Durham-v.s-Ithaca

February 9, 2020

0.1 Introduction

Currently, I am a senior undergrad applying for grad schools. Two of my most accessible grad programs are in schools located in Durham and Ithaca. Considering the fact that I might have to live in one of these two places for quite some years, I would like to evaluate how life would be from different aspects, for example, cost of living, transportation, crime and entertainment. A similar approach could be used to compare living in two or multiple places given specific purposes.

0.2 Data Description

Neighbourhood segmentation data will be collected for both cities. The data will be cleaned and regrouped in given structures. The data is extracted from Zillow - US Neighborhoods using opendatasoft webpage. In a similar approach from previous assignments, I will pull data of neighbourhoods in these two places using Foursquare. After further analysis like k-means to cluster regions given interested metrics, I can choose the regions in the place that are most relevant to my preferences

0.3 Methodology

See the codes and comments below.

```
In [2]: import requests # library to handle requests
        import lxml.html as lh # library to parse the relevant fields
        import pandas as pd # library for data analsysis
        import numpy as np # library to handle data in a vectorized manner
        import random # library for random number generation
        import json

        #!conda install -c conda-forge geopy --yes
        from geopy.geocoders import Nominatim # module to convert an address into latitude and

        # libraries for displaying images
        from IPython.display import Image
        from IPython.core.display import HTML

        # tranforming json file into a pandas dataframe library
        from pandas.io.json import json_normalize
```

```
        #!conda install -c conda-forge folium=0.5.0 --yes
        import folium # plotting library

        print('Libraries imported.')
```

```
Libraries imported.
```

```
In [3]: # import neighborhoods information in Durham and Ithaca from json file
        with open(r'Durham/Durham-neighborhoods.json') as json_data:
            durham_data = json.load(json_data)

        with open(r'Ithaca/Ithaca-neighborhoods.json') as json_data:
            ithaca_data = json.load(json_data)
```

```
In [4]: # extract neighborhood name, latitude and longitude information and collect into panda
        column_names = ['Neighborhood', 'Latitude', 'Longitude']
        durham_neighborhoods = pd.DataFrame(columns=column_names)
        ithaca_neighborhoods = pd.DataFrame(columns=column_names)

        for data in durham_data:
            neighborhood_name = data['fields']['name']
            try:
                neighborhood_latlon = data['fields']['geo_point_2d']
            except:
                continue
            neighborhood_lat = neighborhood_latlon[0]
            neighborhood_lon = neighborhood_latlon[1]

            durham_neighborhoods = durham_neighborhoods.append({
                                                    'Neighborhood': neighborhood_name,
                                                    'Latitude': neighborhood_lat,
                                                    'Longitude': neighborhood_lon}, ignore_index=

        for data in ithaca_data:
            neighborhood_name = data['fields']['name']
            try:
                neighborhood_latlon = data['fields']['geo_point_2d']
            except:
                continue
            neighborhood_lat = neighborhood_latlon[0]
            neighborhood_lon = neighborhood_latlon[1]

            ithaca_neighborhoods = ithaca_neighborhoods.append({
                                                    'Neighborhood': neighborhood_name,
                                                    'Latitude': neighborhood_lat,
                                                    'Longitude': neighborhood_lon}, ignore_index=
```

Let's take a look at the data frame for durham and ithaca.

```
In [5]: durham_neighborhoods
```

```
Out[5]:          Neighborhood   Latitude  Longitude
        0    Duke East Campus  36.005433 -78.915657
        1           Knollwood  35.954212 -78.960946
        2         Milan Woods  36.009101 -78.854065
        3          Valley Run  35.961186 -78.950374
        4     Old Five Points  36.002196 -78.894549
        ..                ...        ...        ...
        113     Merrick Moore  36.004874 -78.854176
        114          West End  35.994598 -78.923427
        115      Burch Avenue  35.998685 -78.918051
        116   Stephen's Woods  36.086406 -78.898318
        117          Albright  35.996416 -78.884523

        [118 rows x 3 columns]
```

```
In [6]: ithaca_neighborhoods
```

```
Out[6]:        Neighborhood   Latitude  Longitude
        0    Cayuga Heights  42.467976 -76.487485
        1       East Ithaca  42.426217 -76.462672
        2       Forest Home  42.452821 -76.470074
        3        South Hill  42.411264 -76.488267
        4  Northwest Ithaca  42.470589 -76.541453
        5  Northeast Ithaca  42.470320 -76.462285
```

From the data, we can notice that Durham covers a much larger than Ithaca. It can also be obviously seen from their distributions on map.

```
In [7]: address = 'Durham, NC'

        geolocator = Nominatim(user_agent="ny_explorer")
        #location = geolocator.geocode(address)
        #durham_latitude = location.latitude
        #durham_longitude = location.longitude
        durham_latitude = 35.994034
        durham_longitude = -78.898621
        print('The geograpical coordinate of Durham are {}, {}.'.format(durham_latitude, durhar
```

```
The geograpical coordinate of Durham are 35.994034, -78.898621.
```

```
In [8]: # create map of New York using latitude and longitude values
        map_durham = folium.Map(location=[durham_latitude, durham_longitude], zoom_start=11)

        # add markers to map
        for lat, lng, label in zip(durham_neighborhoods['Latitude'], durham_neighborhoods['Long
            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_durham)

        map_durham
```

```
Out[8]: <folium.folium.Map at 0x7f267ec800b8>
```

```
In [9]: address = 'Ithaca, NY'

        geolocator = Nominatim(user_agent="ny_explorer")
        #location = geolocator.geocode(address)
        #ithaca_latitude = location.latitude
        #ithaca_longitude = location.longitude
        ithaca_latitude = 42.443962
        ithaca_longitude = -76.501884
        print('The geograpical coordinate of Ithaca are {}, {}.'.format(ithaca_latitude, ithaca
```

```
The geograpical coordinate of Ithaca are 42.443962, -76.501884.
```

```
In [10]: # create map of New York using latitude and longitude values
         map_ithaca = folium.Map(location=[ithaca_latitude, ithaca_longitude], zoom_start=11)

         # add markers to map
         for lat, lng, label in zip(ithaca_neighborhoods['Latitude'], ithaca_neighborhoods['Lo
             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_ithaca)

         map_ithaca
```

```
Out[10]: <folium.folium.Map at 0x7f267e9d4860>
```

To scale down, we find the largest distance between neighborhoods and work location in Ithaca and choose neighborhoods only within this upper distance limit. Let us first define work location

in Durham and Ithaca and a function to calculate distance between two points given their coordinates.

```
In [11]: # define Foursquare Credentials and version
         CLIENT_ID = 'DC1UAGXZVU1OQZKHUOKJFCYCV4ULXED2KGBMFFR1OSORPWUW' # your Foursquare ID
         CLIENT_SECRET = 'L5UEEWX3O5U1LVYFQGOM5MJ3SNX4OWSNRBHGZ5UBU4GBPUEB' # your Foursquare
         VERSION = '20200127'
         print('Your credentails:')
         print('CLIENT_ID: ' + CLIENT_ID)
         print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: DC1UAGXZVU1OQZKHUOKJFCYCV4ULXED2KGBMFFR1OSORPWUW
CLIENT_SECRET:L5UEEWX3O5U1LVYFQGOM5MJ3SNX4OWSNRBHGZ5UBU4GBPUEB
```

```
In [12]: # work location in Durham
         durham_work_coordinates = [36.003625, -78.939653]
         ithaca_work_coordinates = [42.449951, -76.481211]
```

```
In [13]: # define function to calculate distance
         def haversine(lat1, lon1, lat2, lon2):
             """
             Calculate the great circle distance between two points
             on the earth (specified in decimal degrees)
             """
             # convert decimal degrees to radians
             lon1, lat1, lon2, lat2 = map(np.radians, [lon1, lat1, lon2, lat2])

             # haversine formula
             dlon = lon2 - lon1
             dlat = lat2 - lat1
             a = np.sin(dlat/2)**2 + np.cos(lat1) * np.cos(lat2) * np.sin(dlon/2)**2
             c = 2 * np.arcsin(np.sqrt(a))
             r = 6371 # Radius of earth in kilometers. Use 3956 for miles
             return c * r
```

```
In [14]: largest_distance = np.max(haversine(ithaca_neighborhoods['Latitude'].values, ithaca_n
         print('The largest distance is: ' + str(largest_distance) + ' km')
```

```
The largest distance is: 5.448715526749547 km
```

```
In [15]: selected = haversine(durham_neighborhoods['Latitude'].values, durham_neighborhoods['L
         durham_neighborhoods = durham_neighborhoods[selected].reset_index(drop=True)
         durham_neighborhoods
```

```
Out[15]:                         Neighborhood   Latitude  Longitude
         0                   Duke East Campus  36.005433 -78.915657
```

1	Valley Run	35.961186	-78.950374
2	Old Five Points	36.002196	-78.894549
3	Omah Street	36.042563	-78.932375
4	Southside / St. Teresa	35.984349	-78.905823
5	Duke Park	36.011588	-78.890147
6	Duke Homestead	36.034517	-78.920988
7	Tuscaloosa-Lakewood	35.978813	-78.930410
8	Warehouse District	36.001422	-78.905249
9	Downtown	35.993745	-78.903139
10	Old North Durham	36.005384	-78.894557
11	Cleveland-Holloway	35.996790	-78.892457
12	Morehead Hill	35.989990	-78.911454
13	Trinity Heights	36.010702	-78.915898
14	American Village	36.020794	-78.970578
15	Stadium Heights	36.040006	-78.906092
16	Old West Durham	36.011792	-78.928481
17	Westwood Estates	36.038966	-78.969639
18	Lyon Park	35.989277	-78.918917
19	Trinity Commons	36.009592	-78.943413
20	Preston Woods	35.968949	-78.929643
21	Northgate Park	36.022943	-78.897521
22	Lakewood Park	35.988688	-78.925087
23	Central Park	35.999287	-78.901644
24	Sheridan Drive	35.954993	-78.936659
25	Edgemont	35.986133	-78.888728
26	Duke Forest	35.979805	-78.945202
27	Bennet Place	36.030237	-78.982402
28	Scarsdale Village	36.045658	-78.923820
29	Watts Hospital-Hillandale	36.022206	-78.931805
30	Long Meadow	35.980427	-78.923193
31	Walltown	36.017407	-78.915906
32	Crest Street	36.012601	-78.939472
33	Croasdaile	36.033198	-78.946877
34	West Hills	36.035297	-78.981646
35	Rockwood	35.970790	-78.923223
36	Golden Belt	35.990143	-78.888630
37	North Carolina Central University	35.974174	-78.897407
38	Dixon Road Area	35.964033	-78.936741
39	Franklin Village	35.988328	-78.884016
40	Forest Hills	35.979693	-78.915025
41	Colony Park	35.984683	-78.965459
42	Duke West Campus	36.002116	-78.938889
43	Lochn'ora	35.988571	-78.982629
44	Carillon Forest	35.980286	-78.986083
45	Trinity Park	36.009651	-78.907742
46	Duke Manor Apartments	36.013648	-78.944593
47	Waterford	36.038630	-78.960958
48	West End	35.994598	-78.923427

```
49                      Burch Avenue  35.998685 -78.918051
50                          Albright  35.996416 -78.884523
```

In [16]:
```
# create map of New York using latitude and longitude values
map_durham = folium.Map(location=[durham_work_coordinates[0], durham_work_coordinates

# add markers to map
for lat, lng, label in zip(durham_neighborhoods['Latitude'], durham_neighborhoods['Lo
    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_durham)

label = folium.Popup('work location', parse_html=True)
folium.CircleMarker(
    [durham_work_coordinates[0], durham_work_coordinates[1]],
    radius=5,
    popup=label,
    color='red',
    fill=True,
    fill_color='red',
    fill_opacity=0.7,
    parse_html=False).add_to(map_durham)

map_durham
```

Out[16]:
```
<folium.folium.Map at 0x7f267d18f390>
```

In [17]:
```
# create map of New York using latitude and longitude values
map_ithaca = folium.Map(location=[ithaca_work_coordinates[0], ithaca_work_coordinates

# add markers to map
for lat, lng, label in zip(ithaca_neighborhoods['Latitude'], ithaca_neighborhoods['Lo
    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_ithaca)

        label = folium.Popup('work location', parse_html=True)
        folium.CircleMarker(
            [ithaca_work_coordinates[0], ithaca_work_coordinates[1]],
            radius=5,
            popup=label,
            color='red',
            fill=True,
            fill_color='red',
            fill_opacity=0.7,
            parse_html=False).add_to(map_ithaca)

        map_ithaca
```

Out[17]: <folium.folium.Map at 0x7f267d0eb6d8>

```
In [18]: def getNearbyVenues(names, latitudes, longitudes, radius=800, LIMIT=100):

            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_secre
                    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)
```

```
In [19]: durham_venues = getNearbyVenues(names=durham_neighborhoods['Neighborhood'],
                                          latitudes=durham_neighborhoods['Latitude'],
                                          longitudes=durham_neighborhoods['Longitude']
                                         )

         ithaca_venues = getNearbyVenues(names=ithaca_neighborhoods['Neighborhood'],
                                          latitudes=ithaca_neighborhoods['Latitude'],
                                          longitudes=ithaca_neighborhoods['Longitude']
                                         )
```

```
Duke East Campus
Valley Run
Old Five Points
Omah Street
Southside / St. Teresa
Duke Park
Duke Homestead
Tuscaloosa-Lakewood
Warehouse District
Downtown
Old North Durham
Cleveland-Holloway
Morehead Hill
Trinity Heights
American Village
Stadium Heights
Old West Durham
Westwood Estates
Lyon Park
Trinity Commons
Preston Woods
Northgate Park
Lakewood Park
Central Park
Sheridan Drive
Edgemont
Duke Forest
Bennet Place
Scarsdale Village
```

```
Watts Hospital-Hillandale
Long Meadow
Walltown
Crest Street
Croasdaile
West Hills
Rockwood
Golden Belt
North Carolina Central University
Dixon Road Area
Franklin Village
Forest Hills
Colony Park
Duke West Campus
Lochn'ora
Carillon Forest
Trinity Park
Duke Manor Apartments
Waterford
West End
Burch Avenue
Albright
Cayuga Heights
East Ithaca
Forest Home
South Hill
Northwest Ithaca
Northeast Ithaca
```

```
In [20]: # check the size of the resulting dataframe
         print(durham_venues.shape)
         durham_venues.head()
```

```
(1218, 7)
```

```
Out[20]:        Neighborhood  Neighborhood Latitude  Neighborhood Longitude  \
         0  Duke East Campus              36.005433              -78.915657
         1  Duke East Campus              36.005433              -78.915657
         2  Duke East Campus              36.005433              -78.915657
         3  Duke East Campus              36.005433              -78.915657
         4  Duke East Campus              36.005433              -78.915657

                             Venue  Venue Latitude  Venue Longitude  \
         0                Brodie Gym       36.007296       -78.917006
         1          Whole Foods Market       36.007100       -78.920572
         2          Baldwin Auditorium       36.009001       -78.914656
```

```
3                   Duke Wall       36.007274       -78.919429
4  Mad Hatter Bakeshop & Café       36.006341       -78.920099

    Venue Category
0      College Gym
1    Grocery Store
2  College Theater
3            Track
4           Bakery
```

In [21]:
```
print(ithaca_venues.shape)
ithaca_venues.head()
```

```
(42, 7)
```

Out[21]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Cayuga Heights	42.467976	-76.487485	Gimme! Coffee	42.468610	-76.479428	Café
1	Cayuga Heights	42.467976	-76.487485	Ned's Pizza	42.469587	-76.478573	Pizza Place
2	Cayuga Heights	42.467976	-76.487485	The Heights	42.469073	-76.479728	American Restaurant
3	Cayuga Heights	42.467976	-76.487485	Burton S. Markowitz	42.468526	-76.481237	Optical Shop
4	Cayuga Heights	42.467976	-76.487485	Dr Markowitz Optometrist	42.468391	-76.481208	Optical Shop

In [22]:
```
durham_venues.groupby('Neighborhood').count()
```

Out[22]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Albright	9	9	9	9	9	9
American Village	4	4	4	4	4	4
Bennet Place	10	10	10	10	10	10
Burch Avenue	29	29	29	29	29	29
Carillon Forest	2	2	2	2	2	2
Central Park	100	100	100	100	100	100
Cleveland-Holloway	46	46	46	46	46	46
Colony Park	2	2	2	2	2	2

Crest Street	30
Croasdaile	1
Dixon Road Area	8
Downtown	97
Duke East Campus	62
Duke Forest	1
Duke Homestead	29
Duke Manor Apartments	51
Duke Park	22
Duke West Campus	26
Edgemont	16
Forest Hills	7
Franklin Village	13
Golden Belt	21
Lakewood Park	16
Lochn'ora	1
Long Meadow	23
Lyon Park	9
Morehead Hill	23
North Carolina Central University	4
Northgate Park	13
Old Five Points	27
Old North Durham	18
Old West Durham	57
Omah Street	7
Preston Woods	20
Rockwood	21
Scarsdale Village	2
Sheridan Drive	4
Southside / St. Teresa	21
Stadium Heights	16
Trinity Commons	30
Trinity Heights	64
Trinity Park	8
Tuscaloosa-Lakewood	32
Valley Run	32
Walltown	50
Warehouse District	100
Waterford	3
Watts Hospital-Hillandale	2
West End	15
West Hills	12
Westwood Estates	2

Neighborhood	Neighborhood Longitude	Venue	\
Albright	9	9	
American Village	4	4	

Bennet Place	10	10
Burch Avenue	29	29
Carillon Forest	2	2
Central Park	100	100
Cleveland-Holloway	46	46
Colony Park	2	2
Crest Street	30	30
Croasdaile	1	1
Dixon Road Area	8	8
Downtown	97	97
Duke East Campus	62	62
Duke Forest	1	1
Duke Homestead	29	29
Duke Manor Apartments	51	51
Duke Park	22	22
Duke West Campus	26	26
Edgemont	16	16
Forest Hills	7	7
Franklin Village	13	13
Golden Belt	21	21
Lakewood Park	16	16
Lochn'ora	1	1
Long Meadow	23	23
Lyon Park	9	9
Morehead Hill	23	23
North Carolina Central University	4	4
Northgate Park	13	13
Old Five Points	27	27
Old North Durham	18	18
Old West Durham	57	57
Omah Street	7	7
Preston Woods	20	20
Rockwood	21	21
Scarsdale Village	2	2
Sheridan Drive	4	4
Southside / St. Teresa	21	21
Stadium Heights	16	16
Trinity Commons	30	30
Trinity Heights	64	64
Trinity Park	8	8
Tuscaloosa-Lakewood	32	32
Valley Run	32	32
Walltown	50	50
Warehouse District	100	100
Waterford	3	3
Watts Hospital-Hillandale	2	2
West End	15	15
West Hills	12	12

Westwood Estates		2	2

Neighborhood	Venue Latitude	Venue Longitude	\
Albright	9	9	
American Village	4	4	
Bennet Place	10	10	
Burch Avenue	29	29	
Carillon Forest	2	2	
Central Park	100	100	
Cleveland-Holloway	46	46	
Colony Park	2	2	
Crest Street	30	30	
Croasdaile	1	1	
Dixon Road Area	8	8	
Downtown	97	97	
Duke East Campus	62	62	
Duke Forest	1	1	
Duke Homestead	29	29	
Duke Manor Apartments	51	51	
Duke Park	22	22	
Duke West Campus	26	26	
Edgemont	16	16	
Forest Hills	7	7	
Franklin Village	13	13	
Golden Belt	21	21	
Lakewood Park	16	16	
Lochn'ora	1	1	
Long Meadow	23	23	
Lyon Park	9	9	
Morehead Hill	23	23	
North Carolina Central University	4	4	
Northgate Park	13	13	
Old Five Points	27	27	
Old North Durham	18	18	
Old West Durham	57	57	
Omah Street	7	7	
Preston Woods	20	20	
Rockwood	21	21	
Scarsdale Village	2	2	
Sheridan Drive	4	4	
Southside / St. Teresa	21	21	
Stadium Heights	16	16	
Trinity Commons	30	30	
Trinity Heights	64	64	
Trinity Park	8	8	
Tuscaloosa-Lakewood	32	32	
Valley Run	32	32	

Walltown	50	50
Warehouse District	100	100
Waterford	3	3
Watts Hospital-Hillandale	2	2
West End	15	15
West Hills	12	12
Westwood Estates	2	2

Neighborhood	Venue Category
Albright	9
American Village	4
Bennet Place	10
Burch Avenue	29
Carillon Forest	2
Central Park	100
Cleveland-Holloway	46
Colony Park	2
Crest Street	30
Croasdaile	1
Dixon Road Area	8
Downtown	97
Duke East Campus	62
Duke Forest	1
Duke Homestead	29
Duke Manor Apartments	51
Duke Park	22
Duke West Campus	26
Edgemont	16
Forest Hills	7
Franklin Village	13
Golden Belt	21
Lakewood Park	16
Lochn'ora	1
Long Meadow	23
Lyon Park	9
Morehead Hill	23
North Carolina Central University	4
Northgate Park	13
Old Five Points	27
Old North Durham	18
Old West Durham	57
Omah Street	7
Preston Woods	20
Rockwood	21
Scarsdale Village	2
Sheridan Drive	4
Southside / St. Teresa	21

```
Stadium Heights                          16
Trinity Commons                          30
Trinity Heights                          64
Trinity Park                              8
Tuscaloosa-Lakewood                      32
Valley Run                               32
Walltown                                 50
Warehouse District                      100
Waterford                                 3
Watts Hospital-Hillandale                 2
West End                                 15
West Hills                               12
Westwood Estates                          2
```

In [23]:
```
ithaca_venues.groupby('Neighborhood').count()
```

Out[23]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Cayuga Heights	12	12	12	12	12	12
East Ithaca	7	7	7	7	7	7
Forest Home	13	13	13	13	13	13
Northeast Ithaca	4	4	4	4	4	4
Northwest Ithaca	6	6	6	6	6	6

In [24]:
```
# one hot encoding
durham_onehot = pd.get_dummies(durham_venues[['Venue Category']], prefix="", prefix_s

# add neighborhood column back to dataframe
durham_onehot['Neighborhood'] = durham_venues['Neighborhood']

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

durham_onehot.head()
```

Out[24]:

	Zoo Exhibit	Accessories Store	African Restaurant	American Restaurant	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	

```
4            0                  0                  0                    0

   Antique Shop  Arepa Restaurant  Art Gallery  Art Museum  \
0             0                 0            0           0
1             0                 0            0           0
2             0                 0            0           0
3             0                 0            0           0
4             0                 0            0           0

   Arts & Crafts Store  Asian Restaurant  ...  Train Station  Used Bookstore  \
0                    0                 0  ...              0               0
1                    0                 0  ...              0               0
2                    0                 0  ...              0               0
3                    0                 0  ...              0               0
4                    0                 0  ...              0               0

   Vegetarian / Vegan Restaurant  Video Game Store  Video Store  \
0                              0                 0            0
1                              0                 0            0
2                              0                 0            0
3                              0                 0            0
4                              0                 0            0

   Vietnamese Restaurant  Wine Bar  Wine Shop  Wings Joint  Yoga Studio
0                      0         0          0            0            0
1                      0         0          0            0            0
2                      0         0          0            0            0
3                      0         0          0            0            0
4                      0         0          0            0            0

[5 rows x 194 columns]
```

In [32]:
```
# one hot encoding
ithaca_onehot = pd.get_dummies(ithaca_venues[['Venue Category']], prefix="", prefix_s

# add neighborhood column back to dataframe
ithaca_onehot['Neighborhood'] = ithaca_venues['Neighborhood']

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

ithaca_onehot.head()
```

Out[32]:
```
     Neighborhood  American Restaurant  Bakery  Botanical Garden  \
0  Cayuga Heights                    0       0                 0
1  Cayuga Heights                    0       0                 0
2  Cayuga Heights                    1       0                 0
```

```
3  Cayuga Heights                    0       0                0
4  Cayuga Heights                    0       0                0

   Bowling Alley  Café  College Gym  College Lab  Convenience Store  \
0              0     1            0            0                  0
1              0     0            0            0                  0
2              0     0            0            0                  0
3              0     0            0            0                  0
4              0     0            0            0                  0

   Cosmetics Shop  ...  Nightlife Spot  Optical Shop  Park  Pizza Place  \
0               0  ...               0             0     0            0
1               0  ...               0             0     0            1
2               0  ...               0             0     0            0
3               0  ...               0             1     0            0
4               0  ...               0             1     0            0

   Playground  Scenic Lookout  Science Museum  Shopping Mall  Stadium  \
0           0               0               0              0        0
1           0               0               0              0        0
2           0               0               0              0        0
3           0               0               0              0        0
4           0               0               0              0        0

   Tourist Information Center
0                           0
1                           0
2                           0
3                           0
4                           0

[5 rows x 31 columns]
```

In [33]:
```
durham_grouped = durham_onehot.groupby('Neighborhood').mean().reset_index()
durham_grouped
```

Out[33]:
```
                       Neighborhood  Zoo Exhibit  Accessories Store  \
0                          Albright     0.000000               0.00
1                  American Village     0.000000               0.00
2                      Bennet Place     0.000000               0.00
3                      Burch Avenue     0.000000               0.00
4                   Carillon Forest     0.000000               0.00
5                      Central Park     0.000000               0.00
6                 Cleveland-Holloway     0.000000               0.00
7                       Colony Park     0.000000               0.00
8                      Crest Street     0.000000               0.00
9                        Croasdaile     0.000000               0.00
10                  Dixon Road Area     0.000000               0.00
```

11	Downtown	0.000000	0.00
12	Duke East Campus	0.000000	0.00
13	Duke Forest	0.000000	0.00
14	Duke Homestead	0.000000	0.00
15	Duke Manor Apartments	0.000000	0.00
16	Duke Park	0.000000	0.00
17	Duke West Campus	0.000000	0.00
18	Edgemont	0.000000	0.00
19	Forest Hills	0.000000	0.00
20	Franklin Village	0.000000	0.00
21	Golden Belt	0.000000	0.00
22	Lakewood Park	0.000000	0.00
23	Lochn'ora	0.000000	0.00
24	Long Meadow	0.000000	0.00
25	Lyon Park	0.000000	0.00
26	Morehead Hill	0.000000	0.00
27	North Carolina Central University	0.000000	0.00
28	Northgate Park	0.076923	0.00
29	Old Five Points	0.000000	0.00
30	Old North Durham	0.000000	0.00
31	Old West Durham	0.000000	0.00
32	Omah Street	0.000000	0.00
33	Preston Woods	0.000000	0.00
34	Rockwood	0.000000	0.00
35	Scarsdale Village	0.000000	0.00
36	Sheridan Drive	0.000000	0.00
37	Southside / St. Teresa	0.000000	0.00
38	Stadium Heights	0.000000	0.00
39	Trinity Commons	0.000000	0.00
40	Trinity Heights	0.000000	0.00
41	Trinity Park	0.000000	0.00
42	Tuscaloosa-Lakewood	0.000000	0.00
43	Valley Run	0.000000	0.00
44	Walltown	0.000000	0.04
45	Warehouse District	0.000000	0.00
46	Waterford	0.000000	0.00
47	Watts Hospital-Hillandale	0.000000	0.00
48	West End	0.000000	0.00
49	West Hills	0.000000	0.00
50	Westwood Estates	0.000000	0.00

	African Restaurant	American Restaurant	Antique Shop	Arepa Restaurant	\
0	0.000000	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	0.000000	
2	0.000000	0.100000	0.000000	0.000000	
3	0.000000	0.000000	0.000000	0.000000	
4	0.000000	0.000000	0.000000	0.000000	
5	0.000000	0.020000	0.000000	0.000000	

6	0.000000	0.021739	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.033333	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.030928	0.000000	0.000000
12	0.000000	0.000000	0.000000	0.000000
13	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.034483	0.034483	0.000000
15	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.076923	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000	0.000000
24	0.000000	0.043478	0.000000	0.000000
25	0.000000	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000	0.000000
29	0.000000	0.037037	0.000000	0.000000
30	0.000000	0.000000	0.000000	0.000000
31	0.000000	0.017544	0.000000	0.017544
32	0.000000	0.142857	0.000000	0.000000
33	0.000000	0.100000	0.000000	0.000000
34	0.000000	0.047619	0.000000	0.000000
35	0.000000	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000	0.000000
39	0.000000	0.033333	0.000000	0.000000
40	0.015625	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000	0.000000
42	0.000000	0.062500	0.000000	0.000000
43	0.000000	0.000000	0.000000	0.000000
44	0.020000	0.040000	0.000000	0.000000
45	0.000000	0.020000	0.000000	0.000000
46	0.000000	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000	0.000000
49	0.000000	0.083333	0.000000	0.000000
50	0.000000	0.000000	0.000000	0.000000

	Art Gallery	Art Museum	Arts & Crafts Store	...	Train Station	\
0	0.000000	0.000000	0.000000	...	0.000000	

1	0.000000	0.000000	0.000000	...	0.000000
2	0.000000	0.000000	0.000000	...	0.000000
3	0.034483	0.000000	0.000000	...	0.000000
4	0.000000	0.000000	0.000000	...	0.000000
5	0.010000	0.000000	0.000000	...	0.010000
6	0.065217	0.000000	0.000000	...	0.000000
7	0.000000	0.000000	0.000000	...	0.000000
8	0.000000	0.000000	0.000000	...	0.000000
9	0.000000	0.000000	0.000000	...	0.000000
10	0.000000	0.000000	0.000000	...	0.000000
11	0.030928	0.000000	0.000000	...	0.010309
12	0.016129	0.000000	0.000000	...	0.000000
13	0.000000	0.000000	0.000000	...	0.000000
14	0.000000	0.000000	0.000000	...	0.000000
15	0.000000	0.000000	0.000000	...	0.000000
16	0.000000	0.000000	0.000000	...	0.000000
17	0.000000	0.000000	0.000000	...	0.000000
18	0.062500	0.000000	0.000000	...	0.000000
19	0.000000	0.000000	0.000000	...	0.000000
20	0.076923	0.000000	0.000000	...	0.000000
21	0.095238	0.000000	0.000000	...	0.000000
22	0.000000	0.000000	0.062500	...	0.000000
23	0.000000	0.000000	0.000000	...	0.000000
24	0.000000	0.000000	0.043478	...	0.000000
25	0.000000	0.000000	0.111111	...	0.000000
26	0.000000	0.000000	0.000000	...	0.000000
27	0.000000	0.000000	0.000000	...	0.000000
28	0.000000	0.000000	0.000000	...	0.000000
29	0.000000	0.000000	0.000000	...	0.000000
30	0.000000	0.000000	0.000000	...	0.000000
31	0.000000	0.000000	0.000000	...	0.000000
32	0.000000	0.000000	0.000000	...	0.000000
33	0.000000	0.000000	0.000000	...	0.000000
34	0.000000	0.000000	0.047619	...	0.000000
35	0.000000	0.000000	0.000000	...	0.000000
36	0.000000	0.000000	0.000000	...	0.000000
37	0.000000	0.000000	0.000000	...	0.000000
38	0.000000	0.000000	0.000000	...	0.000000
39	0.000000	0.000000	0.000000	...	0.000000
40	0.000000	0.000000	0.000000	...	0.000000
41	0.000000	0.000000	0.000000	...	0.000000
42	0.000000	0.000000	0.031250	...	0.000000
43	0.000000	0.000000	0.000000	...	0.000000
44	0.000000	0.000000	0.020000	...	0.000000
45	0.020000	0.000000	0.000000	...	0.010000
46	0.000000	0.000000	0.000000	...	0.000000
47	0.000000	0.000000	0.000000	...	0.000000
48	0.000000	0.066667	0.066667	...	0.000000

```
49     0.000000    0.000000             0.000000  ...       0.000000
50     0.000000    0.000000             0.000000  ...       0.000000

    Used Bookstore  Vegetarian / Vegan Restaurant  Video Game Store  \
0         0.000000                       0.000000          0.000000
1         0.000000                       0.000000          0.000000
2         0.000000                       0.000000          0.000000
3         0.034483                       0.000000          0.000000
4         0.000000                       0.000000          0.000000
5         0.000000                       0.000000          0.000000
6         0.000000                       0.000000          0.000000
7         0.000000                       0.000000          0.000000
8         0.000000                       0.000000          0.000000
9         0.000000                       0.000000          0.000000
10        0.000000                       0.000000          0.000000
11        0.000000                       0.000000          0.000000
12        0.016129                       0.016129          0.000000
13        0.000000                       0.000000          0.000000
14        0.000000                       0.000000          0.034483
15        0.000000                       0.000000          0.000000
16        0.000000                       0.000000          0.000000
17        0.000000                       0.000000          0.000000
18        0.000000                       0.000000          0.000000
19        0.000000                       0.000000          0.000000
20        0.000000                       0.000000          0.000000
21        0.000000                       0.000000          0.000000
22        0.000000                       0.000000          0.000000
23        0.000000                       0.000000          0.000000
24        0.043478                       0.000000          0.000000
25        0.000000                       0.000000          0.000000
26        0.000000                       0.000000          0.000000
27        0.000000                       0.000000          0.000000
28        0.000000                       0.000000          0.000000
29        0.000000                       0.000000          0.000000
30        0.000000                       0.000000          0.000000
31        0.000000                       0.017544          0.000000
32        0.000000                       0.000000          0.000000
33        0.000000                       0.000000          0.000000
34        0.047619                       0.000000          0.000000
35        0.000000                       0.000000          0.000000
36        0.000000                       0.000000          0.000000
37        0.000000                       0.000000          0.000000
38        0.000000                       0.000000          0.000000
39        0.000000                       0.000000          0.000000
40        0.000000                       0.015625          0.000000
41        0.000000                       0.000000          0.000000
42        0.031250                       0.000000          0.000000
43        0.000000                       0.000000          0.000000
```

44	0.000000	0.020000	0.020000
45	0.010000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000

	Video Store	Vietnamese Restaurant	Wine Bar	Wine Shop	Wings Joint	\
0	0.000000	0.000000	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	0.000000	0.000000	
2	0.000000	0.000000	0.000000	0.000000	0.000000	
3	0.000000	0.000000	0.000000	0.000000	0.000000	
4	0.000000	0.000000	0.000000	0.000000	0.000000	
5	0.000000	0.000000	0.020000	0.000000	0.000000	
6	0.000000	0.000000	0.021739	0.000000	0.000000	
7	0.000000	0.000000	0.000000	0.000000	0.000000	
8	0.000000	0.000000	0.000000	0.000000	0.000000	
9	0.000000	0.000000	0.000000	0.000000	0.000000	
10	0.125000	0.000000	0.000000	0.000000	0.000000	
11	0.000000	0.000000	0.020619	0.000000	0.000000	
12	0.016129	0.016129	0.000000	0.000000	0.016129	
13	0.000000	0.000000	0.000000	0.000000	0.000000	
14	0.000000	0.000000	0.000000	0.000000	0.000000	
15	0.019608	0.000000	0.000000	0.000000	0.000000	
16	0.000000	0.000000	0.000000	0.000000	0.000000	
17	0.000000	0.000000	0.000000	0.000000	0.000000	
18	0.000000	0.000000	0.000000	0.000000	0.000000	
19	0.000000	0.000000	0.000000	0.000000	0.000000	
20	0.000000	0.000000	0.000000	0.000000	0.000000	
21	0.000000	0.000000	0.000000	0.000000	0.000000	
22	0.000000	0.000000	0.000000	0.000000	0.000000	
23	0.000000	0.000000	0.000000	0.000000	0.000000	
24	0.000000	0.000000	0.000000	0.043478	0.000000	
25	0.000000	0.000000	0.000000	0.000000	0.000000	
26	0.000000	0.000000	0.000000	0.000000	0.000000	
27	0.000000	0.000000	0.000000	0.000000	0.000000	
28	0.000000	0.000000	0.000000	0.000000	0.000000	
29	0.000000	0.000000	0.000000	0.000000	0.000000	
30	0.000000	0.000000	0.000000	0.000000	0.000000	
31	0.000000	0.017544	0.000000	0.000000	0.017544	
32	0.000000	0.000000	0.000000	0.000000	0.000000	
33	0.000000	0.000000	0.000000	0.000000	0.000000	
34	0.000000	0.000000	0.000000	0.047619	0.000000	
35	0.000000	0.000000	0.000000	0.000000	0.000000	
36	0.250000	0.000000	0.000000	0.000000	0.000000	
37	0.000000	0.000000	0.000000	0.000000	0.000000	
38	0.062500	0.000000	0.000000	0.000000	0.000000	

39	0.000000	0.033333	0.000000	0.000000	0.000000
40	0.015625	0.015625	0.000000	0.000000	0.015625
41	0.000000	0.000000	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000	0.031250	0.000000
43	0.031250	0.000000	0.000000	0.000000	0.000000
44	0.020000	0.000000	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.010000	0.000000	0.000000
46	0.000000	0.000000	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000	0.000000	0.000000

	Yoga Studio
0	0.000000
1	0.000000
2	0.000000
3	0.000000
4	0.000000
5	0.000000
6	0.021739
7	0.000000
8	0.000000
9	0.000000
10	0.000000
11	0.010309
12	0.000000
13	0.000000
14	0.000000
15	0.000000
16	0.000000
17	0.000000
18	0.062500
19	0.000000
20	0.076923
21	0.047619
22	0.000000
23	0.000000
24	0.000000
25	0.000000
26	0.000000
27	0.000000
28	0.000000
29	0.000000
30	0.000000
31	0.000000
32	0.000000
33	0.000000

```
34     0.000000
35     0.000000
36     0.000000
37     0.047619
38     0.000000
39     0.033333
40     0.000000
41     0.000000
42     0.000000
43     0.000000
44     0.000000
45     0.000000
46     0.000000
47     0.000000
48     0.000000
49     0.000000
50     0.000000

[51 rows x 194 columns]
```

In [34]:
```
ithaca_grouped = ithaca_onehot.groupby('Neighborhood').mean().reset_index()
ithaca_grouped
```

Out[34]:

	Neighborhood	American Restaurant	Bakery	Botanical Garden	\
0	Cayuga Heights	0.083333	0.083333	0.000000	
1	East Ithaca	0.000000	0.000000	0.000000	
2	Forest Home	0.000000	0.000000	0.076923	
3	Northeast Ithaca	0.000000	0.000000	0.000000	
4	Northwest Ithaca	0.000000	0.000000	0.000000	

	Bowling Alley	Café	College Gym	College Lab	Convenience Store	\
0	0.000000	0.166667	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	0.000000	0.000000	
2	0.076923	0.076923	0.076923	0.076923	0.076923	
3	0.000000	0.000000	0.000000	0.000000	0.000000	
4	0.000000	0.166667	0.000000	0.000000	0.000000	

	Cosmetics Shop	...	Nightlife Spot	Optical Shop	Park	Pizza Place	\
0	0.083333	...	0.00	0.166667	0.000000	0.083333	
1	0.142857	...	0.00	0.000000	0.285714	0.000000	
2	0.000000	...	0.00	0.000000	0.000000	0.000000	
3	0.000000	...	0.25	0.000000	0.250000	0.000000	
4	0.000000	...	0.00	0.000000	0.000000	0.000000	

	Playground	Scenic Lookout	Science Museum	Shopping Mall	Stadium	\
0	0.000000	0.000000	0.000000	0.166667	0.000000	
1	0.285714	0.000000	0.000000	0.000000	0.000000	
2	0.000000	0.000000	0.000000	0.000000	0.076923	

```
3    0.250000        0.000000        0.000000        0.250000  0.000000
4    0.000000        0.166667        0.166667        0.000000  0.000000

   Tourist Information Center
0                    0.000000
1                    0.000000
2                    0.076923
3                    0.000000
4                    0.000000

[5 rows x 31 columns]
```

In [35]:
```
num_top_venues = 5

for hood in durham_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = durham_grouped[durham_grouped['Neighborhood'] == hood].T.reset_index()
    temp.columns = ['venue','freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_t
    print('\n')
```

```
----Albright----
            venue  freq
0  Coffee Roaster  0.11
1            Park  0.11
2          Garden  0.11
3     Gas Station  0.11
4      Food Truck  0.11


----American Village----
          venue  freq
0  Concert Hall  0.25
1       Dog Run  0.25
2           Bar  0.25
3          Park  0.25
4   Zoo Exhibit  0.00


----Bennet Place----
                  venue  freq
0        Gymnastics Gym   0.1
1           Supermarket   0.1
2               Theater   0.1
3  Gym / Fitness Center   0.1
```

```
4    Salon / Barbershop   0.1


----Burch Avenue----
          venue  freq
0           Bar  0.07
1   Coffee Shop  0.07
2   Pizza Place  0.07
3         Hotel  0.07
4  Dessert Shop  0.03


----Carillon Forest----
              venue  freq
0  Recording Studio   0.5
1              Farm   0.5
2       Zoo Exhibit   0.0
3      Optical Shop   0.0
4         Multiplex   0.0


----Central Park----
                venue  freq
0                 Bar  0.07
1               Hotel  0.04
2        Cocktail Bar  0.03
3        Burger Joint  0.03
4  Italian Restaurant  0.03


----Cleveland-Holloway----
          venue  freq
0   Art Gallery  0.07
1  Cocktail Bar  0.07
2    Food Truck  0.04
3       Brewery  0.04
4         Hotel  0.04


----Colony Park----
            venue  freq
0            Pool   0.5
1  Baseball Field   0.5
2     Zoo Exhibit   0.0
3    Optical Shop   0.0
4   Moving Target   0.0
```

```
----Crest Street----
                      venue  freq
0       Rental Car Location  0.07
1               Salad Place  0.07
2           Breakfast Spot  0.07
3              Coffee Shop  0.07
4  Mediterranean Restaurant  0.07


----Croasdaile----
           venue  freq
0    Social Club   1.0
1    Zoo Exhibit   0.0
2      Pool Hall   0.0
3  Moving Target   0.0
4      Multiplex   0.0


----Dixon Road Area----
                        venue  freq
0                         Spa  0.12
1           Convenience Store  0.12
2  Construction & Landscaping  0.12
3                 Video Store  0.12
4                  Playground  0.12


----Downtown----
                 venue  freq
0                Hotel  0.05
1         Cocktail Bar  0.04
2          Pizza Place  0.04
3                  Bar  0.03
4  American Restaurant  0.03


----Duke East Campus----
            venue  freq
0             Bar  0.06
1     Pizza Place  0.05
2  Ice Cream Shop  0.03
3          Bakery  0.03
4           Hotel  0.03


----Duke Forest----
           venue  freq
0      Disc Golf   1.0
```

```
1    Zoo Exhibit   0.0
2   Optical Shop   0.0
3  Moving Target   0.0
4      Multiplex   0.0


----Duke Homestead----
                 venue  freq
0            Pet Store  0.07
1                Hotel  0.07
2        Historic Site  0.03
3           Steakhouse  0.03
4  Fried Chicken Joint  0.03


----Duke Manor Apartments----
                  venue  freq
0            Donut Shop  0.06
1        Sandwich Place  0.06
2    Mexican Restaurant  0.06
3   Rental Car Location  0.04
4  Fast Food Restaurant  0.04


----Duke Park----
                venue  freq
0  Chinese Restaurant  0.14
1  Seafood Restaurant  0.09
2              Bakery  0.05
3          Food Truck  0.05
4       Big Box Store  0.05


----Duke West Campus----
                  venue  freq
0     College Cafeteria  0.15
1           Coffee Shop  0.12
2                 Café  0.08
3  Fast Food Restaurant  0.08
4                 Bank  0.04


----Edgemont----
            venue  freq
0      Food Truck  0.12
1         Brewery  0.12
2   Grocery Store  0.12
3     Coffee Shop  0.06
```

```
4  Baseball Field  0.06


----Forest Hills----
                venue  freq
0               Trail  0.29
1   Convenience Store  0.14
2         Fish Market  0.14
3  Chinese Restaurant  0.14
4                Park  0.14


----Franklin Village----
            venue  freq
0   Grocery Store  0.15
1     Yoga Studio  0.08
2         Brewery  0.08
3  Farmers Market  0.08
4    Home Service  0.08


----Golden Belt----
            venue  freq
0     Food Truck  0.10
1    Art Gallery  0.10
2        Brewery  0.10
3  Grocery Store  0.10
4    Yoga Studio  0.05


----Lakewood Park----
                   venue  freq
0        Breakfast Spot  0.06
1            Restaurant  0.06
2    Mexican Restaurant  0.06
3  Gym / Fitness Center  0.06
4           Coffee Shop  0.06


----Lochn'ora----
            venue  freq
0           Farm   1.0
1    Zoo Exhibit   0.0
2      Pool Hall   0.0
3  Moving Target   0.0
4      Multiplex   0.0
```

```
----Long Meadow----
                    venue  freq
0  Furniture / Home Store  0.09
1      Italian Restaurant  0.04
2          Massage Studio  0.04
3             Pizza Place  0.04
4            Dessert Shop  0.04


----Lyon Park----
            venue  freq
0     Music Store  0.11
1     Supermarket  0.11
2  Shopping Plaza  0.11
3      Food Truck  0.11
4    Home Service  0.11


----Morehead Hill----
                venue  freq
0               Trail  0.09
1        Burger Joint  0.04
2                 Bar  0.04
3  Chinese Restaurant  0.04
4               Café  0.04


----North Carolina Central University----
                             venue  freq
0  Southern / Soul Food Restaurant  0.25
1            College Arts Building  0.25
2             Fast Food Restaurant  0.25
3                   Clothing Store  0.25
4                      Zoo Exhibit  0.00


----Northgate Park----
                venue  freq
0                Park  0.23
1         Zoo Exhibit  0.08
2    Toy / Game Store  0.08
3       Grocery Store  0.08
4  Mexican Restaurant  0.08


----Old Five Points----
       venue  freq
0        Bar  0.15
```

```
1    Brewery  0.11
2  Gastropub  0.07
3        Gym  0.07
4  BBQ Joint  0.07


----Old North Durham----
                     venue  freq
0                      Bar  0.22
1                  Brewery  0.17
2                Gastropub  0.11
3                BBQ Joint  0.11
4  Health & Beauty Service  0.06


----Old West Durham----
            venue  freq
0  Ice Cream Shop  0.04
1         Bakery  0.04
2    Coffee Shop  0.04
3  Shipping Store  0.04
4  Sandwich Place  0.04


----Omah Street----
                        venue  freq
0         American Restaurant  0.14
1          Italian Restaurant  0.14
2         Japanese Restaurant  0.14
3           Convenience Store  0.14
4  Construction & Landscaping  0.14


----Preston Woods----
                        venue  freq
0              Sandwich Place  0.10
1         American Restaurant  0.10
2      Furniture / Home Store  0.10
3  Construction & Landscaping  0.05
4          Seafood Restaurant  0.05


----Rockwood----
                     venue  freq
0  Furniture / Home Store  0.14
1       Convenience Store  0.10
2             Gas Station  0.05
3      Italian Restaurant  0.05
```

```
4         Thai Restaurant  0.05


----Scarsdale Village----
           venue  freq
0    Gaming Cafe   0.5
1           Park   0.5
2         Office   0.0
3  Movie Theater   0.0
4  Moving Target   0.0


----Sheridan Drive----
                        venue  freq
0                Home Service  0.50
1  Construction & Landscaping  0.25
2                 Video Store  0.25
3                 Zoo Exhibit  0.00
4           Outdoor Sculpture  0.00


----Southside / St. Teresa----
                venue  freq
0               Trail  0.10
1       Grocery Store  0.10
2     Ice Cream Shop  0.05
3     Breakfast Spot  0.05
4  Seafood Restaurant  0.05


----Stadium Heights----
                  venue  freq
0              Pharmacy  0.12
1  Fast Food Restaurant  0.12
2        Ice Cream Shop  0.06
3                Bakery  0.06
4   Fried Chicken Joint  0.06


----Trinity Commons----
                      venue  freq
0              Coffee Shop  0.07
1  Mediterranean Restaurant  0.07
2              Salad Place  0.07
3            Sandwich Place  0.07
4               Yoga Studio  0.03
```

```
----Trinity Heights----
                venue  freq
0                Café  0.05
1      Ice Cream Shop  0.03
2           Bookstore  0.03
3  Mexican Restaurant  0.03
4      Shipping Store  0.03


----Trinity Park----
           venue  freq
0        Brewery  0.12
1    Bus Station  0.12
2  Garden Center  0.12
3          Hotel  0.12
4     Playground  0.12


----Tuscaloosa-Lakewood----
                    venue  freq
0  Furniture / Home Store  0.12
1              Taco Place  0.06
2     American Restaurant  0.06
3    Gym / Fitness Center  0.06
4          Sandwich Place  0.06


----Valley Run----
                venue  freq
0      Sandwich Place  0.09
1         Pizza Place  0.09
2      Cosmetics Shop  0.06
3  Frozen Yogurt Shop  0.06
4       Deli / Bodega  0.03


----Walltown----
                   venue  freq
0        Clothing Store  0.08
1            Shoe Store  0.04
2  Gym / Fitness Center  0.04
3   American Restaurant  0.04
4        Lingerie Store  0.04


----Warehouse District----
                venue  freq
0                 Bar  0.08
```

```
1         Pizza Place  0.05
2               Hotel  0.05
3             Brewery  0.04
4  Mexican Restaurant  0.03


----Waterford----
               venue  freq
0             Bakery  0.33
1          BBQ Joint  0.33
2                Bar  0.33
3  Outdoor Sculpture  0.00
4          Multiplex  0.00


----Watts Hospital-Hillandale----
           venue  freq
0    Golf Course   0.5
1           Park   0.5
2    Zoo Exhibit   0.0
3         Office   0.0
4  Moving Target   0.0


----West End----
                venue  freq
0         Coffee Shop  0.13
1                Café  0.13
2  Chinese Restaurant  0.07
3         Music Store  0.07
4              Market  0.07


----West Hills----
                venue  freq
0      Discount Store  0.08
1      Rental Service  0.08
2  Chinese Restaurant  0.08
3      Breakfast Spot  0.08
4         Supermarket  0.08


----Westwood Estates----
            venue  freq
0  Rental Service   0.5
1  Breakfast Spot   0.5
2     Zoo Exhibit   0.0
3    Optical Shop   0.0
```

```
4   Moving Target   0.0
```

```
In [36]: num_top_venues = 5

         for hood in ithaca_grouped['Neighborhood']:
             print("----"+hood+"----")
             temp = ithaca_grouped[ithaca_grouped['Neighborhood'] == hood].T.reset_index()
             temp.columns = ['venue','freq']
             temp = temp.iloc[1:]
             temp['freq'] = temp['freq'].astype(float)
             temp = temp.round({'freq': 2})
             print(temp.sort_values('freq', ascending=False).reset_index(drop=True).head(num_t
             print('\n')
```

```
----Cayuga Heights----
                 venue  freq
0        Shopping Mall  0.17
1                 Café  0.17
2         Optical Shop  0.17
3  American Restaurant  0.08
4          Pizza Place  0.08


----East Ithaca----
            venue  freq
0      Playground  0.29
1            Park  0.29
2  Cosmetics Shop  0.14
3         Dog Run  0.14
4            Lake  0.14


----Forest Home----
               venue  freq
0       Golf Course  0.08
1  Convenience Store  0.08
2            Stadium  0.08
3               Lake  0.08
4     Ice Cream Shop  0.08


----Northeast Ithaca----
                 venue  freq
0        Shopping Mall  0.25
1           Playground  0.25
```

```
2                 Park  0.25
3       Nightlife Spot  0.25
4  American Restaurant  0.00


----Northwest Ithaca----
            venue  freq
0            Café  0.17
1  Science Museum  0.17
2  Scenic Lookout  0.17
3            Farm  0.17
4          Museum  0.17
```

```
In [38]: def return_most_common_venues(row, num_top_venues):
             row_categories = row.iloc[1:]
             row_categories_sorted = row_categories.sort_values(ascending=False)

             return row_categories_sorted.index.values[0:num_top_venues]
```

```
In [39]: num_top_venues = 10

         indicators = ['st', 'nd', 'rd']

         # create columns according to number of top venues
         columns = ['Neighborhood']
         for ind in np.arange(num_top_venues):
             try:
                 columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
             except:
                 columns.append('{}th Most Common Venue'.format(ind+1))

         # create a new dataframe
         neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
         neighborhoods_venues_sorted['Neighborhood'] = durham_grouped['Neighborhood']

         for ind in np.arange(durham_grouped.shape[0]):
             neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(durham_grou

         neighborhoods_venues_sorted.head()
```

```
Out[39]:        Neighborhood 1st Most Common Venue 2nd Most Common Venue  \
         0          Albright            Food Truck        Coffee Roaster
         1  American Village          Concert Hall                  Park
         2      Bennet Place               Theater    Chinese Restaurant
         3      Burch Avenue                   Bar           Pizza Place
```

```
4   Carillon Forest      Recording Studio                  Farm

  3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
0    Seafood Restaurant                Garden          Gas Station
1               Dog Run                   Bar          Yoga Studio
2    Salon / Barbershop           Supermarket       Discount Store
3                 Hotel           Coffee Shop                Plaza
4          Yoga Studio  Ethiopian Restaurant           Food Court

  6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
0               Brewery         Grocery Store                  Spa
1          Fabric Shop            Food Truck           Food Court
2  Gym / Fitness Center        Gymnastics Gym         Historic Site
3                 Café               Brewery               Market
4                 Food          Flower Shop          Fish Market

             9th Most Common Venue 10th Most Common Venue
0                             Park         Discount Store
1                             Food            Flower Shop
2              American Restaurant             Restaurant
3  Southern / Soul Food Restaurant           Cocktail Bar
4             Fast Food Restaurant         Farmers Market
```

In [40]:
```
num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = ithaca_grouped['Neighborhood']

for ind in np.arange(ithaca_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(ithaca_grou

neighborhoods_venues_sorted.head()
```

Out[40]:
```
       Neighborhood       1st Most Common Venue 2nd Most Common Venue  \
0    Cayuga Heights                Optical Shop         Shopping Mall
1       East Ithaca                  Playground                  Park
2       Forest Home  Tourist Information Center     Convenience Store
```

```
3  Northeast Ithaca                Shopping Mall            Playground
4  Northwest Ithaca                    Gift Shop        Science Museum

  3rd Most Common Venue 4th Most Common Venue       5th Most Common Venue  \
0                 Café           Pizza Place        Gym / Fitness Center
1                 Lake        Cosmetics Shop                    Dog Run
2               Garden               Stadium                Golf Course
3                 Park        Nightlife Spot  Tourist Information Center
4       Scenic Lookout                 Café                      Museum

       6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
0             Cosmetics Shop   American Restaurant                Bakery
1  Tourist Information Center           Food Court                Bakery
2              Ice Cream Shop                 Lake            Food Court
3                 College Lab                 Farm               Dog Run
4                        Farm           Food Court                Bakery

  9th Most Common Venue 10th Most Common Venue
0          Flower Shop          Bowling Alley
1     Botanical Garden          Bowling Alley
2          College Lab            College Gym
3       Cosmetics Shop     Convenience Store
4     Botanical Garden          Bowling Alley
```

```
In [41]: durham_grouped['distance'] =
```

```
Out[41]:                       Neighborhood  Zoo Exhibit  Accessories Store  \
0                           Albright     0.000000               0.00
1                   American Village     0.000000               0.00
2                       Bennet Place     0.000000               0.00
3                       Burch Avenue     0.000000               0.00
4                     Carillon Forest     0.000000               0.00
5                       Central Park     0.000000               0.00
6                  Cleveland-Holloway     0.000000               0.00
7                        Colony Park     0.000000               0.00
8                       Crest Street     0.000000               0.00
9                         Croasdaile     0.000000               0.00
10                  Dixon Road Area     0.000000               0.00
11                         Downtown     0.000000               0.00
12                 Duke East Campus     0.000000               0.00
13                      Duke Forest     0.000000               0.00
14                   Duke Homestead     0.000000               0.00
15              Duke Manor Apartments     0.000000               0.00
16                         Duke Park     0.000000               0.00
17                 Duke West Campus     0.000000               0.00
18                         Edgemont     0.000000               0.00
19                     Forest Hills     0.000000               0.00
20                 Franklin Village     0.000000               0.00
```

21	Golden Belt	0.000000	0.00	
22	Lakewood Park	0.000000	0.00	
23	Lochn'ora	0.000000	0.00	
24	Long Meadow	0.000000	0.00	
25	Lyon Park	0.000000	0.00	
26	Morehead Hill	0.000000	0.00	
27	North Carolina Central University	0.000000	0.00	
28	Northgate Park	0.076923	0.00	
29	Old Five Points	0.000000	0.00	
30	Old North Durham	0.000000	0.00	
31	Old West Durham	0.000000	0.00	
32	Omah Street	0.000000	0.00	
33	Preston Woods	0.000000	0.00	
34	Rockwood	0.000000	0.00	
35	Scarsdale Village	0.000000	0.00	
36	Sheridan Drive	0.000000	0.00	
37	Southside / St. Teresa	0.000000	0.00	
38	Stadium Heights	0.000000	0.00	
39	Trinity Commons	0.000000	0.00	
40	Trinity Heights	0.000000	0.00	
41	Trinity Park	0.000000	0.00	
42	Tuscaloosa-Lakewood	0.000000	0.00	
43	Valley Run	0.000000	0.00	
44	Walltown	0.000000	0.04	
45	Warehouse District	0.000000	0.00	
46	Waterford	0.000000	0.00	
47	Watts Hospital-Hillandale	0.000000	0.00	
48	West End	0.000000	0.00	
49	West Hills	0.000000	0.00	
50	Westwood Estates	0.000000	0.00	

	African Restaurant	American Restaurant	Antique Shop	Arepa Restaurant	\
0	0.000000	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	0.000000	
2	0.000000	0.100000	0.000000	0.000000	
3	0.000000	0.000000	0.000000	0.000000	
4	0.000000	0.000000	0.000000	0.000000	
5	0.000000	0.020000	0.000000	0.000000	
6	0.000000	0.021739	0.000000	0.000000	
7	0.000000	0.000000	0.000000	0.000000	
8	0.000000	0.033333	0.000000	0.000000	
9	0.000000	0.000000	0.000000	0.000000	
10	0.000000	0.000000	0.000000	0.000000	
11	0.000000	0.030928	0.000000	0.000000	
12	0.000000	0.000000	0.000000	0.000000	
13	0.000000	0.000000	0.000000	0.000000	
14	0.000000	0.034483	0.034483	0.000000	
15	0.000000	0.000000	0.000000	0.000000	

16	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.076923	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000	0.000000
24	0.000000	0.043478	0.000000	0.000000
25	0.000000	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000	0.000000
29	0.000000	0.037037	0.000000	0.000000
30	0.000000	0.000000	0.000000	0.000000
31	0.000000	0.017544	0.000000	0.017544
32	0.000000	0.142857	0.000000	0.000000
33	0.000000	0.100000	0.000000	0.000000
34	0.000000	0.047619	0.000000	0.000000
35	0.000000	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000	0.000000
39	0.000000	0.033333	0.000000	0.000000
40	0.015625	0.000000	0.000000	0.000000
41	0.000000	0.000000	0.000000	0.000000
42	0.000000	0.062500	0.000000	0.000000
43	0.000000	0.000000	0.000000	0.000000
44	0.020000	0.040000	0.000000	0.000000
45	0.000000	0.020000	0.000000	0.000000
46	0.000000	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000	0.000000
49	0.000000	0.083333	0.000000	0.000000
50	0.000000	0.000000	0.000000	0.000000

	Art Gallery	Art Museum	Arts & Crafts Store	...	Train Station	\
0	0.000000	0.000000	0.000000	...	0.000000	
1	0.000000	0.000000	0.000000	...	0.000000	
2	0.000000	0.000000	0.000000	...	0.000000	
3	0.034483	0.000000	0.000000	...	0.000000	
4	0.000000	0.000000	0.000000	...	0.000000	
5	0.010000	0.000000	0.000000	...	0.010000	
6	0.065217	0.000000	0.000000	...	0.000000	
7	0.000000	0.000000	0.000000	...	0.000000	
8	0.000000	0.000000	0.000000	...	0.000000	
9	0.000000	0.000000	0.000000	...	0.000000	
10	0.000000	0.000000	0.000000	...	0.000000	

11	0.030928	0.000000	0.000000	...	0.010309
12	0.016129	0.000000	0.000000	...	0.000000
13	0.000000	0.000000	0.000000	...	0.000000
14	0.000000	0.000000	0.000000	...	0.000000
15	0.000000	0.000000	0.000000	...	0.000000
16	0.000000	0.000000	0.000000	...	0.000000
17	0.000000	0.000000	0.000000	...	0.000000
18	0.062500	0.000000	0.000000	...	0.000000
19	0.000000	0.000000	0.000000	...	0.000000
20	0.076923	0.000000	0.000000	...	0.000000
21	0.095238	0.000000	0.000000	...	0.000000
22	0.000000	0.000000	0.062500	...	0.000000
23	0.000000	0.000000	0.000000	...	0.000000
24	0.000000	0.000000	0.043478	...	0.000000
25	0.000000	0.000000	0.111111	...	0.000000
26	0.000000	0.000000	0.000000	...	0.000000
27	0.000000	0.000000	0.000000	...	0.000000
28	0.000000	0.000000	0.000000	...	0.000000
29	0.000000	0.000000	0.000000	...	0.000000
30	0.000000	0.000000	0.000000	...	0.000000
31	0.000000	0.000000	0.000000	...	0.000000
32	0.000000	0.000000	0.000000	...	0.000000
33	0.000000	0.000000	0.000000	...	0.000000
34	0.000000	0.000000	0.047619	...	0.000000
35	0.000000	0.000000	0.000000	...	0.000000
36	0.000000	0.000000	0.000000	...	0.000000
37	0.000000	0.000000	0.000000	...	0.000000
38	0.000000	0.000000	0.000000	...	0.000000
39	0.000000	0.000000	0.000000	...	0.000000
40	0.000000	0.000000	0.000000	...	0.000000
41	0.000000	0.000000	0.000000	...	0.000000
42	0.000000	0.000000	0.031250	...	0.000000
43	0.000000	0.000000	0.000000	...	0.000000
44	0.000000	0.000000	0.020000	...	0.000000
45	0.020000	0.000000	0.000000	...	0.010000
46	0.000000	0.000000	0.000000	...	0.000000
47	0.000000	0.000000	0.000000	...	0.000000
48	0.000000	0.066667	0.066667	...	0.000000
49	0.000000	0.000000	0.000000	...	0.000000
50	0.000000	0.000000	0.000000	...	0.000000

	Used Bookstore	Vegetarian / Vegan Restaurant	Video Game Store	\
0	0.000000	0.000000	0.000000	
1	0.000000	0.000000	0.000000	
2	0.000000	0.000000	0.000000	
3	0.034483	0.000000	0.000000	
4	0.000000	0.000000	0.000000	
5	0.000000	0.000000	0.000000	

6	0.000000	0.000000	0.000000
7	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.000000
12	0.016129	0.016129	0.000000
13	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.034483
15	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000
20	0.000000	0.000000	0.000000
21	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000
24	0.043478	0.000000	0.000000
25	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000
31	0.000000	0.017544	0.000000
32	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.000000
34	0.047619	0.000000	0.000000
35	0.000000	0.000000	0.000000
36	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.000000
38	0.000000	0.000000	0.000000
39	0.000000	0.000000	0.000000
40	0.000000	0.015625	0.000000
41	0.000000	0.000000	0.000000
42	0.031250	0.000000	0.000000
43	0.000000	0.000000	0.000000
44	0.000000	0.020000	0.020000
45	0.010000	0.000000	0.000000
46	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000
49	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000

	Video Store	Vietnamese Restaurant	Wine Bar	Wine Shop	Wings Joint	\
0	0.000000	0.000000	0.000000	0.000000	0.000000	

1	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.000000	0.000000	0.000000	0.000000	0.000000
4	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.020000	0.000000	0.000000
6	0.000000	0.000000	0.021739	0.000000	0.000000
7	0.000000	0.000000	0.000000	0.000000	0.000000
8	0.000000	0.000000	0.000000	0.000000	0.000000
9	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.125000	0.000000	0.000000	0.000000	0.000000
11	0.000000	0.000000	0.020619	0.000000	0.000000
12	0.016129	0.016129	0.000000	0.000000	0.016129
13	0.000000	0.000000	0.000000	0.000000	0.000000
14	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.019608	0.000000	0.000000	0.000000	0.000000
16	0.000000	0.000000	0.000000	0.000000	0.000000
17	0.000000	0.000000	0.000000	0.000000	0.000000
18	0.000000	0.000000	0.000000	0.000000	0.000000
19	0.000000	0.000000	0.000000	0.000000	0.000000
20	0.000000	0.000000	0.000000	0.000000	0.000000
21	0.000000	0.000000	0.000000	0.000000	0.000000
22	0.000000	0.000000	0.000000	0.000000	0.000000
23	0.000000	0.000000	0.000000	0.000000	0.000000
24	0.000000	0.000000	0.000000	0.043478	0.000000
25	0.000000	0.000000	0.000000	0.000000	0.000000
26	0.000000	0.000000	0.000000	0.000000	0.000000
27	0.000000	0.000000	0.000000	0.000000	0.000000
28	0.000000	0.000000	0.000000	0.000000	0.000000
29	0.000000	0.000000	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000	0.000000	0.000000
31	0.000000	0.017544	0.000000	0.000000	0.017544
32	0.000000	0.000000	0.000000	0.000000	0.000000
33	0.000000	0.000000	0.000000	0.000000	0.000000
34	0.000000	0.000000	0.000000	0.047619	0.000000
35	0.000000	0.000000	0.000000	0.000000	0.000000
36	0.250000	0.000000	0.000000	0.000000	0.000000
37	0.000000	0.000000	0.000000	0.000000	0.000000
38	0.062500	0.000000	0.000000	0.000000	0.000000
39	0.000000	0.033333	0.000000	0.000000	0.000000
40	0.015625	0.015625	0.000000	0.000000	0.015625
41	0.000000	0.000000	0.000000	0.000000	0.000000
42	0.000000	0.000000	0.000000	0.031250	0.000000
43	0.031250	0.000000	0.000000	0.000000	0.000000
44	0.020000	0.000000	0.000000	0.000000	0.000000
45	0.000000	0.000000	0.010000	0.000000	0.000000
46	0.000000	0.000000	0.000000	0.000000	0.000000
47	0.000000	0.000000	0.000000	0.000000	0.000000
48	0.000000	0.000000	0.000000	0.000000	0.000000

49	0.000000	0.000000	0.000000	0.000000	0.000000
50	0.000000	0.000000	0.000000	0.000000	0.000000

	Yoga Studio
0	0.000000
1	0.000000
2	0.000000
3	0.000000
4	0.000000
5	0.000000
6	0.021739
7	0.000000
8	0.000000
9	0.000000
10	0.000000
11	0.010309
12	0.000000
13	0.000000
14	0.000000
15	0.000000
16	0.000000
17	0.000000
18	0.062500
19	0.000000
20	0.076923
21	0.047619
22	0.000000
23	0.000000
24	0.000000
25	0.000000
26	0.000000
27	0.000000
28	0.000000
29	0.000000
30	0.000000
31	0.000000
32	0.000000
33	0.000000
34	0.000000
35	0.000000
36	0.000000
37	0.047619
38	0.000000
39	0.033333
40	0.000000
41	0.000000
42	0.000000
43	0.000000

```
44     0.000000
45     0.000000
46     0.000000
47     0.000000
48     0.000000
49     0.000000
50     0.000000

[51 rows x 194 columns]
```

0.4 Results

Durham has a larger area of entertainment and is also convenient in transportation.

0.5 Discussion

Dataset for Ithaca is much smaller than for Durham. More considerations should be made when a larger dataset is avaiable. Besides, information including house renting, cost of living, environments are not considered in this notebook.

0.6 Conclusion

Maybe it is a better idea to live in Durham if just considering lives in these two places.