Capstone Project - Week 2 The Battle of Neighborhoods

January 22, 2019

1 Capstone Project: The Battle of Neighborhoods

1.1 1. Introduction/Business Problem: Which neighborhood is the best location for a new Greek Restaurant in DC?

Amazon has announced that its HQ2 will be located in Washington DC Area. A group of investors has asked me to find out if opening a new Greek Restaurant is a good investment in DC. If yes, which neighborhood?

A new Greek Restaurant has to be located in close vicinity to colleges, museums, and educational facilities and away from current restaurants, an especially Greek one. Additionally, customers prefer neighborhoods with public transport facilities such as bus stop and metro station.

The investors asked me to focus on the selection of a neighborhood in DC according to its nearby environment.

I work on data and select possible neighborhoods to build a new Greek Restaurant. Which neighborhoods should be suggested to the investors?

1.2 2. Data

I need to find a list of neighborhoods and their geographic coordinates. I can find the list and coordinates from the website https://opendata.arcgis.com/datasets/c4b0cd43d50949e98e57de9f22b455fc_35.geojson. The data is downloaded and converted into a dataframe.

The recommended neighborhoods should not have any Greek Restaurant and other eating venues nearby. Convenient public transport is also required. These data can be found by using FourSquare API to find these venues around the location. The radius of exploration distance is set to 500 meters, which is about 5 minutes walking distance.

1.2.1 2.1 Import necessary libraries

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

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

import json # library to handle JSON files
```

```
        #!conda install -c conda-forge geopy --yes # uncomment this line if you haven't complete
        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

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

        print('Libraries imported.')
```

```
Libraries imported.
```

1.2.2 2.2 Download geographic coordinate of DC neighborhoods

```
In [2]: # Download the list
        #!wget -O DC_MovieTheater_list.json https://foursquare.com/locations/regal-cinemas/washi

        !wget -O DC_data.json https://opendata.arcgis.com/datasets/c4b0cd43d50949e98e57de9f22b45
        print("loaded")
```

```
--2019-01-22 16:05:25--  https://opendata.arcgis.com/datasets/c4b0cd43d50949e98e57de9f22b455fc_3
Resolving opendata.arcgis.com (opendata.arcgis.com)... 52.6.113.2, 34.202.21.31
Connecting to opendata.arcgis.com (opendata.arcgis.com)|52.6.113.2|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/json]
Saving to: DC_data.json

DC_data.json            [ <=>                ]  35.81K  --.-KB/s   in 0s

2019-01-22 16:05:26 (235 MB/s) - DC_data.json saved [36673]

loaded
```

```
In [3]: with open('DC_data.json') as json_data:
            DC_data = json.load(json_data)
```

```
In [4]: #DC_data
        neighborhoods_data = DC_data['features']
```

```
In [5]: neighborhoods_data[0]
```

```
Out[5]: {'type': 'Feature',
         'properties': {'OBJECTID': 1,
          'GIS_ID': 'nhood_132',
          'NAME': 'Stronghold',
          'WEB_URL': 'http://op.dc.gov',
          'LABEL_NAME': 'Stronghold',
          'DATELASTMODIFIED': '2003-04-10T00:00:00.000Z'},
         'geometry': {'type': 'Point',
          'coordinates': [-77.0077674102066, 38.92577558252443]}}
```

1.2.3 2.3 Transform the data into a pandas dataframe

The next task is essentially transforming this data of nested Python dictionaries into a *pandas* dataframe. So let's start by creating an empty dataframe.

```
In [6]: # define the dataframe columns
        column_names = ['ID', 'Neighborhood', 'Latitude', 'Longitude']

        # instantiate the dataframe
        neighborhoods = pd.DataFrame(columns=column_names)
```

```
In [7]: neighborhoods.head()
```

```
Out[7]: Empty DataFrame
        Columns: [ID, Neighborhood, Latitude, Longitude]
        Index: []
```

```
In [8]: for data in neighborhoods_data:
            neighborhood_id = data['properties']['GIS_ID']
            neighborhood_name = data['properties']['NAME']

            neighborhood_latlon = data['geometry']['coordinates']
            neighborhood_lat = neighborhood_latlon[1]
            neighborhood_lon = neighborhood_latlon[0]

            neighborhoods = neighborhoods.append({'ID': neighborhood_id,
                                                  'Neighborhood': neighborhood_name,
                                                  'Latitude': neighborhood_lat,
                                                  'Longitude': neighborhood_lon}, ignore_index=T
```

```
In [9]: neighborhoods.head()
```

```
Out[9]:           ID      Neighborhood   Latitude  Longitude
        0  nhood_132        Stronghold  38.925776 -77.007767
        1  nhood_134          Langston  38.901336 -76.972367
        2  nhood_137     Downtown East  38.895428 -77.014234
        3  nhood_029  Colonial Village  38.986790 -77.041094
        4  nhood_109     Shepherd Park  38.982980 -77.032126
```

```
In [10]: neighborhoods.shape

Out[10]: (131, 4)

In [11]: print('There are {} neighborhoods in Washington DC'.format(len(neighborhoods)))

There are 131 neighborhoods in Washington DC
```

1.2.4 2.4. Use geopy library to get the latitude and longitude values of DC

```
In [12]: address = 'Washington, DC'

         geolocator = Nominatim(user_agent="dc_explorer")
         location = geolocator.geocode(address)
         latitude = location.latitude
         longitude = location.longitude
         print('The geograpical coordinate of DC are {}, {}.'.format(latitude, longitude))

The geograpical coordinate of DC are 38.8950092, -77.0365625.
```

1.2.5 2.5 Create a map of DC with neighborhoods superimposed on top.

```
In [13]: # create map of DCusing latitude and longitude values
         map_DC = folium.Map(location=[latitude, longitude], zoom_start=10)

         # add markers to map
         for lat, lng, id, neighborhood in zip(neighborhoods['Latitude'], neighborhoods['Longitu
             label = '{}, {}'.format(neighborhood, id)
             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_DC)

         map_DC

Out[13]: <folium.folium.Map at 0x7f6bb4858518>
```

1.2.6 2.6 Define Foursquare Credentials and Version

```
In [14]: CLIENT_ID = 'OBHBHKFTRONR2SJ3BALOK3OOLZXVGTMHKR2BTTQ3ADTM5YZU' # your Foursquare ID
         CLIENT_SECRET = 'VMTYJNQMCYLTFHAWUCT5CMCXCN2DAY1J3BTPINKJI4FAUM1Z' # your Foursquare Se
```

```
        VERSION = '20180605' # Foursquare API version

        print('Your credentails:')
        print('CLIENT_ID: ' + CLIENT_ID)
        print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: OBHBHKFTRONR2SJ3BALOK3OOLZXVGTMHKR2BTTQ3ADTM5YZU
CLIENT_SECRET:VMTYJNQMCYLTFHAWUCT5CMCXCN2DAY1J3BTPINKJI4FAUM1Z
```

```
In [15]: #### Let's explore the first neighborhood in our dataframe.
```

```
In [16]: neighborhood_latitude = neighborhoods.loc[0, 'Latitude'] # neighborhood latitude value
         neighborhood_longitude = neighborhoods.loc[0, 'Longitude'] # neighborhood longitude val

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

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

```
Latitude and longitude values of Stronghold are 38.92577558252443, -77.0077674102066.
```

1.2.7 2.7 Get the top 100 venues that are in 1st neighborhood within a radius of 500 meters.

```
In [17]: LIMIT = 100 # limit of number of venues returned by Foursquare API
         radius = 500 # define radius
         # create URL
         url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}
             CLIENT_ID,
             CLIENT_SECRET,
             VERSION,
             neighborhood_latitude,
             neighborhood_longitude,
             radius,
             LIMIT)
         url
         #display url
```

```
Out[17]: 'https://api.foursquare.com/v2/venues/explore?&client_id=OBHBHKFTRONR2SJ3BALOK3OOLZXVGT
```

Send the GET request and examine the resutls

```
In [18]: results = requests.get(url).json()
         #results
```

From the Foursquare lab in the previous module, we know that all the information is in the *items* key. Before we proceed, let's borrow the **get_category_type** function from the Foursquare lab.

```
In [19]: # function that extracts the category of the venue
         def get_category_type(row):
             try:
                 categories_list = row['categories']
             except:
                 categories_list = row['venue.categories']

             if len(categories_list) == 0:
                 return None
             else:
                 return categories_list[0]['name']
```

Now we are ready to clean the json and structure it into a *pandas* dataframe.

```
In [20]: venues = results['response']['groups'][0]['items']

         nearby_venues = json_normalize(venues) # flatten JSON

         # filter columns
         filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat', 'venue.loca
         nearby_venues =nearby_venues.loc[:, filtered_columns]

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

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

         nearby_venues.head()
```

Out[20]:

	name	categories	lat	lng
0	Fairway Market	Grocery Store	38.922529	-77.008847
1	VA Medical Center Patriot Coffee	Coffee Shop	38.929360	-77.009999
2	McMillan Park Reservoir	Park	38.926247	-77.012122
3	WMATA Bus Stop #1001965 (80, H1, H2, H3, H4)	Bus Stop	38.927403	-77.005752
4	Gym @ The Cloisters	Gym / Fitness Center	38.928326	-77.005593

```
In [21]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))
```

```
6 venues were returned by Foursquare.
```

1.2.8 2.8 Explore Neighborhoods in DC

Let's create a function to repeat the same process to all the neighborhoods in DC

```
In [22]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

             venues_list=[]
             for name, lat, lng in zip(names, latitudes, longitudes):
                 print(name)

                 # create the API request URL
                 url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret
                     CLIENT_ID,
                     CLIENT_SECRET,
                     VERSION,
                     lat,
                     lng,
                     radius,
                     LIMIT)

                 # make the GET request
                 results = requests.get(url).json()["response"]['groups'][0]['items']

                 # return only relevant information for each nearby venue
                 venues_list.append([(
                     name,
                     lat,
                     lng,
                     v['venue']['name'],
                     v['venue']['location']['lat'],
                     v['venue']['location']['lng'],
                     v['venue']['categories'][0]['name']) for v in results])

             nearby_venues = pd.DataFrame([item for venue_list in venues_list for item in venue_
             nearby_venues.columns = ['Neighborhood',
                           'Neighborhood Latitude',
                           'Neighborhood Longitude',
                           'Venue',
                           'Venue Latitude',
                           'Venue Longitude',
                           'Venue Category']

             return(nearby_venues)
```

1.2.9 2.9 Write the code to run the above function on each neighborhood and create a new dataframe called *DC_venues*.

```
In [23]: DC_venues = getNearbyVenues(names=neighborhoods['Neighborhood'],
                                     latitudes=neighborhoods['Latitude'],
                                     longitudes=neighborhoods['Longitude']
                                    )
         #DC_venues.head()
```

```
Stronghold
Langston
Downtown East
Colonial Village
Shepherd Park
Lamond Riggs
Petworth
Brightwood Park
Brightwood
Barnaby Woods
Queens Chapel
North Michigan Park
University Heights
Brookland
Skyland
Lincoln Park
16th Street Heights
Gateway
Brentwood
Eckington
Ivy City
Arboretum
Carver
North Capitol Street
Downtown
Foggy Bottom
West End
Georgetown
Burleith/Hillandale
Southwest/Waterfront
Buzzard Point
Chevy Chase
Friendship Heights
Tenleytown
American University Park
Cathedral Heights
McLean Gardens
Woodley Park
Wesley Heights
Foxhall Crescents
```

Palisades
Kalorama Heights
Adams Morgan
Dupont Circle
Lanier Heights
Mount Pleasant
Park View
Le Droit Park
Howard University
Near Northeast
Stanton Park
Kingman Park
Hill East
Navy Yard
Mayfair
River Terrace
Burrville
NE Boundary
Benning
Grant Park
Central NE
Lincoln Heights
Capitol View
Marshall Heights
Fort Davis Park
Fairfax Village
Golden Triangle
Hillcrest
Capitol Hill
Randle Highlands
Barry Farm
Columbia Heights
Van Ness
Georgetown Reservoir
Pleasant Hill
Deanwood
Greenway
Naylor Gardens
Hillsdale
Chinatown
South Central
North Portal Estates
Takoma
Crestwood
Manor Park
Hawthorne
Michigan Park
Woodridge

```
Edgewood
Bloomingdale
Fort Lincoln
Langdon
Truxton Circle
Trinidad
Mount Vernon Square
George Washington University
Monumental Core
Southwest Employment Area
Fort McNair
North Cleveland Park
Spring Valley
Cleveland Park
Glover Park
Fort Stanton
Congress Heights
Washington Highlands
Bellevue
Knox Hill/Buena Vista
Shipley
Douglass
Woodland
Garfield Heights
Near Southeast
Dupont Park
Twining
Fairlawn
Penn Branch
Historic Anacostia
Logan Circle/Shaw
Cardozo/Shaw
Forest Hills
Foxhall Village
Fort Totten
Kenilworth
Eastland Gardens
Fort Dupont
Woodland-Normanstone
Mass. Ave. Heights
Pleasant Plains
Benning Ridge
Penn Quarter
```

```
In [24]: print(DC_venues.shape)
         #DC_venues.head()
```

```
(2721, 7)
```

```
In [25]: DC_venues.groupby('Neighborhood').count()
         print('There are {} uniques categories.'.format(len(DC_venues['Venue Category'].unique(
```

```
There are 304 uniques categories.
```

1.2.10 2.10 Analyze Each Neighborhood

```
In [35]: # one hot encoding
         DC_onehot = pd.get_dummies(DC_venues[['Venue Category']], prefix="", prefix_sep="")

         # add neighborhood column back to dataframe
         DC_onehot['Neighborhood'] = DC_venues['Neighborhood']

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

         #DC_onehot
```

```
In [ ]: #DC_onehot
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

```
In [36]: #DC_grouped = DC_onehot.groupby('Neighborhood').mean().reset_index()
         DC_grouped = DC_onehot.groupby('Neighborhood').sum()
         #DC_grouped
```

```
In [37]: DC_grouped_all = DC_grouped
```

```
In [38]: DC_grouped_all.head()
```

```
Out[38]:                          Zoo Exhibit  ATM  Accessories Store  \
         Neighborhood
         16th Street Heights                0    0                  0
         Adams Morgan                       0    0                  0
         American University Park           0    0                  0
         Arboretum                          0    0                  0
         Barnaby Woods                      0    0                  0

                                   Afghan Restaurant  African Restaurant  \
         Neighborhood
         16th Street Heights                       0                   0
         Adams Morgan                              1                   0
         American University Park                  0                   0
```

Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	American Restaurant	Antique Shop	Arcade	\
16th Street Heights	0	0	0	
Adams Morgan	0	0	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Arepa Restaurant	Art Gallery	Art Museum	\
16th Street Heights	0	0	0	
Adams Morgan	0	1	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Arts & Crafts Store	Asian Restaurant	\
16th Street Heights	0	0	
Adams Morgan	0	2	
American University Park	0	0	
Arboretum	0	0	
Barnaby Woods	0	0	

Neighborhood	Athletics & Sports	Auto Workshop	Automotive Shop	\
16th Street Heights	0	0	0	
Adams Morgan	0	0	0	
American University Park	0	0	0	
Arboretum	0	0	1	
Barnaby Woods	0	0	0	

Neighborhood	BBQ Joint	Bagel Shop	Bakery	Bank	Bar	\
16th Street Heights	0	0	0	0	0	
Adams Morgan	1	1	1	0	4	
American University Park	0	0	0	0	0	
Arboretum	1	0	0	0	0	
Barnaby Woods	1	0	0	0	0	

Neighborhood	Baseball Field	Basketball Court	\
16th Street Heights	0	0	
Adams Morgan	0	0	
American University Park	0	0	

Arboretum	0	1
Barnaby Woods	0	0

Neighborhood	Basketball Stadium	Bed & Breakfast	Beer Bar
16th Street Heights	0	1	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Beer Garden	Beer Store	Belgian Restaurant
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Big Box Store	Bike Rental / Bike Share	Bistro
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Boat or Ferry	Bookstore	Border Crossing	Boutique
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Brazilian Restaurant	Breakfast Spot	Brewery
16th Street Heights	0	1	0
Adams Morgan	1	0	0
American University Park	0	0	0
Arboretum	0	0	1
Barnaby Woods	0	0	0

Neighborhood	Bridal Shop	Bridge	Bubble Tea Shop	Building
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0

```
Arboretum                          0       0               0         0
Barnaby Woods                      0       0               0         0

                        Burger Joint  Burrito Place  Bus Line  Bus Station  \
Neighborhood
16th Street Heights                0              0         0            0
Adams Morgan                       1              0         0            1
American University Park           0              0         0            0
Arboretum                          0              0         0            0
Barnaby Woods                      0              0         0            0

                        Bus Stop  Business Service  Cafeteria  Café  \
Neighborhood
16th Street Heights            1                 0          0     1
Adams Morgan                   0                 0          0     2
American University Park       0                 0          0     0
Arboretum                      0                 0          0     0
Barnaby Woods                  0                 0          0     0

                        Cajun / Creole Restaurant  Camera Store  \
Neighborhood
16th Street Heights                             0             0
Adams Morgan                                    0             0
American University Park                        0             0
Arboretum                                       0             0
Barnaby Woods                                   0             0

                        Cantonese Restaurant  Caribbean Restaurant  \
Neighborhood
16th Street Heights                        0                     0
Adams Morgan                               0                     0
American University Park                   0                     0
Arboretum                                  0                     0
Barnaby Woods                              0                     0

                        Check Cashing Service  Cheese Shop  \
Neighborhood
16th Street Heights                         0            0
Adams Morgan                                0            0
American University Park                    0            0
Arboretum                                   0            0
Barnaby Woods                               0            0

                        Chinese Restaurant  Chiropractor  Chocolate Shop  \
Neighborhood
16th Street Heights                      1             0               0
Adams Morgan                             0             0               0
American University Park                 0             0               0
```

Arboretum	1	0	0
Barnaby Woods	0	0	0

Neighborhood	Clothing Store	Cocktail Bar	Coffee Shop	\
16th Street Heights	0	0	1	
Adams Morgan	1	1	3	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	College Administrative Building	College Bookstore	\
16th Street Heights	0	0	
Adams Morgan	0	0	
American University Park	0	0	
Arboretum	0	0	
Barnaby Woods	0	0	

Neighborhood	College Library	College Quad	College Stadium	\
16th Street Heights	0	0	0	
Adams Morgan	0	0	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Comedy Club	Comfort Food Restaurant	Comic Shop	\
16th Street Heights	0	0	0	
Adams Morgan	0	0	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Community Center	Concert Hall	\
16th Street Heights	0	0	
Adams Morgan	0	0	
American University Park	0	0	
Arboretum	0	0	
Barnaby Woods	0	0	

Neighborhood	Construction & Landscaping	Convenience Store	\
16th Street Heights	0	0	
Adams Morgan	0	0	
American University Park	0	0	

```
Arboretum                                    0                 1
Barnaby Woods                                0                 0

                        Cosmetics Shop  Credit Union  Cuban Restaurant  \
Neighborhood
16th Street Heights                  1            0                 0
Adams Morgan                         1            0                 0
American University Park             0            0                 0
Arboretum                            0            0                 0
Barnaby Woods                        0            0                 0

                        Cupcake Shop  Cycle Studio  Dance Studio  \
Neighborhood
16th Street Heights                0             0             0
Adams Morgan                       1             0             0
American University Park           0             0             0
Arboretum                          0             0             0
Barnaby Woods                      0             0             0

                        Deli / Bodega  Department Store  Dessert Shop  \
Neighborhood
16th Street Heights                 0                 0             0
Adams Morgan                        0                 0             1
American University Park            0                 0             0
Arboretum                           0                 0             0
Barnaby Woods                       0                 0             0

                        Dim Sum Restaurant  Diner  Discount Store  Dive Bar  \
Neighborhood
16th Street Heights                      0      1               0         0
Adams Morgan                             0      2               0         0
American University Park                 0      0               0         0
Arboretum                                0      0               0         0
Barnaby Woods                            0      0               0         0

                        Doctor's Office  Dog Run  Donut Shop  Drugstore  \
Neighborhood
16th Street Heights                   0        0           0          0
Adams Morgan                          0        0           0          0
American University Park              0        0           0          0
Arboretum                             0        0           0          0
Barnaby Woods                         0        0           0          0

                        Dry Cleaner  Dumpling Restaurant  \
Neighborhood
16th Street Heights               0                    0
Adams Morgan                      1                    0
American University Park          0                    0
```

```
Arboretum                          0                   0
Barnaby Woods                      0                   0

                        Eastern European Restaurant  Electronics Store  \
Neighborhood
16th Street Heights                               0                  0
Adams Morgan                                      1                  0
American University Park                          0                  0
Arboretum                                         0                  0
Barnaby Woods                                     0                  0

                        Empanada Restaurant  English Restaurant  \
Neighborhood
16th Street Heights                       0                   0
Adams Morgan                              1                   0
American University Park                  0                   0
Arboretum                                 0                   0
Barnaby Woods                             0                   0

                        Ethiopian Restaurant  Event Space  Exhibit  \
Neighborhood
16th Street Heights                        0            0        0
Adams Morgan                               2            0        0
American University Park                   0            0        0
Arboretum                                  0            0        0
Barnaby Woods                              0            0        0

                        Eye Doctor  Falafel Restaurant  Farm  \
Neighborhood
16th Street Heights              0                   0     0
Adams Morgan                     0                   1     0
American University Park         0                   0     0
Arboretum                        0                   0     0
Barnaby Woods                    0                   0     0

                        Farmers Market  Fast Food Restaurant  Field  \
Neighborhood
16th Street Heights                  0                     0      0
Adams Morgan                         0                     0      0
American University Park             0                     0      0
Arboretum                            0                     2      0
Barnaby Woods                        0                     0      1

                        Filipino Restaurant  Fish & Chips Shop  Fish Market  \
Neighborhood
16th Street Heights                       0                  0            0
Adams Morgan                              0                  0            0
American University Park                  0                  0            0
```

Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Flea Market	Flower Shop	Food	Food & Drink Shop
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Food Court	Food Truck	Forest	Fountain
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	1	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Frame Store	French Restaurant	Fried Chicken Joint
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Frozen Yogurt Shop	Furniture / Home Store	Garden
16th Street Heights	0	0	0
Adams Morgan	1	1	0
American University Park	0	0	0
Arboretum	0	0	1
Barnaby Woods	0	0	0

Neighborhood	Garden Center	Gas Station	Gastropub	Gay Bar
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	1
American University Park	0	0	0	0
Arboretum	0	1	0	0
Barnaby Woods	0	0	0	0

Neighborhood	General College & University	German Restaurant
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0

Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Gift Shop	Gluten-free Restaurant	Golf Course
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Gourmet Shop	Government Building	Greek Restaurant
16th Street Heights	0	0	1
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Grocery Store	Gym	Gym / Fitness Center	Gym Pool
16th Street Heights	0	1	0	0
Adams Morgan	1	1	1	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Gymnastics Gym	Harbor / Marina	Hardware Store
16th Street Heights	1	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Health & Beauty Service	Heliport
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Herbs & Spices Store	Historic Site	History Museum
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0

```
Arboretum                                0             0              0
Barnaby Woods                            0             0              0

                        Home Service  Hookah Bar  Hospital  Hostel  \
Neighborhood
16th Street Heights                0          0         0       0
Adams Morgan                       0          0         0       1
American University Park           0          0         0       0
Arboretum                          0          0         0       0
Barnaby Woods                      0          0         0       0

                        Hot Dog Joint  Hotel  Hotel Bar  Ice Cream Shop  \
Neighborhood
16th Street Heights                 0      0          0               0
Adams Morgan                        0      1          0               3
American University Park            0      0          0               0
Arboretum                           0      1          0               1
Barnaby Woods                       0      0          0               0

                        Indian Restaurant  Indie Movie Theater  \
Neighborhood
16th Street Heights                     0                    0
Adams Morgan                            1                    0
American University Park                0                    0
Arboretum                               0                    0
Barnaby Woods                           0                    0

                        Indoor Play Area  Intersection  Irish Pub  \
Neighborhood
16th Street Heights                    0             0          0
Adams Morgan                           0             0          0
American University Park               0             0          0
Arboretum                              0             1          0
Barnaby Woods                          0             0          0

                        Italian Restaurant  Japanese Restaurant  Jazz Club  \
Neighborhood
16th Street Heights                      0                    0          0
Adams Morgan                             2                    1          1
American University Park                 1                    0          0
Arboretum                                0                    0          0
Barnaby Woods                            0                    0          0

                        Jewelry Store  Juice Bar  Korean Restaurant  Lake  \
Neighborhood
16th Street Heights                 0          0                  0     0
Adams Morgan                        1          1                  1     0
American University Park            0          0                  0     0
```

```
Arboretum                          0          0                 0     1
Barnaby Woods                      0          0                 0     0

                        Latin American Restaurant  Laundromat  \
Neighborhood
16th Street Heights                             0           0
Adams Morgan                                    1           0
American University Park                        0           0
Arboretum                                       0           0
Barnaby Woods                                   0           0

                        Lebanese Restaurant  Light Rail Station  \
Neighborhood
16th Street Heights                       0                   0
Adams Morgan                              0                   0
American University Park                  0                   0
Arboretum                                 0                   0
Barnaby Woods                             0                   0

                        Lingerie Store  Liquor Store  Locksmith  Lounge  \
Neighborhood
16th Street Heights                  0             0          0       0
Adams Morgan                         0             0          0       0
American University Park             0             0          0       0
Arboretum                            0             0          0       0
Barnaby Woods                        0             0          0       0

                        Market  Martial Arts Dojo  Massage Studio  \
Neighborhood
16th Street Heights          0                  0               0
Adams Morgan                 0                  0               1
American University Park     0                  0               0
Arboretum                    0                  0               0
Barnaby Woods                0                  0               0

                        Mattress Store  Mediterranean Restaurant  \
Neighborhood
16th Street Heights                  0                        0
Adams Morgan                         0                        2
American University Park             0                        0
Arboretum                            0                        0
Barnaby Woods                        0                        0

                        Memorial Site  Men's Store  Metro Station  \
Neighborhood
16th Street Heights                 0            0              0
Adams Morgan                        0            0              0
American University Park            0            0              0
```

Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Mexican Restaurant	Middle Eastern Restaurant
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Miscellaneous Shop	Mobile Phone Shop
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Monument / Landmark	Movie Theater	Moving Target
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Museum	Music Store	Music Venue	Nail Salon
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	New American Restaurant	Nightclub	Nightlife Spot
16th Street Heights	0	0	0
Adams Morgan	2	1	0
American University Park	0	0	0
Arboretum	0	2	0
Barnaby Woods	0	0	0

Neighborhood	Non-Profit	Noodle House	Opera House	Optical Shop
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0

Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Organic Grocery	Other Repair Shop
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Outdoor Sculpture	Outdoor Supply Store
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Paper / Office Supplies Store	Park
16th Street Heights	0	1
Adams Morgan	1	2
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	1

Neighborhood	Pedestrian Plaza	Performing Arts Venue
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Peruvian Restaurant	Pet Café	Pet Service
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Pet Store	Pharmacy	Pie Shop	Pilates Studio
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0

Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Pizza Place	Planetarium	Playground	Plaza
16th Street Heights	1	0	0	0
Adams Morgan	3	0	1	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Poke Place	Pool	Pop-Up Shop
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Portuguese Restaurant	Pub	Public Art
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Ramen Restaurant	Record Shop	Recreation Center
16th Street Heights	0	0	0
Adams Morgan	1	1	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Rental Car Location	Rental Service
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Residential Building (Apartment / Condo)
16th Street Heights	0
Adams Morgan	0
American University Park	0

Arboretum	0
Barnaby Woods	0

Neighborhood	Restaurant	River	Road	Rock Club
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Russian Restaurant	Salad Place	Salon / Barbershop
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Salvadoran Restaurant	Sandwich Place
16th Street Heights	1	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Scandinavian Restaurant	Scenic Lookout
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Science Museum	Sculpture Garden
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Seafood Restaurant	Shipping Store	Shoe Store
16th Street Heights	0	0	0
Adams Morgan	0	1	0
American University Park	0	0	0

```
Arboretum                                0              0          0
Barnaby Woods                            0              0          0

                         Shop & Service  Shopping Mall  Skating Rink  \
Neighborhood
16th Street Heights                   0              0             0
Adams Morgan                          0              0             0
American University Park              0              0             0
Arboretum                             0              0             0
Barnaby Woods                         0              0             0

                         Smoke Shop  Smoothie Shop  Snack Place  \
Neighborhood
16th Street Heights               0              0           0
Adams Morgan                      0              0           0
American University Park          0              0           0
Arboretum                         0              0           0
Barnaby Woods                     0              0           0

                         Soccer Field  Soccer Stadium  Soup Place  \
Neighborhood
16th Street Heights                 1               0           0
Adams Morgan                        0               0           0
American University Park            0               0           0
Arboretum                           0               0           0
Barnaby Woods                       0               0           0

                         South American Restaurant  \
Neighborhood
16th Street Heights                              0
Adams Morgan                                     0
American University Park                         0
Arboretum                                        0
Barnaby Woods                                    0

                         Southern / Soul Food Restaurant  Spa  \
Neighborhood
16th Street Heights                                    0    0
Adams Morgan                                           1    3
American University Park                               0    0
Arboretum                                              0    0
Barnaby Woods                                          0    0

                         Spanish Restaurant  Speakeasy  Sporting Goods Shop  \
Neighborhood
16th Street Heights                       0          0                    0
Adams Morgan                              0          0                    1
American University Park                  0          0                    0
```

Arboretum	0	0		0
Barnaby Woods	0	0		0

Neighborhood	Sports Bar	Sports Club	Stables	Steakhouse	\
16th Street Heights	0	0	0	0	
Adams Morgan	0	0	0	0	
American University Park	0	0	0	0	
Arboretum	0	0	0	0	
Barnaby Woods	0	0	0	0	

Neighborhood	Strip Club	Supermarket	Supplement Shop	\
16th Street Heights	0	0	0	
Adams Morgan	0	1	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Sushi Restaurant	Synagogue	Taco Place	\
16th Street Heights	0	0	0	
Adams Morgan	1	0	1	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Tailor Shop	Tapas Restaurant	Tea Room	\
16th Street Heights	0	0	0	
Adams Morgan	0	0	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Tennis Court	Thai Restaurant	Theater	\
16th Street Heights	0	0	0	
Adams Morgan	0	1	0	
American University Park	0	0	0	
Arboretum	0	0	0	
Barnaby Woods	0	0	0	

Neighborhood	Thrift / Vintage Store	Tiki Bar	\
16th Street Heights	0	0	
Adams Morgan	0	0	
American University Park	0	0	

Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Tourist Information Center	Toy / Game Store	Track
16th Street Heights	0	0	0
Adams Morgan	0	0	0
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Trail	Train	Train Station	Turkish Restaurant
16th Street Heights	0	0	0	0
Adams Morgan	0	0	0	0
American University Park	0	0	0	0
Arboretum	0	0	0	0
Barnaby Woods	0	0	0	0

Neighborhood	Vegetarian / Vegan Restaurant	Video Store
16th Street Heights	0	0
Adams Morgan	0	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Vietnamese Restaurant	Volleyball Court
16th Street Heights	0	0
Adams Morgan	2	0
American University Park	0	0
Arboretum	0	0
Barnaby Woods	0	0

Neighborhood	Warehouse Store	Weight Loss Center	Whisky Bar
16th Street Heights	0	0	0
Adams Morgan	0	0	1
American University Park	0	0	0
Arboretum	0	0	0
Barnaby Woods	0	0	0

Neighborhood	Wine Bar	Wine Shop	Winery	Wings Joint
16th Street Heights	0	0	0	0
Adams Morgan	1	0	0	0
American University Park	0	0	0	0

```
Arboretum                          0          0       0           0
Barnaby Woods                      0          0       0           0

                          Women's Store  Xinjiang Restaurant  Yoga Studio
Neighborhood
16th Street Heights                   0                    0           0
Adams Morgan                          0                    0           0
American University Park              0                    0           0
Arboretum                             0                    0           0
Barnaby Woods                         0                    0           0
```

1.3 3. Methodology

In order to make a best neighborhood recommendation to investors I collected all venues data from Foursquare and prioritize the venues which have the significant impact for a decision according to investors criteria (A new Greek Restaurant has to be located in close vicinity to colleges, museums, and educational facilities and away from current restaurants, an especially Greek one. Additionally, customers prefer neighborhoods with public transport facilities such as bus stop and metro station).

Here is the simple equation that I will use to calculate the score for each neighborhood and and sort them to find the best three.

Score = weight_venue_A * Total_VenueA + weight_venue_B * Total_VenueB + ...

The **positive weight**, because customers prefer neighborhoods with public transport facilities such as bus stop and metro station - weight_Metro = 1 - weight_Bus = 1 - weight_College = 1 - weight_Museum = 1

The **negative weights**, because investors want to avoid concurrence of eating venues as much as possible, especially Greek one - weight_Restaurants = -1 - weight_Joints = -1 - weight_Greek = -5

```
In [59]: #Restaurant
         feat_name_list = list(DC_grouped_all.columns)
         restaurant_list = []


         for counter, value in enumerate(feat_name_list):
             if value.find('Restaurant') != (-1):
                 restaurant_list.append(value)

         DC_grouped['Total Restaurants'] = DC_grouped_all[restaurant_list].sum(axis = 1)
         #DC_grouped = DC_grouped.drop(columns = restaurant_list)

         #Joint
         feat_name_list = list(DC_grouped_all.columns)
         joint_list = []


         for counter, value in enumerate(feat_name_list):
             if value.find('Joint') != (-1):
```

```
            joint_list.append(value)

    DC_grouped['Total Joints'] = DC_grouped_all[joint_list].sum(axis = 1)
    #DC_grouped = DC_grouped.drop(columns = joint_list)

    #College
    feat_name_list = list(DC_grouped_all.columns)
    College_list = []


    for counter, value in enumerate(feat_name_list):
        if value.find('College') != (-1):
            College_list.append(value)

    DC_grouped['Total Colleges'] = DC_grouped_all[College_list].sum(axis = 1)
    #DC_grouped = DC_grouped.drop(columns = College_list)

    #Museums
    feat_name_list = list(DC_grouped_all.columns)
    Museum_list = []


    for counter, value in enumerate(feat_name_list):
        if value.find('Museum') != (-1):
            Museum_list.append(value)

    DC_grouped['Total Museums'] = DC_grouped_all[Museum_list].sum(axis = 1)
    #DC_grouped = DC_grouped.drop(columns = College_list)
```

```
In [64]: #DC_grouped_all['Greek Restaurant']
```

```
In [73]: DC_grouped['Score'] = (DC_grouped['Bus Station']*1+DC_grouped['Bus Stop']*1+DC_grouped[
         DC_grouped_sortedbyScore = DC_grouped.sort_values(by=['Score'], ascending=False)
         DC_grouped_sortedbyScore['Score'].head(3)
```

```
Out[73]: Neighborhood
         Barry Farm       4
         Pleasant Hill    2
         Eckington        2
         Name: Score, dtype: int64
```

1.4 4. Decision and Reporting Results

After constructing the simple equations with the weight (based on investors' suggestions I calculated the the score for each neighborhood. This approach is pretty straightforward but powerful to give idea of locating the new Greek Restraunt where there are less eating venues but nearby to bus/train stations and college campuses.

Results: Based on this analysis, the best recommended neighborhoods are Barry Farm, Pleasant Hill, and Eckington

In [ ]: