

Kafor-Final-Project

September 1, 2020

0.0.1 Introduction

The objective is to look at the different venues between University of Chicago and Georgia Institute of Technology (Georgia Tech) since these are universities people as myself would want to attend for a degree. Both locations have good reputations as public institutions so the problem to solve was to find out what venues are available in the areas that does not require long travel. Many people who decide to stay near a campus ride a bike or use there four legs as a mode of transportation and need close by locations for daily activities and community.

To get started, before even running any code first library modules had to be imported.

```
[1]: import pandas as pd
import numpy as np
import requests

!conda install -c conda-forge geopy --yes
import geopy as geopy
from geopy.geocoders import Nominatim

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

!conda install -c conda-forge folium=0.5.0 --yes
import folium # map rendering library

print("Libraries Imported")
```

```
Collecting package metadata (current_repodata.json): done
Solving environment: done
```

```
==> WARNING: A newer version of conda exists. <==
current version: 4.8.3
latest version: 4.8.4
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

```
# All requested packages already installed.
```

```
Collecting package metadata (current_repodata.json): done  
Solving environment: done
```

```
==> WARNING: A newer version of conda exists. <==  
  current version: 4.8.3  
  latest version: 4.8.4
```

Please update conda by running

```
$ conda update -n base -c defaults conda
```

```
# All requested packages already installed.
```

Libraries Imported

0.1 Data Collection

The data for the venues was retrieved using the Foursquare Places API. The Places API offers real-time access to Foursquare's global database of rich venue data and user content to power your location-based experiences.

0.1.1 Foursquare Credentials

```
[2]: CLIENT_ID = 'MWBMLLDCHCNFVS0405PNGLHJPOEWOMAD1MEE00SKMOFSJX'  
      CLIENT_SECRET = '3J30Z5F4I5WW50TRZ0OWNMREHZE0ANOANIOUC3VG2AN5DIM3'  
      VERSION = '20200825'  
  
      print('Credentials:')  
      print('CLIENT_ID: ' + CLIENT_ID)  
      print('CLIENT_SECRET:' + CLIENT_SECRET)
```

Credentials:

CLIENT_ID: MWBMLLDCHCNFVS0405PNGLHJPOEWOMAD1MEE00SKMOFSJX

CLIENT_SECRET: 3J30Z5F4I5WW50TRZ0OWNMREHZE0ANOANIOUC3VG2AN5DIM3

0.1.2 Coordinates

The addresses from both institutions were retrieved from Google Knowledge Graph through search. The Geocoder module was used to get the coordinates for both institutions.

Get nearby venues by Chicago - University of Chicago Address: 5801 S Ellis Ave, Chicago, IL 60637

```
[3]: address = "5801 S Ellis Ave, Chicago, IL 60637"

geolocator = Nominatim(user_agent="ca_explorer")
location = geolocator.geocode(address)
chi_latitude = location.latitude
chi_longitude = location.longitude
print('The geographical coordinate of University of Chicago are {}, {}'.format(chi_latitude, chi_longitude))
```

The geographical coordinate of University of Chicago are 41.784977, -87.5905237123017.

```
[4]: #Map of Chicago using latitude and longitude values
map_chicago = folium.Map(location=[chi_latitude, chi_longitude], zoom_start=10)
map_chicago
```

```
[4]: <folium.folium.Map at 0x7faeac50a780>
```

Get nearby venues by Atlanta - Georgia Institute of Technology Address: North Ave NW, Atlanta, GA 30332

```
[5]: address = "North Ave NW, Atlanta, GA 30332"

geolocator = Nominatim(user_agent="ca_explorer")
location = geolocator.geocode(address)
atl_latitude = location.latitude
atl_longitude = location.longitude
print('The geographical coordinates of Georgia Tech are {}, {}'.format(atl_latitude, atl_longitude))
```

The geographical coordinates of Georgia Tech are 33.7713526, -84.396345.

```
[6]: #Map of Atlanta using latitude and longitude values
map_atlanta = folium.Map(location=[atl_latitude, atl_longitude], zoom_start=10)
map_atlanta
```

```
[6]: <folium.folium.Map at 0x7fae8e0a31d0>
```

0.2 Explore Venues

At first I reduced the radius and then increased it to 500 in order to generate enough venues nearby the universities. The campus size of University of Chicago is 217 acres and as for Georgia Institute of Technology (Georgia Tech), its almost twice as large with over 400 acres according to Google's Knowledge Graph. I completely forgot how large universities can be so this made sense to extend the radius to an appropriate size (500). Even within a 500 radius of the area there was only 13 venue listings nearby the University of Chicago and 17 nearby Georgia Institute of Technology (Georgia Tech). I did set the limit of venues to 100 although the cap was not necessary after seeing that not many locations were not available from either institution.

```
[7]: #Limit 100
      #Radius 500 miles

LIMIT = 100
radius = 500
url = 'https://api.foursquare.com/v2/venues/explore?
      ↪&client_id={} &client_secret={} &v={} &ll={},{} &radius={} &limit={} '.format(
          CLIENT_ID,
          CLIENT_SECRET,
          VERSION,
          chi_latitude,
          chi_longitude,
          radius,
          LIMIT)

# get the result to a json file
chi_results = requests.get(url).json()
chi_results

[7]: {'meta': {'code': 200, 'requestId': '5f4e92bdcd73241163881aba'},
      'response': {'suggestedFilters': {'header': 'Tap to show:',
                                         'filters': [{'name': 'Open now', 'key': 'openNow'}]},
                   'headerLocation': 'Woodlawn',
                   'headerFullLocation': 'Woodlawn, Chicago',
                   'headerLocationGranularity': 'neighborhood',
                   'totalResults': 16,
                   'suggestedBounds': {'ne': {'lat': 41.7894770045, 'lng': -87.58449997727499},
                                         'sw': {'lat': 41.780476995499995, 'lng': -87.59654744732842}},
                   'groups': [{'type': 'Recommended Places',
                                'name': 'recommended',
                                'items': [{'reasons': {'count': 0,
                                                         'items': [{'summary': 'This spot is popular',
                                                                      'type': 'general',
                                                                      'reasonName': 'globalInteractionReason'}]}],
                                'venue': {'id': '594ac600419a9e72144fd6a7',
                                           'name': 'Build Coffee',
                                           'location': {'address': '6100 S Blackstone Ave',
                                                         'lat': 41.78428847865535,
                                                         'lng': -87.59041927423924,
                                                         'labeledLatLngs': [{'label': 'display',
                                                                 'lat': 41.78428847865535,
                                                                 'lng': -87.59041927423924},
                                                                 {'label': 'entrance', 'lat': 41.784157, 'lng': -87.590381}],
                                                         'distance': 77,
                                                         'postalCode': '60637',
                                                         'cc': 'US',
                                                         'city': 'Chicago',
```

```

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    'United States']},
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    'pluralName': 'Coffee Shops',
    'shortName': 'Coffee Shop',
    'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
    'suffix': '.png'},
    'primary': True}],
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    'reasonName': 'globalInteractionReason'}]},
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    'location': { 'address': '61st between Dorchester and Blackstone',
    'lat': 41.784296089572855,
    'lng': -87.59079036498159,
    'labeledLatLngs': [{ 'label': 'display',
    'lat': 41.784296089572855,
    'lng': -87.59079036498159}],
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    'city': 'Chicago',
    'state': 'IL',
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    'United States']},
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    'pluralName': 'Markets',
    'shortName': 'Market',
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'https://ss3.4sqi.net/img/categories_v2/shops/market_',
    'suffix': '.png'},
    'primary': True}],
    'photos': { 'count': 0, 'groups': []},
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    'items': [{ 'summary': 'This spot is popular',

```

```

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    'reasonName': 'globalInteractionReason']]],
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'lng': -87.59445752907632,
'labeledLatLngs': [{'label': 'display',
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'lng': -87.59445752907632}]},
'distance': 369,
'postalCode': '60637',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
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'Chicago, IL 60637',
'United States']},
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'shortName': 'Park',
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'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []}},
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'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason']]],
'venuue': {'id': '4f191ac9e4b099f9dc3cfcf0',
'name': 'University of Chicago @ Midway Plaisance',
'location': {'address': '60th & Dorchester',
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'lng': -87.5887820041004,
'labeledLatLngs': [{'label': 'display',
'lat': 41.787751302023764,
'lng': -87.5887820041004}]},
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'cc': 'US',
'city': 'Chicago',
'state': 'IL',

```

```

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    'shortName': 'Park',
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    'suffix': '.png'},
    'primary': True}],
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    'reasonName': 'globalInteractionReason' } ] },
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    'United States']],
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```

```

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'lng': -87.59003496666666},
{'label': 'entrance', 'lat': 41.785884, 'lng': -87.590542}],
'distance': 123,
'postalCode': '60637',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['1427 E 60th St (Blackstone)',
'Chicago, IL 60637',
'United States']},
'categories': [{'id': '4bf58dd8d48988d16d941735',
'name': 'Café',
'pluralName': 'Cafés',
'shortName': 'Café',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/cafe_',
'suffix': '.png'},
'primary': True}],
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'venue': {'id': '5208e5be498ec4bb24440e34',
'name': 'Jackson Towers Fitness',
'location': {'address': '60th & Harper',
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'lng': -87.58879937037533}],
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```



```

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    'name': 'Metra - 59th St (University of Chicago)',
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    'crossStreet': 'at Harper Ave',
    'lat': 41.787728868561125,
    'lng': -87.588788713734,
    'labeledLatLngs': [{ 'label': 'display',
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    'lng': -87.588788713734}],
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    'cc': 'US',
    'city': 'Chicago',
    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['59th St (at Harper Ave)',
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    'United States']},
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    'pluralName': 'Train Stations',
    'shortName': 'Train Station',
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    'suffix': '.png'},
    'primary': True}],
    'photos': { 'count': 0, 'groups': []},
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```

```

    'items': [{ 'summary': 'This spot is popular',
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                  'reasonName': 'globalInteractionReason' } ] },
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                'location': { 'address': '6100 S Stony Island Ave',
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                              'state': 'IL',
                              'country': 'United States',
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                                                      'United States' ] },
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                                   'suffix': '.png' },
                                   'primary': True } ],
                'photos': { 'count': 0, 'groups': [] },
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                                'type': 'general',
                                'reasonName': 'globalInteractionReason' } ] },
      'venue': { 'id': '4e5d4dec31519cd0f266871a',
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                  'location': { 'address': '1414 E 59th St',
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                                'city': 'Chicago',

```

```

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    'shortName': 'Coffee Shop',
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    'primary': True}],
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    'location': { 'address': '1414 E 59th St',
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    'suffix': '.png'},
    'primary': True}],
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```

```

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                'location': { 'address': '1607 E 59th St',
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                              'lat': 41.78794281,
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                              'labeledLatLngs': [ { 'label': 'display',
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                'distance': 377,
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                'city': 'Chicago',
                'state': 'IL',
                'country': 'United States',
                'formattedAddress': [ '1607 E 59th St (Harper Ave & 59th St)',
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                                      'United States' ] ],
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'https://ss3.4sqi.net/img/categories_v2/shops/bikeshop_',
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    'venue': { 'id': '4e52c89962840c1260e1e164',
                'name': 'Huckleberry Park',
                'location': { 'address': '6200 S Kimbark Ave',
                              'crossStreet': 'at 62nd St.',
                              'lat': 41.78232103190902,
                              'lng': -87.59480953216553,
                              'labeledLatLngs': [ { 'label': 'display',
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                                                       'lng': -87.59480953216553 } ] ],
                'distance': 462,
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                'cc': 'US',
                'city': 'Chicago',

```

```

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    'United States']],
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    'name': 'Playground',
    'pluralName': 'Playgrounds',
    'shortName': 'Playground',
    'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/playground_',
    'suffix': '.png'},
    'primary': True}],
    'photos': { 'count': 0, 'groups': [] },
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    'type': 'general',
    'reasonName': 'globalInteractionReason' } ] },
    'venue': { 'id': '5164a455e4b061c025433e20',
    'name': 'CTA Bus Stop 1513',
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    'labeledLatLngs': [{ 'label': 'display',
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    'state': 'IL',
    'country': 'United States',
    'formattedAddress': ['Chicago, IL', 'United States' ] },
    'categories': [{ 'id': '4bf58dd8d48988d1fe931735',
    'name': 'Bus Station',
    'pluralName': 'Bus Stations',
    'shortName': 'Bus Station',
    'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/travel/busstation_',
    'suffix': '.png'},
    'primary': True}],
    'photos': { 'count': 0, 'groups': [] },
    'referralId': 'e-0-5164a455e4b061c025433e20-13'},
    {'reasons': { 'count': 0,
    'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason' } ] },
    'venue': { 'id': '5aaff0bac58ed74dce15da95',

```

```

'name': "Leon's Barbecue",
'location': {'address': '63rd and Harper',
'lat': 41.780854,
'lng': -87.588451,
'labeledLatLngs': [{'label': 'display',
'lat': 41.780854,
'lng': -87.588451}]},
'distance': 490,
'postalCode': '60637',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['63rd and Harper',
'Chicago, IL 60637',
'United States']},
'categories': [{'id': '4bf58dd8d48988d1df931735',
'name': 'BBQ Joint',
'pluralName': 'BBQ Joints',
'shortName': 'BBQ',
'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/bbqalt_',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []},
'referralId': 'e-0-5aaff0bac58ed74dce15da95-14'},
'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '4f324e9d19836c91c7caceed',
'name': 'Tres Original Pancakes',
'location': {'address': '1528 E 63rd St',
'lat': 41.78086853027344,
'lng': -87.58818817138672,
'labeledLatLngs': [{'label': 'display',
'lat': 41.78086853027344,
'lng': -87.58818817138672}]},
'distance': 496,
'postalCode': '60637',
'cc': 'US',
'city': 'Chicago',
'state': 'IL',
'country': 'United States',
'formattedAddress': ['1528 E 63rd St',
'Chicago, IL 60637',
'United States']},

```

```

        'categories': [{ 'id': '4d4b7105d754a06374d81259',
                          'name': 'Food',
                          'pluralName': 'Food',
                          'shortName': 'Food',
                          'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/default_',
                                'suffix': '.png' },
                          'primary': True }],
        'photos': { 'count': 0, 'groups': [] },
        'referralId': 'e-0-4f324e9d19836c91c7caceed-15' } ] ] ] }

```

0.2.1 Explore Venues nearby Georgia Institute of Technology

```

[8]: #Limit 100
     #Radius 500 miles

LIMIT = 100
radius = 500
url = 'https://api.foursquare.com/v2/venues/explore?
->&client_id={} &client_secret={} &v={} &ll={}, {} &radius={} &limit={}' .format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    atl_latitude,
    atl_longitude,
    radius,
    LIMIT)

# get the result to a json file
atl_results = requests.get(url).json()
atl_results

```

```

[8]: { 'meta': { 'code': 200, 'requestId': '5f4e94af1883f35ebf4e6afa' },
      'response': { 'suggestedFilters': { 'header': 'Tap to show:',
      'filters': [ { 'name': 'Open now', 'key': 'openNow' } ] },
      'headerLocation': 'Marietta Street Artery',
      'headerFullLocation': 'Marietta Street Artery, Atlanta',
      'headerLocationGranularity': 'neighborhood',
      'totalResults': 18,
      'suggestedBounds': { 'ne': { 'lat': 33.7758526045, 'lng': -84.39094164975738 },
      'sw': { 'lat': 33.7668525955, 'lng': -84.40174835024261 } },
      'groups': [ { 'type': 'Recommended Places',
      'name': 'recommended',
      'items': [ { 'reasons': { 'count': 0,
      'items': [ { 'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason' } ] },

```

```

'venue': {'id': '555639d2498ea5420402bccd',
'name': 'Coca-Cola Mainstreet @ AOC',
'location': {'address': '1 Coca Cola Plz NW',
'lat': 33.7709799841634,
'lng': -84.39803676785081,
'labeledLatLngs': [{'label': 'display',
'lat': 33.7709799841634,
'lng': -84.39803676785081}]},
'distance': 161,
'postalCode': '30313',
'cc': 'US',
'city': 'Atlanta',
'state': 'GA',
'country': 'United States',
'formattedAddress': ['1 Coca Cola Plz NW',
'Atlanta, GA 30313',
'United States']},
'categories': [{'id': '4bf58dd8d48988d14e941735',
'name': 'American Restaurant',
'pluralName': 'American Restaurants',
'shortName': 'American',
'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/default_',
'suffix': '.png'},
'primary': True}],
'photos': {'count': 0, 'groups': []},
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'reasons': {'count': 0,
'items': [{'summary': 'This spot is popular',
'type': 'general',
'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '512e4185e0e26a825ba3c825',
'name': 'Highland Bakery',
'location': {'address': '225 North Ave NW',
'lat': 33.77264610481115,
'lng': -84.39458549022675,
'labeledLatLngs': [{'label': 'display',
'lat': 33.77264610481115,
'lng': -84.39458549022675}]},
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'postalCode': '30313',
'cc': 'US',
'city': 'Atlanta',
'state': 'GA',
'country': 'United States',
'formattedAddress': ['225 North Ave NW',
'Atlanta, GA 30313',

```



```

    'United States']},
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        'name': 'Bakery',
        'pluralName': 'Bakeries',
        'shortName': 'Bakery',
        'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/bakery_',
        'suffix': '.png'},
        'primary': True}],
    'delivery': { 'id': '1490525',
        'url': 'https://www.grubhub.com/restaurant/highland-bakery-224-uncle-
heinie-way-northwest-atlanta/1490525?affiliate=1131&utm_source=foursquare-
affiliate-network&utm_medium=affiliate&utm_campaign=1131&utm_content=1490525',
        '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-0-512e4185e0e26a825ba3c825-1'},
    { 'reasons': { 'count': 0,
        'items': [{ 'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]},
        'venue': { 'id': '4b6a8415f964a5206ad72be3',
            'name': 'Ferst Center For The Arts',
            'location': { 'address': '349 North Ave NW',
                'crossStreet': 'Georgia Tech',
                'lat': 33.774819876519174,
                'lng': -84.39919356481722,
                'labeledLatLngs': [{ 'label': 'display',
                    'lat': 33.774819876519174,
                    'lng': -84.39919356481722}],
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                'cc': 'US',
                'city': 'Atlanta',
                'state': 'GA',
                'country': 'United States',
                'formattedAddress': ['349 North Ave NW (Georgia Tech)',
                    'Atlanta, GA 30332',
                    'United States']}},
            'categories': [{ 'id': '4bf58dd8d48988d1ac941735',
                'name': 'College Theater',
                'pluralName': 'College Theaters',
                'shortName': 'Theater',
                'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/arts_enterta
inment/performingarts_theater_',

```

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        'suffix': '.png'},
        'primary': True}],
        'photos': {'count': 0, 'groups': []}},
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                'type': 'general',
                'reasonName': 'globalInteractionReason'}]}},
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            'name': 'Hampton Inn by Hilton',
            'location': {'address': '244 North Ave NW',
                'lat': 33.77114566253568,
                'lng': -84.39578511197396,
                'labeledLatLngs': [{'label': 'display',
                    'lat': 33.77114566253568,
                    'lng': -84.39578511197396}]},
            'distance': 56,
            'postalCode': '30313',
            'cc': 'US',
            'city': 'Atlanta',
            'state': 'GA',
            'country': 'United States',
            'formattedAddress': ['244 North Ave NW',
                'Atlanta, GA 30313',
                'United States']},
            'categories': [{'id': '4bf58dd8d48988d1fa931735',
                'name': 'Hotel',
                'pluralName': 'Hotels',
                'shortName': 'Hotel',
                'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/travel/hotel_',
                    'suffix': '.png'},
                    'primary': True}],
                'photos': {'count': 0, 'groups': []}},
                'referralId': 'e-0-4b9ad39ef964a52097d935e3-3'},
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                    'items': [{'summary': 'This spot is popular',
                        'type': 'general',
                        'reasonName': 'globalInteractionReason'}]}},
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                        'name': 'T-Mobile',
                        'location': {'address': '1 Coca Cola Plz NW #CCP1',
                            'lat': 33.77117919921875,
                            'lng': -84.39620208740234,
                            'labeledLatLngs': [{'label': 'display',
                                'lat': 33.77117919921875,
                                'lng': -84.39620208740234}]},

```

```

'distance': 23,
'postalCode': '30313',
'cc': 'US',
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'state': 'GA',
'country': 'United States',
'formattedAddress': ['1 Coca Cola Plz NW #CCP1',
  'Atlanta, GA 30313',
  'United States']],
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  'name': 'Mobile Phone Shop',
  'pluralName': 'Mobile Phone Shops',
  'shortName': 'Mobile Phones',
  'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/shops/mobilephoneshop_',
  'suffix': '.png'},
  'primary': True}],
'photos': { 'count': 0, 'groups': [] },
'referralId': 'e-0-4e67acf0bd41e96a148c2889-4',
{'reasons': { 'count': 0,
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    'type': 'general',
    'reasonName': 'globalInteractionReason' } ] },
'venue': { 'id': '4a82e9d7f964a52087f91fe3',
  'name': 'Wells Fargo',
  'location': { 'address': '645 State St NW',
    'crossStreet': 'at Tech Pkwy NW',
    'lat': 33.77254846534218,
    'lng': -84.39843042541548,
    'labeledLatLngs': [{ 'label': 'display',
      'lat': 33.77254846534218,
      'lng': -84.39843042541548 },
    { 'label': 'entrance', 'lat': 33.772487, 'lng': -84.398487 } ] },
  'distance': 234,
  'postalCode': '30313',
  'cc': 'US',
  'city': 'Atlanta',
  'state': 'GA',
  'country': 'United States',
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    'Atlanta, GA 30313',
    'United States' ] },
'categories': [{ 'id': '4bf58dd8d48988d10a951735',
  'name': 'Bank',
  'pluralName': 'Banks',
  'shortName': 'Bank',
  'icon': { 'prefix':

```

```

'https://ss3.4sqi.net/img/categories_v2/shops/financial_',
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  'primary': True}],
  'photos': {'count': 0, 'groups': []}},
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    'items': [{'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason'}]}},
  'venue': {'id': '4d922924f5388cfae932c63d',
    'name': 'Chick-fil-A',
    'location': {'address': '350 Ferst Dr',
      'lat': 33.7736732,
      'lng': -84.3982027,
      'labeledLatLngs': [{'label': 'display',
        'lat': 33.7736732,
        'lng': -84.3982027}]},
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    'postalCode': '30332',
    'cc': 'US',
    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['350 Ferst Dr',
      'Atlanta, GA 30332',
      'United States']},
    'categories': [{'id': '4bf58dd8d48988d16e941735',
      'name': 'Fast Food Restaurant',
      'pluralName': 'Fast Food Restaurants',
      'shortName': 'Fast Food',
      'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/fastfood_',
      'suffix': '.png'},
      'primary': True}],
      'photos': {'count': 0, 'groups': []}},
      'referralId': 'e-0-4d922924f5388cfae932c63d-6'},
      {'reasons': {'count': 0,
        'items': [{'summary': 'This spot is popular',
          'type': 'general',
          'reasonName': 'globalInteractionReason'}]}},
        'venue': {'id': '4e53a1b218a8c0ad8f70c448',
          'name': 'Starbucks',
          'location': {'address': '266 4th St NW',
            'lat': 33.774261,
            'lng': -84.396411,
            'labeledLatLngs': [{'label': 'display',
              'lat': 33.774261,

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```

    'lng': -84.396411]],
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    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['266 4th St NW',
    'Atlanta, GA 30332',
    'United States']],
    'categories': [{ 'id': '4bf58dd8d48988d1e0931735',
    'name': 'Coffee Shop',
    'pluralName': 'Coffee Shops',
    'shortName': 'Coffee Shop',
    'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/coffeeshop_',
    'suffix': '.png'},
    'primary': True}],
    'photos': { 'count': 0, 'groups': []}],
    'referralId': 'e-0-4e53a1b218a8c0ad8f70c448-7'},
    {'reasons': { 'count': 0,
    'items': [{ 'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason' } ]}],
    'venue': { 'id': '54beae0c498e8cea02522c8b',
    'name': 'Panda Express',
    'location': { 'address': '350 Ferst Drive NW',
    'lat': 33.773779492893055,
    'lng': -84.39813668981611,
    'labeledLatLngs': [{ 'label': 'display',
    'lat': 33.773779492893055,
    'lng': -84.39813668981611 } ]],
    'distance': 316,
    'postalCode': '30332',
    'cc': 'US',
    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['350 Ferst Drive NW',
    'Atlanta, GA 30332',
    'United States']],
    'categories': [{ 'id': '4bf58dd8d48988d145941735',
    'name': 'Chinese Restaurant',
    'pluralName': 'Chinese Restaurants',
    'shortName': 'Chinese',
    'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/asian_',

```

```

        'suffix': '.png'},
        'primary': True}],
        'photos': {'count': 0, 'groups': []}},
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        {'reasons': {'count': 0,
            'items': [{'summary': 'This spot is popular',
                'type': 'general',
                'reasonName': 'globalInteractionReason'}]}},
        'venue': {'id': '4af4e0f5f964a52031f721e3',
            'name': 'Under The Couch',
            'location': {'address': 'North Ave NW',
                'crossStreet': 'at Georgia Tech',
                'lat': 33.773898208800745,
                'lng': -84.39886903792853,
                'labeledLatLngs': [{'label': 'display',
                    'lat': 33.773898208800745,
                    'lng': -84.39886903792853}]},
            'distance': 367,
            'postalCode': '30332',
            'cc': 'US',
            'city': 'Atlanta',
            'state': 'GA',
            'country': 'United States',
            'formattedAddress': ['North Ave NW (at Georgia Tech)',
                'Atlanta, GA 30332',
                'United States']},
            'categories': [{'id': '4bf58dd8d48988d1e5931735',
                'name': 'Music Venue',
                'pluralName': 'Music Venues',
                'shortName': 'Music Venue',
                'icon': {'prefix':
                    'https://ss3.4sqi.net/img/categories_v2/arts_entertainment/musicvenue_',
                    'suffix': '.png'},
                'primary': True}],
            'photos': {'count': 0, 'groups': []}},
            'referralId': 'e-0-4af4e0f5f964a52031f721e3-9'},
            {'reasons': {'count': 0,
                'items': [{'summary': 'This spot is popular',
                    'type': 'general',
                    'reasonName': 'globalInteractionReason'}]}},
            'venue': {'id': '4c239bd9a852c928b2c5e16c',
                'name': 'Harrison Square',
                'location': {'address': 'Power Plant Dr NW',
                    'lat': 33.77301871776581,
                    'lng': -84.3952989578247,
                    'labeledLatLngs': [{'label': 'display',
                        'lat': 33.77301871776581,

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```

    'lng': -84.3952989578247]],
    'distance': 209,
    'postalCode': '30313',
    'cc': 'US',
    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['Power Plant Dr NW',
        'Atlanta, GA 30313',
        'United States']],
    'categories': [{ 'id': '4bf58dd8d48988d164941735',
        'name': 'Plaza',
        'pluralName': 'Plazas',
        'shortName': 'Plaza',
        'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/plaza_',
        'suffix': '.png'},
        'primary': True}],
    'photos': { 'count': 0, 'groups': []}],
    'referralId': 'e-0-4c239bd9a852c928b2c5e16c-10'},
    { 'reasons': { 'count': 0,
        'items': [{ 'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason' } ]}],
    'venue': { 'id': '4da46601bf22a14372c6dcf8',
        'name': 'Taco Bell',
        'location': { 'address': 'North Ave NW',
            'crossStreet': 'Georgia Tech',
            'lat': 33.773780184594145,
            'lng': -84.39820597474531,
            'labeledLatLngs': [{ 'label': 'display',
                'lat': 33.773780184594145,
                'lng': -84.39820597474531 } ]],
        'distance': 320,
        'postalCode': '30332',
        'cc': 'US',
        'city': 'Atlanta',
        'state': 'GA',
        'country': 'United States',
        'formattedAddress': ['North Ave NW (Georgia Tech)',
            'Atlanta, GA 30332',
            'United States']],
        'categories': [{ 'id': '4bf58dd8d48988d16e941735',
            'name': 'Fast Food Restaurant',
            'pluralName': 'Fast Food Restaurants',
            'shortName': 'Fast Food',
            'icon': { 'prefix':

```

```

'https://ss3.4sqi.net/img/categories_v2/food/fastfood_',
  'suffix': '.png'},
  'primary': True]],
  'photos': {'count': 0, 'groups': []}},
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  {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
      'type': 'general',
      'reasonName': 'globalInteractionReason'}]}],
  'venue': {'id': '4d7555fafc766a31b9268d1a',
    'name': "Burdell's",
    'location': {'address': '350 Ferst Drive NW',
      'crossStreet': 'at Georgia Tech',
      'lat': 33.77376958442543,
      'lng': -84.3980832286946,
      'labeledLatLngs': [{'label': 'display',
        'lat': 33.77376958442543,
        'lng': -84.3980832286946}]},
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      'cc': 'US',
      'city': 'Atlanta',
      'state': 'GA',
      'country': 'United States',
      'formattedAddress': ['350 Ferst Drive NW (at Georgia Tech)',
        'Atlanta, GA 30332',
        'United States']}],
    'categories': [{'id': '4bf58dd8d48988d1b1941735',
      'name': 'College Bookstore',
      'pluralName': 'College Bookstores',
      'shortName': 'College Bookstore',
      'icon': {'prefix':
        'https://ss3.4sqi.net/img/categories_v2/shops/bookstore_',
          'suffix': '.png'},
          'primary': True]],
          'photos': {'count': 0, 'groups': []}},
          'referralId': 'e-0-4d7555fafc766a31b9268d1a-12'},
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              'type': 'general',
              'reasonName': 'globalInteractionReason'}]}],
            'venue': {'id': '4e820b5f7ee61ffc04f4c7d3',
              'name': 'Rooftop Garden',
              'location': {'address': 'North Ave NW',
                'crossStreet': 'at Georgia Tech',
                'lat': 33.7744282899713,
                'lng': -84.39655184225045,

```



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    'labeledLatLngs': [{ 'label': 'display',
        'lat': 33.7744282899713,
        'lng': -84.39655184225045}],
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    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['North Ave NW (at Georgia Tech)',
        'Atlanta, GA 30332',
        'United States']],
    'categories': [{ 'id': '4bf58dd8d48988d133951735',
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        'pluralName': 'Roof Decks',
        'shortName': 'Roof Deck',
        'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/travel/hotel_roofdeck_',
        'suffix': '.png'},
        'primary': True}],
    'photos': { 'count': 0, 'groups': []},
    'referralId': 'e-0-4e820b5f7ee61ffc04f4c7d3-13'},
    { 'reasons': { 'count': 0,
        'items': [{ 'summary': 'This spot is popular',
            'type': 'general',
            'reasonName': 'globalInteractionReason'}]},
    'venue': { 'id': '506b929eb0edcdd34cd227c8',
        'name': 'GT Stinger Stop - Techwood and North Ave',
        'location': { 'address': 'Techwood Dr NW',
            'crossStreet': 'at North Ave NW',
            'lat': 33.771245913278335,
            'lng': -84.3920373916626,
            'labeledLatLngs': [{ 'label': 'display',
                'lat': 33.771245913278335,
                'lng': -84.3920373916626}],
            'distance': 398,
            'postalCode': '30332',
            'cc': 'US',
            'city': 'Atlanta',
            'state': 'GA',
            'country': 'United States',
            'formattedAddress': ['Techwood Dr NW (at North Ave NW)',
                'Atlanta, GA 30332',
                'United States']},
        'categories': [{ 'id': '52f2ab2ebcb57f1066b8b4f',
            'name': 'Bus Stop',
            'pluralName': 'Bus Stops',

```

```

    'shortName': 'Bus Stop',
    'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/travel/busstation_',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-506b929eb0edcdd34cd227c8-14'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
    'venue': {'id': '4dadda617abacefe5c8b201e',
    'name': 'Student Center Food Court',
    'location': {'address': '350 Ferst Dr NW',
    'crossStreet': 'at Georgia Tech',
    'lat': 33.77445091089932,
    'lng': -84.39890435841951,
    'labeledLatLngs': [{'label': 'display',
    'lat': 33.77445091089932,
    'lng': -84.39890435841951}]},
    'distance': 418,
    'postalCode': '30332',
    'cc': 'US',
    'neighborhood': 'Georgia Tech',
    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['350 Ferst Dr NW (at Georgia Tech)',
    'Atlanta, GA 30332',
    'United States']},
    'categories': [{'id': '4bf58dd8d48988d120951735',
    'name': 'Food Court',
    'pluralName': 'Food Courts',
    'shortName': 'Food Court',
    'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/shops/food_foodcourt_',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-4dadda617abacefe5c8b201e-15'},
    {'reasons': {'count': 0,
    'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
    'venue': {'id': '4d5bd186fb186dcb8b03f89a',
    'name': "Dunkin'",
    'location': {'address': 'North Ave NW',

```

```

'crossStreet': 'at Georgia Tech',
'lat': 33.77442791392891,
'lng': -84.39880812280745,
'labeledLatLngs': [{'label': 'display',
  'lat': 33.77442791392891,
  'lng': -84.39880812280745}],
'distance': 411,
'postalCode': '30332',
'cc': 'US',
'city': 'Atlanta',
'state': 'GA',
'country': 'United States',
'formattedAddress': ['North Ave NW (at Georgia Tech)',
  'Atlanta, GA 30332',
  'United States']],
'categories': [{'id': '4bf58dd8d48988d148941735',
  'name': 'Donut Shop',
  'pluralName': 'Donut Shops',
  'shortName': 'Donuts',
  'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/donuts_',
  'suffix': '.png'},
  'primary': True}],
'photos': {'count': 0, 'groups': []}},
'referralId': 'e-0-4d5bd186fb186dcb8b03f89a-16'},
{'reasons': {'count': 0,
  'items': [{'summary': 'This spot is popular',
    'type': 'general',
    'reasonName': 'globalInteractionReason'}]},
'venue': {'id': '5701c802498ef642af8ca74c',
  'name': 'Einstein Statue',
  'location': {'lat': 33.77522394551474,
    'lng': -84.39718993342497,
    'labeledLatLngs': [{'label': 'display',
      'lat': 33.77522394551474,
      'lng': -84.39718993342497}],
    'distance': 437,
    'cc': 'US',
    'city': 'Atlanta',
    'state': 'GA',
    'country': 'United States',
    'formattedAddress': ['Atlanta, GA', 'United States']}],
  'categories': [{'id': '52e81612bcbcb57f1066b79ed',
    'name': 'Outdoor Sculpture',
    'pluralName': 'Outdoor Sculptures',
    'shortName': 'Outdoor Sculpture',
    'icon': {'prefix':

```

```
'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/sculpture_',
    'suffix': '.png'},
    'primary': True}],
    'photos': {'count': 0, 'groups': []}},
    'referralId': 'e-0-5701c802498ef642af8ca74c-17'}}]]]]}
```

0.3 Data Preparation

0.3.1 Venues Nearby

The venues were grouped by categories in Foursquare to know what types are listed and available around each university. Then the venues were order by which are closer to the universities. After previewing the columns available in the JSON response I seen that we did not need all the columns. The name, categories, and coordinates should be efficient data to continue on for further data analysis.

We stored the venue results for University of Chicago and Georgia Institute of Technology (Georgia Tech) in a pandas dataframe.

Since the venues were not many I did not have to run any code to see unique or common categories and venues. There were not many similar category types.

```
[9]: chi_venues = chi_results['response']['groups'][0]['items']
      #chi_nearby_venues = pd.json_normalize(chi_venues) #flatten JSON

chi_venues_list = []
chi_venues_list.append([
    (
        v['venue']['name'],
        v['venue']['categories'][0]['name'],
        v['venue']['location']['lat'],
        v['venue']['location']['lng']
    ) for v in chi_venues])

chi_df = pd.DataFrame([item for chi_venue_list in chi_venues_list for item in
    ↪chi_venue_list])
chi_df.columns = ['Name', 'Category Type', 'Latitude', 'Longitude']
chi_df
```

```
[9]:
```

	Name \
0	Build Coffee
1	61st Street Farmers' Market
2	Midway Plaisance Park
3	University of Chicago @ Midway Plaisance
4	B'Gabs Goodies
5	Plum Cafe at Chicago Press Building
6	Jackson Towers Fitness
7	Metra - 59th St (University of Chicago)
8	Jackson Park Track & Soccer Field

```

9                               Tiffin Cafe
10  International House at the University of Chicago
11                               Divvy Station
12                               Huckleberry Park
13                               CTA Bus Stop 1513
14                               Leon's Barbecue
15                               Tres Original Pancakes

```

	Category Type	Latitude	Longitude
0	Coffee Shop	41.784288	-87.590419
1	Market	41.784296	-87.590790
2	Park	41.786526	-87.594458
3	Park	41.787751	-87.588782
4	Food & Drink Shop	41.784245	-87.590372
5	Café	41.786028	-87.590035
6	Gym / Fitness Center	41.784879	-87.588799
7	Train Station	41.787729	-87.588789
8	Soccer Field	41.783368	-87.586806
9	Coffee Shop	41.788219	-87.590965
10	Concert Hall	41.788240	-87.590804
11	Bike Rental / Bike Share	41.787943	-87.588315
12	Playground	41.782321	-87.594810
13	Bus Station	41.787987	-87.586560
14	BBQ Joint	41.780854	-87.588451
15	Food	41.780869	-87.588188

```
[10]: print(chi_df.shape)
```

```
(16, 4)
```

```
[11]: chi_df.groupby('Category Type').count()
```

```
[11]:
```

	Name	Latitude	Longitude
Category Type			
BBQ Joint	1	1	1
Bike Rental / Bike Share	1	1	1
Bus Station	1	1	1
Café	1	1	1
Coffee Shop	2	2	2
Concert Hall	1	1	1
Food	1	1	1
Food & Drink Shop	1	1	1
Gym / Fitness Center	1	1	1
Market	1	1	1
Park	2	2	2
Playground	1	1	1
Soccer Field	1	1	1

Train Station	1	1	1
---------------	---	---	---

0.3.2 Categories for Venues nearby Georgia Tech

```
[12]: atl_venues = atl_results['response']['groups'][0]['items']

atl_venues_list = []
atl_venues_list.append([
    (
        v['venue']['name'],
        v['venue']['categories'][0]['name'],
        v['venue']['location']['lat'],
        v['venue']['location']['lng']
    ) for v in atl_venues])

atl_df = pd.DataFrame([item for atl_venue_list in atl_venues_list for item in atl_venue_list])
atl_df.columns = ['Name', 'Category Type', 'Latitude', 'Longitude']
atl_df
```

```
[12]:
```

	Name	Category Type	Latitude \
0	Coca-Cola Mainstreet @ AOC	American Restaurant	33.770980
1	Highland Bakery	Bakery	33.772646
2	Ferst Center For The Arts	College Theater	33.774820
3	Hampton Inn by Hilton	Hotel	33.771146
4	T-Mobile	Mobile Phone Shop	33.771179
5	Wells Fargo	Bank	33.772548
6	Chick-fil-A	Fast Food Restaurant	33.773673
7	Starbucks	Coffee Shop	33.774261
8	Panda Express	Chinese Restaurant	33.773779
9	Under The Couch	Music Venue	33.773898
10	Harrison Square	Plaza	33.773019
11	Taco Bell	Fast Food Restaurant	33.773780
12	Burdell's	College Bookstore	33.773770
13	Rooftop Garden	Roof Deck	33.774428
14	GT Stinger Stop - Techwood and North Ave	Bus Stop	33.771246
15	Student Center Food Court	Food Court	33.774451
16	Dunkin'	Donut Shop	33.774428
17	Einstein Statue	Outdoor Sculpture	33.775224

	Longitude
0	-84.398037
1	-84.394585
2	-84.399194
3	-84.395785
4	-84.396202
5	-84.398430

```

6 -84.398203
7 -84.396411
8 -84.398137
9 -84.398869
10 -84.395299
11 -84.398206
12 -84.398083
13 -84.396552
14 -84.392037
15 -84.398904
16 -84.398808
17 -84.397190

```

```
[13]: print(atl_df.shape)
```

```
(18, 4)
```

```
[14]: atl_df.groupby('Category Type').count()
```

```
[14]:
```

	Name	Latitude	Longitude
Category Type			
American Restaurant	1	1	1
Bakery	1	1	1
Bank	1	1	1
Bus Stop	1	1	1
Chinese Restaurant	1	1	1
Coffee Shop	1	1	1
College Bookstore	1	1	1
College Theater	1	1	1
Donut Shop	1	1	1
Fast Food Restaurant	2	2	2
Food Court	1	1	1
Hotel	1	1	1
Mobile Phone Shop	1	1	1
Music Venue	1	1	1
Outdoor Sculpture	1	1	1
Plaza	1	1	1
Roof Deck	1	1	1

0.4 Data Exploration (Results)

The University of Chicago had only two repeated category types which were parks and coffee shops.

There is a nearby bus station at the University of Chicago, so a user does not need a car or uber as much if there is a bus route and a gym, but most universities already have a recreation center that someone could use. If a break is needed a person has the choice of more than one park to walk or go running at. If they do not want to eat coffee shop food and want something more hearty there is a BBQ joint nearby.

At Georgia Institute of Technology (Georgia Tech), they have many different kind of restaurants nearby that are just not inside the college. One of the greatest perks is a music venue so people can probably get to hear local bands and if they do not want to stay at a dorm can have a night at the nearby hotel at the Hampton Inn and not too far from the hotel is a bank.

There could be shopping center in the area.

0.5 Data Analysis

0.5.1 Maps with Markers

After looking at the venues for each university, maps were created with markers for each of the venues around each of the universities. We remove the 'Name' and 'Category Type' columns since we only need the coordinates for k-Means cluster labels. The maps will not be ordinary maps with markers, but will have clusters using k-Means with a initial k/clusters of 3.

After creating the dataframes with the clusters we can see the clusters were color-coded and of course grouped by distances. The elbow method was not necessary since the data points are very few. The perfect zoom size at 16 let us see some data points that were like outliers, but as you know they don't exist in k-Means. For instance, based on Google maps Leon's Barbecue takes 19 minutes by car and up to two hours walking distance. This venue is about 6.6 miles away from the University of Chicago. The venue with the farthest distance from Georgia Institute of Technology (Georgia Tech) would be Cocoa Cola Mainstreet at AOC although GT Stinger Shop was close and has it's own cluster group. The location for Coca Cola @ AOC was not easy to locate by name in Google Maps and the address was retrieved for the restaurant through Foursquare. Again, Georgia Tech wins with the farthest distance being less than 1.7 miles with only a 35 minute walk.

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

# set number of clusters
kclusters = 3

chi_df_clustering = chi_df.drop(['Name', 'Category Type'], 1)

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

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:13]
```

```
[15]: array([2, 2, 0, 1, 2, 1, 2, 1, 2, 1, 1, 1, 0], dtype=int32)
```

We then need to create a new dataframe with the cluster.

```
[16]: chi_df_merged = chi_df_clustering
chi_df_merged.insert(0, 'Cluster Labels', kmeans.labels_)
name_column = chi_df['Name']
chi_df_with_clusters = pd.concat([chi_df_merged, name_column], axis = 1)
chi_df_with_clusters
```



```
[16]:
```

	Cluster	Labels	Latitude	Longitude	\
0	2		41.784288	-87.590419	
1	2		41.784296	-87.590790	
2	0		41.786526	-87.594458	
3	1		41.787751	-87.588782	
4	2		41.784245	-87.590372	
5	1		41.786028	-87.590035	
6	2		41.784879	-87.588799	
7	1		41.787729	-87.588789	
8	2		41.783368	-87.586806	
9	1		41.788219	-87.590965	
10	1		41.788240	-87.590804	
11	1		41.787943	-87.588315	
12	0		41.782321	-87.594810	
13	1		41.787987	-87.586560	
14	2		41.780854	-87.588451	
15	2		41.780869	-87.588188	

	Name
0	Build Coffee
1	61st Street Farmers' Market
2	Midway Plaisance Park
3	University of Chicago @ Midway Plaisance
4	B'Gabs Goodies
5	Plum Cafe at Chicago Press Building
6	Jackson Towers Fitness
7	Metra - 59th St (University of Chicago)
8	Jackson Park Track & Soccer Field
9	Tiffin Cafe
10	International House at the University of Chicago
11	Divvy Station
12	Huckleberry Park
13	CTA Bus Stop 1513
14	Leon's Barbecue
15	Tres Original Pancakes

One of the most distance locations are two restaurants in one cluster group (green). Many would have thought the bus station may have been closer to the University of Chicago. Midway Plaisance Park is the closest data point to the college while the Huckleberry Park is one of the farthest.

```
[17]: # create map
map_clusters = folium.Map(location=[chi_latitude, chi_longitude], zoom_start=16)

# 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(chi_df_with_clusters['Latitude'],
    ↪ chi_df_with_clusters['Longitude'], chi_df_with_clusters['Name'],
    ↪ chi_df_with_clusters['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters

```

[17]: <folium.folium.Map at 0x7fadd06ff60>

```

[18]: # set number of clusters
kclusters = 3

atl_df_clustering = atl_df.drop(['Name', 'Category Type'], 1)

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

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:17]

```

[18]: array([2, 2, 0, 2, 2, 0, 0, 0, 0, 0, 2, 0, 0, 0, 1, 0, 0], dtype=int32)

We then need to create a new dataframe with the clusters.

```

[19]: atl_df_merged = atl_df_clustering
atl_df_merged.insert(0, 'Cluster Labels', kmeans.labels_)
name_column = atl_df['Name']
atl_df_with_clusters = pd.concat([atl_df_merged, name_column], axis = 1)
atl_df_with_clusters

```

[19]:

	Cluster Labels	Latitude	Longitude	\
0	2	33.770980	-84.398037	
1	2	33.772646	-84.394585	
2	0	33.774820	-84.399194	
3	2	33.771146	-84.395785	

```

4          2  33.771179 -84.396202
5          0  33.772548 -84.398430
6          0  33.773673 -84.398203
7          0  33.774261 -84.396411
8          0  33.773779 -84.398137
9          0  33.773898 -84.398869
10         2  33.773019 -84.395299
11         0  33.773780 -84.398206
12         0  33.773770 -84.398083
13         0  33.774428 -84.396552
14         1  33.771246 -84.392037
15         0  33.774451 -84.398904
16         0  33.774428 -84.398808
17         0  33.775224 -84.397190

```

```

                                Name
0          Coca-Cola Mainstreet @ AOC
1                    Highland Bakery
2          Ferst Center For The Arts
3          Hampton Inn by Hilton
4                    T-Mobile
5                    Wells Fargo
6          Chick-fil-A
7                    Starbucks
8                    Panda Express
9          Under The Couch
10         Harrison Square
11         Taco Bell
12         Burdell's
13         Rooftop Garden
14  GT Stinger Stop - Techwood and North Ave
15         Student Center Food Court
16         Dunkin'
17         Einstein Statue

```

As you can see with the clusters, the prediction was correct that near Georgia Institute of Technology there is shopping enter based on the venues. There was a color coordinated data points and one outlier was present based on the map which is location GT Stringer Shop in its own cluster group as one data point.

```

[20]: # create map
map_clusters = folium.Map(location=[atl_latitude, atl_longitude], zoom_start=16)

# 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(atl_df_with_clusters['Latitude'],
    ↪ atl_df_with_clusters['Longitude'], atl_df_with_clusters['Name'],
    ↪ atl_df_with_clusters['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)

map_clusters

```

[20]: <folium.folium.Map at 0x7fadd005048>

0.6 Conclusion

After viewing both universities and the only option was to choose one it would due to mobility it would definitely be Georgia Institute of Technology (Georgia Tech) since there is a shopping center that is walking distance from the institution. As a foodie, I would have preferred Chicago, but as you can see two of the nice restaurants are quite far. They do have the Divvy Station and bus route nearby for easy transportation if you do not want to commute by foot.

Many people have different threshold of what is too far to travel without having a bike, vehicle or public transportation. Overall the venues surrounding both institutions (University of Chicago and Georgia Institute of Technology (Georgia Tech)) are good for pedestrians who need commutable distances to get around.