-forge geopy --yes")
from geopy.geocoders import Nominatim # convert an address into latitude and longitude v

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

get_ipython().system("conda install -c conda-forge folium=0.5.0 --yes")
import folium # map rendering library

get_ipython().system('conda install -c conda-forge beautifulsoup4 --yes')
from bs4 import BeautifulSoup

get_ipython().system('conda install -c conda-forge lxml --yes')
get_ipython().system('conda install -c conda-forge html5lib --yes')
get_ipython().system('conda install -c conda-forge requests --yes')

import requests
get_ipython().system('conda install -c conda-forge geocoder --yes')
import geocoder

print('Libraries imported.')
```

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Solving environment: done

# All requested packages already installed.

Solving environment: done

# All requested packages already installed.

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Solving environment: done

# All requested packages already installed.

Solving environment: done

# All requested packages already installed.

Libraries imported.

```

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In [2]: from bs4 import BeautifulSoup
        import requests
        import folium
        from pandas.io.json import json_normalize
        import numpy as np
        import pandas as pd

        page = requests.get("https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M")
        soup = BeautifulSoup(page.content, 'html.parser')
        theTable = soup.find('table')
        dfs = pd.read_html(str(theTable))
        df = dfs[0]
        df = pd.DataFrame(df)
        df.columns = df.iloc[0]
        df = df.iloc[1:].reset_index(drop=True)
        df = df[~(df == 'Not assigned').any(axis=1)]
        df['longitude'] = np.zeros(df.shape[0])

```

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df['latitude'] = np.zeros(df.shape[0])
df.shape
df
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Out[2]: 0  Postcode      Borough \
2      M3A      North York
3      M4A      North York
4      M5A  Downtown Toronto
5      M5A  Downtown Toronto
6      M6A      North York
7      M6A      North York
10     M9A      Etobicoke
11     M1B      Scarborough
12     M1B      Scarborough
14     M3B      North York
15     M4B      East York
16     M4B      East York
17     M5B  Downtown Toronto
18     M5B  Downtown Toronto
19     M6B      North York
22     M9B      Etobicoke
23     M9B      Etobicoke
24     M9B      Etobicoke
25     M9B      Etobicoke
26     M9B      Etobicoke
27     M1C      Scarborough
28     M1C      Scarborough
29     M1C      Scarborough
31     M3C      North York
32     M3C      North York
33     M4C      East York
34     M5C  Downtown Toronto
35     M6C      York
38     M9C      Etobicoke
39     M9C      Etobicoke
40     M9C      Etobicoke
41     M9C      Etobicoke
42     M1E      Scarborough
43     M1E      Scarborough
44     M1E      Scarborough
47     M4E      East Toronto
48     M5E  Downtown Toronto
49     M6E      York
53     M1G      Scarborough
56     M4G      East York
57     M5G  Downtown Toronto
58     M6G  Downtown Toronto
62     M1H      Scarborough
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63	M2H	North York
64	M3H	North York
65	M3H	North York
66	M3H	North York
67	M4H	East York
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69	M5H	Downtown Toronto
70	M5H	Downtown Toronto
71	M6H	West Toronto
72	M6H	West Toronto
76	M1J	Scarborough
77	M2J	North York
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79	M2J	North York
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81	M3J	North York
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110	M2L	North York
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112	M3L	North York
113	M4L	East Toronto
114	M4L	East Toronto
115	M5L	Downtown Toronto
116	M5L	Downtown Toronto
117	M6L	North York
118	M6L	North York
119	M6L	North York

122	M9L	North York
123	M1M	Scarborough
124	M1M	Scarborough
125	M1M	Scarborough
126	M2M	North York
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128	M3M	North York
129	M4M	East Toronto
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131	M5M	North York
132	M6M	York
133	M6M	York
134	M6M	York
135	M6M	York
138	M9M	North York
139	M9M	North York
140	M1N	Scarborough
141	M1N	Scarborough
142	M2N	North York
143	M3N	North York
144	M4N	Central Toronto
145	M5N	Central Toronto
146	M6N	York
147	M6N	York
150	M9N	York
151	M1P	Scarborough
152	M1P	Scarborough
153	M1P	Scarborough
154	M2P	North York
156	M4P	Central Toronto
157	M5P	Central Toronto
158	M5P	Central Toronto
159	M6P	West Toronto
160	M6P	West Toronto
163	M9P	Etobicoke
164	M1R	Scarborough
165	M1R	Scarborough
166	M2R	North York
168	M4R	Central Toronto
169	M5R	Central Toronto
170	M5R	Central Toronto
171	M5R	Central Toronto
172	M6R	West Toronto
173	M6R	West Toronto
174	M7R	Mississauga
176	M9R	Etobicoke
177	M9R	Etobicoke
178	M9R	Etobicoke

179	M9R	Etobicoke
180	M1S	Scarborough
183	M4S	Central Toronto
184	M5S	Downtown Toronto
185	M5S	Downtown Toronto
186	M6S	West Toronto
187	M6S	West Toronto
191	M1T	Scarborough
192	M1T	Scarborough
193	M1T	Scarborough
196	M4T	Central Toronto
197	M4T	Central Toronto
198	M5T	Downtown Toronto
199	M5T	Downtown Toronto
200	M5T	Downtown Toronto
205	M1V	Scarborough
206	M1V	Scarborough
207	M1V	Scarborough
208	M1V	Scarborough
211	M4V	Central Toronto
212	M4V	Central Toronto
213	M4V	Central Toronto
214	M4V	Central Toronto
215	M4V	Central Toronto
216	M5V	Downtown Toronto
217	M5V	Downtown Toronto
218	M5V	Downtown Toronto
219	M5V	Downtown Toronto
220	M5V	Downtown Toronto
221	M5V	Downtown Toronto
222	M5V	Downtown Toronto
225	M8V	Etobicoke
226	M8V	Etobicoke
227	M8V	Etobicoke
228	M9V	Etobicoke
229	M9V	Etobicoke
230	M9V	Etobicoke
231	M9V	Etobicoke
232	M9V	Etobicoke
233	M9V	Etobicoke
234	M9V	Etobicoke
235	M9V	Etobicoke
236	M1W	Scarborough
237	M1W	Scarborough
240	M4W	Downtown Toronto
241	M5W	Downtown Toronto
244	M8W	Etobicoke
245	M8W	Etobicoke

246	M9W	Etobicoke
247	M1X	Scarborough
250	M4X	Downtown Toronto
251	M4X	Downtown Toronto
252	M5X	Downtown Toronto
253	M5X	Downtown Toronto
256	M8X	Etobicoke
257	M8X	Etobicoke
258	M8X	Etobicoke
263	M4Y	Downtown Toronto
266	M7Y	East Toronto
267	M8Y	Etobicoke
268	M8Y	Etobicoke
269	M8Y	Etobicoke
270	M8Y	Etobicoke
271	M8Y	Etobicoke
272	M8Y	Etobicoke
273	M8Y	Etobicoke
274	M8Y	Etobicoke
283	M8Z	Etobicoke
284	M8Z	Etobicoke
285	M8Z	Etobicoke
286	M8Z	Etobicoke
287	M8Z	Etobicoke

0	Neighbourhood	longitude	latitude
2	Parkwoods	0.0	0.0
3	Victoria Village	0.0	0.0
4	Harbourfront	0.0	0.0
5	Regent Park	0.0	0.0
6	Lawrence Heights	0.0	0.0
7	Lawrence Manor	0.0	0.0
10	Islington Avenue	0.0	0.0
11	Rouge	0.0	0.0
12	Malvern	0.0	0.0
14	Don Mills North	0.0	0.0
15	Woodbine Gardens	0.0	0.0
16	Parkview Hill	0.0	0.0
17	Ryerson	0.0	0.0
18	Garden District	0.0	0.0
19	Glencairn	0.0	0.0
22	Cloverdale	0.0	0.0
23	Islington	0.0	0.0
24	Martin Grove	0.0	0.0
25	Princess Gardens	0.0	0.0
26	West Deane Park	0.0	0.0
27	Highland Creek	0.0	0.0
28	Rouge Hill	0.0	0.0

29	Port Union	0.0	0.0
31	Flemingdon Park	0.0	0.0
32	Don Mills South	0.0	0.0
33	Woodbine Heights	0.0	0.0
34	St. James Town	0.0	0.0
35	Humewood-Cedarvale	0.0	0.0
38	Bloordale Gardens	0.0	0.0
39	Eringate	0.0	0.0
40	Markland Wood	0.0	0.0
41	Old Burnhamthorpe	0.0	0.0
42	Guildwood]]	0.0	0.0
43	Morningside	0.0	0.0
44	West Hill	0.0	0.0
47	The Beaches	0.0	0.0
48	Berczy Park	0.0	0.0
49	Caledonia-Fairbanks]]	0.0	0.0
53	Woburn	0.0	0.0
56	Leaside	0.0	0.0
57	Central Bay Street	0.0	0.0
58	Christie	0.0	0.0
62	Cedarbrae	0.0	0.0
63	Hillcrest Village	0.0	0.0
64	Bathurst Manor	0.0	0.0
65	Downsview North	0.0	0.0
66	Wilson Heights	0.0	0.0
67	Thorncliffe Park	0.0	0.0
68	Adelaide	0.0	0.0
69	King	0.0	0.0
70	Richmond	0.0	0.0
71	Dovercourt Village	0.0	0.0
72	Dufferin	0.0	0.0
76	Scarborough Village	0.0	0.0
77	Fairview	0.0	0.0
78	Henry Farm	0.0	0.0
79	Oriole	0.0	0.0
80	Northwood Park	0.0	0.0
81	York University	0.0	0.0
82	East Toronto	0.0	0.0
83	Harbourfront East	0.0	0.0
84	Toronto Islands	0.0	0.0
85	Union Station	0.0	0.0
86	Little Portugal	0.0	0.0
87	Trinity	0.0	0.0
91	East Birchmount Park	0.0	0.0
92	Ionview	0.0	0.0
93	Kennedy Park	0.0	0.0
94	Bayview Village	0.0	0.0
95	CFB Toronto	0.0	0.0



96	Downsview East	0.0	0.0
97	The Danforth West	0.0	0.0
98	Riverdale	0.0	0.0
99	Design Exchange	0.0	0.0
100	Toronto Dominion Centre	0.0	0.0
101	Brockton	0.0	0.0
102	Exhibition Place	0.0	0.0
103	Parkdale Village	0.0	0.0
107	Clairlea	0.0	0.0
108	Golden Mile	0.0	0.0
109	Oakridge	0.0	0.0
110	Silver Hills	0.0	0.0
111	York Mills	0.0	0.0
112	Downsview West	0.0	0.0
113	The Beaches West	0.0	0.0
114	India Bazaar	0.0	0.0
115	Commerce Court	0.0	0.0
116	Victoria Hotel	0.0	0.0
117	Maple Leaf Park	0.0	0.0
118	North Park	0.0	0.0
119	Upwood Park	0.0	0.0
122	Humber Summit	0.0	0.0
123	Cliffcrest	0.0	0.0
124	Cliffside	0.0	0.0
125	Scarborough Village West	0.0	0.0
126	Newtonbrook	0.0	0.0
127	Willowdale	0.0	0.0
128	Downsview Central	0.0	0.0
129	Studio District	0.0	0.0
130	Bedford Park	0.0	0.0
131	Lawrence Manor East	0.0	0.0
132	Del Ray	0.0	0.0
133	Keelsdale	0.0	0.0
134	Mount Dennis	0.0	0.0
135	Silverthorn	0.0	0.0
138	Emery	0.0	0.0
139	Humberlea	0.0	0.0
140	Birch Cliff	0.0	0.0
141	Cliffside West	0.0	0.0
142	Willowdale South	0.0	0.0
143	Downsview Northwest	0.0	0.0
144	Lawrence Park	0.0	0.0
145	Roselawn	0.0	0.0
146	]The Junction North]]	0.0	0.0
147	Runnymede]]	0.0	0.0
150	Weston	0.0	0.0
151	Dorset Park	0.0	0.0
152	Scarborough Town Centre	0.0	0.0

153	Wexford Heights	0.0	0.0
154	York Mills West	0.0	0.0
156	Davisville North	0.0	0.0
157	Forest Hill North	0.0	0.0
158	Forest Hill West	0.0	0.0
159	High Park	0.0	0.0
160	The Junction South	0.0	0.0
163	Westmount	0.0	0.0
164	Maryvale	0.0	0.0
165	Wexford	0.0	0.0
166	Willowdale West	0.0	0.0
168	North Toronto West	0.0	0.0
169	The Annex	0.0	0.0
170	North Midtown	0.0	0.0
171	Yorkville	0.0	0.0
172	Parkdale	0.0	0.0
173	Roncesvalles	0.0	0.0
174	Canada Post Gateway Processing Centre	0.0	0.0
176	Kingsview Village	0.0	0.0
177	Martin Grove Gardens	0.0	0.0
178	Richview Gardens	0.0	0.0
179	St. Phillips	0.0	0.0
180	Agincourt	0.0	0.0
183	Davisville	0.0	0.0
184	Harbord	0.0	0.0
185	University of Toronto	0.0	0.0
186	Runnymede	0.0	0.0
187	Swansea	0.0	0.0
191	Clarks Corners	0.0	0.0
192	Sullivan	0.0	0.0
193	Tam O'Shanter	0.0	0.0
196	Moore Park	0.0	0.0
197	Summerhill East	0.0	0.0
198	Chinatown	0.0	0.0
199	Grange Park	0.0	0.0
200	Kensington Market	0.0	0.0
205	Agincourt North	0.0	0.0
206	L'Amoreaux East	0.0	0.0
207	Milliken	0.0	0.0
208	Steeles East	0.0	0.0
211	Deer Park	0.0	0.0
212	Forest Hill SE	0.0	0.0
213	Rathnelly	0.0	0.0
214	South Hill	0.0	0.0
215	Summerhill West	0.0	0.0
216	CN Tower	0.0	0.0
217	Bathurst Quay	0.0	0.0
218	Island airport	0.0	0.0

219	Harbourfront West	0.0	0.0
220	King and Spadina	0.0	0.0
221	Railway Lands	0.0	0.0
222	South Niagara	0.0	0.0
225	Humber Bay Shores	0.0	0.0
226	Mimico South	0.0	0.0
227	New Toronto	0.0	0.0
228	Albion Gardens	0.0	0.0
229	Beaumont Heights	0.0	0.0
230	Humbergate	0.0	0.0
231	Jamestown	0.0	0.0
232	Mount Olive	0.0	0.0
233	Silverstone	0.0	0.0
234	South Steeles	0.0	0.0
235	Thistletown	0.0	0.0
236	L'Amoreaux West	0.0	0.0
237	Steeles West	0.0	0.0
240	Rosedale	0.0	0.0
241	Stn A PO Boxes 25 The Esplanade	0.0	0.0
244	Alderwood	0.0	0.0
245	Long Branch	0.0	0.0
246	Northwest	0.0	0.0
247	Upper Rouge	0.0	0.0
250	Cabbagetown	0.0	0.0
251	St. James Town	0.0	0.0
252	First Canadian Place	0.0	0.0
253	Underground city	0.0	0.0
256	The Kingsway	0.0	0.0
257	Montgomery Road	0.0	0.0
258	Old Mill North	0.0	0.0
263	Church and Wellesley	0.0	0.0
266	Business reply mail Processing Centre969 Eastern	0.0	0.0
267	Humber Bay	0.0	0.0
268	King's Mill Park	0.0	0.0
269	Kingsway Park South East	0.0	0.0
270	Mimico NE	0.0	0.0
271	Old Mill South	0.0	0.0
272	The Queensway East	0.0	0.0
273	Royal York South East	0.0	0.0
274	Sunnylea	0.0	0.0
283	Kingsway Park South West	0.0	0.0
284	Mimico NW	0.0	0.0
285	The Queensway West	0.0	0.0
286	Royal York South West	0.0	0.0
287	South of Bloor	0.0	0.0

```
In [3]: def get_google_results(address, api_key=None, return_full_response=False):
        # Set up your Geocoding url
```

```

geocode_url = "https://maps.googleapis.com/maps/api/geocode/json?address={}".format(
if api_key is not None:
    geocode_url = geocode_url + "&key={}".format(api_key)

# Ping google for the results:
results = requests.get(geocode_url)
# Results will be in JSON format - convert to dict using requests functionality
results = results.json()

# if there's no results or an error, return empty results.
if len(results['results']) == 0:
    output = {
        "latitude": None,
        "longitude": None
    }
else:
    answer = results['results'][0]
    output = {
        "latitude": answer.get('geometry').get('location').get('lat'),
        "longitude": answer.get('geometry').get('location').get('lng'),
    }
return output

```

```
In [4]: RETURN_FULL_RESULTS = False
```

```

for x in range(211):
    print(x)
    adress = df.iloc[x,0]+' ,+Toronto,+Ontario'
    result = geocode_result = get_google_results(adress, API_KEY, return_full_response=R
    df.iloc[x,3] = result['longitude']
    df.iloc[x,4] = result['latitude']

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In [5]: df

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Out[5]: 0  Postcode      Borough \
      2      M3A      North York
      3      M4A      North York
      4      M5A  Downtown Toronto
      5      M5A  Downtown Toronto
      6      M6A      North York
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     14      M3B      North York
     15      M4B      East York
     16      M4B      East York
     17      M5B  Downtown Toronto
     18      M5B  Downtown Toronto
     19      M6B      North York
     22      M9B      Etobicoke
     23      M9B      Etobicoke
     24      M9B      Etobicoke
     25      M9B      Etobicoke
     26      M9B      Etobicoke
     27      M1C      Scarborough
     28      M1C      Scarborough
     29      M1C      Scarborough
     31      M3C      North York
     32      M3C      North York
     33      M4C      East York
     34      M5C  Downtown Toronto
     35      M6C      York
     38      M9C      Etobicoke
     39      M9C      Etobicoke
     40      M9C      Etobicoke
     41      M9C      Etobicoke
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     44      M1E      Scarborough
     47      M4E      East Toronto
     48      M5E  Downtown Toronto
     49      M6E      York
     53      M1G      Scarborough
     56      M4G      East York
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57	M5G	Downtown Toronto
58	M6G	Downtown Toronto
62	M1H	Scarborough
63	M2H	North York
64	M3H	North York
65	M3H	North York
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67	M4H	East York
68	M5H	Downtown Toronto
69	M5H	Downtown Toronto
70	M5H	Downtown Toronto
71	M6H	West Toronto
72	M6H	West Toronto
76	M1J	Scarborough
77	M2J	North York
78	M2J	North York
79	M2J	North York
80	M3J	North York
81	M3J	North York
82	M4J	East York
83	M5J	Downtown Toronto
84	M5J	Downtown Toronto
85	M5J	Downtown Toronto
86	M6J	West Toronto
87	M6J	West Toronto
91	M1K	Scarborough
92	M1K	Scarborough
93	M1K	Scarborough
94	M2K	North York
95	M3K	North York
96	M3K	North York
97	M4K	East Toronto
98	M4K	East Toronto
99	M5K	Downtown Toronto
100	M5K	Downtown Toronto
101	M6K	West Toronto
102	M6K	West Toronto
103	M6K	West Toronto
107	M1L	Scarborough
108	M1L	Scarborough
109	M1L	Scarborough
110	M2L	North York
111	M2L	North York
112	M3L	North York
113	M4L	East Toronto
114	M4L	East Toronto
115	M5L	Downtown Toronto
116	M5L	Downtown Toronto

117	M6L	North York
118	M6L	North York
119	M6L	North York
122	M9L	North York
123	M1M	Scarborough
124	M1M	Scarborough
125	M1M	Scarborough
126	M2M	North York
127	M2M	North York
128	M3M	North York
129	M4M	East Toronto
130	M5M	North York
131	M5M	North York
132	M6M	York
133	M6M	York
134	M6M	York
135	M6M	York
138	M9M	North York
139	M9M	North York
140	M1N	Scarborough
141	M1N	Scarborough
142	M2N	North York
143	M3N	North York
144	M4N	Central Toronto
145	M5N	Central Toronto
146	M6N	York
147	M6N	York
150	M9N	York
151	M1P	Scarborough
152	M1P	Scarborough
153	M1P	Scarborough
154	M2P	North York
156	M4P	Central Toronto
157	M5P	Central Toronto
158	M5P	Central Toronto
159	M6P	West Toronto
160	M6P	West Toronto
163	M9P	Etobicoke
164	M1R	Scarborough
165	M1R	Scarborough
166	M2R	North York
168	M4R	Central Toronto
169	M5R	Central Toronto
170	M5R	Central Toronto
171	M5R	Central Toronto
172	M6R	West Toronto
173	M6R	West Toronto
174	M7R	Mississauga

176	M9R	Etobicoke
177	M9R	Etobicoke
178	M9R	Etobicoke
179	M9R	Etobicoke
180	M1S	Scarborough
183	M4S	Central Toronto
184	M5S	Downtown Toronto
185	M5S	Downtown Toronto
186	M6S	West Toronto
187	M6S	West Toronto
191	M1T	Scarborough
192	M1T	Scarborough
193	M1T	Scarborough
196	M4T	Central Toronto
197	M4T	Central Toronto
198	M5T	Downtown Toronto
199	M5T	Downtown Toronto
200	M5T	Downtown Toronto
205	M1V	Scarborough
206	M1V	Scarborough
207	M1V	Scarborough
208	M1V	Scarborough
211	M4V	Central Toronto
212	M4V	Central Toronto
213	M4V	Central Toronto
214	M4V	Central Toronto
215	M4V	Central Toronto
216	M5V	Downtown Toronto
217	M5V	Downtown Toronto
218	M5V	Downtown Toronto
219	M5V	Downtown Toronto
220	M5V	Downtown Toronto
221	M5V	Downtown Toronto
222	M5V	Downtown Toronto
225	M8V	Etobicoke
226	M8V	Etobicoke
227	M8V	Etobicoke
228	M9V	Etobicoke
229	M9V	Etobicoke
230	M9V	Etobicoke
231	M9V	Etobicoke
232	M9V	Etobicoke
233	M9V	Etobicoke
234	M9V	Etobicoke
235	M9V	Etobicoke
236	M1W	Scarborough
237	M1W	Scarborough
240	M4W	Downtown Toronto

241	M5W	Downtown Toronto
244	M8W	Etobicoke
245	M8W	Etobicoke
246	M9W	Etobicoke
247	M1X	Scarborough
250	M4X	Downtown Toronto
251	M4X	Downtown Toronto
252	M5X	Downtown Toronto
253	M5X	Downtown Toronto
256	M8X	Etobicoke
257	M8X	Etobicoke
258	M8X	Etobicoke
263	M4Y	Downtown Toronto
266	M7Y	East Toronto
267	M8Y	Etobicoke
268	M8Y	Etobicoke
269	M8Y	Etobicoke
270	M8Y	Etobicoke
271	M8Y	Etobicoke
272	M8Y	Etobicoke
273	M8Y	Etobicoke
274	M8Y	Etobicoke
283	M8Z	Etobicoke
284	M8Z	Etobicoke
285	M8Z	Etobicoke
286	M8Z	Etobicoke
287	M8Z	Etobicoke

0	Neighbourhood	longitude	latitude
2	Parkwoods	-79.329656	43.753259
3	Victoria Village	-79.315572	43.725882
4	Harbourfront	-79.360636	43.654260
5	Regent Park	-79.360636	43.654260
6	Lawrence Heights	-79.464763	43.718518
7	Lawrence Manor	-79.464763	43.718518
10	Islington Avenue	-79.532242	43.667856
11	Rouge	-79.194353	43.806686
12	Malvern	-79.194353	43.806686
14	Don Mills North	-79.352188	43.745906
15	Woodbine Gardens	-79.309937	43.706397
16	Parkview Hill	-79.309937	43.706397
17	Ryerson	-79.378937	43.657162
18	Garden District	-79.378937	43.657162
19	Glencairn	-79.445073	43.709577
22	Cloverdale	-79.554724	43.650943
23	Islington	-79.554724	43.650943
24	Martin Grove	-79.554724	43.650943
25	Princess Gardens	-79.554724	43.650943

26	West Deane Park	-79.554724	43.650943
27	Highland Creek	-79.160497	43.784535
28	Rouge Hill	-79.160497	43.784535
29	Port Union	-79.160497	43.784535
31	Flemingdon Park	-79.340923	43.725900
32	Don Mills South	-79.340923	43.725900
33	Woodbine Heights	-79.318389	43.695344
34	St. James Town	-79.375418	43.651494
35	Humewood-Cedarvale	-79.428191	43.693781
38	Bloordale Gardens	-79.577201	43.643515
39	Eringate	-79.577201	43.643515
40	Markland Wood	-79.577201	43.643515
41	Old Burnhamthorpe	-79.577201	43.643515
42	Guildwood]]	-79.188711	43.763573
43	Morningside	-79.188711	43.763573
44	West Hill	-79.188711	43.763573
47	The Beaches	-79.293031	43.676357
48	Berczy Park	-79.373306	43.644771
49	Caledonia-Fairbanks]]	-79.453512	43.689026
53	Woburn	-79.216917	43.770992
56	Leaside	-79.363452	43.709060
57	Central Bay Street	-79.387383	43.657952
58	Christie	-79.422564	43.669542
62	Cedarbrae	-79.239476	43.773136
63	Hillcrest Village	-79.363452	43.803762
64	Bathurst Manor	-79.442259	43.754328
65	Downsview North	-79.442259	43.754328
66	Wilson Heights	-79.442259	43.754328
67	Thorncliffe Park	-79.349372	43.705369
68	Adelaide	-79.384568	43.650571
69	King	-79.384568	43.650571
70	Richmond	-79.384568	43.650571
71	Dovercourt Village	-79.442259	43.669005
72	Dufferin	-79.442259	43.669005
76	Scarborough Village	-79.239476	43.744734
77	Fairview	-79.346556	43.778517
78	Henry Farm	-79.346556	43.778517
79	Oriole	-79.346556	43.778517
80	Northwood Park	-79.487262	43.767980
81	York University	-79.487262	43.767980
82	East Toronto	-79.338106	43.685347
83	Harbourfront East	-79.381752	43.640816
84	Toronto Islands	-79.381752	43.640816
85	Union Station	-79.381752	43.640816
86	Little Portugal	-79.419750	43.647927
87	Trinity	-79.419750	43.647927
91	East Birchmount Park	-79.262029	43.727929
92	Ionview	-79.262029	43.727929

93	Kennedy Park	-79.262029	43.727929
94	Bayview Village	-79.385975	43.786947
95	CFB Toronto	-79.464763	43.737473
96	Downsview East	-79.464763	43.737473
97	The Danforth West	-79.352188	43.679557
98	Riverdale	-79.352188	43.679557
99	Design Exchange	-79.381576	43.647177
100	Toronto Dominion Centre	-79.381576	43.647177
101	Brockton	-79.428191	43.636847
102	Exhibition Place	-79.428191	43.636847
103	Parkdale Village	-79.428191	43.636847
107	Clairlea	-79.284577	43.711112
108	Golden Mile	-79.284577	43.711112
109	Oakridge	-79.284577	43.711112
110	Silver Hills	-79.374714	43.757490
111	York Mills	-79.374714	43.757490
112	Downsview West	-79.506944	43.739015
113	The Beaches West	-79.315572	43.668999
114	India Bazaar	-79.315572	43.668999
115	Commerce Court	-79.379817	43.648198
116	Victoria Hotel	-79.379817	43.648198
117	Maple Leaf Park	-79.490074	43.713756
118	North Park	-79.490074	43.713756
119	Upwood Park	-79.490074	43.713756
122	Humber Summit	-79.565963	43.756303
123	Cliffcrest	-79.239476	43.716316
124	Cliffside	-79.239476	43.716316
125	Scarborough Village West	-79.239476	43.716316
126	Newtonbrook	-79.408493	43.789053
127	Willowdale	-79.408493	43.789053
128	Downsview Central	-79.495697	43.728496
129	Studio District	-79.340923	43.659526
130	Bedford Park	-79.419750	43.733283
131	Lawrence Manor East	-79.419750	43.733283
132	Del Ray	-79.476013	43.691116
133	Keelsdale	-79.476013	43.691116
134	Mount Dennis	-79.476013	43.691116
135	Silverthorn	-79.476013	43.691116
138	Emery	-79.532242	43.724766
139	Humberlea	-79.532242	43.724766
140	Birch Cliff	-79.264848	43.692657
141	Cliffside West	-79.264848	43.692657
142	Willowdale South	-79.408493	43.770120
143	Downsview Northwest	-79.520999	43.761631
144	Lawrence Park	-79.388790	43.728020
145	Roselawn	-79.416936	43.711695
146	]The Junction North]]	-79.487262	43.673185
147	Runnymede]]	-79.487262	43.673185

150	Weston	-79.518188	43.706876
151	Dorset Park	-79.273304	43.757410
152	Scarborough Town Centre	-79.273304	43.757410
153	Wexford Heights	-79.273304	43.757410
154	York Mills West	-79.400049	43.752758
156	Davisville North	-79.390197	43.712751
157	Forest Hill North	-79.411307	43.696948
158	Forest Hill West	-79.411307	43.696948
159	High Park	-79.464763	43.661608
160	The Junction South	-79.464763	43.661608
163	Westmount	-79.532242	43.696319
164	Maryvale	-79.295849	43.750071
165	Wexford	-79.295849	43.750071
166	Willowdale West	-79.442259	43.782736
168	North Toronto West	-79.405678	43.715383
169	The Annex	-79.405678	43.672710
170	North Midtown	-79.405678	43.672710
171	Yorkville	-79.405678	43.672710
172	Parkdale	-79.456325	43.648960
173	Roncesvalles	-79.456325	43.648960
174	Canada Post Gateway Processing Centre	-79.615819	43.636966
176	Kingsview Village	-79.554724	43.688905
177	Martin Grove Gardens	-79.554724	43.688905
178	Richview Gardens	-79.554724	43.688905
179	St. Phillips	-79.554724	43.688905
180	Agincourt	-79.262029	43.794200
183	Davisville	-79.388790	43.704324
184	Harbord	-79.400049	43.662696
185	University of Toronto	-79.400049	43.662696
186	Runnymede	-79.484450	43.651571
187	Swansea	-79.484450	43.651571
191	Clarks Corners	-79.304302	43.781638
192	Sullivan	-79.304302	43.781638
193	Tam O'Shanter	-79.304302	43.781638
196	Moore Park	-79.383160	43.689574
197	Summerhill East	-79.383160	43.689574
198	Chinatown	-79.400049	43.653206
199	Grange Park	-79.400049	43.653206
200	Kensington Market	-79.400049	43.653206
205	Agincourt North	-79.284577	43.815252
206	L'Amoreaux East	-79.284577	43.815252
207	Milliken	-79.284577	43.815252
208	Steeles East	-79.284577	43.815252
211	Deer Park	-79.400049	43.686412
212	Forest Hill SE	-79.400049	43.686412
213	Rathnelly	-79.400049	43.686412
214	South Hill	-79.400049	43.686412
215	Summerhill West	-79.400049	43.686412



216	CN Tower	-79.394420	43.628947
217	Bathurst Quay	-79.394420	43.628947
218	Island airport	-79.394420	43.628947
219	Harbourfront West	-79.394420	43.628947
220	King and Spadina	-79.394420	43.628947
221	Railway Lands	-79.394420	43.628947
222	South Niagara	-79.394420	43.628947
225	Humber Bay Shores	-79.501321	43.605647
226	Mimico South	-79.501321	43.605647
227	New Toronto	-79.501321	43.605647
228	Albion Gardens	-79.588437	43.739416
229	Beaumont Heights	-79.588437	43.739416
230	Humbergate	-79.588437	43.739416
231	Jamestown	-79.588437	43.739416
232	Mount Olive	-79.588437	43.739416
233	Silverstone	-79.588437	43.739416
234	South Steeles	-79.588437	43.739416
235	Thistletown	-79.588437	43.739416
236	L'Amoreaux West	-79.318389	43.799525
237	Steeles West	-79.318389	43.799525
240	Rosedale	-79.377529	43.679563
241	Stn A PO Boxes 25 The Esplanade	-79.374846	43.646435
244	Alderwood	-79.543484	43.602414
245	Long Branch	-79.543484	43.602414
246	Northwest	-79.594054	43.706748
247	Upper Rouge	-79.205636	43.836125
250	Cabbagetown	-79.367675	43.667967
251	St. James Town	-79.367675	43.667967
252	First Canadian Place	-79.382280	43.648429
253	Underground city	-79.382280	43.648429
256	The Kingsway	-79.506944	43.653654
257	Montgomery Road	-79.506944	43.653654
258	Old Mill North	-79.506944	43.653654
263	Church and Wellesley	-79.383160	43.665860
266	Business reply mail Processing Centre969 Eastern	-79.321558	43.662744
267	Humber Bay	-79.498509	43.636258
268	King's Mill Park	-79.498509	43.636258
269	Kingsway Park South East	-79.498509	43.636258
270	Mimico NE	-79.498509	43.636258
271	Old Mill South	-79.498509	43.636258
272	The Queensway East	-79.498509	43.636258
273	Royal York South East	-79.498509	43.636258
274	Sunnylea	-79.498509	43.636258
283	Kingsway Park South West	-79.520999	43.628841
284	Mimico NW	-79.520999	43.628841
285	The Queensway West	-79.520999	43.628841
286	Royal York South West	-79.520999	43.628841
287	South of Bloor	-79.520999	43.628841

```
In [6]: toronto_data = df[df['Borough'].str.contains("Toronto")].reset_index(drop=True)
toronto_data
```

```
Out[6]: 0 Postcode Borough \
0 M5A Downtown Toronto
1 M5A Downtown Toronto
2 M5B Downtown Toronto
3 M5B Downtown Toronto
4 M5C Downtown Toronto
5 M4E East Toronto
6 M5E Downtown Toronto
7 M5G Downtown Toronto
8 M6G Downtown Toronto
9 M5H Downtown Toronto
10 M5H Downtown Toronto
11 M5H Downtown Toronto
12 M6H West Toronto
13 M6H West Toronto
14 M5J Downtown Toronto
15 M5J Downtown Toronto
16 M5J Downtown Toronto
17 M6J West Toronto
18 M6J West Toronto
19 M4K East Toronto
20 M4K East Toronto
21 M5K Downtown Toronto
22 M5K Downtown Toronto
23 M6K West Toronto
24 M6K West Toronto
25 M6K West Toronto
26 M4L East Toronto
27 M4L East Toronto
28 M5L Downtown Toronto
29 M5L Downtown Toronto
30 M4M East Toronto
31 M4N Central Toronto
32 M5N Central Toronto
33 M4P Central Toronto
34 M5P Central Toronto
35 M5P Central Toronto
36 M6P West Toronto
37 M6P West Toronto
38 M4R Central Toronto
39 M5R Central Toronto
40 M5R Central Toronto
41 M5R Central Toronto
42 M6R West Toronto
43 M6R West Toronto
```

44	M4S	Central Toronto
45	M5S	Downtown Toronto
46	M5S	Downtown Toronto
47	M6S	West Toronto
48	M6S	West Toronto
49	M4T	Central Toronto
50	M4T	Central Toronto
51	M5T	Downtown Toronto
52	M5T	Downtown Toronto
53	M5T	Downtown Toronto
54	M4V	Central Toronto
55	M4V	Central Toronto
56	M4V	Central Toronto
57	M4V	Central Toronto
58	M4V	Central Toronto
59	M5V	Downtown Toronto
60	M5V	Downtown Toronto
61	M5V	Downtown Toronto
62	M5V	Downtown Toronto
63	M5V	Downtown Toronto
64	M5V	Downtown Toronto
65	M5V	Downtown Toronto
66	M4W	Downtown Toronto
67	M5W	Downtown Toronto
68	M4X	Downtown Toronto
69	M4X	Downtown Toronto
70	M5X	Downtown Toronto
71	M5X	Downtown Toronto
72	M4Y	Downtown Toronto
73	M7Y	East Toronto

0	Neighbourhood	longitude	latitude
0	Harbourfront	-79.360636	43.654260
1	Regent Park	-79.360636	43.654260
2	Ryerson	-79.378937	43.657162
3	Garden District	-79.378937	43.657162
4	St. James Town	-79.375418	43.651494
5	The Beaches	-79.293031	43.676357
6	Berczy Park	-79.373306	43.644771
7	Central Bay Street	-79.387383	43.657952
8	Christie	-79.422564	43.669542
9	Adelaide	-79.384568	43.650571
10	King	-79.384568	43.650571
11	Richmond	-79.384568	43.650571
12	Dovercourt Village	-79.442259	43.669005
13	Dufferin	-79.442259	43.669005
14	Harbourfront East	-79.381752	43.640816
15	Toronto Islands	-79.381752	43.640816

16	Union Station	-79.381752	43.640816
17	Little Portugal	-79.419750	43.647927
18	Trinity	-79.419750	43.647927
19	The Danforth West	-79.352188	43.679557
20	Riverdale	-79.352188	43.679557
21	Design Exchange	-79.381576	43.647177
22	Toronto Dominion Centre	-79.381576	43.647177
23	Brockton	-79.428191	43.636847
24	Exhibition Place	-79.428191	43.636847
25	Parkdale Village	-79.428191	43.636847
26	The Beaches West	-79.315572	43.668999
27	India Bazaar	-79.315572	43.668999
28	Commerce Court	-79.379817	43.648198
29	Victoria Hotel	-79.379817	43.648198
30	Studio District	-79.340923	43.659526
31	Lawrence Park	-79.388790	43.728020
32	Roselawn	-79.416936	43.711695
33	Davisville North	-79.390197	43.712751
34	Forest Hill North	-79.411307	43.696948
35	Forest Hill West	-79.411307	43.696948
36	High Park	-79.464763	43.661608
37	The Junction South	-79.464763	43.661608
38	North Toronto West	-79.405678	43.715383
39	The Annex	-79.405678	43.672710
40	North Midtown	-79.405678	43.672710
41	Yorkville	-79.405678	43.672710
42	Parkdale	-79.456325	43.648960
43	Roncesvalles	-79.456325	43.648960
44	Davisville	-79.388790	43.704324
45	Harbord	-79.400049	43.662696
46	University of Toronto	-79.400049	43.662696
47	Runnymede	-79.484450	43.651571
48	Swansea	-79.484450	43.651571
49	Moore Park	-79.383160	43.689574
50	Summerhill East	-79.383160	43.689574
51	Chinatown	-79.400049	43.653206
52	Grange Park	-79.400049	43.653206
53	Kensington Market	-79.400049	43.653206
54	Deer Park	-79.400049	43.686412
55	Forest Hill SE	-79.400049	43.686412
56	Rathnelly	-79.400049	43.686412
57	South Hill	-79.400049	43.686412
58	Summerhill West	-79.400049	43.686412
59	CN Tower	-79.394420	43.628947
60	Bathurst Quay	-79.394420	43.628947
61	Island airport	-79.394420	43.628947
62	Harbourfront West	-79.394420	43.628947
63	King and Spadina	-79.394420	43.628947

```

64                                     Railway Lands -79.394420  43.628947
65                                     South Niagara -79.394420  43.628947
66                                     Rosedale -79.377529  43.679563
67                               Stn A PO Boxes 25 The Esplanade -79.374846  43.646435
68                                     Cabbagetown -79.367675  43.667967
69                                     St. James Town -79.367675  43.667967
70                               First Canadian Place -79.382280  43.648429
71                               Underground city -79.382280  43.648429
72                               Church and Wellesley -79.383160  43.665860
73 Business reply mail Processing Centre969 Eastern -79.321558  43.662744

```

```
In [7]: # set number of clusters
```

```
kclusters = 5
```

```
toronto_grouped_clustering = toronto_data.drop(['Postcode', 'Borough', 'Neighbourhood'], 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[7]: array([3, 3, 3, 3, 3, 4, 3, 3, 0, 3], dtype=int32)
```

```
In [8]: toronto_merged = toronto_data
```

```
# add clustering labels
```

```
toronto_merged['Cluster Labels'] = kmeans.labels_
```

```
# merge toronto_grouped with toronto_data to add latitude/longitude for each neighborhood
```

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

```
Out[8]: 0 Postcode      Borough  Neighbourhood  longitude  latitude \
0      M5A  Downtown Toronto  Harbourfront -79.360636  43.654260
1      M5A  Downtown Toronto    Regent Park -79.360636  43.654260
2      M5B  Downtown Toronto      Ryerson -79.378937  43.657162
3      M5B  Downtown Toronto  Garden District -79.378937  43.657162
4      M5C  Downtown Toronto  St. James Town -79.375418  43.651494
```

```
0 Cluster Labels
```

```
0          3
```

```
1          3
```

```
2          3
```

```
3          3
```

```
4          3
```

```
In [9]: # location of toronto
```

```
latitude = 43.6532
```

```
longitude = -79.3832
```

```
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'],
```

```
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
```

```
    folium.CircleMarker(
```

```
        [lat, lon],
```

```
        radius=5,
```

```
        popup=label,
```

```
        color=rainbow[cluster-1],
```

```
        fill=True,
```

```
        fill_color=rainbow[cluster-1],
```

```
        fill_opacity=0.7).add_to(map_clusters)
```

```
map_clusters
```

```
Out[9]: <folium.folium.Map at 0x7fdc67e8feb8>
```