

my-projects (/github/shoang22/my-projects/tree/master)

/ chicago-crime-clusters (/github/shoang22/my-projects/tree/master/chicago-crime-clusters)

In [1]:

```
import numpy as np # Library to handle data in a vectorized manner

import pandas as pd
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # Library to handle JSON files

from geopy.geocoders import Nominatim # Convert an address into Latitude and Longitude

import requests # Library to handle requests
from pandas.io.json import json_normalize # transform JSON file into a pandas DataFrame

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors

# Import k-means from clustering stage
from sklearn.cluster import KMeans

import folium # Map rendering Library

#SQL Libraries
import ibm_db
import ibm_db_sa
import ibm_db_dbi
```

In [2]:

```
%load_ext sql
```

In [3]:

```
# Connect to Db2 instance
%sql ibm_db_sa://vcc60770:rzxhtplrb5v0t9%403@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
```

Out[3]:

```
'Connected: vcc60770@BLUDB'
```

In [4]:

```
df = %sql SELECT * from CRIMES

* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
Done.
```

In [5]:

```
%sql select COUNT(*) from CRIMES
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.bluemix
Done.
```

Out[5]:

1

533

In [6]:

```
%sql select COUNT(*) from CRIMES\
      where ARREST = 'TRUE'
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
Done.
```

Out[6]:

1

163

In [7]:

```
%sql select DISTINCT PRIMARY_TYPE from CRIMES
```

```
* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.ibm.com Done.
```

Out[7]:

primary_type
ARSON
ASSAULT
BATTERY
BURGLARY
CONCEALED CARRY LICENSE VIOLATION
CRIM SEXUAL ASSAULT
CRIMINAL DAMAGE
CRIMINAL TRESPASS
DECEPTIVE PRACTICE
DOMESTIC VIOLENCE
GAMBLING
HOMICIDE
HUMAN TRAFFICKING
INTERFERENCE WITH PUBLIC OFFICER
INTIMIDATION
KIDNAPPING
LIQUOR LAW VIOLATION
MOTOR VEHICLE THEFT
NARCOTICS
NON - CRIMINAL
NON-CRIMINAL
NON-CRIMINAL (SUBJECT SPECIFIED)
OBSCENITY
OFFENSE INVOLVING CHILDREN
OTHER NARCOTIC VIOLATION
OTHER OFFENSE
PROSTITUTION
PUBLIC INDECENCY
PUBLIC PEACE VIOLATION
RITUALISM
ROBBERY
SEX OFFENSE

STALKING
THEFT
WEAPONS VIOLATION

```
In [8]: crime_df = df.DataFrame()  
crime_df.head()
```

```
Out[8]:
```

	id	case_number	DATE	block	iucr	primary_type	description	location_des
0	3512276	HK587712	2004-08-28 17:50:56	047XX S KEDZIE AVE	890	THEFT	FROM BUILDING	SMALL
1	3406613	HK456306	2004-06-26 12:40:00	009XX N CENTRAL PARK AVE	820	THEFT	\$500 AND UNDER	
2	8002131	HT233595	2011-04-04 05:45:00	043XX S WABASH AVE	820	THEFT	\$500 AND UNDER	NL HOME/RETIR
3	7903289	HT133522	2010-12-30 16:30:00	083XX S KINGSTON AVE	840	THEFT	FINANCIAL ID THEFT: OVER \$300	RESI
4	10402076	HZ138551	2016-02-02 19:30:00	033XX W 66TH ST	820	THEFT	\$500 AND UNDER	

```
In [9]: census = %sql select * from CENSUS  
census_df = census.DataFrame()  
census_df = census_df[['community_area_name', 'community_area_number']].dropna()  
census_df.head()
```

* ibm_db_sa://vcc60770:***@dashdb-txn-sbox-yp-dal09-08.services.dal.blue
Done.

```
Out[9]:
```

	community_area_name	community_area_number
0	Rogers Park	1.0
1	West Ridge	2.0
2	Uptown	3.0
3	Lincoln Square	4.0
4	North Center	5.0

```
In [10]: merged_df = pd.merge(crime_df,census_df,left_on='community_area_number',right_on='community_area_number',how='left')
merged_df.head()
```

Out[10]:

	id	case_number	DATE	block	iucr	primary_type	description
0	3512276	HK587712	2004-08-28 17:50:56	047XX S KEDZIE AVE	890	THEFT	FROM BUILDING
1	7937542	HT169840	2011-02-18 19:30:00	029XX W 36TH ST	1310	CRIMINAL DAMAGE	TO PROPERTY
2	7881407	HT112422	2011-01-09 18:27:00	039XX S ROCKWELL ST	1310	CRIMINAL DAMAGE	TO PROPERTY
3	10770065	HZ535494	2016-11-30 22:00:00	033XX W 38TH ST	1320	CRIMINAL DAMAGE	TO VEHICLE
4	7502426	HS305355	2010-05-13 11:00:00	035XX S WASHTENAW AVE	1821	NARCOTICS	MANU/DEL:CANNABIS 10GM OR LESS

```
In [11]: chicago_df = merged_df[['id','primary_type', 'latitude', 'longitude', 'community_area_name']]
chicago_df.head()
```

Out[11]:

	id	primary_type	latitude	longitude	community_area_name
0	3512276	THEFT	41.80744050	-87.70395585	Brighton Park
1	7937542	CRIMINAL DAMAGE	41.82818901	-87.69879200	Brighton Park
2	7881407	CRIMINAL DAMAGE	41.82167019	-87.68970283	Brighton Park
3	10770065	CRIMINAL DAMAGE	41.82435275	-87.70784072	Brighton Park
4	7502426	NARCOTICS	41.82890791	-87.69234919	Brighton Park

```
In [12]: address = 'Chicago, IL'

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

The geograpical coordinate of Chicago are 41.8755616, -87.6244212.

```

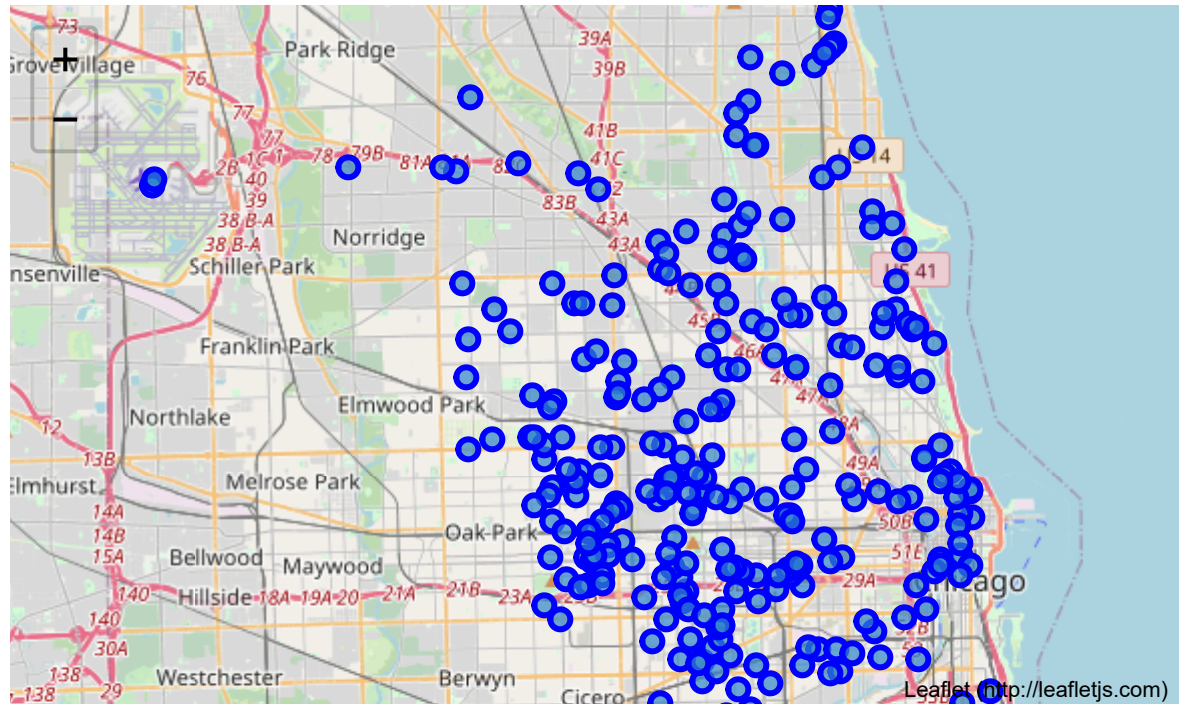
In [13]: # create map of Chicago using latitude and longitude values
map_chicago = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers of incident locations to map
for lat, lng, community, crime in zip(chicago_df['latitude'], chicago_df['lc
    label = '{}', {}'.format(community, crime)
    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_chicago)

map_chicago

```

Out[13]:



```

In [23]: CLIENT_ID = 'BAZCOY2HNEDY5YKC0BKYLNLQRRTW4VV0VZPJVI2RWXJGLZMH'
CLIENT_SECRET = 'KYRLXKWKTIIRIV1P3Z2FVLAZLUENARRUPOS4VHBZCH2ZIBF1Z'
VERSION = '20180605'

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

Your credentails:
CLIENT_ID: BAZCOY2HNEDY5YKC0BKYLNLQRRTW4VV0VZPJVI2RWXJGLZMH
CLIENT_SECRET: KYRLXKWKTIIRIV1P3Z2FVLAZLUENARRUPOS4VHBZCH2ZIBF1Z

```

```
In [24]: community_latitude = chicago_df.loc[0, 'latitude'] # community latitude value
community_longitude = chicago_df.loc[0, 'longitude'] # community longitude value

community_name = chicago_df.loc[0, 'community_area_name'] # community name

print('Latitude and longitude values of {} are {}, {}'.format(community_name,
                                                             community_latitude,
                                                             community_longitude))
```

Latitude and longitude values of Brighton Park are 41.80744050, -87.70395585

```
In [25]: LIMIT = 100 # limit of number of venues returned by Foursquare API

radius = 500 # define radius

# create URL
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&version={}&lat={}&lon={}&radius={}&limit={}'
url = url.format(CLIENT_ID,
                 CLIENT_SECRET,
                 VERSION,
                 community_latitude,
                 community_longitude,
                 radius,
                 LIMIT)
url # display URL
```

```
Out[25]: 'https://api.foursquare.com/v2/venues/explore?&client_id=BAZCOY2HNEDY5YKC&client_secret=BAZCOY2HNEDY5YKC&version=20180801&lat=41.80744050&lon=-87.70395585&radius=500&limit=100'
```

```
In [26]: results = requests.get(url).json()
results
```

```
Out[26]: {'meta': {'code': 200, 'requestId': '5eadceecb1cac0001b8e9069'},
'response': {'suggestedFilters': {'header': 'Tap to show:',
  'filters': [{'name': 'Open now', 'key': 'openNow'},
    {'name': '$-$$$$', 'key': 'price'}]},
  'headerLocation': 'Brighton Park',
  'headerFullLocation': 'Brighton Park, Chicago',
  'headerLocationGranularity': 'neighborhood',
  'totalResults': 31,
  'suggestedBounds': {'ne': {'lat': 41.8119405045, 'lng': -87.6979300033007},
    'sw': {'lat': 41.802940495499996, 'lng': -87.7099816966993}},
  'groups': [{'type': 'Recommended Places',
    'name': 'recommended',
    'items': [{'reasons': {'count': 0,
      'items': [{'summary': 'This spot is popular',
        'type': 'general',
        'reasonName': 'globalInteractionReason'}]}],
    'venue': {'id': '4b93f135f964a520975b34e3',
      'name': "Pete's Fresh Market",
      'location': {'address': '4700 S Kedzie Ave',
        'lat': 41.80776733903465,
        'lng': -87.7042837308118,
        'labeledLatLngs': [{'label': 'display',
          'lat': 41.80776733903465,
          'lng': -87.7042837308118},
        {'label': 'entrance', 'lat': 41.806898, 'lng': -87.705038}]},
        'distance': 45,
        'postalCode': '60632',
        'cc': 'US',
        'city': 'Chicago',
        'state': 'IL',
        'country': 'United States',
        'formattedAddress': ['4700 S Kedzie Ave',
          'Chicago, IL 60632',
          'United States']},
        'categories': [{'id': '4bf58dd8d48988d118951735',
          'name': 'Grocery Store',
          'pluralName': 'Grocery Stores',
          'shortName': 'Grocery Store',
          'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fo',
            'suffix': '.png'},
          'primary': True}],
        'photos': {'count': 0, 'groups': []}},
        'referralId': 'e-0-4b93f135f964a520975b34e3-0'},
        {'reasons': {'count': 0,
          'items': [{'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]}],
          'venue': {'id': '4aef9687f964a5206dd921e3',
            'name': 'Carnitas Don Rafa',
            'location': {'address': '4617 S Kedzie Ave',
              'lat': 41.809205930975416,
              'lng': -87.70396292599497,
              'labeledLatLngs': [{'label': 'display',
                'lat': 41.809205930975416,
```



```
    'lng': -87.70396292599497},
    {'label': 'entrance', 'lat': 41.80937, 'lng': -87.703894}],
    'distance': 196,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['4617 S Kedzie Ave',
    'Chicago, IL 60632',
    'United States']],
    'categories': [{'id': '4bf58dd8d48988d1c1941735',
    'name': 'Mexican Restaurant',
    'pluralName': 'Mexican Restaurants',
    'shortName': 'Mexican',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/mex',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4aef9687f964a5206dd921e3-1'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]}},
    'venue': {'id': '4fe34113754a0767553e5fcb',
    'name': "LaCoco's Pizza & Pasta",
    'location': {'address': '3350 W 47th St',
    'crossStreet': 'at Homan Ave',
    'lat': 41.80838,
    'lng': -87.708364,
    'labeledLatLngs': [{'label': 'display',
    'lat': 41.80838,
    'lng': -87.708364},
    {'label': 'entrance', 'lat': 41.808288, 'lng': -87.708412}],
    'distance': 380,
    'postalCode': '60632',
    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['3350 W 47th St (at Homan Ave)',
    'Chicago, IL 60632',
    'United States']],
    'categories': [{'id': '4bf58dd8d48988d110941735',
    'name': 'Italian Restaurant',
    'pluralName': 'Italian Restaurants',
    'shortName': 'Italian',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/ita',
    'suffix': '.png'},
    'primary': True}],
    'delivery': {'id': '121122',
    'url': 'https://www.grubhub.com/restaurant/la-cocos-pizza--pasta-335',
    'provider': {'name': 'grubhub',
    'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
    'sizes': [40, 50],
    'name': '/delivery_provider_grubhub_20180129.png'}}},
    'photos': {'count': 0, 'groups': []},
```

```
'venuePage': {'id': '33714250'}},
'referralId': 'e-0-4fe34113754a0767553e5fcb-2'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4d489a579544a09335791fe7',
  'name': 'Town & Country Self-Service Liquor Mart',
  'location': {'address': '2944 W 47th Street',
    'lat': 41.80834071302504,
    'lng': -87.69833207130432,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.80834071302504,
      'lng': -87.69833207130432}],
    {'label': 'entrance', 'lat': 41.808302, 'lng': -87.698478}],
  'distance': 477,
  'cc': 'US',
  'city': 'Chicago',
  'state': 'IL',
  'country': 'United States',
  'formattedAddress': ['2944 W 47th Street',
    'Chicago, IL',
    'United States']},
  'categories': [{'id': '4bf58dd8d48988d186941735',
    'name': 'Liquor Store',
    'pluralName': 'Liquor Stores',
    'shortName': 'Liquor Store',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fo',
      'suffix': '.png'},
    'primary': True}],
  'photos': {'count': 0, 'groups': []},
  'venuePage': {'id': '1358733758'}},
'referralId': 'e-0-4d489a579544a09335791fe7-3'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4e54253588770c1e5226ef36',
  'name': 'T.J. Maxx',
  'location': {'address': '4932 S Kedzie Ave',
    'crossStreet': 'at Steeple Center',
    'lat': 41.8036205,
    'lng': -87.7052622,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.8036205,
      'lng': -87.7052622}],
  'distance': 438,
  'postalCode': '60632',
  'cc': 'US',
  'city': 'Chicago',
  'state': 'IL',
  'country': 'United States',
  'formattedAddress': ['4932 S Kedzie Ave (at Steeple Center)',
    'Chicago, IL 60632',
    'United States']},
  'categories': [{'id': '4bf58dd8d48988d1f6941735',
    'name': 'Department Store',
```

```
    'pluralName': 'Department Stores',
    'shortName': 'Department Store',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/de',
             'suffix': '.png'},
    'primary': True}],
  'photos': {'count': 0, 'groups': []}},
  'referralId': 'e-0-4e54253588770c1e5226ef36-4'},
  {'reasons': {'count': 0,
               'items': [{'summary': 'This spot is popular',
                           'type': 'general',
                           'reasonName': 'globalInteractionReason'}]}],
  'venue': {'id': '4e4cef1cbd413c4cc66d58b4',
            'name': 'Subway',
            'location': {'address': '4711 S Kedzie Ave',
                        'lat': 41.807602918837674,
                        'lng': -87.70326385273859,
                        'labeledLatLngs': [{'label': 'display',
                                             'lat': 41.807602918837674,
                                             'lng': -87.70326385273859},
                                           {'label': 'entrance', 'lat': 41.807613, 'lng': -87.703352}],
                        'distance': 60,
                        'postalCode': '60632',
                        'cc': 'US',
                        'city': 'Chicago',
                        'state': 'IL',
                        'country': 'United States',
                        'formattedAddress': ['4711 S Kedzie Ave',
                                             'Chicago, IL 60632',
                                             'United States']}],
            'categories': [{'id': '4bf58dd8d48988d1c5941735',
                            'name': 'Sandwich Place',
                            'pluralName': 'Sandwich Places',
                            'shortName': 'Sandwiches',
                            'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/del',
                                     'suffix': '.png'},
                            'primary': True}],
            'photos': {'count': 0, 'groups': []}},
  'referralId': 'e-0-4e4cef1cbd413c4cc66d58b4-5'},
  {'reasons': {'count': 0,
               'items': [{'summary': 'This spot is popular',
                           'type': 'general',
                           'reasonName': 'globalInteractionReason'}]}],
  'venue': {'id': '4caf48b51463a1434d3a93a9',
            'name': 'T-Mobile',
            'location': {'address': '4612 S Kedzie Ave',
                        'lat': 41.809523,
                        'lng': -87.704245,
                        'labeledLatLngs': [{'label': 'display',
                                             'lat': 41.809523,
                                             'lng': -87.704245},
                                           {'label': 'entrance', 'lat': 41.809492, 'lng': -87.704138}],
                        'distance': 233,
                        'postalCode': '60632',
                        'cc': 'US',
                        'city': 'Chicago',
                        'state': 'IL',
                        'country': 'United States',
```

```
    'formattedAddress': ['4612 S Kedzie Ave',  
      'Chicago, IL 60632',  
      'United States']},  
    'categories': [{ 'id': '4f04afc02fb6e1c99f3db0bc',  
      'name': 'Mobile Phone Shop',  
      'pluralName': 'Mobile Phone Shops',  
      'shortName': 'Mobile Phones',  
      'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/mo',  
        'suffix': '.png'},  
      'primary': True}],  
    'photos': { 'count': 0, 'groups': []},  
    'referralId': 'e-0-4caf48b51463a1434d3a93a9-6'},  
{ 'reasons': { 'count': 0,  
  'items': [{ 'summary': 'This spot is popular',  
    'type': 'general',  
    'reasonName': 'globalInteractionReason'}]},  
  'venue': { 'id': '4e3975ecbd4180188ce3453a',  
    'name': 'Dollar Tree',  
    'location': { 'address': '4756 South Kedzie Ave',  
      'lat': 41.8065723449043,  
      'lng': -87.70452913048803,  
      'labeledLatLngs': [{ 'label': 'display',  
        'lat': 41.8065723449043,  
        'lng': -87.70452913048803},  
      { 'label': 'entrance', 'lat': 41.806595, 'lng': -87.704153}],  
      'distance': 107,  
      'postalCode': '60632',  
      'cc': 'US',  
      'city': 'Chicago',  
      'state': 'IL',  
      'country': 'United States',  
      'formattedAddress': ['4756 South Kedzie Ave',  
        'Chicago, IL 60632',  
        'United States']},  
    'categories': [{ 'id': '52dea92d3cf9994f4e043dbb',  
      'name': 'Discount Store',  
      'pluralName': 'Discount Stores',  
      'shortName': 'Discount Store',  
      'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/di',  
        'suffix': '.png'},  
      'primary': True}],  
    'photos': { 'count': 0, 'groups': []},  
    'referralId': 'e-0-4e3975ecbd4180188ce3453a-7'},  
  { 'reasons': { 'count': 0,  
    'items': [{ 'summary': 'This spot is popular',  
      'type': 'general',  
      'reasonName': 'globalInteractionReason'}]},  
    'venue': { 'id': '4b51cb67f964a520ce5527e3',  
      'name': "Dunkin'",  
      'location': { 'address': '4701 S Kedzie Ave',  
        'crossStreet': 'at 47th St.',  
        'lat': 41.80797104818447,  
        'lng': -87.70329367881868,  
        'labeledLatLngs': [{ 'label': 'display',  
          'lat': 41.80797104818447,  
          'lng': -87.70329367881868},  
        { 'label': 'entrance', 'lat': 41.807907, 'lng': -87.703361}],
```

```
'distance': 80,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['4701 S Kedzie Ave (at 47th St.)',
'Chicago, IL 60632',
'United States']],
'categories': [{ 'id': '4bf58dd8d48988d148941735',
'name': 'Donut Shop',
'pluralName': 'Donut Shops',
'shortName': 'Donuts',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/donut.png',
'suffix': '.png'},
'primary': True}],
'photos': { 'count': 0, 'groups': []}],
'referralId': 'e-0-4b51cb67f964a520ce5527e3-8'},
{ 'reasons': { 'count': 0,
'items': [{ 'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '4c4e655e92b6a593ae95d46f',
'name': "Madd Anthony's Bar",
'location': { 'address': '3350 W 47th St',
'lat': 41.80824399151883,
'lng': -87.70835932296178,
'labeledLatLngs': [{ 'label': 'display',
'lat': 41.80824399151883,
'lng': -87.70835932296178 } ] },
'distance': 376,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['3350 W 47th St',
'Chicago, IL 60632',
'United States']],
'categories': [{ 'id': '4bf58dd8d48988d116941735',
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'categories': [{'id': '4bf58dd8d48988d1ce941735',
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'pluralName': 'Seafood Restaurants',
'shortName': 'Seafood',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/sea',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-4f32959719836c91c7e61331-27'},
{'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}}]],
'venue': {'id': '53764cd4498e08f3529e14f5',
'name': 'Cubicle Concepts',
'location': {'address': '4801 South Whipple Street',
'lat': 41.80609964,
'lng': -87.69982578,
'labeledLatLngs': [{'label': 'display',
'lat': 41.80609964,
'lng': -87.69982578},
{'label': 'entrance', 'lat': 41.806405, 'lng': -87.700139}],
'distance': 373,
'postalCode': '60632',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['4801 South Whipple Street',
'Chicago, IL 60632',
'United States']},
'categories': [{'id': '4bf58dd8d48988d1f8941735',
'name': 'Furniture / Home Store',
'pluralName': 'Furniture / Home Stores',
'shortName': 'Furniture / Home',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/fu',
'suffix': '.png'},
'primary': True}],
```

```
'photos': {'count': 0, 'groups': []},
'venuePage': {'id': '86058325'}},
'referralId': 'e-0-53764cd4498e08f3529e14f5-28'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4e1602df18a8addae8cf80bd',
  'name': 'The Athletes Foot',
  'location': {'address': '4824 s. Kedzie',
    'lat': 41.803354999999996,
    'lng': -87.705389,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.803354999999996,
      'lng': -87.705389}]},
  'distance': 470,
  'cc': 'US',
  'city': 'Chicago',
  'state': 'IL',
  'country': 'United States',
  'formattedAddress': ['4824 s. Kedzie',
    'Chicago, IL',
    'United States']},
  'categories': [{'id': '4bf58dd8d48988d107951735',
    'name': 'Shoe Store',
    'pluralName': 'Shoe Stores',
    'shortName': 'Shoes',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/ap',
      'suffix': '.png'},
    'primary': True}],
  'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-4e1602df18a8addae8cf80bd-29'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4d226427bdd7a093d423fdce',
  'name': "Lugano's Pizza",
  'location': {'address': '4460 S Kedzie Ave',
    'lat': 41.811809000000004,
    'lng': -87.704466,
    'labeledLatLngs': [{'label': 'display',
      'lat': 41.811809000000004,
      'lng': -87.704466},
    {'label': 'entrance', 'lat': 41.811821, 'lng': -87.70424}]},
  'distance': 488,
  'postalCode': '60632',
  'cc': 'US',
  'city': 'Chicago',
  'state': 'IL',
  'country': 'United States',
  'formattedAddress': ['4460 S Kedzie Ave',
    'Chicago, IL 60632',
    'United States']},
  'categories': [{'id': '4bf58dd8d48988d1ca941735',
    'name': 'Pizza Place',
    'pluralName': 'Pizza Places',
```



```

'shortName': 'Pizza',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/piz',
'suffix': '.png'},
'primary': True}],
'delivery': {'id': '31097',
'url': 'https://www.grubhub.com/restaurant/luganos-pizza-4460-s-kedz',
'provider': {'name': 'grubhub',
'icon': {'prefix': 'https://fastly.4sqi.net/img/general/cap/',
'sizes': [40, 50],
'name': '/delivery_provider_grubhub_20180129.png'}}},
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-4d226427bdd7a093d423fdce-30'}]]]]}

```

```

In [27]: # function that extracts the category of the venue
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

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

```

```

In [28]: venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

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

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

# clean columns
nearby_venues.columns = [col.split(".")[0] for col in nearby_venues.columns]

nearby_venues.head()

```

Out[28]:

	name	categories	lat	lng
0	Pete's Fresh Market	Grocery Store	41.807767	-87.704284
1	Carnitas Don Rafa	Mexican Restaurant	41.809206	-87.703963
2	LaCoco's Pizza & Pasta	Italian Restaurant	41.808380	-87.708364
3	Town & Country Self-Service Liquor Mart	Liquor Store	41.808341	-87.698332
4	T.J. Maxx	Department Store	41.803621	-87.705262

```
In [29]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0])
```

31 venues were returned by Foursquare.

```
In [30]: def getNearbyVenues(names, latitudes, longitudes, radius=500):

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

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&version={}&lat={}&lng={}&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 = ['Community',
                            'Community Latitude',
                            'Community Longitude',
                            'Venue',
                            'Venue Latitude',
                            'Venue Longitude',
                            'Venue Category']

    return(nearby_venues)
```

In [31]:

```
chicago_venues = getNearbyVenues(names=chicago_df['community_area_name'],
                                  latitudes=chicago_df['latitude'],
                                  longitudes=chicago_df['longitude']
                                  )

print(chicago_venues.shape) # please note: this might return an error if nun
```

[illegible]

[illegible]

[illegible]

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Avalon Park
Avalon Park
Avalon Park
Near South Side
Hermosa
Hermosa
Hermosa
Forest Glen
(9316, 7)

In [32]:

```
chicago_venues.head()
```

Out[32]:

	Community	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Brighton Park	41.80744050	-87.70395585	Pete's Fresh Market	41.807767	-87.704284	Grocery Store
1	Brighton Park	41.80744050	-87.70395585	Carnitas Don Rafa	41.809206	-87.703963	Mexican Restaurant
2	Brighton Park	41.80744050	-87.70395585	LaCoco's Pizza & Pasta	41.808380	-87.708364	Italian Restaurant
3	Brighton Park	41.80744050	-87.70395585	Town & Country Self-Service Liquor Mart	41.808341	-87.698332	Liquor Store
4	Brighton Park	41.80744050	-87.70395585	T.J. Maxx	41.803621	-87.705262	Department Store

In [33]:

```
chicago_venues.groupby('Community').count()
```

Out[33]:

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
Albany Park	134	134	134	134	134	134
Ashburn	52	52	52	52	52	52
Auburn Gresham	113	113	113	113	113	113
Austin	363	363	363	363	363	363
Avalon Park	55	55	55	55	55	55
Avondale	217	217	217	217	217	217
Belmont Cragin	80	80	80	80	80	80
Beverly	69	69	69	69	69	69
Bridgeport	19	19	19	19	19	19
Brighton Park	136	136	136	136	136	136
Burnside	2	2	2	2	2	2
Calumet Heights	100	100	100	100	100	100
Chatham	116	116	116	116	116	116
Chicago Lawn	117	117	117	117	117	117
Clearing	36	36	36	36	36	36
Douglas	68	68	68	68	68	68
Dunning	19	19	19	19	19	19
East Garfield Park	80	80	80	80	80	80
East Side	17	17	17	17	17	17
Edgewater	86	86	86	86	86	86
Englewood	149	149	149	149	149	149
Forest Glen	11	11	11	11	11	11
Fuller Park	28	28	28	28	28	28
Gage Park	68	68	68	68	68	68
Garfield Ridge	22	22	22	22	22	22
Grand Boulevard	96	96	96	96	96	96
Greater Grand Crossing	99	99	99	99	99	99
Hegewisch	6	6	6	6	6	6
Hermosa	50	50	50	50	50	50
Humboldt park	232	232	232	232	232	232

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
Hyde Park	56	56	56	56	56	56
Irving Park	202	202	202	202	202	202
Jefferson Park	25	25	25	25	25	25
Kenwood	44	44	44	44	44	44
Lake View	699	699	699	699	699	699
Lincoln Park	229	229	229	229	229	229
Lincoln Square	114	114	114	114	114	114
Logan Square	344	344	344	344	344	344
Loop	558	558	558	558	558	558
Lower West Side	284	284	284	284	284	284
McKinley Park	34	34	34	34	34	34
Montclair	16	16	16	16	16	16
Morgan Park	6	6	6	6	6	6
Near North Side	1046	1046	1046	1046	1046	1046
Near South Side	6	6	6	6	6	6
Near West Side	368	368	368	368	368	368
New City	89	89	89	89	89	89
North Center	176	176	176	176	176	176
North Lawndale	146	146	146	146	146	146
Norwood Park	41	41	41	41	41	41
O'Hare	266	266	266	266	266	266
Portage Park	84	84	84	84	84	84
Pullman	22	22	22	22	22	22
Riverdale	2	2	2	2	2	2
Rogers Park	164	164	164	164	164	164
Roseland	57	57	57	57	57	57
South Chicago	61	61	61	61	61	61
South Deering	46	46	46	46	46	46
South Lawndale	110	110	110	110	110	110
South Shore	136	136	136	136	136	136
Uptown	196	196	196	196	196	196
Washington Height	26	26	26	26	26	26
West Elsdon	61	61	61	61	61	61
West Englewood	58	58	58	58	58	58

	Community Latitude	Community Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Community						
West Garfield Park	112	112	112	112	112	112
West Lawn	99	99	99	99	99	99
West Pullman	25	25	25	25	25	25
West Ridge	148	148	148	148	148	148
West Town	457	457	457	457	457	457
Woodlawn	63	63	63	63	63	63

In [34]:

```
print('There are {} uniques categories.'.format(len(chicago_venues['Venue Ca
```

There are 385 uniques categories.

In [35]:

```
# one hot encoding
chicago_onehot = pd.get_dummies(chicago_venues[['Venue Category']], prefix='

# add community column back to dataframe
chicago_onehot['Community'] = chicago_venues['Community']

# move community column to the first column
fixed_columns = [chicago_onehot.columns[-1]] + list(chicago_onehot.columns[:
chicago_onehot = chicago_onehot[fixed_columns]

chicago_onehot.head()
```

Out[35]:

	Community	ATM	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	Airport	Airport Lounge	Airport Service
0	Brighton Park	0	0	0	0	0	0	0	0
1	Brighton Park	0	0	0	0	0	0	0	0
2	Brighton Park	0	0	0	0	0	0	0	0
3	Brighton Park	0	0	0	0	0	0	0	0
4	Brighton Park	0	0	0	0	0	0	0	0

	Community	ATM	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	Airport	Airp Loui
26	Greater Grand Crossing	0.000000	0.000000	0.000000	0.000000	0.020202	0.000000	0.000
27	Hegewisch	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
28	Hermosa	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
29	Humboldt park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
30	Hyde Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
31	Irving Park	0.000000	0.000000	0.000000	0.004950	0.000000	0.000000	0.000
32	Jefferson Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
33	Kenwood	0.000000	0.000000	0.000000	0.000000	0.022727	0.000000	0.000
34	Lake View	0.000000	0.000000	0.001431	0.000000	0.000000	0.000000	0.000
35	Lincoln Park	0.004367	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
36	Lincoln Square	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
37	Logan Square	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
38	Loop	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
39	Lower West Side	0.003521	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
40	McKinley Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
41	Montclair	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
42	Morgan Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
43	Near North Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
44	Near South Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
45	Near West Side	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
46	New City	0.000000	0.011236	0.000000	0.000000	0.000000	0.000000	0.000
47	North Center	0.000000	0.000000	0.005682	0.000000	0.000000	0.000000	0.000
48	North Lawndale	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
49	Norwood Park	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
50	O'Hare	0.000000	0.033835	0.000000	0.000000	0.000000	0.011278	0.090

In [37]:

```
num_top_venues = 5

for hood in chicago_grouped['Community']:
    print("----"+hood+"----")
    temp = chicago_grouped[chicago_grouped['Community'] == 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_top_venues))
    print('\n')
```

----Albany Park----

	venue	freq
0	Mexican Restaurant	0.09
1	Bus Station	0.06
2	Bakery	0.04
3	Middle Eastern Restaurant	0.04
4	Pizza Place	0.04

----Ashburn----

	venue	freq
0	Park	0.13
1	Pizza Place	0.10
2	Martial Arts Dojo	0.04
3	Liquor Store	0.04
4	Bakery	0.04

----Auburn Gresham----

	venue	freq
0	Discount Store	0.10
1	Pharmacy	0.08
2	Seafood Restaurant	0.07
3	Fast Food Restaurant	0.05
4	Chinese Restaurant	0.04

----Austin----

	venue	freq
0	Fast Food Restaurant	0.07
1	Sandwich Place	0.06
2	Park	0.05
3	Fried Chicken Joint	0.05
4	BBQ Joint	0.05

----Avalon Park----

	venue	freq
0	Fast Food Restaurant	0.13
1	Burger Joint	0.09
2	Sandwich Place	0.07
3	Diner	0.05
4	Fried Chicken Joint	0.05

----Avondale----

	venue	freq
0	Mexican Restaurant	0.05
1	Bus Station	0.04
2	Park	0.04
3	Grocery Store	0.03
4	Bar	0.03

----Belmont Cragin----

	venue	freq
0	Mexican Restaurant	0.10
1	Pizza Place	0.09
2	Pharmacy	0.08
3	Fast Food Restaurant	0.08
4	Cuban Restaurant	0.06

----Beverly----

	venue	freq
0	Cosmetics Shop	0.07
1	Park	0.06
2	Burger Joint	0.04
3	Pizza Place	0.04
4	Fast Food Restaurant	0.04

----Bridgeport----

	venue	freq
0	Mexican Restaurant	0.11
1	Mediterranean Restaurant	0.11
2	Bar	0.11
3	Pizza Place	0.11
4	Convenience Store	0.05

----Brighton Park----

	venue	freq
0	Mexican Restaurant	0.10
1	Seafood Restaurant	0.05
2	Grocery Store	0.05
3	Taco Place	0.04
4	Pizza Place	0.04

----Burnside----

	venue	freq
0	Park	0.5
1	Bus Station	0.5
2	ATM	0.0
3	Optical Shop	0.0
4	Paper / Office Supplies Store	0.0

----Calumet Heights----

	venue	freq
0	Pharmacy	0.08
1	Fast Food Restaurant	0.06
2	Chinese Restaurant	0.06
3	Fried Chicken Joint	0.04
4	Wings Joint	0.04

----Chatham----

	venue	freq
0	Sandwich Place	0.08
1	Fast Food Restaurant	0.07
2	Fried Chicken Joint	0.04
3	Pizza Place	0.04
4	Bus Station	0.03

----Chicago Lawn----

	venue	freq
0	Discount Store	0.09
1	Fast Food Restaurant	0.09
2	Mexican Restaurant	0.09
3	Sandwich Place	0.05
4	Intersection	0.05

----Clearing----

	venue	freq
0	Mexican Restaurant	0.08
1	Restaurant	0.08
2	Pizza Place	0.08
3	Construction & Landscaping	0.08
4	Hot Dog Joint	0.06

----Douglas----

	venue	freq
0	Park	0.07
1	Sandwich Place	0.07
2	Fast Food Restaurant	0.06
3	Gym / Fitness Center	0.04
4	Bus Station	0.04

----Dunning----

	venue	freq
0	Bar	0.21
1	Café	0.05
2	Donut Shop	0.05
3	Mexican Restaurant	0.05
4	Scenic Lookout	0.05

----East Garfield Park----

	venue	freq
0	Diner	0.12
1	Discount Store	0.12

2	American Restaurant	0.09
3	Pharmacy	0.09
4	Food	0.06

----East Side----

	venue	freq
0	Mexican Restaurant	0.18
1	ATM	0.06
2	Convenience Store	0.06
3	Baseball Field	0.06
4	Bar	0.06

----Edgewater----

	venue	freq
0	Gym	0.05
1	Coffee Shop	0.03
2	Mexican Restaurant	0.03
3	Bakery	0.03
4	Breakfast Spot	0.03

----Englewood----

	venue	freq
0	Fast Food Restaurant	0.13
1	Pizza Place	0.05
2	Sandwich Place	0.05
3	Train Station	0.05
4	Park	0.05

----Forest Glen----

	venue	freq
0	Pizza Place	0.09
1	BBQ Joint	0.09
2	Sandwich Place	0.09
3	Donut Shop	0.09
4	Ice Cream Shop	0.09

----Fuller Park----

	venue	freq
0	Fast Food Restaurant	0.14
1	Park	0.07
2	Pizza Place	0.07
3	Women's Store	0.07
4	Fried Chicken Joint	0.07

----Gage Park----

	venue	freq
0	Mexican Restaurant	0.19
1	Bakery	0.06
2	Gym / Fitness Center	0.04
3	Food & Drink Shop	0.04
4	Coffee Shop	0.04

----Garfield Ridge----

	venue	freq
0	Pizza Place	0.14
1	Breakfast Spot	0.05
2	Convenience Store	0.05
3	Mexican Restaurant	0.05
4	Thai Restaurant	0.05

----Grand Boulevard----

	venue	freq
0	Park	0.12
1	Discount Store	0.05
2	Seafood Restaurant	0.04
3	BBQ Joint	0.04
4	Bus Station	0.04

----Greater Grand Crossing----

	venue	freq
0	American Restaurant	0.09
1	Fast Food Restaurant	0.08
2	Grocery Store	0.06
3	Lounge	0.06
4	Seafood Restaurant	0.06

----Hegewisch----

	venue	freq
0	Bar	0.33
1	Intersection	0.17
2	Hostel	0.17
3	Fast Food Restaurant	0.17
4	Resort	0.17

----Hermosa----

	venue	freq
0	Mexican Restaurant	0.12
1	Grocery Store	0.06
2	Fast Food Restaurant	0.04
3	Pharmacy	0.04
4	Pizza Place	0.04

----Humboldt park----

	venue	freq
0	Park	0.09
1	Mexican Restaurant	0.06
2	Grocery Store	0.06
3	Fast Food Restaurant	0.04
4	Music Venue	0.04

----Hyde Park----

	venue	freq
0	Bus Station	0.09
1	Sandwich Place	0.09
2	Thai Restaurant	0.05
3	Deli / Bodega	0.04
4	Grocery Store	0.04

----Irving Park----

	venue	freq
0	Bar	0.06
1	Bus Station	0.05
2	Pizza Place	0.04
3	Sandwich Place	0.04
4	Donut Shop	0.03

----Jefferson Park----

	venue	freq
0	Pub	0.08
1	Mexican Restaurant	0.08
2	Park	0.08
3	Train Station	0.08
4	Pizza Place	0.08

----Kenwood----

	venue	freq
0	Discount Store	0.09
1	Fast Food Restaurant	0.09
2	Art Gallery	0.07
3	Bus Station	0.07
4	Fried Chicken Joint	0.07

----Lake View----

	venue	freq
0	Coffee Shop	0.04
1	Bar	0.04
2	Mexican Restaurant	0.04
3	Pizza Place	0.03
4	Spa	0.03

----Lincoln Park----

	venue	freq
0	Coffee Shop	0.05
1	Music Venue	0.03
2	Hot Dog Joint	0.03
3	Sushi Restaurant	0.03
4	Pizza Place	0.03

----Lincoln Square----

	venue	freq
0	Bar	0.08
1	Pizza Place	0.04

2	Coffee Shop	0.04
3	Thai Restaurant	0.04
4	New American Restaurant	0.03

----Logan Square----

	venue	freq
0	Bar	0.04
1	Mexican Restaurant	0.04
2	Coffee Shop	0.04
3	Park	0.02
4	Cocktail Bar	0.02

----Loop----

	venue	freq
0	Coffee Shop	0.06
1	Hotel	0.06
2	Sandwich Place	0.05
3	Theater	0.04
4	Mediterranean Restaurant	0.03

----Lower West Side----

	venue	freq
0	Mexican Restaurant	0.18
1	Pizza Place	0.05
2	Art Gallery	0.05
3	Bar	0.04
4	Bakery	0.03

----McKinley Park----

	venue	freq
0	Video Store	0.09
1	Mexican Restaurant	0.09
2	Fried Chicken Joint	0.06
3	Train Station	0.06
4	Supermarket	0.06

----Montclair----

	venue	freq
0	Liquor Store	0.12
1	Park	0.12
2	Czech Restaurant	0.06
3	Dive Bar	0.06
4	Gift Shop	0.06

----Morgan Park----

	venue	freq
0	Currency Exchange	0.17
1	American Restaurant	0.17
2	Park	0.17
3	Track	0.17
4	BBQ Joint	0.17

----Near North Side----

	venue	freq
0	Hotel	0.08
1	Italian Restaurant	0.06
2	Coffee Shop	0.04
3	American Restaurant	0.04
4	Steakhouse	0.03

----Near South Side----

	venue	freq
0	Train Station	0.17
1	Gym / Fitness Center	0.17
2	Fast Food Restaurant	0.17
3	Pharmacy	0.17
4	Hotel	0.17

----Near West Side----

	venue	freq
0	Sandwich Place	0.06
1	Park	0.05
2	Fast Food Restaurant	0.04
3	Bus Station	0.04
4	Pizza Place	0.03

----New City----

	venue	freq
0	Mexican Restaurant	0.07
1	Cocktail Bar	0.06
2	Intersection	0.06
3	Discount Store	0.06
4	Clothing Store	0.04

----North Center----

	venue	freq
0	Bus Station	0.09
1	Bar	0.05
2	Pizza Place	0.04
3	Salon / Barbershop	0.04
4	Liquor Store	0.03

----North Lawndale----

	venue	freq
0	Fast Food Restaurant	0.13
1	Sandwich Place	0.05
2	Cosmetics Shop	0.04
3	Fried Chicken Joint	0.04
4	Movie Theater	0.04

----Norwood Park----

	venue	freq
0	Pizza Place	0.15
1	Bar	0.07
2	Flower Shop	0.05
3	Jewelry Store	0.05
4	Moving Target	0.05

----O'Hare----

	venue	freq
0	Coffee Shop	0.09
1	Airport Lounge	0.09
2	Airport Service	0.08
3	Snack Place	0.07
4	Accessories Store	0.03

----Portage Park----

	venue	freq
0	Mexican Restaurant	0.07
1	Gas Station	0.05
2	Sandwich Place	0.05
3	Pizza Place	0.05
4	Fast Food Restaurant	0.04

----Pullman----

	venue	freq
0	Park	0.14
1	Train Station	0.09
2	Sandwich Place	0.09
3	ATM	0.05
4	Pharmacy	0.05

----Riverdale----

	venue	freq
0	Harbor / Marina	0.5
1	Park	0.5
2	Music Venue	0.0
3	Paper / Office Supplies Store	0.0
4	Pakistani Restaurant	0.0

----Rogers Park----

	venue	freq
0	Mexican Restaurant	0.16
1	Sandwich Place	0.07
2	Bakery	0.05
3	Taco Place	0.04
4	Pizza Place	0.04

----Roseland----

	venue	freq
0	Food	0.14
1	Bus Station	0.09

2	Park	0.09
3	Convenience Store	0.07
4	Liquor Store	0.05

----South Chicago----

	venue	freq
0	Pizza Place	0.11
1	Mexican Restaurant	0.08
2	Train Station	0.07
3	Discount Store	0.05
4	Park	0.05

----South Deering----

	venue	freq
0	Fast Food Restaurant	0.09
1	Park	0.09
2	Cosmetics Shop	0.07
3	Sandwich Place	0.04
4	Fried Chicken Joint	0.04

----South Lawndale----

	venue	freq
0	Mexican Restaurant	0.25
1	Sandwich Place	0.05
2	Taco Place	0.05
3	Fast Food Restaurant	0.05
4	Gas Station	0.04

----South Shore----

	venue	freq
0	Pizza Place	0.09
1	Sandwich Place	0.06
2	Train Station	0.06
3	Grocery Store	0.06
4	Discount Store	0.06

----Uptown----

	venue	freq
0	Vietnamese Restaurant	0.06
1	Bus Station	0.06
2	Coffee Shop	0.05
3	Mexican Restaurant	0.05
4	Pizza Place	0.05

----Washington Height----

	venue	freq
0	Fried Chicken Joint	0.15
1	Pizza Place	0.12
2	Discount Store	0.08
3	Shop & Service	0.08
4	Sandwich Place	0.08

----West Elsdon----

	venue	freq
0	Mexican Restaurant	0.10
1	Bar	0.08
2	Pizza Place	0.08
3	Pharmacy	0.07
4	Ice Cream Shop	0.07

----West Englewood----

	venue	freq
0	Fast Food Restaurant	0.10
1	Park	0.09
2	Cosmetics Shop	0.07
3	Southern / Soul Food Restaurant	0.05
4	Discount Store	0.05

----West Garfield Park----

	venue	freq
0	Fast Food Restaurant	0.15
1	Shoe Store	0.10
2	Train Station	0.07
3	Sandwich Place	0.06
4	Cosmetics Shop	0.04

----West Lawn----

	venue	freq
0	Shoe Store	0.14
1	Discount Store	0.06
2	Mobile Phone Shop	0.06
3	Hotel	0.04
4	Kids Store	0.04

----West Pullman----

	venue	freq
0	Bar	0.16
1	Resort	0.08
2	Food	0.08
3	Train Station	0.08
4	Bus Station	0.08

----West Ridge----

	venue	freq
0	Indian Restaurant	0.06
1	Korean Restaurant	0.06
2	Grocery Store	0.06
3	Bakery	0.05
4	Pizza Place	0.04

----West Town----

	venue	freq
0	Mexican Restaurant	0.05
1	Coffee Shop	0.05
2	Bar	0.04
3	Pizza Place	0.04
4	Yoga Studio	0.02

----Woodlawn----

	venue	freq
0	Fast Food Restaurant	0.11
1	Food	0.06
2	Train Station	0.06
3	Cosmetics Shop	0.06
4	American Restaurant	0.06

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 = ['Community']
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
community_venues_sorted = pd.DataFrame(columns=columns)
community_venues_sorted['Community'] = chicago_grouped['Community']

for ind in np.arange(chicago_grouped.shape[0]):
    community_venues_sorted.iloc[ind, 1:] = return_most_common_venues(chicago_grouped[ind, :], num_top_venues)

community_venues_sorted.head()
```

Out[39]:

	Community	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 Most Common Venue
0	Albany Park	Mexican Restaurant	Bus Station	Middle Eastern Restaurant	Bakery	Pizza Place	Park	Ice Cream Shop
1	Ashburn	Park	Pizza Place	Mexican Restaurant	Liquor Store	Bus Station	Martial Arts Dojo	Cosmetics Shop
2	Auburn Gresham	Discount Store	Pharmacy	Seafood Restaurant	Fast Food Restaurant	Sandwich Place	Chinese Restaurant	Lounge
3	Austin	Fast Food Restaurant	Sandwich Place	Fried Chicken Joint	Park	BBQ Joint	Discount Store	Chinese Restaurant
4	Avalon Park	Fast Food Restaurant	Burger Joint	Sandwich Place	Grocery Store	Fried Chicken Joint	Diner	ATM

```
In [40]: # set number of clusters
kclusters = 5

chicago_grouped_clustering = chicago_grouped.drop('Community', 1)

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

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

```
Out[40]: array([0, 0, 2, 2, 2, 0, 0, 2, 0, 0])
```

```
In [41]: # add clustering labels
community_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
```

```
In [42]: chicago_merged = chicago_df

# merge chicago_merged with chicago_df to add latitude/longitude for each community
chicago_merged = chicago_merged.join(community_venues_sorted.set_index('Community', 'Cluster Labels'))

chicago_merged.sort_values('primary_type').head()
```

```
Out[42]:
```

	id	primary_type	latitude	longitude	community_area_name	Cluster Labels	1st I Com Ve
467	4607081	ARSON	41.67980945	-87.62587044	West Pullman	3	
453	9692995	ARSON	41.65371054	-87.60952871	Riverdale	4	Har Mi
396	4681320	ASSAULT	41.75501329	-87.66598631	Auburn Gresham	2	Disc ξ
397	3661130	ASSAULT	41.74047635	-87.65468280	Auburn Gresham	2	Disc ξ
431	10502099	ASSAULT	41.87014181	-87.69703716	East Garfield Park	2	Disc ξ

In [43]:

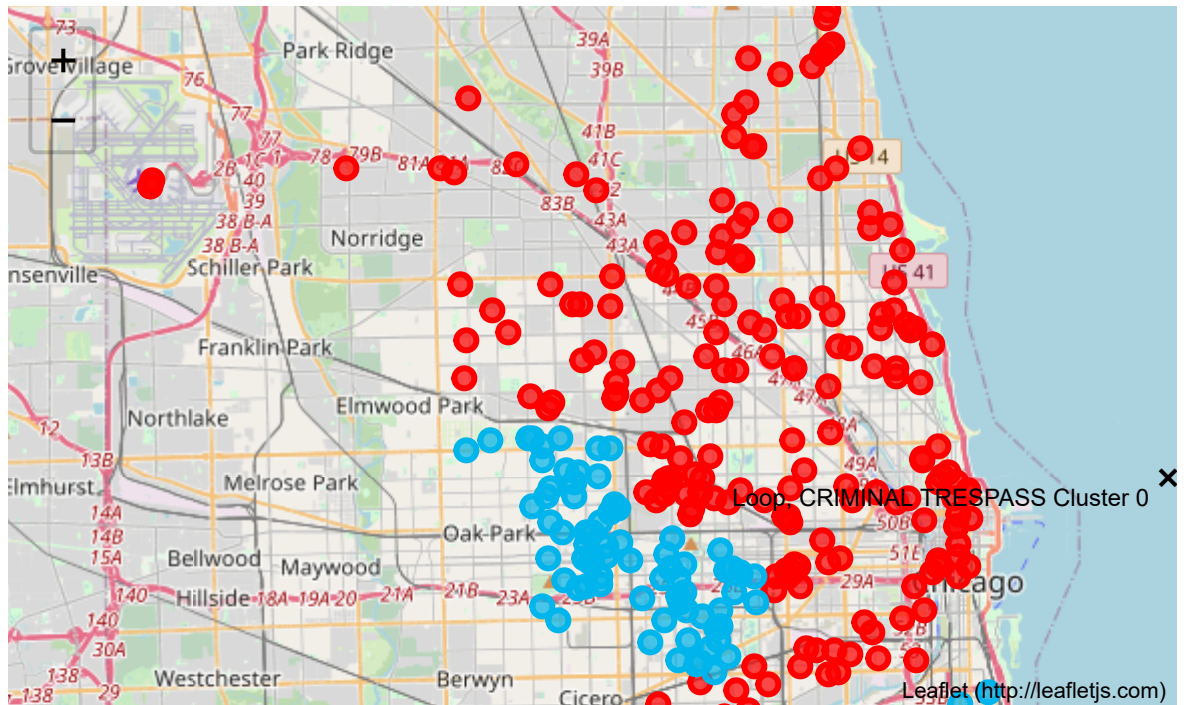
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# 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, lng, poi, crime, cluster in zip(chicago_merged['latitude'], chicago_merged['longitude'],
    chicago_merged['poi'], chicago_merged['crime'], chicago_merged['cluster']):
    label = '{} , {}'.format(poi, crime)
    label = folium.Popup(label + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        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[43]:



In [44]:

```
# select rows by cluster and include columns 2 - 15
cluster0 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 0, chicago_merged.columns[2:16]]
print(cluster0.shape)
```

(249, 12)

```
In [45]: cluster1 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 1, chicago_merged]
print(cluster1.shape)
```

(1, 12)

```
In [46]: cluster2 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 2, chicago_merged]
print(cluster2.shape)
```

(228, 12)

```
In [47]: cluster3 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 3, chicago_merged]
print(cluster3.shape)
```

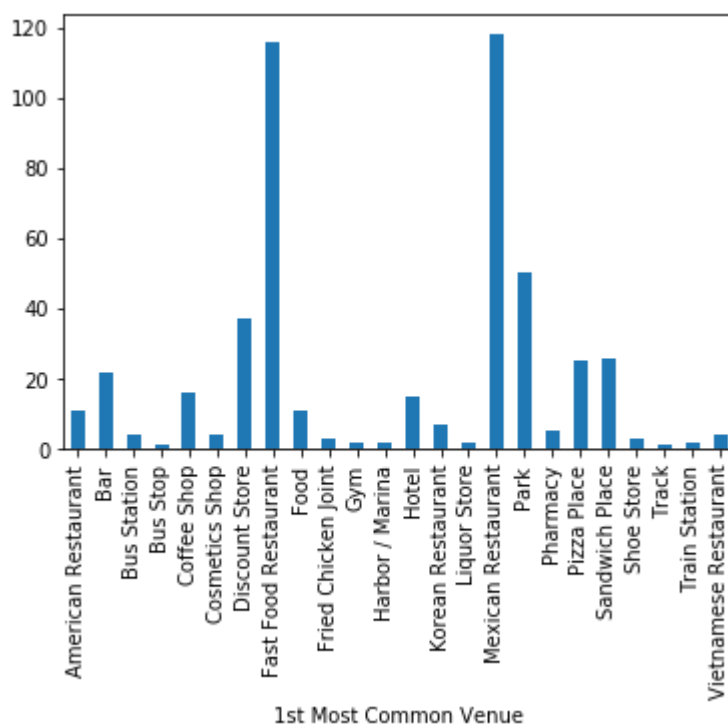
(7, 12)

```
In [48]: cluster4 = chicago_merged.loc[chicago_merged['Cluster Labels'] == 4, chicago_merged]
print(cluster4.shape)
```

(2, 12)

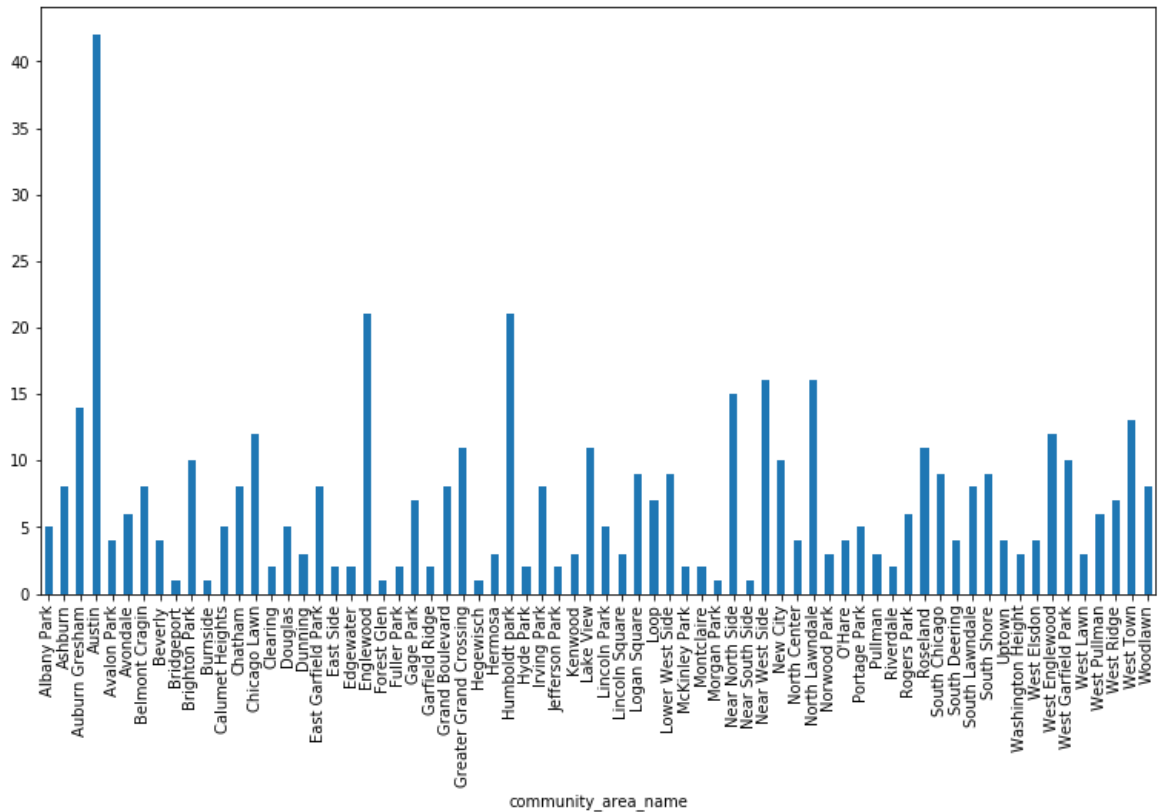
```
In [87]: chicago_merged.groupby('1st Most Common Venue')['primary_type'].count().plot
```

Out[87]: <matplotlib.axes._subplots.AxesSubplot at 0x2624ef6ea08>



```
In [81]: plt.figure(figsize=(13,7))
chicago_merged.groupby('community_area_name')['primary_type'].count().plot(k
```

```
Out[81]: <matplotlib.axes._subplots.AxesSubplot at 0x2624bd2d508>
```



```
In [ ]:
```