## Toronto Capstone W3

August 25, 2019

## 1 Segmenting and Clustering Neighborhoods in Toronto - Assignment Week3

```
[1]: pip install beautifulsoup4
    Collecting beautifulsoup4
      Downloading https://files.pythonhosted.org/packages/1a/b7/34eec2fe5a4971
    8944e215fde81288eec1fa04638aa3fb57c1c6cd0f98c3/beautifulsoup4-4.8.0-py3-none-
    any.whl (97kB)
                            | 102kB 994kB/s ta 0:00:01
    Collecting soupsieve>=1.2 (from beautifulsoup4)
      Downloading https://files.pythonhosted.org/packages/0b/44/0474f2207fdd601bb257
    87671c81076333d2c80e6f97e92790f8887cf682/soupsieve-1.9.3-py2.py3-none-any.whl
    Installing collected packages: soupsieve, beautifulsoup4
    Successfully installed beautifulsoup4-4.8.0 soupsieve-1.9.3
    Note: you may need to restart the kernel to use updated packages.
[2]: pip install lxml #used in the Tutorial
    Collecting lxml
      Downloading https://files.pythonhosted.org/packages/ec/be/5ab8abdd8663c0
    386ec2dd595a5bc0e23330a0549b8a91e32f38c20845b6/lxml-4.4.1-cp36-cp36m-manylinux1_
    x86_64.whl (5.8MB)
                            | 5.8MB 3.0MB/s eta 0:00:01
    Installing collected packages: lxml
    Successfully installed lxml-4.4.1
    Note: you may need to restart the kernel to use updated packages.
[3]: pip install html5lib #only for reference - it wasn't used in the Tutorial on
      \rightarrow Youtube
    Requirement already satisfied: html5lib in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (0.9999999)
    Requirement already satisfied: six in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from html5lib)
    (1.12.0)
    Note: you may need to restart the kernel to use updated packages.
```

```
[4]: pip install requests
    Requirement already satisfied: requests in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (2.22.0)
    Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from requests)
    (1.24.3)
    Requirement already satisfied: chardet<3.1.0,>=3.0.2 in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from requests)
    Requirement already satisfied: idna<2.9,>=2.5 in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from requests)
    (2.8)
    Requirement already satisfied: certifi>=2017.4.17 in
    /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from requests)
    (2019.6.16)
    Note: you may need to restart the kernel to use updated packages.
[5]: from bs4 import BeautifulSoup
     import requests
     import pandas as pd
     import numpy as np
    1.0.1 Let's start by scrapping Wikipedia website and transforming it into a pandas
          data frame, then working on the data frame:
[6]: #extract the HTML content of the website
     website_url = requests.get('https://en.wikipedia.org/wiki/
     →List_of_postal_codes_of_Canada:_M').text
     soup = BeautifulSoup(website_url, 'lxml')
     print(soup.prettify())
    <!DOCTYPE html>
    <html class="client-nojs" dir="ltr" lang="en">
     <head>
      <meta charset="utf-8"/>
      <title>
       List of postal codes of Canada: M - Wikipedia
      </title>
      <script>
       document.documentElement.className=document.documentElement.className.replace
    (/(^|\s)client-nojs(\s|$)/,"$1client-js$2");RLCONF={"wgCanonicalNamespace":"","w
    gCanonicalSpecialPageName":!1, "wgNamespaceNumber":0, "wgPageName": "List_of_postal
    _codes_of_Canada:_M","wgTitle":"List of postal codes of Canada: M","wgCurRevisio
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```

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```
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ober", "November", "December"], "wgMonthNamesShort": ["", "Jan", "Feb", "Mar", "Apr", "Ma
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r":{"pageLanguageCode":"en","pageLanguageDir":"ltr","pageVariantFallbacks":"en"}
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ine":!1}, "wgWMESchemaEditAttemptStepOversample":!1, "wgPoweredByHHVM":!0, "wgULSCu
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ady", "jquery.tablesorter.styles": "ready", "wikibase.client.init": "ready", "ext.vis
ualEditor.desktopArticleTarget.noscript":"ready","ext.uls.interlanguage":"ready"
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ks", "ext.uls.interface", "ext.cx.eventlogging.campaigns", "ext.quicksurveys.init",
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  </script>
  <script>
   (RLQ=window.RLQ||[]).push(function(){mw.loader.implement("user.tokens@Otffind
",function($,jQuery,require,module){/*@nomin*/mw.user.tokens.set({"editToken":"+
\\","patrolToken":"+\\","watchToken":"+\\","csrfToken":"+\\"});
});});
  </script>
  <link href="/w/load.php?lang=en&amp;modules=ext.3d.styles%7Cext.cite.styles%7C</pre>
ext.uls.interlanguage%7Cext.visualEditor.desktopArticleTarget.noscript%7Cext.wik
imediaBadges%7Cjquery.tablesorter.styles%7Cmediawiki.legacy.commonPrint%2Cshared
%7Cmediawiki.skinning.interface%7Cskins.vector.styles%7Cwikibase.client.init&amp
;only=styles&skin=vector" rel="stylesheet"/>
```

<script async="" src="/w/load.php?lang=en&amp;modules=startup&amp;only=scripts</pre>

```
& raw=1& skin=vector">
  </script>
  <meta content="" name="ResourceLoaderDynamicStyles"/>
  <link href="/w/load.php?lang=en&amp;modules=ext.gadget.charinsert-</pre>
styles&only=styles&skin=vector" rel="stylesheet"/>
  <link href="/w/load.php?lang=en&amp;modules=site.styles&amp;only=styles&amp;sk</pre>
in=vector" rel="stylesheet"/>
  <meta content="MediaWiki 1.34.0-wmf.19" name="generator"/>
  <meta content="origin" name="referrer"/>
  <meta content="origin-when-crossorigin" name="referrer"/>
  <meta content="origin-when-cross-origin" name="referrer"/>
  <link href="android-app://org.wikipedia/http/en.m.wikipedia.org/wiki/List_of_p</pre>
ostal_codes_of_Canada:_M" rel="alternate"/>
  link
href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&action=edit"
rel="alternate" title="Edit this page" type="application/x-wiki"/>
  link
href="/w/index.php?title=List_of_postal_codes_of_Canada: M&action=edit"
rel="edit" title="Edit this page"/>
  <link href="/static/apple-touch/wikipedia.png" rel="apple-touch-icon"/>
  <link href="/static/favicon/wikipedia.ico" rel="shortcut icon"/>
  <link href="/w/opensearch_desc.php" rel="search" title="Wikipedia (en)"</pre>
type="application/opensearchdescription+xml"/>
  <link href="//en.wikipedia.org/w/api.php?action=rsd" rel="EditURI"</pre>
type="application/rsd+xml"/>
  <link href="//creativecommons.org/licenses/by-sa/3.0/" rel="license"/>
  <link href="https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada: M"</pre>
rel="canonical"/>
  <link href="//login.wikimedia.org" rel="dns-prefetch"/>
  <link href="//meta.wikimedia.org" rel="dns-prefetch"/>
  <!--[if lt IE 9]><script
src="/w/resources/lib/html5shiv/html5shiv.js"></script><![endif]-->
 </head>
 <body class="mediawiki ltr sitedir-ltr mw-hide-empty-elt ns-0 ns-subject mw-</pre>
editable page-List of postal codes of Canada M rootpage-
List_of_postal_codes_of_Canada_M skin-vector action-view">
  <div class="noprint" id="mw-page-base">
  <div class="noprint" id="mw-head-base">
  <div class="mw-body" id="content" role="main">
   <a id="top">
   </a>
   <div class="mw-body-content" id="siteNotice">
    <!-- CentralNotice -->
   <div class="mw-indicators mw-body-content">
   </div>
```

```
<h1 class="firstHeading" id="firstHeading" lang="en">
   List of postal codes of Canada: M
   </h1>
   <div class="mw-body-content" id="bodyContent">
    <div class="noprint" id="siteSub">
    From Wikipedia, the free encyclopedia
    </div>
    <div id="contentSub">
    </div>
    <div id="jump-to-nav">
    </div>
    <a class="mw-jump-link" href="#mw-head">
     Jump to navigation
    </a>
    <a class="mw-jump-link" href="#p-search">
    Jump to search
    \langle a \rangle
    <div class="mw-content-ltr" dir="ltr" id="mw-content-text" lang="en">
     <div class="mw-parser-output">
      >
       This is a list of
       <a href="/wiki/Postal_codes_in_Canada" title="Postal codes in Canada">
       postal codes in Canada
       </a>
       where the first letter is M. Postal codes beginning with M are located
within the city of
       <a href="/wiki/Toronto" title="Toronto">
        Toronto
       </a>
       in the province of
       <a href="/wiki/Ontario" title="Ontario">
        Ontario
       </a>
       . Only the first three characters are listed, corresponding to the
Forward Sortation Area.
      <a href="/wiki/Canada_Post" title="Canada Post">
        Canada Post
       provides a free postal code look-up tool on its website,
       <sup class="reference" id="cite_ref-1">
        <a href="#cite_note-1">
         [1]
        </a>
       </sup>
       via its
       <a href="/wiki/Mobile_app" title="Mobile app">
```

```
applications
       </a>
       for such
       <a class="mw-redirect" href="/wiki/Smartphones" title="Smartphones">
        smartphones
       </a>
       as the
       <a href="/wiki/IPhone" title="IPhone">
        iPhone
       </a>
       and
       <a href="/wiki/BlackBerry" title="BlackBerry">
        BlackBerry
       </a>
       <sup class="reference" id="cite_ref-2">
        <a href="#cite_note-2">
         [2]
        </a>
       </sup>
       and sells hard-copy directories and
       <a href="/wiki/CD-ROM" title="CD-ROM">
        CD-ROMs
       </a>
       . Many vendors also sell validation tools, which allow customers to
properly match addresses and postal codes. Hard-copy directories can also be
consulted in all post offices, and some libraries.
      <h2>
       <span class="mw-headline" id="Toronto_-_FSAs">
        <a href="/wiki/Toronto" title="Toronto">
         Toronto
        </a>
        <a href="/wiki/Postal_codes_in_Canada#Forward_sortation_areas"</pre>
title="Postal codes in Canada">
         FSAs
        </a>
       </span>
       <span class="mw-editsection">
        <span class="mw-editsection-bracket">
         </span>
        <a href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&amp;action</pre>
=edit&section=1" title="Edit section: Toronto - FSAs">
         edit
        </a>
        <span class="mw-editsection-bracket">
```

```
]
     </span>
    </span>
    </h2>
    >
    Note: There are no rural FSAs in Toronto, hence no postal codes should
start with MO, however, the postal code MOR 8TO is assigned to an amazon
warehouse in Mississauga, suggesting that Canada Post may be allocating the MO
FSA for high volume addresses.
    Postcode
      Borough
      Neighbourhood
      M1A
      Not assigned
      Not assigned
      M2A
      Not assigned
      Not assigned
```

МЗА

```
<a href="/wiki/North_York" title="North York">
  North York
 </a>
<a href="/wiki/Parkwoods" title="Parkwoods">
 Parkwoods
 </a>
M4A
<a href="/wiki/North_York" title="North York">
  North York
 </a>
<a href="/wiki/Victoria_Village" title="Victoria Village">
  Victoria Village
 </a>
M5A
<a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
 Downtown Toronto
 </a>
<a href="/wiki/Harbourfront_(Toronto)" title="Harbourfront (Toronto)">
 Harbourfront
 </a>
M5A
<a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
```

```
</a>
       <a href="/wiki/Regent_Park" title="Regent Park">
        Regent Park
       </a>
       M6A
       <a href="/wiki/North_York" title="North York">
        North York
       </a>
       <a href="/wiki/Lawrence_Heights" title="Lawrence Heights">
        Lawrence Heights
       </a>
       M6A
       <a href="/wiki/North_York" title="North York">
        North York
       </a>
       <a href="/wiki/Lawrence_Manor" title="Lawrence Manor">
        Lawrence Manor
       </a>
       M7A
       <a href="/wiki/Queen%27s_Park_(Toronto)" title="Queen's Park</pre>
(Toronto)">
        Queen's Park
       </a>
```

Downtown Toronto

```
Not assigned
      A8M
      Not assigned
      Not assigned
      M9A
      <a href="/wiki/Etobicoke" title="Etobicoke">
       Etobicoke
       </a>
      <a class="mw-redirect" href="/wiki/Islington_Avenue" title="Islington</pre>
Avenue">
        Islington Avenue
       </a>
      M1B
      <a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
        Scarborough
       </a>
      <a href="/wiki/Rouge,_Toronto" title="Rouge, Toronto">
       </a>
```

```
M1B
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
 Scarborough
 </a>
<a href="/wiki/Malvern,_Toronto" title="Malvern, Toronto">
 Malvern
 </a>
M2B
Not assigned
Not assigned
МЗВ
<a href="/wiki/North_York" title="North York">
 North York
 </a>
Don Mills North
M4B
<a href="/wiki/East_York" title="East York">
 East York
 </a>
```

```
<a class="mw-redirect" href="/wiki/Woodbine_Gardens" title="Woodbine</pre>
Gardens">
        Woodbine Gardens
        </a>
       M4B
       <a href="/wiki/East_York" title="East York">
        East York
        </a>
       <a class="mw-redirect" href="/wiki/Parkview_Hill" title="Parkview</pre>
Hill">
        Parkview Hill
        </a>
       M5B
       <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
        Downtown Toronto
        </a>
       Ryerson
       M5B
       <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
        Downtown Toronto
        </a>
       Garden District
```

```
M6B
<a href="/wiki/North_York" title="North York">
 North York
 </a>
Glencairn
M7B
Not assigned
Not assigned
M8B
Not assigned
Not assigned
M9B
<a href="/wiki/Etobicoke" title="Etobicoke">
 Etobicoke
 </a>
Cloverdale
```

```
M9B
      <a href="/wiki/Etobicoke" title="Etobicoke">
        Etobicoke
       </a>
      <a class="mw-redirect" href="/wiki/Islington,_Toronto"</pre>
title="Islington, Toronto">
        Islington
       </a>
      M9B
      <a href="/wiki/Etobicoke" title="Etobicoke">
       Etobicoke
       </a>
      Martin Grove
      M9B
      <a href="/wiki/Etobicoke" title="Etobicoke">
        Etobicoke
       </a>
      <a href="/wiki/Princess_Gardens" title="Princess Gardens">
       Princess Gardens
       </a>
      M9B
```

```
<a href="/wiki/Etobicoke" title="Etobicoke">
         Etobicoke
        </a>
       <a class="mw-redirect" href="/wiki/West_Deane_Park" title="West Deane</pre>
Park">
        West Deane Park
        </a>
       M1C
       <a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
         Scarborough
        </a>
       <a href="/wiki/Highland_Creek_(Toronto)" title="Highland Creek</pre>
(Toronto)">
        Highland Creek
        </a>
       M1C
       <a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
         Scarborough
        </a>
       <a class="mw-redirect" href="/wiki/Rouge_Hill" title="Rouge Hill">
        Rouge Hill
        </a>
       M1C
```

```
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
  Scarborough
 </a>
<a href="/wiki/Port_Union,_Toronto" title="Port Union, Toronto">
 Port Union
 </a>
M2C
Not assigned
Not assigned
МЗС
<a href="/wiki/North_York" title="North York">
  North York
 </a>
<a href="/wiki/Flemingdon_Park" title="Flemingdon Park">
  Flemingdon Park
 </a>
M3C
<a href="/wiki/North_York" title="North York">
  North York
 </a>
Don Mills South
```

```
M4C
       <a href="/wiki/East_York" title="East York">
        East York
        </a>
       <a class="mw-redirect" href="/wiki/Woodbine_Heights" title="Woodbine</pre>
Heights">
        Woodbine Heights
        </a>
       M5C
       <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
        Downtown Toronto
       </a>
       <a href="/wiki/St._James_Town" title="St. James Town">
        St. James Town
        </a>
       M6C
       York
       <a class="mw-redirect" href="/wiki/Humewood-Cedarvale"</pre>
title="Humewood-Cedarvale">
        Humewood-Cedarvale
        </a>
```

```
M7C
Not assigned
Not assigned
M8C
Not assigned
Not assigned
M9C
<a href="/wiki/Etobicoke" title="Etobicoke">
 Etobicoke
 </a>
Bloordale Gardens
M9C
<a href="/wiki/Etobicoke" title="Etobicoke">
 Etobicoke
 </a>
Eringate
```

```
M9C
<a href="/wiki/Etobicoke" title="Etobicoke">
  Etobicoke
 </a>
<a href="/wiki/Markland_Wood" title="Markland Wood">
 Markland Wood
 </a>
M9C
<a href="/wiki/Etobicoke" title="Etobicoke">
 Etobicoke
 </a>
Old Burnhamthorpe
M1E
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
  Scarborough
 </a>
Guildwood
M1E
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
  Scarborough
 </a>
```

```
<a href="/wiki/Morningside,_Toronto" title="Morningside, Toronto">
 Morningside
 </a>
M1E
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
 Scarborough
 </a>
<a href="/wiki/West_Hill,_Toronto" title="West Hill, Toronto">
 West Hill
 </a>
M2E
Not assigned
Not assigned
M3E
Not assigned
Not assigned
M4E
```

```
<a href="/wiki/East_Toronto" title="East Toronto">
 East Toronto
 </a>
<a href="/wiki/The_Beaches" title="The Beaches">
 The Beaches
 </a>
M5E
<a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
 Downtown Toronto
 </a>
<a href="/wiki/Berczy_Park" title="Berczy Park">
 Berczy Park
 </a>
M6E
York
Caledonia-Fairbanks
M7E
Not assigned
Not assigned
```

```
M8E
Not assigned
Not assigned
M9E
Not assigned
Not assigned
M1G
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
 Scarborough
 </a>
<a href="/wiki/Woburn,_Toronto" title="Woburn, Toronto">
 Woburn
 </a>
M2G
Not assigned
Not assigned
```

```
M3G
Not assigned
Not assigned
M4G
<a href="/wiki/East_York" title="East York">
 East York
 </a>
<a href="/wiki/Leaside" title="Leaside">
 Leaside
 </a>
M5G
<a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
 Downtown Toronto
 </a>
Central Bay Street
M6G
<a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
 Downtown Toronto
 </a>
```

```
Christie
M7G
Not assigned
Not assigned
M8G
Not assigned
Not assigned
M9G
Not assigned
Not assigned
M1H
<a href="/wiki/Scarborough,_Toronto" title="Scarborough, Toronto">
 Scarborough
 </a>
Cedarbrae
```

```
M2H
<a href="/wiki/North_York" title="North York">
 North York
 </a>
<a href="/wiki/Hillcrest_Village" title="Hillcrest Village">
 Hillcrest Village
 </a>
МЗН
<a href="/wiki/North_York" title="North York">
 North York
 </a>
<a href="/wiki/Bathurst_Manor" title="Bathurst Manor">
 Bathurst Manor
 </a>
МЗН
<a href="/wiki/North_York" title="North York">
 North York
 </a>
Downsview North
МЗН
```

```
<a href="/wiki/North_York" title="North York">
         North York
        </a>
       <a class="mw-redirect" href="/wiki/Wilson_Heights,_Toronto"</pre>
title="Wilson Heights, Toronto">
         Wilson Heights
        </a>
       M4H
       <a href="/wiki/East_York" title="East York">
        East York
        </a>
       <a href="/wiki/Thorncliffe_Park" title="Thorncliffe Park">
         Thorncliffe Park
        </a>
       M5H
       <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
        Downtown Toronto
        </a>
       Adelaide
       M5H
       <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
         Downtown Toronto
        </a>
```

```
King
      M5H
      <a href="/wiki/Downtown_Toronto" title="Downtown Toronto">
        Downtown Toronto
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      Richmond
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Y8M
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Royal York South West
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             b
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          . 15 October 2008.
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             \langle a \rangle
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postal codes of Canada: L">
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postal codes of Canada: P">
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          Х
         </a>
         color: #FFE0FF; font-size: 135%;" width="5%">
         <a href="/wiki/List_of_postal_codes_of_Canada:_Y" title="List of</pre>
postal codes of Canada: Y">
          γ
         </a>
```

```
<!--
NewPP limit report
Parsed by mw1256
Cached time: 20190814214045
Cache expiry: 2592000
Dynamic content: false
Complications: [vary-revision-sha1]
CPU time usage: 0.220 seconds
Real time usage: 0.256 seconds
Preprocessor visited node count: 575/1000000
Preprocessor generated node count: 0/1500000
Post-expand include size: 10232/2097152 bytes
Template argument size: 13/2097152 bytes
Highest expansion depth: 4/40
Expensive parser function count: 0/500
Unstrip recursion depth: 1/20
Unstrip post-expand size: 9025/5000000 bytes
Number of Wikibase entities loaded: 0/400
Lua time usage: 0.063/10.000 seconds
Lua memory usage: 1.71 MB/50 MB
-->
Transclusion expansion time report (%,ms,calls,template)
100.00% 118.546 1 -total
80.17% 95.043
                     3 Template:Cite_web
 4.81% 5.699
                    1 Template: Canadian_postal_codes
                   1 Template:Col-2
1 Template:Col-be
 4.56% 5.406
  2.49% 2.951
                     1 Template:Col-begin
  2.09%
        2.477
                     1 Template:Col-break
 2.00%
        2.367
                      2 Template:Col-end
      <!-- Saved in parser cache with key
enwiki:pcache:idhash:539066-0!canonical and timestamp 20190814214045 and
revision id 906439794
 -->
     </div>
     <noscript>
      <img alt="" height="1"</pre>
src="//en.wikipedia.org/wiki/Special:CentralAutoLogin/start?type=1x1"
style="border: none; position: absolute;" title="" width="1"/>
    </noscript>
    </div>
    <div class="printfooter">
    Retrieved from "
     <a dir="ltr" href="https://en.wikipedia.org/w/index.php?title=List_of_posta</pre>
1_codes_of_Canada:_M&oldid=906439794">
      https://en.wikipedia.org/w/index.php?title=List_of_postal_codes_of_Canada:
```

```
_M&oldid=906439794
     </a>
    </div>
    <div class="catlinks" data-mw="interface" id="catlinks">
    <div class="mw-normal-catlinks" id="mw-normal-catlinks">
     <a href="/wiki/Help:Category" title="Help:Category">
      Categories
     </a>
     <l
       <
        <a href="/wiki/Category:Communications_in_Ontario"</pre>
title="Category:Communications in Ontario">
        Communications in Ontario
        </a>
       <
        <a href="/wiki/Category:Postal_codes_in_Canada" title="Category:Postal")</pre>
codes in Canada">
        Postal codes in Canada
       </a>
       <
       <a href="/wiki/Category:Toronto" title="Category:Toronto">
        Toronto
       </a>
       <
        <a href="/wiki/Category:Ontario-related_lists" title="Category:Ontario-</pre>
related lists">
        Ontario-related lists
       </a>
      </div>
    </div>
    <div class="visualClear">
   </div>
  </div>
  </div>
  <div id="mw-data-after-content">
  <div class="read-more-container">
  </div>
  </div>
  <div id="mw-navigation">
   <h2>
   Navigation menu
```

```
</h2>
  <div id="mw-head">
   <div aria-labelledby="p-personal-label" id="p-personal" role="navigation">
    <h3 id="p-personal-label">
     Personal tools
    </h3>
    <l
     Not logged in
     <a accesskey="n" href="/wiki/Special:MyTalk" title="Discussion about</pre>
edits from this IP address [n]">
       Talk
      </a>
     <a accesskey="y" href="/wiki/Special:MyContributions" title="A list of</pre>
edits made from this IP address [y]">
      Contributions
      </a>
     <a href="/w/index.php?title=Special:CreateAccount&amp;returnto=List+of+po</pre>
stal+codes+of+Canada%3A+M" title="You are encouraged to create an account and
log in; however, it is not mandatory">
      Create account
      </a>
     id="pt-login">
      <a accesskey="o" href="/w/index.php?title=Special:UserLogin&amp;returnto=</pre>
List+of+postal+codes+of+Canada%3A+M" title="You're encouraged to log in;
however, it's not mandatory. [o]">
      Log in
      </a>
     </div>
   <div id="left-navigation">
    <div aria-labelledby="p-namespaces-label" class="vectorTabs"</pre>
id="p-namespaces" role="navigation">
     <h3 id="p-namespaces-label">
      Namespaces
     </h3>
     <l
      <span>
        <a accesskey="c" href="/wiki/List_of_postal_codes_of_Canada:_M"</pre>
```

```
title="View the content page [c]">
        Article
        </a>
       </span>
      id="ca-talk">
       <span>
        <a accesskey="t" href="/wiki/Talk:List_of_postal_codes_of_Canada:_M"</pre>
rel="discussion" title="Discussion about the content page [t]">
        Talk
        </a>
       </span>
      </div>
    <div aria-labelledby="p-variants-label" class="vectorMenu emptyPortlet"</pre>
id="p-variants" role="navigation">
     <input aria-labelledby="p-variants-label" class="vectorMenuCheckbox"</pre>
type="checkbox"/>
     <h3 id="p-variants-label">
      <span>
       Variants
      </span>
     </h3>
     </div>
   </div>
   <div id="right-navigation">
    <div aria-labelledby="p-views-label" class="vectorTabs" id="p-views"</pre>
role="navigation">
     <h3 id="p-views-label">
      Views
     </h3>
     <l
      <a href="/wiki/List_of_postal_codes_of_Canada:_M">
        Read
        </a>
       </span>
      <a accesskey="e"
href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&action=edit"
title="Edit this page [e]">
        Edit
```

```
</a>
       </span>
      <span>
        <a accesskey="h"
href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&action=history"
title="Past revisions of this page [h]">
         View history
        </a>
       </span>
      </div>
     <div aria-labelledby="p-cactions-label" class="vectorMenu emptyPortlet"</pre>
id="p-cactions" role="navigation">
     <input aria-labelledby="p-cactions-label" class="vectorMenuCheckbox"</pre>
type="checkbox"/>
     <h3 id="p-cactions-label">
      <span>
       More
      </span>
     </h3>
     </111>
     </div>
     <div id="p-search" role="search">
     <h3>
      <label for="searchInput">
       Search
      </label>
     <form action="/w/index.php" id="searchform">
      <div id="simpleSearch">
       <input accesskey="f" id="searchInput" name="search" placeholder="Search</pre>
Wikipedia" title="Search Wikipedia [f]" type="search"/>
       <input name="title" type="hidden" value="Special:Search"/>
       <input class="searchButton mw-fallbackSearchButton" id="mw-searchButton"</pre>
name="fulltext" title="Search Wikipedia for this text" type="submit"
value="Search"/>
       <input class="searchButton" id="searchButton" name="go" title="Go to a</pre>
page with this exact name if it exists" type="submit" value="Go"/>
      </div>
     </form>
    </div>
   </div>
   </div>
   <div id="mw-panel">
```

```
<div id="p-logo" role="banner">
    <a class="mw-wiki-logo" href="/wiki/Main_Page" title="Visit the main page">
    \langle a \rangle
   </div>
   <div aria-labelledby="p-navigation-label" class="portal" id="p-navigation"</pre>
role="navigation">
    <h3 id="p-navigation-label">
     Navigation
    </h3>
    <div class="body">
     <l
      <a accesskey="z" href="/wiki/Main_Page" title="Visit the main page [z]">
        Main page
       </a>
      id="n-contents">
       <a href="/wiki/Portal:Contents" title="Guides to browsing Wikipedia">
        Contents
       </a>
      <a href="/wiki/Portal:Featured_content" title="Featured content - the</pre>
best of Wikipedia">
       Featured content
       </a>
      <a href="/wiki/Portal:Current_events" title="Find background information</pre>
on current events">
        Current events
       \langle a \rangle
      <a accesskey="x" href="/wiki/Special:Random" title="Load a random</pre>
article [x]">
       Random article
       </a>
      <a href="https://donate.wikimedia.org/wiki/Special:FundraiserRedirector?"</pre>
utm_source=donate&utm_medium=sidebar&utm_campaign=C13_en.wikipedia.org&a
mp;uselang=en" title="Support us">
        Donate to Wikipedia
       </a>
      id="n-shoplink">
       <a href="//shop.wikimedia.org" title="Visit the Wikipedia store">
```

```
Wikipedia store
       </a>
      </div>
   </div>
   <div aria-labelledby="p-interaction-label" class="portal" id="p-interaction"</pre>
role="navigation">
    <h3 id="p-interaction-label">
     Interaction
    </h3>
    <div class="body">
     <l
      id="n-help">
       <a href="/wiki/Help:Contents" title="Guidance on how to use and edit</pre>
Wikipedia">
        Help
       </a>
      <a href="/wiki/Wikipedia:About" title="Find out about Wikipedia">
        About Wikipedia
       </a>
      id="n-portal">
       <a href="/wiki/Wikipedia:Community_portal" title="About the project,</pre>
what you can do, where to find things">
        Community portal
       </a>
      <a accesskey="r" href="/wiki/Special:RecentChanges" title="A list of</pre>
recent changes in the wiki [r]">
        Recent changes
       </a>
      <a href="//en.wikipedia.org/wiki/Wikipedia:Contact_us" title="How to</pre>
contact Wikipedia">
        Contact page
       </a>
      </div>
   <div aria-labelledby="p-tb-label" class="portal" id="p-tb"</pre>
role="navigation">
    <h3 id="p-tb-label">
```

```
Tools
    </h3>
    <div class="body">
     <111>
      <a accesskey="j"
href="/wiki/Special:WhatLinksHere/List_of_postal_codes_of_Canada:_M" title="List
of all English Wikipedia pages containing links to this page [j]">
        What links here
       </a>
      <a accesskey="k"
href="/wiki/Special:RecentChangesLinked/List_of_postal_codes_of_Canada: M"
rel="nofollow" title="Recent changes in pages linked from this page [k]">
       Related changes
       </a>
      id="t-upload">
       <a accesskey="u" href="/wiki/Wikipedia:File_Upload_Wizard" title="Upload</pre>
files [u]">
       Upload file
       </a>
      <a accesskey="q" href="/wiki/Special:SpecialPages" title="A list of all</pre>
special pages [q]">
       Special pages
       </a>
      href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&oldid=906439794"
title="Permanent link to this revision of the page">
       Permanent link
       </a>
      id="t-info">
href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&action=info"
title="More information about this page">
        Page information
       </a>
      id="t-wikibase">
       <a accesskey="g"
href="https://www.wikidata.org/wiki/Special:EntityPage/Q3248240" title="Link to
connected data repository item [g]">
```

```
Wikidata item
       </a>
      id="t-cite">
       <a href="/w/index.php?title=Special:CiteThisPage&amp;page=List of postal</pre>
_codes_of_Canada%3A_M&id=906439794" title="Information on how to cite this
page">
        Cite this page
       </a>
      </div>
    </div>
    <div aria-labelledby="p-coll-print_export-label" class="portal" id="p-coll-</pre>
print_export" role="navigation">
    <h3 id="p-coll-print_export-label">
     Print/export
    </h3>
    <div class="body">
     ul>
      id="coll-create a book">
       <a href="/w/index.php?title=Special:Book&amp;bookcmd=book creator&amp;re</pre>
ferer=List+of+postal+codes+of+Canada%3A+M">
        Create a book
       </a>
      <a href="/w/index.php?title=Special:ElectronPdf&amp;page=List+of+postal+</pre>
codes+of+Canada%3A+M&action=show-download-screen">
        Download as PDF
       </a>
      id="t-print">
       <a accesskey="p"
href="/w/index.php?title=List_of_postal_codes_of_Canada:_M&printable=yes"
title="Printable version of this page [p]">
        Printable version
       </a>
      </111>
    </div>
    </div>
    <div aria-labelledby="p-lang-label" class="portal" id="p-lang"</pre>
role="navigation">
    <h3 id="p-lang-label">
     Languages
    </h3>
     <div class="body">
```

```
<l
      <a class="interlanguage-link-target" href="https://fr.wikipedia.org/wiki</pre>
/Liste_des_codes_postaux_canadiens_d%C3%A9butant_par_M" hreflang="fr" lang="fr"
title="Liste des codes postaux canadiens débutant par M - French">
        Français
       </a>
      <div class="after-portlet after-portlet-lang">
      <span class="wb-langlinks-edit wb-langlinks-link">
       <a class="wbc-editpage"</pre>
href="https://www.wikidata.org/wiki/Special:EntityPage/Q3248240#sitelinks-
wikipedia" title="Edit interlanguage links">
        Edit links
       </a>
      </span>
     </div>
    </div>
   </div>
  </div>
 </div>
 <div id="footer" role="contentinfo">
  'd="footer-info">
   This page was last edited on 15 July 2019, at 21:03
    <span class="anonymous-show">
     (UTC)
    </span>
   Text is available under the
href="//en.wikipedia.org/wiki/Wikipedia:Text_of_Creative_Commons_Attribution-
ShareAlike 3.0 Unported License" rel="license">
     Creative Commons Attribution-ShareAlike License
    <a href="//creativecommons.org/licenses/by-sa/3.0/" rel="license"</pre>
style="display:none;">
    </a>
additional terms may apply. By using this site, you agree to the
    <a href="//foundation.wikimedia.org/wiki/Terms_of_Use">
     Terms of Use
    </a>
    and
    <a href="//foundation.wikimedia.org/wiki/Privacy_policy">
```

```
Privacy Policy
    </a>
    . Wikipedia® is a registered trademark of the
    <a href="//www.wikimediafoundation.org/">
    Wikimedia Foundation, Inc.
    , a non-profit organization.
   d="footer-places">
   <a class="extiw"</pre>
href="https://foundation.wikimedia.org/wiki/Privacy_policy" title="wmf:Privacy_
policy">
    Privacy policy
    \langle a \rangle
   <a href="/wiki/Wikipedia:About" title="Wikipedia:About">
    About Wikipedia
    </a>
   <a href="/wiki/Wikipedia:General_disclaimer" title="Wikipedia:General</pre>
disclaimer">
    Disclaimers
    </a>
   <a href="//en.wikipedia.org/wiki/Wikipedia:Contact_us">
    Contact Wikipedia
    \langle a \rangle
   href="https://www.mediawiki.org/wiki/Special:MyLanguage/How_to_contribute">
    Developers
    </a>
   <a href="https://foundation.wikimedia.org/wiki/Cookie_statement">
    Cookie statement
   </a>
   <a class="noprint stopMobileRedirectToggle" href="//en.m.wikipedia.org/w/in</pre>
dex.php?title=List_of_postal_codes_of_Canada:_M&mobileaction=toggle_view_mob
ile">
```

```
Mobile view
    </a>
   <a href="https://wikimediafoundation.org/">
     <img alt="Wikimedia Foundation" height="31" src="/static/images/wikimedia-</pre>
button.png" srcset="/static/images/wikimedia-button-1.5x.png 1.5x,
/static/images/wikimedia-button-2x.png 2x" width="88"/>
    </a>
   <a href="https://www.mediawiki.org/">
     <img alt="Powered by MediaWiki" height="31"</pre>
src="/static/images/poweredby_mediawiki_88x31.png"
srcset="/static/images/poweredby_mediawiki_132x47.png 1.5x,
/static/images/poweredby_mediawiki_176x62.png 2x" width="88"/>
    </a>
   <div style="clear: both;">
  </div>
  </div>
  <script>
   (RLQ=window.RLQ||[]).push(function(){mw.config.set({"wgPageParseReport":{"lim
itreport":{"cputime":"0.220","walltime":"0.256","ppvisitednodes":{"value":575,"l
imit":1000000}, "ppgeneratednodes": {"value":0, "limit":1500000}, "postexpandinclude
size":{"value":10232,"limit":2097152},"templateargumentsize":{"value":13,"limit"
:2097152}, "expansiondepth": {"value":4, "limit":40}, "expensivefunctioncount": {"val
ue":0,"limit":500}, "unstrip-depth":{"value":1,"limit":20}, "unstrip-size":{"value
":9025, "limit":5000000}, "entityaccesscount": {"value":0, "limit":400}, "timingprofi
                           1 -total"," 80.17%
le":["100.00% 118.546
                                               95.043
Template:Cite web"," 4.81%
                              5.699
                                         1 Template: Canadian_postal_codes","
                   1 Template:Col-2"," 2.49%
4.56%
                                                           1 Template:Col-
        5.406
                                                2.951
                  2.477
                                                              2.367
begin"," 2.09%
                             1 Template:Col-break", 2.00%
Template:Col-end"]}, "scribunto":{"limitreport-
timeusage":{"value":"0.063","limit":"10.000"},"limitreport-memusage":{"value":17
88770, "limit": 52428800}}, "cachereport": {"origin": "mw1256", "timestamp": "201908142
14045", "ttl":2592000, "transientcontent":false}});});
  </script>
  <script type="application/ld+json">
   {"@context":"https:\/\/schema.org","@type":"Article","name":"List of postal
codes of Canada: M", "url": "https:\/\en.wikipedia.org\/wiki\/List_of_postal_code
s_of_Canada:_M", "sameAs": "http:\/\/www.wikidata.org\/entity\/Q3248240", "mainEnti
ty": "http:\/\/www.wikidata.org\/entity\/Q3248240", "author": { "@type": "Organizatio
n", "name": "Contributors to Wikimedia
projects"}, "publisher": {"@type": "Organization", "name": "Wikimedia Foundation, Inc
```

```
.","logo":{"@type":"ImageObject","url":"https:\/\/www.wikimedia.org\/static\/ima
    ges\/wmf-hor-googpub.png"}}, "datePublished": "2004-03-20T10:02:13Z", "dateModified
    ":"2019-07-15T21:03:58Z", "headline": "Wikimedia list article"}
      </script>
      <script>
       (RLQ=window.RLQ||[]).push(function(){mw.config.set({"wgBackendResponseTime":1
    03, "wgHostname": "mw1269"}); });
      </script>
     </body>
    </html>
[7]: #transforming the HTML in a Pandas Dataframe
     table = soup.find('table', {'class':'wikitable sortable'})
     table_rows = table.find_all('tr')
     res = []
     for tr in table_rows:
         td = tr.find_all('td')
         row = [tr.text.strip() for tr in td]
         if row:
             res.append(row)
     df = pd.DataFrame(res, columns=["PostalCode", "Borough", "Neighborhood"])
     df.head()
[7]:
      PostalCode
                                          Neighborhood
                            Borough
     0
              M1A
                       Not assigned
                                         Not assigned
     1
              M2A
                       Not assigned
                                         Not assigned
                         North York
     2
              M3A
                                            Parkwoods
     3
              M4A
                         North York Victoria Village
              M5A Downtown Toronto
                                         Harbourfront
[8]: #original number of rows
     df.shape
[8]: (288, 3)
[9]: #Drop all the 'Not assigned' in 'Borough' column --> I used the math's
     → complement theory
     mask = df['Borough'].isin(['Not assigned'])
     bor clean = df[~mask]
     bor_clean.reset_index(drop=True, inplace=True)
     bor_clean.head()
[9]:
      PostalCode
                            Borough
                                          Neighborhood
     0
              МЗА
                         North York
                                             Parkwoods
     1
              M4A
                         North York Victoria Village
```

```
2
               M5A Downtown Toronto
                                           Harbourfront
      3
               M5A Downtown Toronto
                                            Regent Park
      4
               M6A
                          North York Lawrence Heights
[10]: | #number of rows after eliminating the 'not assigned' values in 'Borough'
      bor_clean.shape
[10]: (211, 3)
[11]: #check if some 'Neighborhood' has a 'Not assigned'
      print(bor clean[bor clean['Neighborhood']=='Not assigned'])
                         Borough Neighborhood
       PostalCode
     6
                  Queen's Park Not assigned
              M7A
[12]: #replace the 'Not assigned' in the 'Neighborhood' column with the same value as
       → the 'Borough' column
      #in the documentation page it says this is a bad practice
      bor_clean.loc[bor_clean['Neighborhood'] == ('Not assigned'), 'Neighborhood'] =_ ('Not assigned'), 'Neighborhood']
       →bor_clean['Borough']
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-
     packages/pandas/core/indexing.py:205: SettingWithCopyWarning:
     A value is trying to be set on a copy of a slice from a DataFrame
     See the caveats in the documentation: http://pandas.pydata.org/pandas-
     docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
       self._setitem_with_indexer(indexer, value)
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-
     packages/ipykernel_launcher.py:3: SettingWithCopyWarning:
     A value is trying to be set on a copy of a slice from a DataFrame
     See the caveats in the documentation: http://pandas.pydata.org/pandas-
     docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
       This is separate from the ipykernel package so we can avoid doing imports
     until
[13]: bor_clean.head(10)
[13]:
        PostalCode
                             Borough
                                           Neighborhood
      0
               МЗА
                          North York
                                              Parkwoods
      1
               M4A
                          North York Victoria Village
      2
               M5A Downtown Toronto
                                           Harbourfront
               M5A Downtown Toronto
      3
                                            Regent Park
      4
               M6A
                          North York Lawrence Heights
      5
               M6A
                          North York
                                         Lawrence Manor
      6
               M7A
                        Queen's Park
                                           Queen's Park
```

```
7
               M9A
                           Etobicoke Islington Avenue
      8
               M1B
                         Scarborough
                                                 Rouge
      9
               M1B
                         Scarborough
                                               Malvern
[14]: #check if the bad practice led to a good result lol
      bor_clean[bor_clean['PostalCode'].str.match('M7A')]
[14]:
                         Borough Neighborhood
       PostalCode
               M7A Queen's Park Queen's Park
[15]: #merge cells containing the same PostalCode
      toronto = bor_clean.groupby(['PostalCode', 'Borough'])['Neighborhood'].apply(', __
      →'.join).reset index()
      toronto.head()
[15]:
       PostalCode
                       Borough
                                                           Neighborhood
               M1B Scarborough
                                                         Rouge, Malvern
               M1C Scarborough Highland Creek, Rouge Hill, Port Union
      1
              M1E Scarborough
                                      Guildwood, Morningside, West Hill
              M1G Scarborough
                                                                 Woburn
      3
              M1H Scarborough
                                                              Cedarbrae
[16]: #just checking if the PostalCode M5A has the same Neighborhoods as displayed in_
      → Coursera 'My submission'
      toronto[toronto['PostalCode'].str.match('M5A')]
[16]:
        PostalCode
                              Borough
                                                    Neighborhood
      53
               M5A Downtown Toronto Harbourfront, Regent Park
          Question 1: check the final shape of the data frame:
[17]: #display final number of rows in the dataframe:
      toronto.shape
[17]: (103, 3)
          Question 2: get the coordinates for all Boroughs in Toronto
[18]: pip install geopy
     Collecting geopy
       Downloading https://files.pythonhosted.org/packages/80/93/d384479da0ead7
     12bdaf697a8399c13a9a89bd856ada5a27d462fb45e47b/geopy-1.20.0-py2.py3-none-any.whl
     (100kB)
                            | 102kB 2.6MB/s ta 0:00:011
     Collecting geographiclib<2,>=1.49 (from geopy)
       Downloading https://files.pythonhosted.org/packages/5b/ac/4f348828091490d77899
```

```
bc74e92238e2b55c59392f21948f296e94e50e2b/geographiclib-1.49.tar.gz
     Building wheels for collected packages: geographiclib
       Building wheel for geographiclib (setup.py) ... done
       Stored in directory: /home/jupyterlab/.cache/pip/wheels/99/45/d1/1495479
     7e2a976083182c2e7da9b4e924509e59b6e5c661061
     Successfully built geographiclib
     Installing collected packages: geographiclib, geopy
     Successfully installed geographiclib-1.49 geopy-1.20.0
     Note: you may need to restart the kernel to use updated packages.
[19]: !pip install geocoder
     Collecting geocoder
       Downloading https://files.pythonhosted.org/packages/4f/6b/13166c909ad2f2
     d76b929a4227c952630ebaf0d729f6317eb09cbceccbab/geocoder-1.38.1-py2.py3-none-
     any.whl (98kB)
                            | 102kB 2.8MB/s ta 0:00:011
     Collecting ratelim (from geocoder)
       Downloading https://files.pythonhosted.org/packages/f2/98/7e6d147fd16a10a5f821
     db6e25f192265d6ecca3d82957a4fdd592cad49c/ratelim-0.1.6-py2.py3-none-any.whl
     Requirement already satisfied: requests in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
     (2.22.0)
     Collecting future (from geocoder)
       Downloading https://files.pythonhosted.org/packages/90/52/e20466b85000a1
     81e1e144fd8305caf2cf475e2f9674e797b222f8105f5f/future-0.17.1.tar.gz (829kB)
                            | 829kB 24.5MB/s eta 0:00:01
     Requirement already satisfied: six in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from geocoder)
     (1.12.0)
     Collecting click (from geocoder)
       Downloading https://files.pythonhosted.org/packages/fa/37/45185cb5abbc30
     d7257104c434fe0b07e5a195a6847506c074527aa599ec/Click-7.0-py2.py3-none-any.whl
     (81kB)
                            | 81kB 18.1MB/s eta 0:00:01
     Requirement already satisfied: decorator in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
     ratelim->geocoder) (4.4.0)
     Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
     requests->geocoder) (1.24.3)
     Requirement already satisfied: chardet<3.1.0,>=3.0.2 in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
     requests->geocoder) (3.0.4)
     Requirement already satisfied: idna<2.9,>=2.5 in
     /home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
     requests->geocoder) (2.8)
     Requirement already satisfied: certifi>=2017.4.17 in
```

```
/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages (from
     requests->geocoder) (2019.6.16)
     Building wheels for collected packages: future
       Building wheel for future (setup.py) ... done
       Stored in directory: /home/jupyterlab/.cache/pip/wheels/0c/61/d2/d6b7317
     325828fbb39ee6ad559dbe4664d0896da4721bf379e
     Successfully built future
     Installing collected packages: ratelim, future, click, geocoder
     Successfully installed click-7.0 future-0.17.1 geocoder-1.38.1 ratelim-0.1.6
[20]: import geocoder # import geocoder
[21]: # define the dataframe columns
      column_names = ['PostalCode', 'Borough', 'Neighborhood', 'Latitude', 'Longitude']
      # instantiate the dataframe
      neighborhoods = pd.DataFrame(columns=column names)
      #empty dataframe
      neighborhoods.head()
[21]: Empty DataFrame
      Columns: [PostalCode, Borough, Neighborhood, Latitude, Longitude]
      Index: []
[22]: lastvalue = toronto.shape[0]
      n = 0
      while(n<lastvalue) :</pre>
          postal_code = toronto['PostalCode'][n]
          borough = toronto['Borough'][n]
          neighborhood_name = toronto['Neighborhood'][n]
          #while(lat_lng_coords is None) :
          g = geocoder.arcgis('{}, Toronto, Ontario'.format(postal_code))
          lat_lng_coords = g.latlng
          neighborhood_lat = lat_lng_coords[0]
          neighborhood_lon = lat_lng_coords[1]
         # print(n, greg, lat_lng_coords, borough, neighborhood_name,_
       →neighborhood_lat, neighborhood_lon)
          neighborhoods = neighborhoods.append({'PostalCode': postal_code,
                                                 'Borough': borough,
                                                 'Neighborhood': neighborhood_name,
                                                 'Latitude': neighborhood_lat,
                                                 'Longitude':
       →neighborhood_lon},ignore_index=True)
```

```
n = n+1
[23]: neighborhoods.head()
[23]:
       PostalCode
                                                           Neighborhood
                        Borough
                                                                          Latitude
      0
              M1B Scarborough
                                                         Rouge, Malvern 43.811525
      1
              M1C Scarborough
                                Highland Creek, Rouge Hill, Port Union 43.785730
      2
                                      Guildwood, Morningside, West Hill 43.765690
              M1E Scarborough
      3
              M1G Scarborough
                                                                 Woburn 43.768359
      4
                                                              Cedarbrae 43.769688
               M1H Scarborough
        Longitude
      0 -79.195517
      1 -79.158750
      2 -79.175256
      3 -79.217590
      4 -79.239440
[24]: neighborhoods.shape
[24]: (103, 5)
[25]: neighborhoods.Borough.unique()
[25]: array(['Scarborough', 'North York', 'East York', 'East Toronto',
             'Central Toronto', 'Downtown Toronto', 'York', 'West Toronto',
             "Queen's Park", 'Mississauga', 'Etobicoke'], dtype=object)
     1.3 Question 3: explore and cluster the neighborhoods in Toronto
     1.3.1 Let's take a look at all the neighborhoods in Toronto in a beautiful map
[26]: from geopy.geocoders import Nominatim
      import folium
[27]: address = 'Toronto, ON'
      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 43.653963, -79.387207.

```
[28]: # create map of Toronto 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'], u
       →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
```

[28]: <folium.folium.Map at 0x7f0fe025b6a0>

# 1.4 Foursquare API to explore the neighborhoods in Toronto

```
[29]: CLIENT_ID = 'QOITL1ZB5Z2J554VCKJTHJOYKXGHHHRISFOGDPJ4PFGEOFHG' # your_

→Foursquare ID

CLIENT_SECRET = 'NWBZLOFJQ41XMF5V5FNXPSZSJGUNZALLSEOUFUTO3DWMV2IM' # your_

→Foursquare Secret

VERSION = '20180605' # Foursquare API version

print('Your credentails:')

print('CLIENT_ID: ' + CLIENT_ID)

print('CLIENT_SECRET:' + CLIENT_SECRET)
```

Your credentails:

CLIENT\_ID: Q0ITL1ZB5Z2J554VCKJTHJOYKXGHHHRISF0GDPJ4PFGE0FHG CLIENT\_SECRET:NWBZL0FJQ41XMF5V5FNXPSZSJGUNZALLSEOUFUT03DWMV2IM

```
[30]: LIMIT2 = 10000
radius2 = 1000
url2 = 'https://api.foursquare.com/v2/venues/explore?

→client_id={}&client_secret={}&ll={},{}&v={}&radius={}&limit={}'.

→format(CLIENT_ID, CLIENT_SECRET, latitude, longitude, VERSION, radius2, 
→LIMIT2)
url2
```

[30]: 'https://api.foursquare.com/v2/venues/explore?client\_id=Q0ITL1ZB5Z2J554VCKJTHJ0Y KXGHHHRISF0GDPJ4PFGE0FHG&client\_secret=NWBZL0FJQ41XMF5V5FNXPSZSJGUNZALLSE0UFUT03 DWMV2IM&11=43.653963,-79.387207&v=20180605&radius=1000&limit=10000'

```
[31]: radius = 1000
LIMIT=1000
```

## 1.5 Question 3: explore and cluster the neighborhoods in Toronto

# 1.5.1 Explore the whole city of Toronto and its Boroughs

```
[32]: def getNearbyVenues_ari(names, postalcodes, latitudes, longitudes, radius=500):
          venues list=[]
          for name, postalCode, lat, lng in zip(names, postalcodes, 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,
                  postalCode,
                  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 = ['Borough',
                                    'PostalCode',
```

```
'Neighborhood Latitude',
'Neighborhood Longitude',
'Venue',
'Venue Latitude',
'Venue Longitude',
'Venue Category']

return(nearby_venues)
```

```
[]: #eu troquei pd.neighborhoods por pd.explore_toronto pra tentar entender a

clusterização

toronto_venues = getNearbyVenues_ari(names=neighborhoods['Borough'],

postalcodes=neighborhoods['PostalCode'],

latitudes=neighborhoods['Latitude'],

longitudes=neighborhoods['Longitude']

)
```

Scarborough North York North York

```
North York
    North York
    North York
    North York
    East York
    East York
    East Toronto
    East York
    East York
    East York
    East Toronto
    East Toronto
    East Toronto
    Central Toronto
    Central Toronto
    Central Toronto
    Central Toronto
    Central Toronto
    Central Toronto
    Downtown Toronto
[]: print(toronto_venues.shape)
    toronto_venues.head()
[]: print('There are {} uniques categories.'.format(len(toronto_venues['Venue_
     []: toronto_venues.groupby('Borough').count()
    1.5.2 One hote encoding
[]: # one hot encoding
    toronto_onehot = pd.get_dummies(toronto_venues[['Venue Category']], prefix="",_
     →prefix_sep="")
```

North York

```
# add neighborhood column back to dataframe
# ver se faz sentido trocar Borough por PostalCode para fazer a analise (?)
toronto_onehot['Borough'] = toronto_venues['Borough']

# move neighborhood column to the first column
fixed_columns = [toronto_onehot.columns[-1]] + list(toronto_onehot.columns[:-1])
toronto_onehot = toronto_onehot[fixed_columns]

pd.set_option('display.max_columns', None)
toronto_onehot.head()
```

Working on the data: there are some columns with very similar names, such as 'Café' and 'Coffee Shop'. For those columns I will merge them and drop, so instead of two, we will have only one column named, for example, 'Café & Shop'

```
[]: toronto_onehot.shape
```

```
[]: #group the postalcodes and append the column Borough
toronto_grouped = toronto_onehot.groupby('Borough').mean().reset_index()
#toronto_grouped['Borough']=toronto['Borough']
toronto_grouped.head()
```

```
[]: toronto_grouped.shape
```

# 1.6 Print most commun venues for each Borough

```
print('\n')
```

## 1.6.1 Let's make a data frame with the 10 most popular venues in each borough

```
[]: 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]
```

```
[]: num_top_venues = 10
     indicators = ['st', 'nd', 'rd']
     # create columns according to number of top venues
     columns = ['Borough']
     for ind in np.arange(num_top_venues):
         trv:
             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['Borough'] = toronto_grouped['Borough']
     for ind in np.arange(toronto_grouped.shape[0]):
         neighborhoods_venues_sorted.iloc[ind, 1:] = __
     -return_most_common_venues(toronto_grouped.iloc[ind, :], num_top_venues)
     neighborhoods_venues_sorted
```

## 1.6.2 And the clusters begin!

```
[]: from sklearn.cluster import KMeans
```

```
[]: # set number of clusters
kclusters = 4

toronto_grouped_clustering = toronto_grouped.drop('Borough', 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
```

```
[]: import matplotlib.cm as cm import matplotlib.colors as colors
```

## 1.6.3 Create a map from the clusters

```
[]: # 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 \text{ for } i \text{ 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['Borough'],
      →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=1).add_to(map_clusters)
     map clusters
```

### 1.6.4 Shape of the clusters

```
[]: A2 = toronto merged.loc[toronto merged['Cluster Labels'] == 2, toronto merged.
     →columns[[1] + list(range(5, toronto_merged.shape[1]))]]
    #A2
    A2.shape
[]: A1 = toronto merged.loc[toronto merged['Cluster Labels'] == 1, toronto merged.

→columns[[1] + list(range(5, toronto merged.shape[1]))]]
    #A1
    A1.shape
[]: A3 = toronto_merged.loc[toronto_merged['Cluster Labels'] == 3, toronto_merged.
     #A3
    A3.shape
[]: A0 = toronto_merged.loc[toronto_merged['Cluster Labels'] == 0, toronto_merged.
     →columns[[1] + list(range(5, toronto_merged.shape[1]))]]
    #A0
    A0.shape
    1.6.5 Most commum venues for each cluster
[]: import matplotlib.pyplot as plt
    from matplotlib import cm
[]: plt.figure(figsize=(9, 3))
    plt.suptitle('Cluster 2')
    plt.subplot(131)
    plt.xlabel('1st Most Comum Venues')
    A2['1st Most Common Venue'].value_counts()[:3].plot(kind='bar')
    plt.subplot(132)
    plt.xlabel('2nd Most Comum Venues')
    A2['2nd Most Common Venue'].value_counts()[:5].plot(kind='bar')
    plt.subplot(133)
    plt.xlabel('3rd Most Comum Venues')
    A2['3rd Most Common Venue'].value_counts()[:4].plot(kind='bar')
    plt.show()
[]: plt.figure(figsize=(9, 3))
    plt.suptitle('Cluster 1')
    plt.subplot(131)
    plt.xlabel('1st Most Comum Venues')
```

```
A1['1st Most Common Venue'].value_counts()[:3].plot(kind='bar')
plt.subplot(132)
plt.xlabel('2nd Most Comum Venues')
A1['2nd Most Common Venue'].value_counts()[:5].plot(kind='bar')
plt.subplot(133)
plt.xlabel('3rd Most Comum Venues')
A1['3rd Most Common Venue'].value_counts()[:4].plot(kind='bar')
plt.show()
```

```
plt.figure(figsize=(9, 3))

plt.suptitle('Cluster 3')
plt.subplot(131)
plt.xlabel('1st Most Comum Venues')
A3['1st Most Common Venue'].value_counts()[:3].plot(kind='bar')
plt.subplot(132)
plt.xlabel('2nd Most Comum Venues')
A3['2nd Most Common Venue'].value_counts()[:5].plot(kind='bar')
plt.subplot(133)
plt.xlabel('3rd Most Comum Venues')
A3['3rd Most Common Venue'].value_counts()[:4].plot(kind='bar')

plt.show()
```

```
plt.figure(figsize=(9, 3))

plt.suptitle('Cluster 0')
plt.subplot(131)
plt.xlabel('3rd Most Comum Venues')
A0['3rd Most Common Venue'].value_counts()[:3].plot(kind='bar')
plt.subplot(132)
plt.xlabel('4th Most Comum Venues')
A0['4th Most Common Venue'].value_counts()[:5].plot(kind='bar')
plt.subplot(133)
plt.xlabel('5th Most Comum Venues')
A0['5th Most Common Venue'].value_counts()[:4].plot(kind='bar')
plt.show()
```

#### 1.6.6 Cluster profiles

Toronto seems to be a gastronomic trip destination with lots of Cafés and Restaurants. I also put the clusters in order of children number. Comparing the clusters, we could name:

CLuster 2: Shopping clothing, explore chinese cuisine and by groceries to make a special meal

CLuster 1: Italian, Café and other restaurants

CLuster 3: Parks

CLuster 0: Indian and Tea