The Battle of Neighborhood — Arabic Coffee Shop in London

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Introduction

As one of the largest English cities, London has one of the most ethnically diverse population in the world. It is considered to the world's cultural capital with a diverse range of cultures and people. Even though English is the official Language in London, there are over 300 languages spoken in the city. According to the 2011 census, over 36.7% of the London residents or 2,998,254 people are foreign-born, which is the second largest population of immigrants in the world right behind New York. Some of the largest ethnic groups in the city include Arabs, Chinese, Bangladeshis, Pakistanis, Indians, and Africans.

My friend asked me to help him exploring London city and choose the best location for his business as he is going to open an Arabic Coffee shop in London. He wants to provide authentic Arabic coffee to Arab and non-Arab people, so that the community knows the ancient original Arab culture, and he believes that there is no much competition in this field.

Arabic coffee is a version of the brewed coffee of Coffea arabica beans. Most Arab countries throughout the Middle East have developed distinct methods forbrewing and preparing coffee. Cardamom is an often-added spice, but it can alternatively be served plain.

It was agreed that the location of the business should be close to the main most popular venues and neighborhoods in London, also the presence of Arab and Turkish restaurants would be an advantage.

In this project, we will Scrap London Boroughs, Neighborhoods and Postcode data from Wikipedia, then using geopy library to convert postcodes addresses into their equivalent latitude and longitude values.

After that, we will get the top 10 venues for each Neighborhood using Foursquare API, and using clustering K-Means algorithm to group the neighborhoods into clusters. We will also visualize the neighborhoods in London City and their emerging clusters using Folium library.

Finally, we will choose the best location for the business based on the criteria mentioned above.

Data

This project will rely on public data from Wikipedia and Foursquare.

In [5]:
```
# Lets install main Libraries
import numpy as np
import pandas as pd
import requests
from bs4 import BeautifulSoup
```

In [2]:
```
# Scrapping london Data from wikipedia source link: (https://en.wikipedia.org/
wiki/List_of_areas_of_London)

url = "https://en.wikipedia.org/wiki/List_of_areas_of_London"
s = requests.Session()
response = s.get(url, timeout=10)
response
# If the request is successful, then reponse output = '200'.
```

Out[2]:
```
<Response [200]>
```

In [6]:
```
# scrape the request response to HTML
soup = BeautifulSoup(response.content, 'html.parser')

# to view the content in html format
pretty_soup = soup.prettify()
```

In [7]:
```
# getting Wikipedia page title
soup.title.string
```

Out[7]:
```
'List of areas of London - Wikipedia'
```

In [8]:
```
# find all the tables in the wikipedia link
all_tables=soup.find_all('table')

# get right table to scrap
right_table=soup.find('table', {"class":'wikitable sortable'})
```

In [9]:
```
# Number of columns in the table
for row in right_table.findAll("tr"):
    cells = row.findAll('td')

len(cells)
```

Out[9]:
```
6
```

In [10]:
```
# number of rows in the table including header
rows = right_table.findAll("tr")
len(rows)
```

Out[10]:
```
533
```

In [11]:
```
# header attributes of the table
header = [th.text.rstrip() for th in rows[0].find_all('th')]
print(header)
print(len(header))
```

```
['Location', 'London\xa0borough', 'Post town', 'Postcode\xa0district', 'Dial
\xa0code', 'OS grid ref']
6
```

In [12]:
```
# Getting the table data
lst_data = []
for row in rows[1:]:
            data = [d.text.rstrip() for d in row.find_all('td')]
            lst_data.append(data)
```

In [13]:
```
# Convert the data into pandas dataframe
df = pd.DataFrame(lst_data)
df
```

Out[13]:

	0	1	2	3	4	5
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728
...	...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020	TQ435795
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020	TQ225655
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020	TQ225815
530	Yeading	Hillingdon	HAYES	UB4	020	TQ115825
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020	TQ063804

532 rows × 6 columns

In [14]:
```
# Adding Headr information to the df
df.columns = header
df.head()
```

Out[14]:

	Location	London borough	Post town	Postcode district	Dial code	OS grid ref
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728

In [15]:
```
# Renaming Column Names
df.rename(columns={"Location": "neighbourhood "})
```

Out[15]:

	neighbourhood	London borough	Post town	Postcode district	Dial code	OS grid ref
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728
...	...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020	TQ435795
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020	TQ225655
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020	TQ225815
530	Yeading	Hillingdon	HAYES	UB4	020	TQ115825
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020	TQ063804

532 rows × 6 columns

In [16]:
```
df.rename(columns={"London borough": "borough "})
df = df.drop(['OS grid ref'], axis=1)
```

Out[16]:

	Location	London borough	Post town	Postcode district	Dial code	OS grid ref
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020	TQ465785
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020	TQ205805
2	Addington	Croydon[8]	CROYDON	CR0	020	TQ375645
3	Addiscombe	Croydon[8]	CROYDON	CR0	020	TQ345665
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020	TQ478728
...	...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020	TQ435795
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020	TQ225655
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020	TQ225815
530	Yeading	Hillingdon	HAYES	UB4	020	TQ115825
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020	TQ063804

532 rows × 6 columns

In [20]:
```
df
```

Out[20]:

	neighbourhood	London borough	Post town	Postcode district	Dial code
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020
2	Addington	Croydon[8]	CROYDON	CR0	020
3	Addiscombe	Croydon[8]	CROYDON	CR0	020
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020
...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020
530	Yeading	Hillingdon	HAYES	UB4	020
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020

532 rows × 5 columns

In [21]:
```
# Removing space everywhere
df.columns = df.columns.str.replace(' ', '_')
df
```

Out[21]:

	neighbourhood	London borough	Post_town	Postcode district	Dial code
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020
2	Addington	Croydon[8]	CROYDON	CR0	020
3	Addiscombe	Croydon[8]	CROYDON	CR0	020
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020
...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020
530	Yeading	Hillingdon	HAYES	UB4	020
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020

532 rows × 5 columns

In [22]:
```
df.columns = [x.strip().replace(' ', '_') for x in df.columns]
df
```

Out[22]:

	neighbourhood	London borough	Post_town	Postcode district	Dial code
0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	020
1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	020
2	Addington	Croydon[8]	CROYDON	CR0	020
3	Addiscombe	Croydon[8]	CROYDON	CR0	020
4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	020
...	...	...	...	...	...
527	Woolwich	Greenwich	LONDON	SE18	020
528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	020
529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	020
530	Yeading	Hillingdon	HAYES	UB4	020
531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	020

532 rows × 5 columns

In [26]:
```
df1
```

Out[26]:

	Unnamed: 0	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code
0	0	Abbey Wood	Bexley, Greenwich [7]	LONDON	SE2	20
1	1	Acton	Ealing, Hammersmith and Fulham[8]	LONDON	W3, W4	20
2	2	Addington	Croydon[8]	CROYDON	CR0	20
3	3	Addiscombe	Croydon[8]	CROYDON	CR0	20
4	4	Albany Park	Bexley	BEXLEY, SIDCUP	DA5, DA14	20
...	...	...	...	...	...	...
527	527	Woolwich	Greenwich	LONDON	SE18	20
528	528	Worcester Park	Sutton, Kingston upon Thames	WORCESTER PARK	KT4	20
529	529	Wormwood Scrubs	Hammersmith and Fulham	LONDON	W12	20
530	530	Yeading	Hillingdon	HAYES	UB4	20
531	531	Yiewsley	Hillingdon	WEST DRAYTON	UB7	20

532 rows × 6 columns

In [27]:
```
# Installaing required Packages
!pip -q install geopy
!pip -q install geocoder
```

```
WARNING: You are using pip version 20.1.1; however, version 20.2.4 is availab
le.
You should consider upgrading via the 'c:\users\abdar\appdata\local\programs
\python\python37-32\python.exe -m pip install --upgrade pip' command.
WARNING: You are using pip version 20.1.1; however, version 20.2.4 is availab
le.
You should consider upgrading via the 'c:\users\abdar\appdata\local\programs
\python\python37-32\python.exe -m pip install --upgrade pip' command.
```

In [28]:
```
#importing required libraries
import geocoder
from geopy.geocoders import Nominatim
import matplotlib.cm as cm
import matplotlib.colors as colors
from sklearn.cluster import KMeans
import folium
```

In [29]:
```
# Geocoder Function
def get_latlng(arcgis_geocoder):

    # Initialize the Location (lat. and long.) to "None"
    lat_lng_coords = None

    # While loop helps to create a continous run until all the location coordi
nates are geocoded
    while(lat_lng_coords is None):
        g = geocoder.arcgis('{}, London, United Kingdom'.format(arcgis_geocode
r))
        lat_lng_coords = g.latlng
    return lat_lng_coords
# Geocoder ends here # Thanks to Mr. Dayo John
```

In [40]:
```
df2 = df1
```

In [31]:
```
import time
start = time.time()
postal_codes = df2['Postcode_district']
coordinates = [get_latlng(postal_code) for postal_code in postal_codes.tolist
()]
end = time.time()
print("Time of execution: ", end - start, "seconds")
```

```
Time of execution:  481.7160575389862 seconds
```

In [37]:
```
# Adding Lat / long information corresponding to each Post_Code
df2 = df1
df2_coordinates = pd.DataFrame(coordinates, columns = ['Latitude', 'Longitude'
])
df2['Latitude'] = df2_coordinates['Latitude']
df2['Longitude'] = df2_coordinates['Longitude']
```

In [34]:
```
# define an instance of the geocoder
address = 'London, United Kingdom'

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

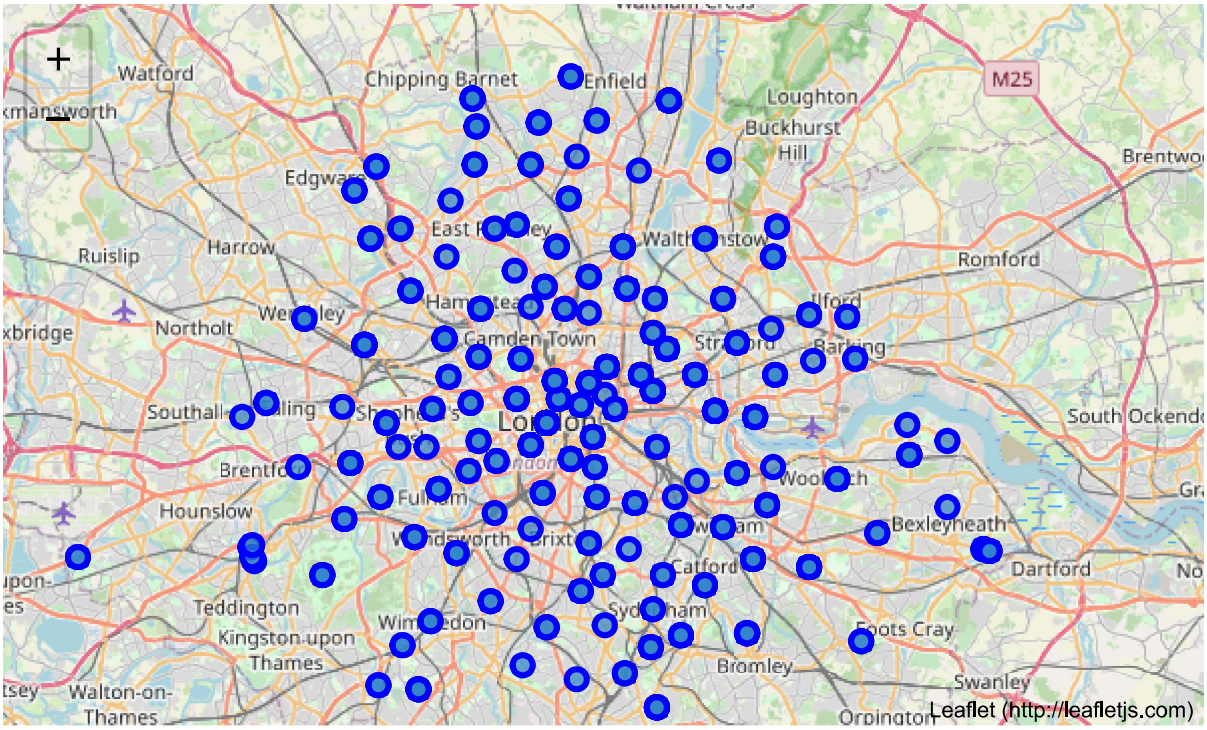
```
The geograpical coordinate of London City are 51.5073219, -0.1276474.
```

In [35]:
```
# create map of London using latitude and longitude values
map_newyork = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, London_borough, neighbourhood in zip(df2['Latitude'], df2['Longi
tude'], df2['London_borough'], df2['neighbourhood']):
    label = '{}, {}'.format(neighbourhood, London_borough)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_newyork)

map_newyork
```

Out[35]:



In [36]:
```
#lets have some insights on the data
df2['London_borough'].value_counts()
```

Out[36]:
```
Barnet                 28
Bromley                28
Havering               20
Croydon                20
Bexley                 20
                       ..
Brent, Ealing           1
Barnet[37]              1
Redbridge[9]            1
City[10]                1
Lambeth, Wandsworth     1
Name: London_borough, Length: 127, dtype: int64
```

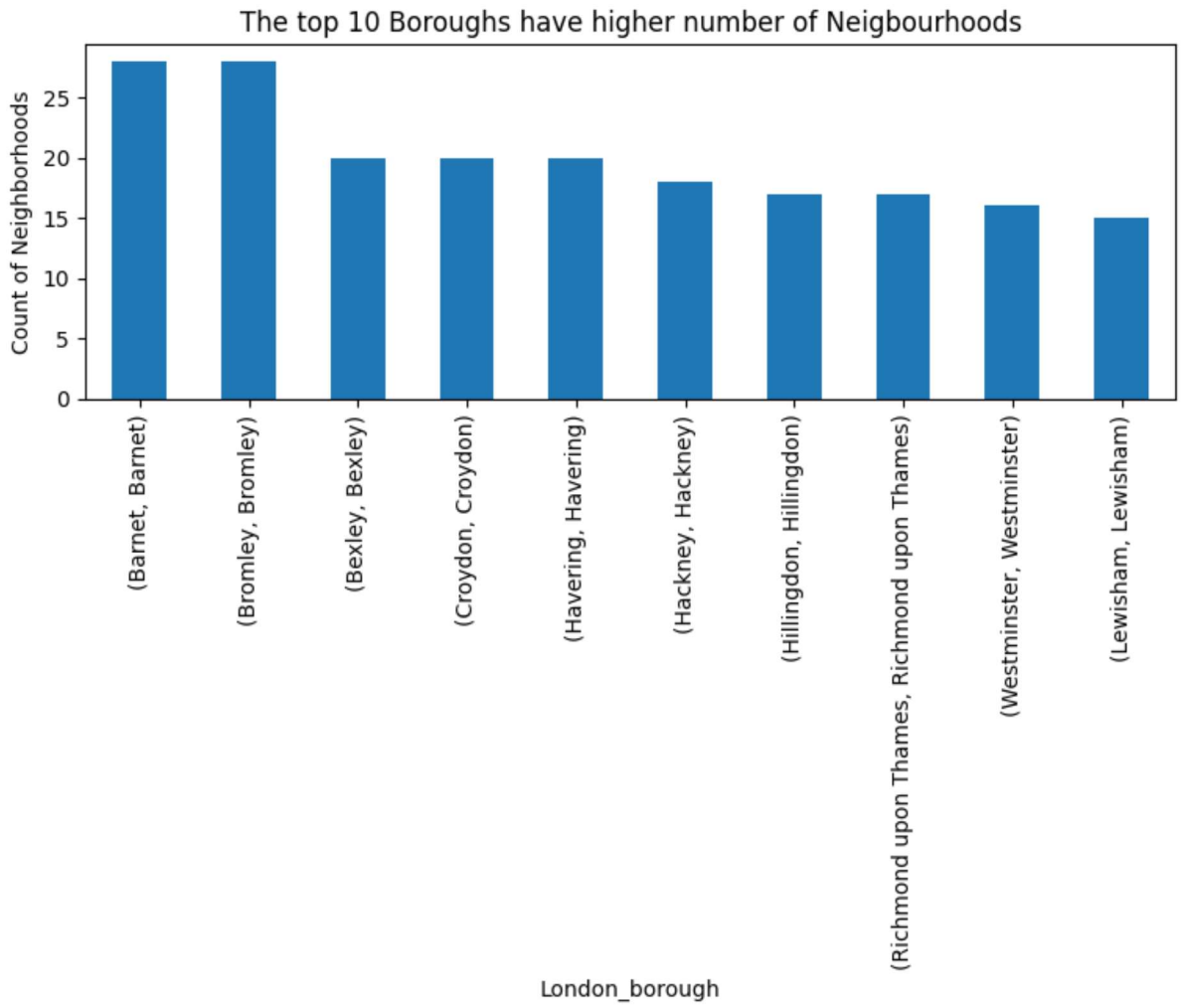
In [41]:
```
#lets have insights on the data
df2['neighbourhood'].value_counts()
```

Out[41]:
```
Belmont          2
Hayes            2
Plaistow         2
Church End       2
Coombe           2
                ..
Swiss Cottage    1
Barking          1
Tolworth         1
Honor Oak        1
Finsbury         1
Name: neighbourhood, Length: 526, dtype: int64
```

In [47]:
```
#x.groupby(['London_borough']).London_borough.value_counts().nlargest(5)
x2= df2['London_borough'].value_counts().nlargest(5)
x2
```

Out[47]:
```
Barnet      28
Bromley     28
Havering    20
Croydon     20
Bexley      20
Name: London_borough, dtype: int64
```

In [54]:
```
# Visualize top London borough's based on number of neighbourhoods
import matplotlib.pyplot as plt
plt.figure(figsize=(9,3), dpi = 100)
plt.title('The top 10 Boroughs have higher number of Neigbourhoods')
df2.groupby('London_borough')['London_borough'].value_counts().nlargest(10).pl
ot(kind='bar')
plt.xlabel('London_borough')
plt.ylabel('Count of Neighborhoods')
plt.show()
```



From the graph above we can see that Barnet and Bromley both have Max. Number of Neighbourhoods. This will lead us to choose Barnet as a Target Bourough to Open Business.

Now, lets Explore London Borough of Barnet

In [55]:
```
# Exploring London Borough of Barnet
df3 = df2[df2['London_borough']=='Barnet']
df3
```

Out[55]:

	Unnamed: 0	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Lat
24	24	Barnet Gate	Barnet	LONDON, BARNET	NW7, EN5	20	51.6
60	60	Brent Cross	Barnet	LONDON	NW2, NW4	20	51.5
94	94	Childs Hill	Barnet	LONDON	NW2	20	51.5
101	101	Church End	Barnet	LONDON	N3	20	51.6
105	105	Colindale	Barnet	LONDON	NW9	20	51.5
108	108	Colney Hatch	Barnet	LONDON	N11, N10	20	51.5
144	144	East Barnet	Barnet	BARNET	EN4	20	51.5
147	147	East Finchley	Barnet	LONDON	N2	20	51.5
153	153	Edgware	Barnet	EDGWARE	HA8	20	51.6
170	170	Finchley	Barnet	LONDON	N2, N3, N12	20	51.6
180	180	Friern Barnet	Barnet	LONDON	N11	20	51.6
189	189	Golders Green	Barnet	LONDON	NW11	20	51.5
192	192	Grahame Park	Barnet	LONDON	NW9	20	51.5
206	206	The Hale	Barnet	LONDON	NW7	20	51.6
210	210	Hampstead Garden Suburb	Barnet	LONDON	N2	20	51.5
233	233	Hendon	Barnet	LONDON	NW4	20	51.5
252	252	The Hyde	Barnet	LONDON	NW9	20	51.5
307	307	Mill Hill	Barnet	LONDON	NW7	20	51.6
311	311	Monken Hadley	Barnet	BARNET	EN5	20	51.6
321	321	New Barnet	Barnet	BARNET	EN4, EN5	20	51.6
325	325	New Southgate	Barnet	LONDON	N11	20	51.6
334	334	North Finchley	Barnet	LONDON	N12	20	51.6
346	346	Oakleigh Park	Barnet	LONDON	N20	20	51.6
352	352	Osidge	Barnet	LONDON	N14	20	51.6
467	467	Totteridge	Barnet	LONDON	N20	20	51.6
507	507	West Hendon	Barnet	LONDON	NW9	20	51.5
513	513	Whetstone	Barnet	LONDON	N20	20	51.6
526	526	Woodside Park	Barnet	LONDON	N12	20	51.6

In [57]:
```
df3.shape
```

Out[57]:
```
(28, 8)
```

In [60]:
```
# Lets Clean the data nad drop un wanted coulumns
df3.drop('Unnamed: 0',
  axis='columns', inplace=True)
```

```
c:\users\abdar\appdata\local\programs\python\python37-32\lib\site-packages\pa
ndas\core\frame.py:4164: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/s
table/user_guide/indexing.html#returning-a-view-versus-a-copy
  errors=errors,
```

In [61]:
```
df3
```

Out[61]:

	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Latitude	Long
24	Barnet Gate	Barnet	LONDON, BARNET	NW7, EN5	20	51.615680	-0.2
60	Brent Cross	Barnet	LONDON	NW2, NW4	20	51.589180	-0.22
94	Childs Hill	Barnet	LONDON	NW2	20	51.562370	-0.22
101	Church End	Barnet	LONDON	N3	20	51.601040	-0.19
105	Colindale	Barnet	LONDON	NW9	20	51.584860	-0.24
108	Colney Hatch	Barnet	LONDON	N11, N10	20	51.591070	-0.14
144	East Barnet	Barnet	BARNET	EN4	20	51.506420	-0.12
147	East Finchley	Barnet	LONDON	N2	20	51.589270	-0.16
153	Edgware	Barnet	EDGWARE	HA8	20	51.604980	-0.26
170	Finchley	Barnet	LONDON	N2, N3, N12	20	51.615920	-0.17
180	Friern Barnet	Barnet	LONDON	N11	20	51.616310	-0.13
189	Golders Green	Barnet	LONDON	NW11	20	51.576730	-0.19
192	Grahame Park	Barnet	LONDON	NW9	20	51.584860	-0.24
206	The Hale	Barnet	LONDON	NW7	20	51.615680	-0.2
210	Hampstead Garden Suburb	Barnet	LONDON	N2	20	51.589270	-0.16
233	Hendon	Barnet	LONDON	NW4	20	51.589180	-0.22
252	The Hyde	Barnet	LONDON	NW9	20	51.584860	-0.24
307	Mill Hill	Barnet	LONDON	NW7	20	51.615680	-0.2
311	Monken Hadley	Barnet	BARNET	EN5	20	51.644415	-0.17
321	New Barnet	Barnet	BARNET	EN4, EN5	20	51.644415	-0.17
325	New Southgate	Barnet	LONDON	N11	20	51.616310	-0.13
334	North Finchley	Barnet	LONDON	N12	20	51.615920	-0.17
346	Oakleigh Park	Barnet	LONDON	N20	20	51.632610	-0.17
352	Osidge	Barnet	LONDON	N14	20	51.634290	-0.13
467	Totteridge	Barnet	LONDON	N20	20	51.632610	-0.17
507	West Hendon	Barnet	LONDON	NW9	20	51.584860	-0.24
513	Whetstone	Barnet	LONDON	N20	20	51.632610	-0.17
526	Woodside Park	Barnet	LONDON	N12	20	51.615920	-0.17

In [62]:
```
# define an instance of the geocoder
address1 = 'London Borough of Barnet, United Kingdom'

geolocator1 = Nominatim(user_agent="London_explorer")
location1 = geolocator.geocode(address)
latitude1 = location.latitude
longitude1 = location.longitude
print('The geographical coordinate of London Borough of Barnet are {}, {}.'.fo
rmat(latitude1, longitude1))
```

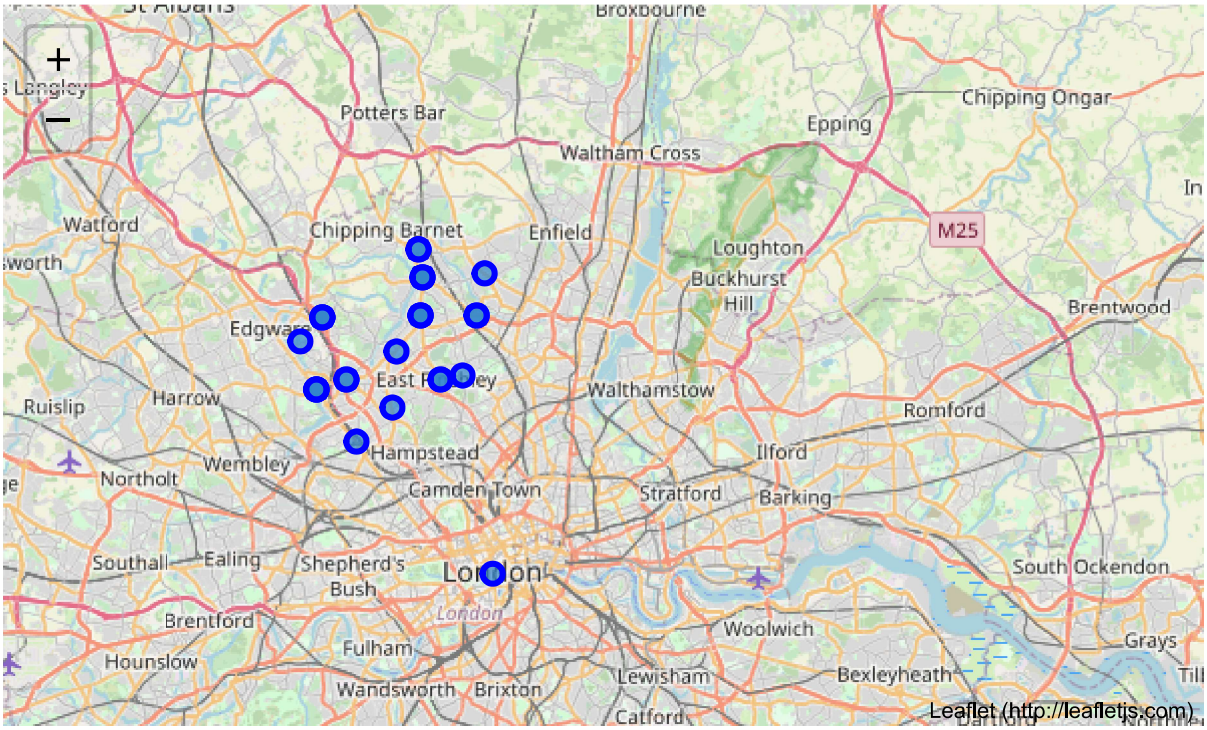
```
The geographical coordinate of London Borough of Barnet are 51.5073219, -0.12
76474.
```

In [63]:
```
# create map of London Borough of Barnet, United Kingdom using latitude and lo
ngitude values
map_newyork1 = folium.Map(location=[latitude1, longitude1], zoom_start=10)

# add markers to map
for lat, lng, London_borough, neighbourhood in zip(df3['Latitude'], df3['Longi
tude'], df3['London_borough'], df3['neighbourhood']):
    label = '{}, {}'.format(neighbourhood, London_borough)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_newyork1)

map_newyork1
```

Out[63]:



Now, we will explore all Neighborhoods in Barnet using Foursquare API

In [167]:
```
# Define Foursquare Credentials and Version
CLIENT_ID = 'XXXXXXXXXXXXXXXXXXXXXXXXXXX' # your Foursquare ID
CLIENT_SECRET = 'XXXXXXXXXXXXXXXXXXXXXXXXXXX' # your Foursquare Secret
VERSION = '20180605' # Foursquare API version
LIMIT = 100 # A default Foursquare API limit value
```

In [65]:
```
#Let's create a function to repeat the same process to all the neighborhoods i
n Manhattan
# Let's create a function to repeat the same process to all the neighborhoods
 in Manhattan
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={}&clie
nt_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

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

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

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

    return(nearby_venues)
```

In [66]:
```
# run the above function on each neighborhood and create a new dataframe calle
d Barnet_venues
# type your answer here
Barnet_venues = getNearbyVenues(names=df3['neighbourhood'],
                                latitudes=df3['Latitude'],
                                longitudes=df3['Longitude']
                               )
```

```
Barnet Gate
Brent Cross
Childs Hill
Church End
Colindale
Colney Hatch
East Barnet
East Finchley
Edgware
Finchley
Friern Barnet
Golders Green
Grahame Park
The Hale
Hampstead Garden Suburb
Hendon
The Hyde
Mill Hill
Monken Hadley
New Barnet
New Southgate
North Finchley
Oakleigh Park
Osidge
Totteridge
West Hendon
Whetstone
Woodside Park
```

Let's check the size of the resulting dataframe

In [67]:
```
# Let's check the size of the resulting dataframe
print(Barnet_venues.shape)
Barnet_venues.head()
```

```
(666, 7)
```

Out[67]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Barnet Gate	51.61568	-0.24511	The Good Earth	51.616961	-0.245282	Chinese Restaurant
1	Barnet Gate	51.61568	-0.24511	Bluebelles of Portabello	51.614848	-0.246753	Café
2	Barnet Gate	51.61568	-0.24511	Day of the Raj	51.616012	-0.244872	Indian Restaurant
3	Barnet Gate	51.61568	-0.24511	PizzaExpress	51.615861	-0.244703	Pizza Place
4	Barnet Gate	51.61568	-0.24511	M&S Foodhall	51.614187	-0.249267	Grocery Store

In [68]:
```
# Let's check how many venues were returned for each neighborhood
Barnet_venues.groupby('Neighborhood').count()
```

Out[68]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Barnet Gate	20	20	20	20	20	20
Brent Cross	16	16	16	16	16	16
Childs Hill	6	6	6	6	6	6
Church End	35	35	35	35	35	35
Colindale	16	16	16	16	16	16
Colney Hatch	45	45	45	45	45	45
East Barnet	88	88	88	88	88	88
East Finchley	33	33	33	33	33	33
Edgware	3	3	3	3	3	3
Finchley	39	39	39	39	39	39
Friern Barnet	9	9	9	9	9	9
Golders Green	26	26	26	26	26	26
Grahame Park	16	16	16	16	16	16
Hampstead Garden Suburb	33	33	33	33	33	33
Hendon	16	16	16	16	16	16
Mill Hill	20	20	20	20	20	20
Monken Hadley	4	4	4	4	4	4
New Barnet	4	4	4	4	4	4
New Southgate	9	9	9	9	9	9
North Finchley	39	39	39	39	39	39
Oakleigh Park	24	24	24	24	24	24
Osidge	26	26	26	26	26	26
The Hale	20	20	20	20	20	20
The Hyde	16	16	16	16	16	16
Totteridge	24	24	24	24	24	24
West Hendon	16	16	16	16	16	16
Whetstone	24	24	24	24	24	24
Woodside Park	39	39	39	39	39	39

In [75]:
```
# Lets Visualize Top 10 Neighborhoods based on Count of Venues
#y = Barnet_venues.groupby('Neighborhood').count()
y= Barnet_venues
```

In [76]:
```
y.columns
```

Out[76]:
```
Index(['Neighborhood', 'Neighborhood Latitude', 'Neighborhood Longitude',
       'Venue', 'Venue Latitude', 'Venue Longitude', 'Venue Category'],
      dtype='object')
```

In [77]:
```
y
```

Out[77]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Barnet Gate	51.61568	-0.24511	The Good Earth	51.616961	-0.245282	Chinese Restauran
1	Barnet Gate	51.61568	-0.24511	Bluebelles of Portabello	51.614848	-0.246753	Cafe
2	Barnet Gate	51.61568	-0.24511	Day of the Raj	51.616012	-0.244872	Indian Restauran
3	Barnet Gate	51.61568	-0.24511	PizzaExpress	51.615861	-0.244703	Pizza Place
4	Barnet Gate	51.61568	-0.24511	M&S Foodhall	51.614187	-0.249267	Grocery Store
...	...	...	...	...	...	...	...
661	Woodside Park	51.61592	-0.17674	Khoai Cafe	51.613467	-0.177361	Vietnamese Restauran
662	Woodside Park	51.61592	-0.17674	Bus Stop E	51.613343	-0.175889	Bus Stop
663	Woodside Park	51.61592	-0.17674	Coffee Seeker	51.611947	-0.178683	Cafe
664	Woodside Park	51.61592	-0.17674	Il Tocca d'Artista	51.612078	-0.178413	Italian Restauran
665	Woodside Park	51.61592	-0.17674	Tuck In Cafe	51.611851	-0.178376	Cafe

666 rows × 7 columns

In [78]:
```
y = y.groupby('Neighborhood').count()
```

In [79]:
```
y
```

Out[79]:

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Barnet Gate	20	20	20	20	20	20
Brent Cross	16	16	16	16	16	16
Childs Hill	6	6	6	6	6	6
Church End	35	35	35	35	35	35
Colindale	16	16	16	16	16	16
Colney Hatch	45	45	45	45	45	45
East Barnet	88	88	88	88	88	88
East Finchley	33	33	33	33	33	33
Edgware	3	3	3	3	3	3
Finchley	39	39	39	39	39	39
Friern Barnet	9	9	9	9	9	9
Golders Green	26	26	26	26	26	26
Grahame Park	16	16	16	16	16	16
Hampstead Garden Suburb	33	33	33	33	33	33
Hendon	16	16	16	16	16	16
Mill Hill	20	20	20	20	20	20
Monken Hadley	4	4	4	4	4	4
New Barnet	4	4	4	4	4	4
New Southgate	9	9	9	9	9	9
North Finchley	39	39	39	39	39	39
Oakleigh Park	24	24	24	24	24	24
Osidge	26	26	26	26	26	26
The Hale	20	20	20	20	20	20
The Hyde	16	16	16	16	16	16
Totteridge	24	24	24	24	24	24
West Hendon	16	16	16	16	16	16
Whetstone	24	24	24	24	24	24
Woodside Park	39	39	39	39	39	39

In [80]:
```
y= y["Venue"]
```

In [95]:
```
z= Barnet_venues
z= z[["Neighborhood","Venue"]]
z
```

Out[95]:

	Neighborhood	Venue
0	Barnet Gate	The Good Earth
1	Barnet Gate	Bluebelles of Portabello
2	Barnet Gate	Day of the Raj
3	Barnet Gate	PizzaExpress
4	Barnet Gate	M&S Foodhall
...	...	...
661	Woodside Park	Khoai Cafe
662	Woodside Park	Bus Stop E
663	Woodside Park	Coffee Seeker
664	Woodside Park	Il Tocca d'Artista
665	Woodside Park	Tuck In Cafe

666 rows × 2 columns

In [96]:
```
z= z.groupby('Neighborhood').count()
z
```

Out[96]:

Neighborhood	Venue
Barnet Gate	20
Brent Cross	16
Childs Hill	6
Church End	35
Colindale	16
Colney Hatch	45
East Barnet	88
East Finchley	33
Edgware	3
Finchley	39
Friern Barnet	9
Golders Green	26
Grahame Park	16
Hampstead Garden Suburb	33
Hendon	16
Mill Hill	20
Monken Hadley	4
New Barnet	4
New Southgate	9
North Finchley	39
Oakleigh Park	24
Osidge	26
The Hale	20
The Hyde	16
Totteridge	24
West Hendon	16
Whetstone	24
Woodside Park	39

In [101]:
```
z.columns
```

Out[101]:
```
Index(['Venue'], dtype='object')
```

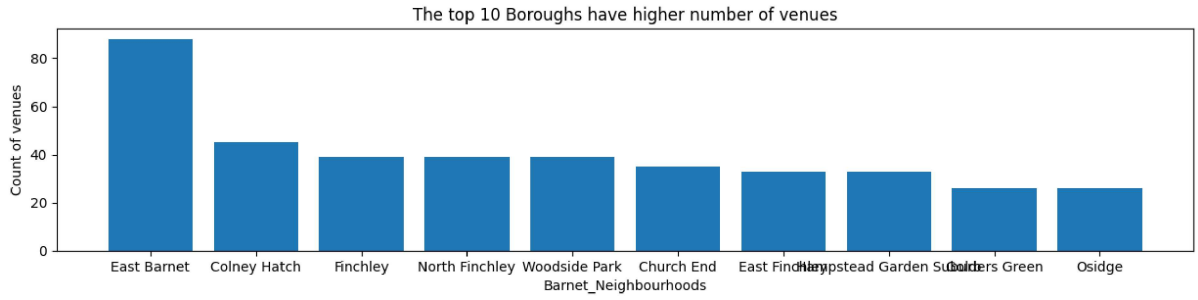
In [114]:
```
#top 10 Neighbourhoods having higher number of venues
z2= z.nlargest(10, 'Venue')
```

In [115]:
```
z2
```

Out[115]:

Neighborhood	Venue
East Barnet	88
Colney Hatch	45
Finchley	39
North Finchley	39
Woodside Park	39
Church End	35
East Finchley	33
Hampstead Garden Suburb	33
Golders Green	26
Osidge	26

In [125]:
```
# Visualize top 10 Barent_Neighbourhoods based on count of venues
import matplotlib.pyplot as plt
plt.figure(figsize=(15,3), dpi = 100)
plt.title('The top 10 Neighbourhoods have higher number of venues')
#z.groupby('Neighborhood')['Venue'].value_counts().nlargest(10).plot(kind='ba
r')
#plt.plot(z.index.values, z['Venue'], kind = 'bar')
plt.bar(z2.index.values, z2['Venue'])
plt.xlabel('Barnet_Neighbourhoods')
plt.ylabel('Count of venues')
plt.show()
#plt.plot(site2.index.values, site2['Cl'])
#plt.show()
#ax.bar(langs,students)
```



Let's find out how many unique categories can be curated from all the returned venues

In [118]:
```
# Let's find out how many unique categories can be curated from all the return
ed venues
print('There are {} uniques categories.'.format(len(Barnet_venues['Venue Categ
ory'].unique())))
```

```
There are 111 uniques categories.
```

3. Analyze Each Neighborhood

In [119]:
```
# one hot encoding
Barnet_onehot = pd.get_dummies(Barnet_venues[['Venue Category']], prefix="", p
refix_sep="")

# add neighborhood column back to dataframe
Barnet_onehot['Neighborhood'] = Barnet_venues['Neighborhood']

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

Barnet_onehot.head()
```

Out[119]:

	Neighborhood	American Restaurant	Argentinian Restaurant	Art Gallery	Art Museum	Asian Restaurant	Auto Workshop	BBQ Joint	Bage Shop
0	Barnet Gate	0	0	0	0	0	0	0	0
1	Barnet Gate	0	0	0	0	0	0	0	0
2	Barnet Gate	0	0	0	0	0	0	0	0
3	Barnet Gate	0	0	0	0	0	0	0	0
4	Barnet Gate	0	0	0	0	0	0	0	0

5 rows × 112 columns

In [120]:
```
# And let's examine the new dataframe size
Barnet_onehot.shape
```

Out[120]:
```
(666, 112)
```

In [121]:
```
# let's group rows by neighborhood and by taking the mean of the frequency of
 occurrence of each category
Barnet_grouped = Barnet_onehot.groupby('Neighborhood').mean().reset_index()
Barnet_grouped
```

Out[121]:

	Neighborhood	American Restaurant	Argentinian Restaurant	Art Gallery	Art Museum	Asian Restaurant	Auto Workshop	BBQ Joint
0	Barnet Gate	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
1	Brent Cross	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
2	Childs Hill	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
3	Church End	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
4	Colindale	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
5	Colney Hatch	0.022222	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
6	East Barnet	0.000000	0.00	0.034091	0.022727	0.000000	0.0000	0.000000
7	East Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
8	Edgware	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
9	Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
10	Friern Barnet	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
11	Golders Green	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.038462
12	Grahame Park	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
13	Hampstead Garden Suburb	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
14	Hendon	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
15	Mill Hill	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
16	Monken Hadley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
17	New Barnet	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
18	New Southgate	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
19	North Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
20	Oakleigh Park	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
21	Osidge	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
22	The Hale	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
23	The Hyde	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
24	Totteridge	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
25	West Hendon	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
26	Whetstone	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
27	Woodside Park	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000

28 rows × 112 columns

In [122]:
```
# Let's confirm the new size
Barnet_grouped.shape
```

Out[122]: (28, 112)

In [123]:
```
# Let's print each neighborhood along with the top 5 most common venues
# print each neighborhood along with the top 5 most common venues
num_top_venues = 5

for hood in Barnet_grouped['Neighborhood']:
    print("----"+hood+"----")
    temp = Barnet_grouped[Barnet_grouped['Neighborhood'] == hood].T.reset_inde
x()
    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).hea
d(num_top_venues))
    print('\n')
```

```
----Barnet Gate----
              venue  freq
0         Juice Bar  0.10
1          Platform  0.10
2     Grocery Store  0.10
3  Stationery Store  0.05
4          Pharmacy  0.05


----Brent Cross----
                  venue  freq
0           Coffee Shop  0.12
1                   Pub  0.06
2      Sushi Restaurant  0.06
3             Irish Pub  0.06
4  Gym / Fitness Center  0.06


----Childs Hill----
                  venue  freq
0           Bus Station  0.17
1  Gym / Fitness Center  0.17
2           Music Venue  0.17
3           Supermarket  0.17
4         Historic Site  0.17


----Church End----
                venue  freq
0         Supermarket  0.09
1  Turkish Restaurant  0.09
2         Pizza Place  0.06
3      Cosmetics Shop  0.06
4         Coffee Shop  0.06


----Colindale----
              venue  freq
0          Bus Stop  0.12
1  Asian Restaurant  0.12
2    Ice Cream Shop  0.06
3       Coffee Shop  0.06
4              Café  0.06


----Colney Hatch----
                venue  freq
0                Café  0.13
1          Coffee Shop  0.09
2                 Pub  0.07
3          Pizza Place  0.07
4  Japanese Restaurant  0.04


----East Barnet----
                venue  freq
0               Hotel  0.09
```

```
1              Theater  0.07
2               Garden  0.05
3  Monument / Landmark  0.05
4                Plaza  0.05


----East Finchley----
         venue  freq
0  Coffee Shop  0.12
1         Café  0.09
2     Platform  0.06
3     Bus Stop  0.06
4          Pub  0.06


----Edgware----
                     venue  freq
0                   Bakery  0.33
1            Metro Station  0.33
2                      Gym  0.33
3     American Restaurant  0.00
4  North Indian Restaurant  0.00


----Finchley----
                  venue  freq
0           Coffee Shop  0.13
1      Sushi Restaurant  0.05
2              Pharmacy  0.05
3  Fast Food Restaurant  0.05
4    Italian Restaurant  0.05


----Friern Barnet----
               venue  freq
0      Grocery Store  0.33
1      Train Station  0.11
2  Fish & Chips Shop  0.11
3     Breakfast Spot  0.11
4           Beer Bar  0.11


----Golders Green----
                venue  freq
0   Korean Restaurant  0.08
1  Italian Restaurant  0.08
2       Grocery Store  0.08
3              Bakery  0.08
4               Café  0.08


----Grahame Park----
              venue  freq
0          Bus Stop  0.12
1  Asian Restaurant  0.12
2    Ice Cream Shop  0.06
3       Coffee Shop  0.06
```

```
4             Café  0.06


----Hampstead Garden Suburb----
         venue  freq
0  Coffee Shop  0.12
1         Café  0.09
2     Platform  0.06
3     Bus Stop  0.06
4          Pub  0.06


----Hendon----
                  venue  freq
0           Coffee Shop  0.12
1                   Pub  0.06
2      Sushi Restaurant  0.06
3             Irish Pub  0.06
4  Gym / Fitness Center  0.06


----Mill Hill----
              venue  freq
0         Juice Bar  0.10
1          Platform  0.10
2     Grocery Store  0.10
3  Stationery Store  0.05
4          Pharmacy  0.05


----Monken Hadley----
               venue  freq
0                Pub  0.25
1  Recruiting Agency  0.25
2        Coffee Shop  0.25
3               Café  0.25
4        Opera House  0.00


----New Barnet----
               venue  freq
0                Pub  0.25
1  Recruiting Agency  0.25
2        Coffee Shop  0.25
3               Café  0.25
4        Opera House  0.00


----New Southgate----
               venue  freq
0      Grocery Store  0.33
1      Train Station  0.11
2  Fish & Chips Shop  0.11
3     Breakfast Spot  0.11
4           Beer Bar  0.11
```

```
----North Finchley----
                 venue  freq
0          Coffee Shop  0.13
1      Sushi Restaurant  0.05
2              Pharmacy  0.05
3  Fast Food Restaurant  0.05
4    Italian Restaurant  0.05


----Oakleigh Park----
                venue  freq
0         Coffee Shop  0.17
1                Café  0.12
2  Italian Restaurant  0.08
3       Metro Station  0.04
4      Sandwich Place  0.04


----Osidge----
                 venue  freq
0  Fast Food Restaurant  0.12
1          Coffee Shop  0.12
2  Gym / Fitness Center  0.08
3          Pizza Place  0.08
4                Café  0.08


----The Hale----
              venue  freq
0         Juice Bar  0.10
1          Platform  0.10
2     Grocery Store  0.10
3  Stationery Store  0.05
4          Pharmacy  0.05


----The Hyde----
              venue  freq
0          Bus Stop  0.12
1  Asian Restaurant  0.12
2    Ice Cream Shop  0.06
3       Coffee Shop  0.06
4              Café  0.06


----Totteridge----
                venue  freq
0         Coffee Shop  0.17
1                Café  0.12
2  Italian Restaurant  0.08
3       Metro Station  0.04
4      Sandwich Place  0.04


----West Hendon----
              venue  freq
0          Bus Stop  0.12
```

```
1  Asian Restaurant  0.12
2    Ice Cream Shop  0.06
3       Coffee Shop  0.06
4              Café  0.06


----Whetstone----
                venue  freq
0         Coffee Shop  0.17
1               Café  0.12
2  Italian Restaurant  0.08
3       Metro Station  0.04
4      Sandwich Place  0.04


----Woodside Park----
                  venue  freq
0           Coffee Shop  0.13
1      Sushi Restaurant  0.05
2              Pharmacy  0.05
3  Fast Food Restaurant  0.05
4    Italian Restaurant  0.05
```

In [124]:
```
# Let's put that into a pandas dataframe
# let's write a function to sort the venues in descending order
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]
```

Now let's create the new dataframe and display the top 10 venues for each neighborhood.

In [126]:
```
# Now let's create the new dataframe and display the top 10 venues for each ne
ighborhood.
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'] = Barnet_grouped['Neighborhood']

for ind in np.arange(Barnet_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(Barn
et_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

Out[126]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Mos Commo Venu
0	Barnet Gate	Grocery Store	Platform	Juice Bar	Pizza Place	Italian Restaurant	Restaurant	Bus Sto
1	Brent Cross	Coffee Shop	Pizza Place	Japanese Restaurant	Noodle House	Pub	Chinese Restaurant	Frie Chicke Joir
2	Childs Hill	Music Venue	Historic Site	Gym / Fitness Center	Clothing Store	Supermarket	Bus Station	Wine Ba
3	Church End	Supermarket	Turkish Restaurant	Cosmetics Shop	Pizza Place	Pub	Japanese Restaurant	Caf
4	Colindale	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar	Hotel	Coffee Shop	Pul

In [127]:
```
Barnet_grouped
```

Out[127]:

	Neighborhood	American Restaurant	Argentinian Restaurant	Art Gallery	Art Museum	Asian Restaurant	Auto Workshop	BBQ Joint
0	Barnet Gate	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
1	Brent Cross	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
2	Childs Hill	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
3	Church End	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
4	Colindale	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
5	Colney Hatch	0.022222	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
6	East Barnet	0.000000	0.00	0.034091	0.022727	0.000000	0.0000	0.000000
7	East Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
8	Edgware	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
9	Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
10	Friern Barnet	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
11	Golders Green	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.038462
12	Grahame Park	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
13	Hampstead Garden Suburb	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
14	Hendon	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
15	Mill Hill	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
16	Monken Hadley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
17	New Barnet	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
18	New Southgate	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
19	North Finchley	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
20	Oakleigh Park	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
21	Osidge	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000
22	The Hale	0.000000	0.05	0.000000	0.000000	0.000000	0.0000	0.000000
23	The Hyde	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
24	Totteridge	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
25	West Hendon	0.000000	0.00	0.000000	0.000000	0.125000	0.0625	0.000000
26	Whetstone	0.041667	0.00	0.000000	0.000000	0.041667	0.0000	0.000000
27	Woodside Park	0.000000	0.00	0.000000	0.000000	0.000000	0.0000	0.000000

28 rows × 112 columns

4. Cluster Neighborhoods

Run k-means to cluster the neighborhood into 5 clusters

In [128]:
```
# set number of clusters
kclusters = 5

Barnet_grouped_clustering = Barnet_grouped.drop('Neighborhood', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(Barnet_grouped_clust
ering)

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

Out[128]:
```
array([2, 2, 1, 2, 1, 2, 2, 2, 3, 2])
```

In [129]:
```
neighborhoods_venues_sorted
```

Out[129]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7tl Co
0	Barnet Gate	Grocery Store	Platform	Juice Bar	Pizza Place	Italian Restaurant	Restaurant	Bu
1	Brent Cross	Coffee Shop	Pizza Place	Japanese Restaurant	Noodle House	Pub	Chinese Restaurant	C
2	Childs Hill	Music Venue	Historic Site	Gym / Fitness Center	Clothing Store	Supermarket	Bus Station	Wi
3	Church End	Supermarket	Turkish Restaurant	Cosmetics Shop	Pizza Place	Pub	Japanese Restaurant	
4	Colindale	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar	Hotel	Coffee Shop	
5	Colney Hatch	Café	Coffee Shop	Pizza Place	Pub	Bakery	Grocery Store	E
6	East Barnet	Hotel	Theater	Monument / Landmark	Plaza	Pub	Garden	Art
7	East Finchley	Coffee Shop	Café	Pub	Bus Stop	Platform	Grocery Store	Sa
8	Edgware	Gym	Bakery	Metro Station	Wine Bar	Fried Chicken Joint	Diner	Di
9	Finchley	Coffee Shop	Café	Italian Restaurant	Fast Food Restaurant	Pharmacy	Supermarket	Rest
10	Friern Barnet	Grocery Store	Pub	Fish & Chips Shop	Beer Bar	Breakfast Spot	Train Station	- Rest
11	Golders Green	Bakery	Café	Grocery Store	Turkish Restaurant	Korean Restaurant	Italian Restaurant	Rest
12	Grahame Park	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar	Hotel	Coffee Shop	
13	Hampstead Garden Suburb	Coffee Shop	Café	Pub	Bus Stop	Platform	Grocery Store	Sa
14	Hendon	Coffee Shop	Pizza Place	Japanese Restaurant	Noodle House	Pub	Chinese Restaurant	C
15	Mill Hill	Grocery Store	Platform	Juice Bar	Pizza Place	Italian Restaurant	Restaurant	Bu
16	Monken Hadley	Coffee Shop	Pub	Recruiting Agency	Café	Wine Bar	Dance Studio	D
17	New Barnet	Coffee Shop	Pub	Recruiting Agency	Café	Wine Bar	Dance Studio	D
18	New Southgate	Grocery Store	Pub	Fish & Chips Shop	Beer Bar	Breakfast Spot	Train Station	- Rest

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Co
19	North Finchley	Coffee Shop	Café	Italian Restaurant	Fast Food Restaurant	Pharmacy	Supermarket	Rest
20	Oakleigh Park	Coffee Shop	Café	Italian Restaurant	Breakfast Spot	Grocery Store	Hotel	Rest
21	Osidge	Fast Food Restaurant	Coffee Shop	Pizza Place	Café	Gym / Fitness Center	Turkish Restaurant	Rest
22	The Hale	Grocery Store	Platform	Juice Bar	Pizza Place	Italian Restaurant	Restaurant	Bu
23	The Hyde	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar	Hotel	Coffee Shop	
24	Totteridge	Coffee Shop	Café	Italian Restaurant	Breakfast Spot	Grocery Store	Hotel	Rest
25	West Hendon	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar	Hotel	Coffee Shop	
26	Whetstone	Coffee Shop	Café	Italian Restaurant	Breakfast Spot	Grocery Store	Hotel	Rest
27	Woodside Park	Coffee Shop	Café	Italian Restaurant	Fast Food Restaurant	Pharmacy	Supermarket	Rest

In [132]:
```
# Let's create a new dataframe that includes the cluster as well as the top 10 venues for each neighborhood
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

Barnet_merged = df3

# merge manhattan_grouped with manhattan_data to add latitude/longitude for each neighborhood
Barnet_merged = Barnet_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), on='neighbourhood')

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

Out[132]:

	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Latitude	Longit
24	Barnet Gate	Barnet	LONDON, BARNET	NW7, EN5	20	51.61568	-0.24
60	Brent Cross	Barnet	LONDON	NW2, NW4	20	51.58918	-0.22
94	Childs Hill	Barnet	LONDON	NW2	20	51.56237	-0.22
101	Church End	Barnet	LONDON	N3	20	51.60104	-0.19
105	Colindale	Barnet	LONDON	NW9	20	51.58486	-0.24

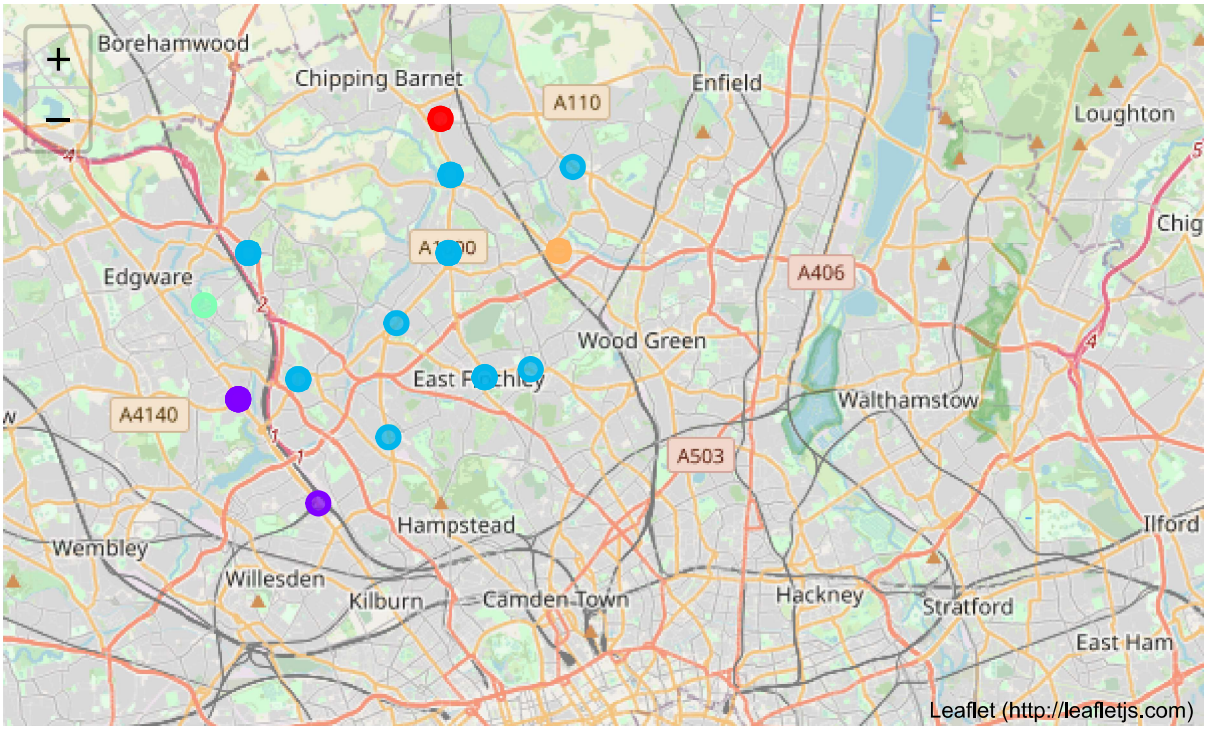
In [133]:
```
# Finally let's visualize the resulting clusters
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(Barnet_merged['Latitude'], Barnet_merged['Lo
ngitude'], Barnet_merged['neighbourhood'], Barnet_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=Tru
e)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters
```

Out[133]:



In [134]:
```
# Save the work into CSV
Barnet_merged.to_csv(r'df_Clustered.CSV')
```

In [135]:
```
#lets have insights on the data, How many Points per cluster
Barnet_merged['Cluster Labels'].value_counts()
```

Out[135]:
```
2    18
1     5
4     2
0     2
3     1
Name: Cluster Labels, dtype: int64
```

In [148]:
```
# Cluster 1
Barnet_merged.loc[Barnet_merged['Cluster Labels'] == 0, Barnet_merged.columns
[[1] + list(range(5, Barnet_merged.shape[1]))]]
```

Out[148]:

	London_borough	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
311	Barnet	51.644415	-0.179183	0	Coffee Shop	Pub	Recruiting Agency	Café
321	Barnet	51.644415	-0.179183	0	Coffee Shop	Pub	Recruiting Agency	Café

In [149]:
```
# Cluster 2
Barnet_merged.loc[Barnet_merged['Cluster Labels'] == 1, Barnet_merged.columns
[[1] + list(range(5, Barnet_merged.shape[1]))]]
```

Out[149]:

	London_borough	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue
94	Barnet	51.56237	-0.22131	1	Music Venue	Historic Site	Gym / Fitness Center	Clothing Store
105	Barnet	51.58486	-0.24881	1	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar
192	Barnet	51.58486	-0.24881	1	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar
252	Barnet	51.58486	-0.24881	1	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar
507	Barnet	51.58486	-0.24881	1	Asian Restaurant	Bus Stop	Ice Cream Shop	Bar

In [150]:
```
# Cluster 3
Barnet_merged.loc[Barnet_merged['Cluster Labels'] == 2, Barnet_merged.columns
[[1] + list(range(5, Barnet_merged.shape[1]))]]
```

Out[150]:

	London_borough	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Mc Comm Ven
24	Barnet	51.61568	-0.24511	2	Grocery Store	Platform	Juice Bar	Piz Pla
60	Barnet	51.58918	-0.22805	2	Coffee Shop	Pizza Place	Japanese Restaurant	Noo Hou
101	Barnet	51.60104	-0.19401	2	Supermarket	Turkish Restaurant	Cosmetics Shop	Piz Pla
108	Barnet	51.59107	-0.14852	2	Café	Coffee Shop	Pizza Place	F
144	Barnet	51.50642	-0.12721	2	Hotel	Theater	Monument / Landmark	Pla
147	Barnet	51.58927	-0.16395	2	Coffee Shop	Café	Pub	Bus St
170	Barnet	51.61592	-0.17674	2	Coffee Shop	Café	Italian Restaurant	Fast Fc Restaur
189	Barnet	51.57673	-0.19695	2	Bakery	Café	Grocery Store	Turk Restaur
206	Barnet	51.61568	-0.24511	2	Grocery Store	Platform	Juice Bar	Piz Pla
210	Barnet	51.58927	-0.16395	2	Coffee Shop	Café	Pub	Bus St
233	Barnet	51.58918	-0.22805	2	Coffee Shop	Pizza Place	Japanese Restaurant	Noo Hou
307	Barnet	51.61568	-0.24511	2	Grocery Store	Platform	Juice Bar	Piz Pla
334	Barnet	51.61592	-0.17674	2	Coffee Shop	Café	Italian Restaurant	Fast Fc Restaur
346	Barnet	51.63261	-0.17562	2	Coffee Shop	Café	Italian Restaurant	Breakf Sp
352	Barnet	51.63429	-0.13366	2	Fast Food Restaurant	Coffee Shop	Pizza Place	C
467	Barnet	51.63261	-0.17562	2	Coffee Shop	Café	Italian Restaurant	Breakf Sp
513	Barnet	51.63261	-0.17562	2	Coffee Shop	Café	Italian Restaurant	Breakf Sp
526	Barnet	51.61592	-0.17674	2	Coffee Shop	Café	Italian Restaurant	Fast Fc Restaur

Cluster 3, rich in multicultural cuisine restaurants

In [152]:
```
# Cluster 4
Barnet_merged.loc[Barnet_merged['Cluster Labels'] == 3, Barnet_merged.columns
[[1] + list(range(5, Barnet_merged.shape[1]))]]
```

Out[152]:

	London_borough	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5 C
153	Barnet	51.60498	-0.260219	3	Gym	Bakery	Metro Station	Wine Bar	(

In [153]:
```
# Cluster 5
Barnet_merged.loc[Barnet_merged['Cluster Labels'] == 4, Barnet_merged.columns
[[1] + list(range(5, Barnet_merged.shape[1]))]]
```

Out[153]:

	London_borough	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5 C
180	Barnet	51.61631	-0.13839	4	Grocery Store	Pub	Fish & Chips Shop	Beer Bar	Bı
325	Barnet	51.61631	-0.13839	4	Grocery Store	Pub	Fish & Chips Shop	Beer Bar	Bı

Note: Cluster 3, rich in multicultural cuisine restaurants

So because the business is about Arabic Coffee Shop, its important to be close to Middle east resturants ..

In [143]:
```
Barnet_merged.apply(lambda row: row.astype(str).str.contains('Middle').any(),
axis=1)
```

Out[143]:
```
24     False
60     False
94     False
101    False
105    False
108    False
144    False
147    False
153    False
170    False
180    False
189     True
192    False
206    False
210    False
233    False
252    False
307    False
311    False
321    False
325    False
334    False
346    False
352     True
467    False
507    False
513    False
526    False
dtype: bool
```

In [144]:
```
# Function To Search for a specific Keywords in entire dataset - pandas
def search(regex: str, df, case=False):
    """Search all the text columns of `df`, return rows with any matches."""
    textlikes = df.select_dtypes(include=[object, "string"])
    return df[
        textlikes.apply(
            lambda column: column.str.contains(regex, regex=True, case=case, n
a=False)
        ).any(axis=1)
    ]
```

In [145]:
```
# Searching for neighbourhoods that has Middle Eastern Restaurant
search ('Middle', Barnet_merged, case=False )
```

Out[145]:

	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Latitude	Longit
189	Golders Green	Barnet	LONDON	NW11	20	51.57673	-0.19
352	Osidge	Barnet	LONDON	N14	20	51.63429	-0.13

Now, we get to know best locations to open Arabic Coffee Business. Its recommended to Open the Business nearby Golders Green neighbourhood because its in top 10 neighbourhoods in Barnet in terms of number of venues

In [146]:
```
# Lets Visualize the Target locations
Business_Loc = search ('Middle', Barnet_merged, case=False )
Business_Loc
```

Out[146]:

	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Latitude	Longit
189	Golders Green	Barnet	LONDON	NW11	20	51.57673	-0.19
352	Osidge	Barnet	LONDON	N14	20	51.63429	-0.13

In [154]:
```
# Lets Drop Osidge from the dataframe
Business_Loc = Business_Loc.drop([352], axis=0)
Business_Loc
```

Out[154]:

	neighbourhood	London_borough	Post_town	Postcode_district	Dial_code	Latitude	Longit
189	Golders Green	Barnet	LONDON	NW11	20	51.57673	-0.19

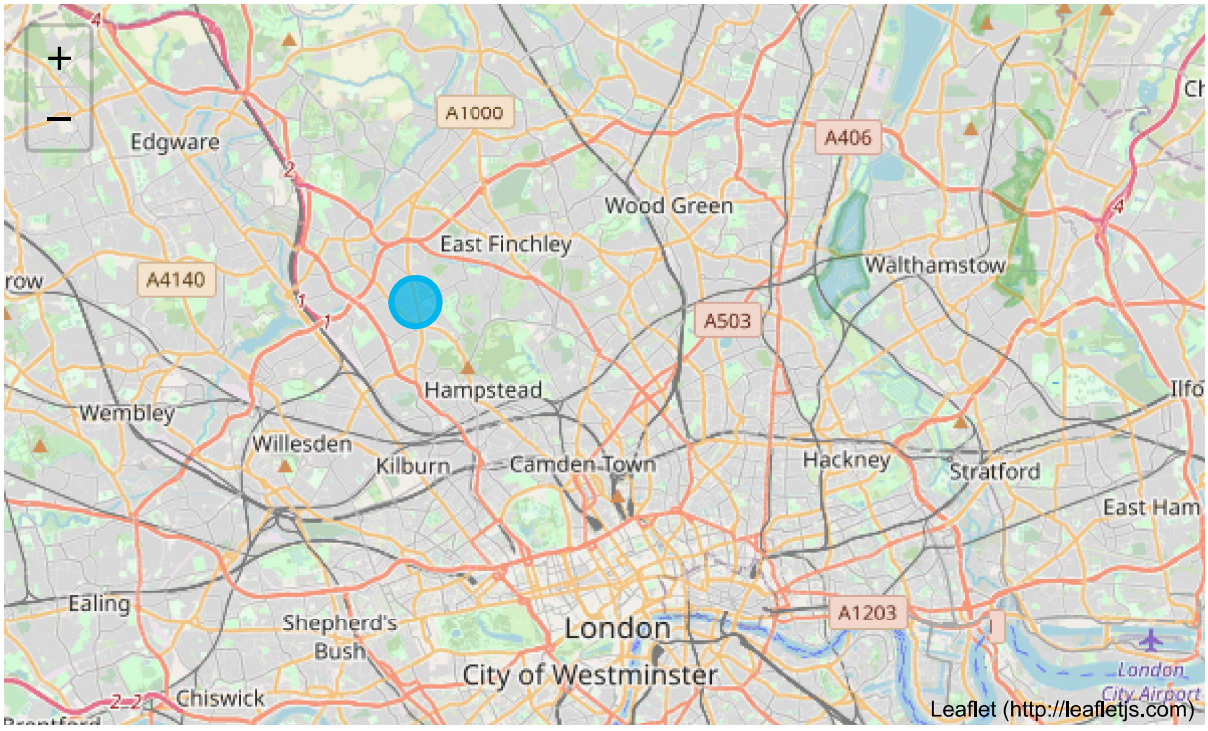
In [162]:
```
# Finally let's visualize the resulting clusters
# create map
Target_Location = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(Business_Loc['Latitude'], Business_Loc['Long
itude'], Business_Loc['neighbourhood'], Business_Loc['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=Tru
e)
    folium.CircleMarker(
        [lat, lon],
        radius=12,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(Target_Location)

Target_Location
```

Out[162]:



Result and Findings

1. Barnet and Bromley Bouroughs both have 28 Neighborhoods in the top compared to other Boroughs in London, for simplicity we choosed London Borough of Barnet to Explore.
2. East Barnet Neighborhood has the Max. Number of Venues (88 venues) based on Foursquare data
3. Top 10 Neighborhoods in Barnet based on Number of venues are: East Barnet, Colney Hatch , Finchley, North Finchley, Woodside Park, Church End, East Finchley, Hampstead Garden Suburb, Golders Green, Osidge
4. Its important to Open Arabic Coffee Shop business near to Middle Eastern Resturants.
5. Only Golders Green and Osidge neighbourhoods have Middle Eastern Resturants in their Most Common Venues.
6. The Best Location for the business recommended to be nearby Golders Green neighbourhood because its in the top 10 neighbourhoods in Barnet in terms of number of venues.