

# Capstone Project - The Battle of Neighborhoods

## Introduction

*Introduction where you discuss the business problem and who would be interested in this project*

**Business Problem:** Would you recommend a best location in Bangalore to open a new Offshore Development Center aka 'ODC'? My organization want to set up the ODC in Bangalore, India to develop own product for the banking CCAR and provide the 24/7 technical support to client's bank who purchased the CCAR Products.

In this regard, my boss explains that what are the factors to be considered when recommending the location with consideration of 24/7 operations, need to take care of transportations, Restaurants access, shopping places etc. He explains, ODC should has many restaurants, shopping places and housing society (Building Apartments) nearby for the employees. Transportation is also an important factor. Within 10 to 15 minutes' walk to ODC from public transport facilities is perfect. He wants me concentrated on selection of ODC location according to its nearby environment. ODC should have facilities 'Security', 'Day Care Service', 'Fire Safety, Transposts, EATERIES,AMBULANCE SERVICES for Imergency,AMPHITHEATRE,and PARKING. Rental/Lease price is not my concern. He lists out his top 5 favorite IT Parks in Bangalore with rating. I work with my teammates and select 5 possible locations to set up the ODC. Which location should be suggested to the stakeholder?

From Wikipedia,Bangalore is sometimes referred to as the "Silicon Valley of India" (or "IT capital of India") because of its role as the nation's leading information technology (IT) exporter. Indian technological organizations ISRO, Infosys, Wipro and HAL are headquartered in the city. A demographically diverse city, Bangalore is the second fastest-growing major metropolis in India. Bangalore has one of the most highly educated workforces in the world. It is home to many educational and research institutions in India, such as Indian Institute of Science (IISc), Indian Institute of Management (Bangalore) (IIMB), International Institute of Information Technology, Bangalore (IIITB), National Institute of Fashion Technology, Bangalore, National Institute of Design, Bangalore (NID R&D Campus), National Law School of India University (NLSIU) and National Institute of Mental Health and Neurosciences (NIMHANS). Numerous state-owned aerospace and defenses, such as Bharat Electronics, Hindustan Aeronautics and National Aerospace Laboratories are located in the city. The city also houses the Kannada film industry.

## Data

*Data where you describe the data that will be used to solve the problem and the source of the data. According to the question, following data are required.*

According to the question, following data are required

1. Geographic coordinate of Tech Parks in Bangalore. Need to compare 10 possible locations with current IT Tech Parks in Bangalore. Therefore, I need to find a list of Bangalore tech Parks' geographic coordinates. Have done a quick research on public information uploaded to internet and wikipedia pages and found there is no consolidated datasheet available currently. So there is a need to prepare the dataset, IT Park Name, Latitude and Longitude.

Information extracted from Wiki -

1. Name: Bagmane Tech Park Address: CV Raman Nagar, Bengaluru, Karnataka, India Latitude: 12.978611 Longitude: 77.661111
2. Name : Embassy GolfLinks Business Park Address: Off Intermediate Ring Road,Bengaluru, Karnataka, India Latitude: 12.949102 Longitude: 77.644314
3. Name : Embassy TechVillage Address: Outer Ring Road,Bengaluru, Karnataka, India Latitude: 12.9313798 Longitude: 77.6911923
4. Name : Manyata Embassy Business Park Address: Nagawara, Outer Ring Road,Bengaluru, Karnataka, India Latitude: 13.0481 Longitude: 77.6222
5. Name :Electronic City Address: Electronic City,Bengaluru, Karnataka, India Latitude: 12.8399 Longitude: 77.6770
6. Name :RMZ Ecoworld Address: devarabisanahalli outer ring road, Bengaluru, Karnataka, India Latitude: 12.9256 Longitude: 77.6878
7. Name :International Tech Park Address: ITPL,Bengaluru, Karnataka, India Latitude: 12.8399 Longitude: 77.6770
8. Name :Prestige Tech Park Address: Sarjapur Ring Road, Marathahalli,Bengaluru, Karnataka, India Latitude: 12.9425 Longitude: 77.6927

```

In [1]: import pandas as pd
itparks=[]
itparks.append({
    'Name': 'Bagmane Tech Park',
    'Address': 'CV Raman Nagar, Bengaluru, Karnataka, India',
    'Latitude': 12.978611,
    'Longitude': 77.661111
})
itparks.append({
    'Name': 'Embassy GolfLinks Business Park',
    'Address': 'Off Intermediate Ring Road,Bengaluru, Karnataka, India',
    'Latitude': 12.949102,
    'Longitude': 77.644314
})
itparks.append({
    'Name': 'Manyata Embassy Business Park',
    'Address': 'Nagawara, Outer Ring Road,Bengaluru, Karnataka, India',
    'Latitude': 13.0481,
    'Longitude': 77.6222
})
itparks.append({
    'Name': 'Embassy TechVillage',
    'Address': 'Outer Ring Road,Bengaluru, Karnataka, India',
    'Latitude': 12.9313798,
    'Longitude': 77.6911923
})
itparks.append({
    'Name' : 'Electronic City',
    'Address' : 'Electronic City,Bengaluru, Karnataka, India',
    'Latitude' : 12.8399,
    'Longitude' : 77.6770
})
itparks.append({
    'Name' : 'RMZ Ecoworld',
    'Address': 'devarabisanahalli outer ring road, Bengaluru, Karnataka, India',
    'Latitude': 12.9256,
    'Longitude': 77.6878
})
itparks.append({
    'Name' : 'International Tech Park',
    'Address': 'ITPL,Bengaluru, Karnataka, India',
    'Latitude': 12.8399,
    'Longitude': 77.6770
})
itparks.append({
    'Name' : 'Prestige Tech Park',
    'Address': 'Sarjapur Ring Road, Marathahalli,Bengaluru, Karnataka, India',
    'Latitude': 12.9425,
    'Longitude': 77.6927
})
itparks.append({
    "Name" : "Kalyani Magnum Tech Park",
    "Address" : "Bannerghatta Main Rd, Krishnaraju Layout, Doraisanipalya, Panduranga Nagar, Bengaluru, Karnataka 560076, India",
    "Latitude" : "12.9",

```

```
"Longitude" : "77.5971"
})
itparks.append({
  "Name" : "Bhoruka Park Pvt Limited",
  "Address" : "Whitefield Road, Mahadevapura, Bangalore",
  "Latitude" : "12.973",
  "Longitude" : "77.599"
})
itparks.append({
  "Name" : "IBC Knowledge Park ",
  "Address" : "Bannerghatta Road, Bangalore - 560076, Near Dairy Circle",
  "Latitude" : "12.9326",
  "Longitude" : "77.6036"
})
itparks.append({
  "Name" : "Sigma Soft Tech Park",
  "Address" : "Whitefield Main Road, Bangalore - 560066, Opposite To Varthur Lake",
  "Latitude" : "12.9576",
  "Longitude" : "77.7442"
})
itparks.append({
  "Name" : "Brigade Tech Park",
  "Address" : "Pattandur Agrahara Village, Whitefield, Bangalore - 560066, Next To Itpl",
  "Latitude" : "12.986",
  "Longitude" : "77.7402"
})
itparks.append({
  "Name" : "Divyasree Techno Park",
  "Address" : "Epip Zone, accenture campus, Whitefield, Bangalore ",
  "Latitude" : "12.9712",
  "Longitude" : "77.726"
})
itparks.append({
  "Name" : "Vrindavan Tech Village",
  "Address" : "Devarabeesanhalli, Outer Ring Road, Varthur Hobli, Bellandur, Bangalore",
  "Latitude" : "12.9309",
  "Longitude" : "77.6921"
})
itparks.append({
  "Name" : "Eco Space",
  "Address" : "Teck Park, 7th Cross, Chinayanpalya, Bellandur, Bangalore",
  "Latitude" : "12.9275",
  "Longitude" : "77.681"
})
itparks.append({
  "Name" : "Prasad Technology Park",
  "Address" : "Epip Industrial Area, Whitefield, Bangalore",
  "Latitude" : "12.9764",
  "Longitude" : "77.7258"
})
itparks.append({
  "Name" : "Shailendra Tech Park",
  "Address" : "KIADB Export Promotion Industrial Area, Whitefield, Bangalore",
  "Latitude" : "12.9786",
```

```
"Longitude" : "77.7248"  
})
```

```
df_itparks = pd.DataFrame(itparks, columns=['Name','Address','Latitude','Longitude'])
```

```
df_itparks.head(25)
```

Out[1]:

|    | Name                            | Address   | Latitude | Longitude |
|----|---------------------------------|---|----------|-----------|
| 0  | Bagmane Tech Park               | CV Raman Nagar, Bengaluru, Karnataka, India       | 12.9786  | 77.6611   |
| 1  | Embassy GolfLinks Business Park | Off Intermediate Ring Road,Bengaluru, Karnatak... | 12.9491  | 77.6443   |
| 2  | Manyata Embassy Business Park   | Nagawara, Outer Ring Road,Bengaluru, Karnataka... | 13.0481  | 77.6222   |
| 3  | Embassy TechVillage             | Outer Ring Road,Bengaluru, Karnataka, India       | 12.9314  | 77.6912   |
| 4  | Electronic City                 | Electronic City,Bengaluru, Karnataka, India       | 12.8399  | 77.677    |
| 5  | RMZ Ecoworld                    | devarabisanahalli outer ring road, Bengaluru, ... | 12.9256  | 77.6878   |
| 6  | International Tech Park         | ITPL,Bengaluru, Karnataka, India                  | 12.8399  | 77.677    |
| 7  | Prestige Tech Park              | Sarjapur Ring Road, Marathahalli,Bengaluru, Ka... | 12.9425  | 77.6927   |
| 8  | Kalyani Magnum Tech Park        | Bannerghatta Main Rd, Krishnaraju Layout, Dora... | 12.9     | 77.5971   |
| 9  | Bhoruka Park Pvt Limited        | Whitefield Road, Mahadevapura, Bangalore          | 12.973   | 77.599    |
| 10 | IBC Knowledge Park              | Bannerghatta Road, Bangalore - 560076, Near Da... | 12.9326  | 77.6036   |
| 11 | Sigma Soft Tech Park            | Whitefield Main Road, Bangalore - 560066, Oppo... | 12.9576  | 77.7442   |
| 12 | Brigade Tech Park               | Pattandur Agrahara Village, Whitefield, Bangal... | 12.986   | 77.7402   |
| 13 | Divyasree Techno Park           | Epip Zone, accenture campus, Whitefield, Banga... | 12.9712  | 77.726    |
| 14 | Vrindavan Tech Village          | Devarabeesanhalli, Outer Ring Road, Varthur Ho... | 12.9309  | 77.6921   |
| 15 | Eco Space                       | Teck Park, 7th Cross, Chinayanpalya, Bellandur... | 12.9275  | 77.681    |
| 16 | Prasad Technology Park          | Epip Industrial Area, Whitefield, Bangalore       | 12.9764  | 77.7258   |
| 17 | Shailendra Tech Park            | KIADB Export Promotion Industrial Area, Whitef... | 12.9786  | 77.7248   |

```
In [2]: print('There are {} top IT Parks in Bangalore'.format(len(df_itparks)))
```

There are 18 top IT Parks in Bangalore

The recommended ODC location needs to have many eating and shopping venues nearby. Convenient public transport is also required. These data can be found by using FourSquare API to find these venues around the location. The radius of exploration distance is set to 1000 meters, which is about 10 to 15 minutes walking distance.

Following type of venue category will be used to search

1. Geographic coordinates of 5 possible IT Parks addresses - newly coming up Geographic coordinates of 5 possible IT Park are required. lets build it

```
In [3]: possible_locations = [  
    { 'Location': 'L1', 'Address': 'Whitefield, Bangalore'},  
    { 'Location': 'L2', 'Address': 'Bellandure, Bangalore'},  
    { 'Location': 'L3', 'Address': 'Krishnarajapuram, Bangalore'},  
    { 'Location': 'L4', 'Address': 'Hebal, Bangalore'},  
]
```

```
In [4]: # install the google map api client library
!pip install -U googlemaps

import googlemaps
gmaps = googlemaps.Client(key='AIzaSyDhvNlwb7kICr1wq9rNKcFj1tnuXCre3hY')

# Retrieve geolocation and create the dataframe of pending IT Park addresses
def getLatLng(address):
    latlng = gmaps.geocode('{}', Bangalore'.format(address))
    return (latlng[0]['geometry']['location']['lat'], latlng[0]['geometry']['location']['lng'])
```

Collecting googlemaps

Downloading <https://files.pythonhosted.org/packages/5a/3d/13b4230f3c1b8a586cdc8d8179f3c6af771c11247f8de9c166d1ab37f51d/googlemaps-3.0.2.tar.gz>

Requirement not upgraded as not directly required: requests<3.0,>=2.11.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from googlemaps)

Requirement not upgraded as not directly required: chardet<3.1.0,>=3.0.2 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps)

Requirement not upgraded as not directly required: idna<2.7,>=2.5 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps)

Requirement not upgraded as not directly required: urllib3<1.23,>=1.21.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps)

Requirement not upgraded as not directly required: certifi>=2017.4.17 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests<3.0,>=2.11.1->googlemaps)

Building wheels for collected packages: googlemaps

Running setup.py bdist\_wheel for googlemaps ... done

Stored in directory: /home/dsxuser/.cache/pip/wheels/3c/3f/25/ce6d7722dba07e5d4a12d27ab38f3d7add65ef43171b02c819

Successfully built googlemaps

Installing collected packages: googlemaps

Successfully installed googlemaps-3.0.2



```
In [5]: for loc in possible_locations:
        (lat, lng) = getLatLng(loc['Address'])
        loc['Latitude'] = lat
        loc['Longitude'] = lng

df_possible_locations = pd.DataFrame(possible_locations, columns=['Location',
'Address', 'Latitude', 'Longitude'])
df_possible_locations
```

Out[5]:

|   | Location | Address                     | Latitude  | Longitude |
|---|----------|-----------------------------|-----------|-----------|
| 0 | L1       | Whitefield, Bangalore       | 12.969800 | 77.749947 |
| 1 | L2       | Bellandure, Bangalore       | 12.926031 | 77.676246 |
| 2 | L3       | Krishnarajapuram, Bangalore | 13.004017 | 77.687776 |
| 3 | L4       | Hebal, Bangalore            | 13.035770 | 77.597022 |

1. Favorite IT Park list of stakeholder The favorite IT Park list of stakeholder is an important information that I can use it as profile to select the best location.

```
In [6]: boss_favorite = [
        {'IT Park Name': 'Prestige Tech Park', 'Rating': 4.5},
        {'IT Park Name': 'Electronic City', 'Rating': 4.5},
        {'IT Park Name': 'Embassy GolfLinks Business Park', 'Rating': 4.3},
        {'IT Park Name': 'Sigma Soft Tech Park', 'Rating': 3.4},
        ]

df_boss_favorite = pd.DataFrame(boss_favorite, columns=['IT Park Name','Rating'])
df_boss_favorite
```

Out[6]:

|   | IT Park Name                    | Rating |
|---|---------------------------------|--------|
| 0 | Prestige Tech Park              | 4.5    |
| 1 | Electronic City                 | 4.5    |
| 2 | Embassy GolfLinks Business Park | 4.3    |
| 3 | Sigma Soft Tech Park            | 3.4    |

## 4. Eating, Shopping and Public transportation facility around IT Park

```
In [7]: fs_categories = {
        'Food': '4d4b7105d754a06374d81259',
        'Shop & Service': '4d4b7105d754a06378d81259',
        'Bus Stop': '52f2ab2ebcbc57f1066b8b4f',
        'Metro Station': '4bf58dd8d48988d1fd931735',
        'Arts & Entertainment': '4d4b7104d754a06370d81259',
        'Train Station' : '4bf58dd8d48988d129951735',
        'Taxi Stand' : '53fca564498e1a175f32528b',
        'Bus Station' : '4bf58dd8d48988d1fe931735',
        'Airport' : '4bf58dd8d48988d1ed931735',
        'Residence' : '4e67e38e036454776db1fb3a',
        'Office' : '4bf58dd8d48988d124941735',
        'Business Center' : '56aa371be4b08b9a8d573517'
    }
```

```
In [8]: ', '.join([ fs for fs in fs_categories])
```

```
Out[8]: 'Food, Metro Station, Shop & Service, Train Station, Airport, Business Center, Residence, Bus Station, Taxi Stand, Arts & Entertainment, Bus Stop, Office'
```

```
In [9]: ITPark = df_itparks.loc[0]

print('Use the first IT Park "{}" in the list as example to explore venues nearby'.format(ITPark['Name']))
```

Use the first IT Park "Bagmane Tech Park" in the list as example to explore venues nearby

```
In [10]: # Install FourSquare client library
!pip install foursquare
```

Collecting foursquare

Downloading <https://files.pythonhosted.org/packages/7e/9f/21ef283c50eb576eae9bb0525d8a988baffe4d59ac2bbb1f9d84434bdf616/foursquare-1%212016.9.12.tar.gz>

Requirement not upgraded as not directly required: requests>=2.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from foursquare)

Requirement not upgraded as not directly required: six in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from foursquare)

Requirement not upgraded as not directly required: chardet<3.1.0,>=3.0.2 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests>=2.1->foursquare)

Requirement not upgraded as not directly required: idna<2.7,>=2.5 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests>=2.1->foursquare)

Requirement not upgraded as not directly required: urllib3<1.23,>=1.21.1 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests>=2.1->foursquare)

Requirement not upgraded as not directly required: certifi>=2017.4.17 in /opt/conda/envs/DSX-Python35/lib/python3.5/site-packages (from requests>=2.1->foursquare)

Building wheels for collected packages: foursquare

Running setup.py bdist\_wheel for foursquare ... done

Stored in directory: /home/dsxuser/.cache/pip/wheels/c1/a4/ff/e07a4f4f02ef9189c5b1e0738a09131f6c5f2de811ce3a39a0

Successfully built foursquare

Installing collected packages: foursquare

Successfully installed foursquare-1!2016.9.12

```
In [11]: # Let create url to call foursquare API
CLIENT_ID = '3QMDP42DYXT0M5LCCXYJNY5B2WNPZFZIKQEL1NAQA1FUFNYKC' # your Foursquare ID
CLIENT_SECRET = 'AD3MSB2U4MLVBBTK5YMNYBF2ULA5J4JSN3L05NVWMQY4BEBD' # your Foursquare Secret
VERSION = '20180605' # Foursquare API version

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

Your credentials:

CLIENT\_ID: 3QMDP42DYXT0M5LCCXYJNY5B2WNPZFZIKQEL1NAQA1FUFNYKC

CLIENT\_SECRET: AD3MSB2U4MLVBBTK5YMNYBF2ULA5J4JSN3L05NVWMQY4BEBD

```
In [12]: import foursquare
from pandas.io.json import json_normalize # transform JSON file into a pandas dataframe
fs = foursquare.Foursquare(client_id=CLIENT_ID, client_secret=CLIENT_SECRET)
RADIUS = 2000 # 500m, around 5 minutes walking time
```

```
In [13]: # Define a function to search nearby information and convert the result as dataframe
def venues_nearby(latitude, longitude, category, verbose=True):
    results = fs.venues.search(
        params = {
            'query': category,
            'll': '{}{}'.format(latitude, longitude),
            'radius': RADIUS,
            'categoryId': fs_categories[category]
        }
    )
    df = json_normalize(results['venues'])
    cols = ['Name', 'Latitude', 'Longitude', 'Tips', 'Users', 'Visits']
    if( len(df) == 0 ):
        df = pd.DataFrame(columns=cols)
    else:
        df = df[['name', 'location.lat', 'location.lng', 'stats.tipCount', 'stats.usersCount', 'stats.visitsCount']]
        df.columns = cols
    if( verbose ):
        print('{} {} venues are found within {}m of location'.format(len(df), category, RADIUS))
    return df
```

```
In [14]: #Train Station
venues_nearby(ITPark['Latitude'], ITPark['Longitude'], 'Train Station').head()

2 "Train Station" venues are found within 2000m of location
```

Out[14]:

|   | Name                            | Latitude  | Longitude | Tips | Users | Visits |
|---|---------------------------------|-----------|-----------|------|-------|--------|
| 0 | Baiyappanahalli Metro Station   | 12.991302 | 77.655208 | 0    | 0     | 0      |
| 1 | Baiyappanahalli Railway station | 12.991104 | 77.652010 | 0    | 0     | 0      |

```
In [15]: venues_nearby(ITPark['Latitude'], ITPark['Longitude'], 'Metro Station').head()

1 "Metro Station" venues are found within 2000m of location
```

Out[15]:

|   | Name                        | Latitude  | Longitude | Tips | Users | Visits |
|---|-----------------------------|-----------|-----------|------|-------|--------|
| 0 | Byappanahalli Metro Station | 12.995587 | 77.658733 | 0    | 0     | 0      |

```
In [16]: venues_nearby(ITPark['Latitude'], ITPark['Longitude'], 'Bus Stop').head()
```

4 "Bus Stop" venues are found within 2000m of location

```
Out[16]:
```

|   | Name                   | Latitude  | Longitude | Tips | Users | Visits |
|---|------------------------|-----------|-----------|------|-------|--------|
| 0 | CMH Hospital Bus Stop  | 12.978642 | 77.645746 | 0    | 0     | 0      |
| 1 | Murgeshpallya Bus Stop | 12.959106 | 77.657144 | 0    | 0     | 0      |
| 2 | DRDO Phase 2 Bus stop  | 12.985845 | 77.679030 | 0    | 0     | 0      |
| 3 | Tin Factory Bus Stop   | 12.996921 | 77.669179 | 0    | 0     | 0      |

```
In [17]: venues_nearby(ITPark['Latitude'], ITPark['Longitude'], 'Food').head()
```

30 "Food" venues are found within 2000m of location

```
Out[17]:
```

|   | Name                   | Latitude  | Longitude | Tips | Users | Visits |
|---|------------------------|-----------|-----------|------|-------|--------|
| 0 | Punjabi Food House     | 12.978229 | 77.657765 | 0    | 0     | 0      |
| 1 | Escape Mall Food Court | 12.978632 | 77.658313 | 0    | 0     | 0      |
| 2 | Food Palette           | 12.983570 | 77.656688 | 0    | 0     | 0      |
| 3 | food                   | 12.973529 | 77.645863 | 0    | 0     | 0      |
| 4 | Mayur Fast Food        | 12.975077 | 77.666170 | 0    | 0     | 0      |

```
In [18]: venues_nearby(ITPark['Latitude'], ITPark['Longitude'], 'Arts & Entertainment')
.head()
```

1 "Arts & Entertainment" venues are found within 2000m of location

```
Out[18]:
```

|   | Name           | Latitude  | Longitude | Tips | Users | Visits |
|---|----------------|-----------|-----------|------|-------|--------|
| 0 | The Art School | 12.979715 | 77.646926 | 0    | 0     | 0      |

```
In [19]: df_itparks.loc[0, 'Name']
itpark_latitude = df_itparks.loc[0, 'Latitude'] # Latitude value
itpark_longitude = df_itparks.loc[0, 'Longitude'] # Longitude value

itpark_name = df_itparks.loc[0, 'Name'] # name

print('Latitude and longitude values of {} are {}, {}'.format(itpark_name,
                                                                itpark_latitude
                                                                ,
                                                                itpark_longitude))
```

Latitude and longitude values of Bagmane Tech Park are 12.978611, 77.661111.

```
In [20]: LIMIT = 500 # limit of number of venues returned by Foursquare API
radius = 2000 # define radius
import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas dataframe
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    itpark_latitude,
    itpark_longitude,
    radius,
    LIMIT)
url # display URL

results = requests.get(url).json()
results
```

```

Out[20]: {'meta': {'code': 200, 'requestId': '5c3a9ef6dd5797600b831170'},
  'response': {'groups': [{'items': [{'reasons': {'count': 0,
  'items': [{'reasonName': 'globalInteractionReason',
  'summary': 'This spot is popular',
  'type': 'general'}]}],
  'referralId': 'e-0-4d4cdf76a7f86ea878b930de-0',
  'venue': {'categories': [{'icon': {'prefix': 'https://ss3.4sqi.net/img/
categories_v2/food/german_',
  'suffix': '.png'},
  'id': '4bf58dd8d48988d10d941735',
  'name': 'German Restaurant',
  'pluralName': 'German Restaurants',
  'primary': True,
  'shortName': 'German'}]},
  'id': '4d4cdf76a7f86ea878b930de',
  'location': {'address': '3rd Floor, Goethe Institut',
  'cc': 'IN',
  'city': 'Bangalore',
  'country': 'India',
  'crossStreet': '716, CMH Road, Indiranagar',
  'distance': 1826,
  'formattedAddress': ['3rd Floor, Goethe Institut (716, CMH Road, Indi
ranagar)',
  'Bangalore',
  'Karnāṭaka',
  'India'],
  'labeledLatLngs': [{'label': 'display',
  'lat': 12.978407737568805,
  'lng': 77.64427149288929}],
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```



```

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    'primary': True,
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    'shortName': 'Intersection'}]],
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```

```

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```

```

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```

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'suggestedFilters': { 'filters': [{ 'key': 'openNow', 'name': 'Open now' }],
'header': 'Tap to show:'},
'totalResults': 100}}

```

In [21]: *# 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 [22]: venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

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

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

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

nearby_venues.head(1000)
```

Out[22]:

|   | count | items   | referralId                     | categories        |                            |
|---|-------|---|--------------------------------|-------------------|----------------------------|
| 0 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-4d4cdf76a7f86ea878b930de-0 | German Restaurant | 4d4cdf76a7f86ea878b930de-0 |
| 1 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-558412cf498e1c1b56659ae3-1 | Ice Cream Shop    | 558412cf498e1c1b56659ae3-1 |
| 2 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-551f9434498e41a1317bd816-2 | Burger Joint      | 551f9434498e41a1317bd816-2 |
| 3 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-5392ce10498e97c3af36354c-3 | Asian Restaurant  | 5392ce10498e97c3af36354c-3 |
| 4 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-533850ad498e5cc1a990f184-4 | Pub               | 533850ad498e5cc1a990f184-4 |
| 5 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-4cdab0e3a1bba35db42a90e5-5 | Bookstore         | 4cdab0e3a1bba35db42a90e5-5 |
| 6 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-50cddeffe4b0c490c8573c7d-6 | Arcade            | 50cddeffe4b0c490c8573c7d-6 |
| 7 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-4b82a4e7f964a5203bdc30e3-7 | Dessert Shop      | 4b82a4e7f964a5203bdc30e3-7 |



|    | count | items  | referralId                      | categories                     |                        |
|----|-------|--|---------------------------------|--------------------------------|------------------------|
| 8  | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4cb6ca1d55af224b7b4a9c7e-8  | Butcher                        | 4cb6ca1d55af224b7b4a9  |
| 9  | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4d553d30611aa35df36f3239-9  | Indian Restaurant              | 4d553d30611aa35df36f32 |
| 10 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-5869197465e7c7534b2868be-10 | Multicuisine Indian Restaurant | 5869197465e7c7534b286  |
| 11 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4ea00dca0aaf09533178e13f-11 | Light Rail Station             | 4ea00dca0aaf09533178e  |
| 12 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-56ab7a49498ea6e0e9fcb26a-12 | Pizza Place                    | 56ab7a49498ea6e0e9fcb  |
| 13 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-558ff6a2498ef8e404dc365b-13 | Ice Cream Shop                 | 558ff6a2498ef8e404dc36 |
| 14 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4b9e4b64f964a520f0d736e3-14 | Indian Restaurant              | 4b9e4b64f964a520f0d736 |
| 15 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-504b6bcae4b0d1cf33a3581b-15 | Lounge                         | 504b6bcae4b0d1cf33a35  |

|    | count | items  | referralId                      | categories         |                             |
|----|-------|--|---------------------------------|--------------------|-----------------------------|
| 16 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4e9f7e250aaf92a86e7b30a8-16 | Tea Room           | 4e9f7e250aaf92a86e7b30a8-16 |
| 17 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4b7037d3f964a5202b0c2de3-17 | Steakhouse         | 4b7037d3f964a5202b0c2de3-17 |
| 18 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-50828760e4b0cd9d3a925d7c-18 | Convenience Store  | 50828760e4b0cd9d3a925d7c-18 |
| 19 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-5221baab11d2e7bc4b4273f3-19 | Burger Joint       | 5221baab11d2e7bc4b4273f3-19 |
| 20 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4dd695fcc65bee535a9c857d-20 | Indian Restaurant  | 4dd695fcc65bee535a9c857d-20 |
| 21 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4d4a5bc711a36ea8dfad301c-21 | Chinese Restaurant | 4d4a5bc711a36ea8dfad301c-21 |
| 22 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-5340596b498e3c13ad5f59a7-22 | Bar                | 5340596b498e3c13ad5f59a7-22 |
| 23 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-514d77e8e4b0f2f188c5695c-23 | Korean Restaurant  | 514d77e8e4b0f2f188c5695c-23 |

|     | count | items  | referralId                      | categories        |                         |
|-----|-------|--|---------------------------------|-------------------|-------------------------|
| 24  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4f2ff1f9e4b01982f38e1b6f-24 | Bar               | 4f2ff1f9e4b01982f38e1b6 |
| 25  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4c066fa38f8fa5930944f30d-25 | Gym               | 4c066fa38f8fa5930944f30 |
| 26  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4f2a9131e4b043ec6e07e24f-26 | Burger Joint      | 4f2a9131e4b043ec6e07e   |
| 27  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4c18aa61d4d9c9289db1ef29-27 | Juice Bar         | 4c18aa61d4d9c9289db1e   |
| 28  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4c62bb6879d1e21e39c0d615-28 | Indian Restaurant | 4c62bb6879d1e21e39c0c   |
| 29  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4cc976d4d063a143adee0db4-29 | Accessories Store | 4cc976d4d063a143adee0   |
| ... | ...   | ...  | ...                             | ...               | ...                     |
| 70  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-540c03f0498e20a6ab35bf78-70 | Indian Restaurant | 540c03f0498e20a6ab35b   |
| 71  | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4f2a8b40e4b0ce029f867821-71 | Clothing Store    | 4f2a8b40e4b0ce029f8678  |

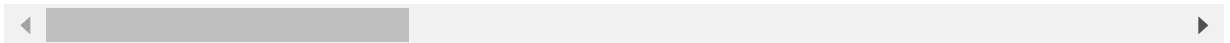
|    | count | items  | referralId                      | categories        |                        |
|----|-------|--|---------------------------------|-------------------|------------------------|
| 72 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4ee5f8436c25be9631cf3763-72 | Shopping Mall     | 4ee5f8436c25be9631cf37 |
| 73 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-5117c8ebe4b0261e00ae2d12-73 | Indian Restaurant | 5117c8ebe4b0261e00ae2  |
| 74 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-50efcc57e4b002d1a1abc3f5-74 | Indian Restaurant | 50efcc57e4b002d1a1abc: |
| 75 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4ba4e79ef964a5204bc138e3-75 | Indian Restaurant | 4ba4e79ef964a5204bc13  |
| 76 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4dbafe38f7b1ab37dd3946ad-76 | Park              | 4dbafe38f7b1ab37dd3946 |
| 77 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4ec63a04f79041351b2ef036-77 | Department Store  | 4ec63a04f79041351b2ef0 |
| 78 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4be3ba4521d5a59341ee1911-78 | Indian Restaurant | 4be3ba4521d5a59341ee   |
| 79 | 0     | {'type': 'general', 'summary': 'This spot is ... | e-0-4f2d0c01e4b056f83abba386-79 | Department Store  | 4f2d0c01e4b056f83abba3 |

|    | count | items  | referralId                      | categories         |                             |
|----|-------|--|---------------------------------|--------------------|-----------------------------|
| 80 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4bde9c446198c9b6d04f14ff-80 | Indian Restaurant  | 4bde9c446198c9b6d04f14ff-80 |
| 81 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4f97fe91e4b012474d3b0502-81 | Food Truck         | 4f97fe91e4b012474d3b0502-81 |
| 82 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4c66a9a719f3c9b68e61a0ff-82 | Food & Drink Shop  | 4c66a9a719f3c9b68e61a0ff-82 |
| 83 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4c712da8df6b8cfabd43ba4d-83 | Chinese Restaurant | 4c712da8df6b8cfabd43ba4d-83 |
| 84 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4ee2f27d775b86c402c7081d-84 | Bakery             | 4ee2f27d775b86c402c7081d-84 |
| 85 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4f2e986be4b0d411bc30ef21-85 | Pizza Place        | 4f2e986be4b0d411bc30ef21-85 |
| 86 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-504b18d7e4b084386aada6f8-86 | Clothing Store     | 504b18d7e4b084386aada6f8-86 |
| 87 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4fc9ddc2e4b0f82a4b62183e-87 | Electronics Store  | 4fc9ddc2e4b0f82a4b62183e-87 |

|    | count | items  | referralId                      | categories        |                        |
|----|-------|--|---------------------------------|-------------------|------------------------|
| 88 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-50e6e237e4b0abc0cd9b7809-88 | Electronics Store | 50e6e237e4b0abc0cd9b7  |
| 89 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-508936eae4b02a7b07cc9108-89 | Pizza Place       | 508936eae4b02a7b07cc9  |
| 90 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-5305b98f498ee5e5b226dab3-90 | Indian Restaurant | 5305b98f498ee5e5b226d  |
| 91 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4ec65b1c93ad41338b70f7d3-91 | Intersection      | 4ec65b1c93ad41338b70f  |
| 92 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-5209acf711d2875948cb11a2-92 | Intersection      | 5209acf711d2875948cb1  |
| 93 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-519dd7be498e2ebb1171f9e4-93 | Platform          | 519dd7be498e2ebb1171f  |
| 94 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4d7a5544777bb1f7055e555b-94 | Bus Station       | 4d7a5544777bb1f7055e5  |
| 95 | 0     | [{"type": "general", "summary": "This spot is ..."}] | e-0-4eedc14e7ee5f45387f67940-95 | Snack Place       | 4eedc14e7ee5f45387f679 |

|    | count | items   | referralId                      | categories         |                          |
|----|-------|---|---------------------------------|--------------------|--------------------------|
| 96 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-51f1fbc2498ef8884a6fff85-96 | Light Rail Station | 51f1fbc2498ef8884a6fff85 |
| 97 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-4c813ad6d34ca14386622080-97 | Hotel              | 4c813ad6d34ca14386622    |
| 98 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-4d7e24a8dd4a6ea83ada6325-98 | Indian Restaurant  | 4d7e24a8dd4a6ea83ada6    |
| 99 | 0     | [{'type': 'general', 'summary': 'This spot is ... | e-0-5277b3e911d26c4df6a1dca1-99 | Diner              | 5277b3e911d26c4df6a1d    |

100 rows × 22 columns



```
In [23]: nearby_venues.categories.unique()
```

```
Out[23]: array(['German Restaurant', 'Ice Cream Shop', 'Burger Joint',
                'Asian Restaurant', 'Pub', 'Bookstore', 'Arcade', 'Dessert Shop',
                'Butcher', 'Indian Restaurant', 'Multicuisine Indian Restaurant',
                'Light Rail Station', 'Pizza Place', 'Lounge', 'Tea Room',
                'Steakhouse', 'Convenience Store', 'Chinese Restaurant', 'Bar',
                'Korean Restaurant', 'Gym', 'Juice Bar', 'Accessories Store',
                'Nightclub', 'Donut Shop', 'Coffee Shop', 'Café', 'BBQ Joint',
                'Department Store', 'Mexican Restaurant', 'Sandwich Place',
                'Italian Restaurant', 'Cocktail Bar', 'Flea Market', 'Food Truck',
                'Gourmet Shop', 'Vegetarian / Vegan Restaurant', 'Speakeasy',
                'Fast Food Restaurant', 'Clothing Store', 'Shopping Mall', 'Park',
                'Food & Drink Shop', 'Bakery', 'Electronics Store', 'Intersection',
                'Platform', 'Bus Station', 'Snack Place', 'Hotel', 'Diner'], dtype=object)
```

```
In [24]: print('{} venues were returned by Foursquare.'.format(nearby_venues.shape))

(100, 22) venues were returned by Foursquare.
```

## Methodology

Methodology section which represents the main component of the report where you discuss and describe any exploratory data analysis that you did, any inferential statistical testing that you performed, and what machine learnings were used and why.

With above data, I can build a content-based recommender systems to resolve the problem.

Combine with FourSquare API on counting how many different venues (Food, Transport) and Bangalore IT Park list, a IT Park nearby venues matrix can be built. The weighted matrix can be applied on 5 possible locations with venues information to generate a ranking result. The the top one on the ranking list can be recommended to the stakeholder.

Before building the matrix, I have to prepare the required data and apply some data analysis.

Data Cleansing and Preparation Check the IT Park dataset contains any duplicated address

```
In [25]: duplicated = df_itparks.duplicated('Address', keep=False)
         df_itparks[duplicated].sort_values('Address')
```

Out[25]:

|  | Name | Address | Latitude | Longitude |
|--|------|---------|----------|-----------|
|--|------|---------|----------|-----------|

There is no duplicate address in Banagalore IT Park list. We are good to proceed with next step



In [26]: `df_itparks.head(10)`

Out[26]:

|   | Name                            | Address   | Latitude | Longitude |
|---|---------------------------------|---|----------|-----------|
| 0 | Bagmane Tech Park               | CV Raman Nagar, Bengaluru, Karnataka, India       | 12.9786  | 77.6611   |
| 1 | Embassy GolfLinks Business Park | Off Intermediate Ring Road,Bengaluru, Karnatak... | 12.9491  | 77.6443   |
| 2 | Manyata Embassy Business Park   | Nagawara, Outer Ring Road,Bengaluru, Karnataka... | 13.0481  | 77.6222   |
| 3 | Embassy TechVillage             | Outer Ring Road,Bengaluru, Karnataka, India       | 12.9314  | 77.6912   |
| 4 | Electronic City                 | Electronic City,Bengaluru, Karnataka, India       | 12.8399  | 77.677    |
| 5 | RMZ Ecoworld                    | devarabisanahalli outer ring road, Bengaluru, ... | 12.9256  | 77.6878   |
| 6 | International Tech Park         | ITPL,Bengaluru, Karnataka, India                  | 12.8399  | 77.677    |
| 7 | Prestige Tech Park              | Sarjapur Ring Road, Marathahalli,Bengaluru, Ka... | 12.9425  | 77.6927   |
| 8 | Kalyani Magnum Tech Park        | Bannerghatta Main Rd, Krishnaraju Layout, Dora... | 12.9     | 77.5971   |
| 9 | Bhoruka Park Pvt Limited        | Whitefield Road, Mahadevapura, Bangalore          | 12.973   | 77.599    |

```
In [27]: from pathlib import Path
# construct a dataframe to store data
df_venues = pd.DataFrame(columns=['IT park Name', 'Category', 'Name', 'Latitude', 'Longitude', 'Tips', 'Users', 'Visits'])
for (name, address, latitude, longitude) in df_itparks.itertuples(index=False):
    for cat, cat_id in fs_categories.items():
        df = venues_nearby(latitude, longitude, cat, verbose=False)
        df['IT Park Name'] = name
        df['Category'] = cat
        df_venues = df_venues.append(df)
df_venues.to_csv('itpark_venues.csv', index=False)
```

In [28]: `print('Total {} of venues are found'.format(len(df_venues)))`

Total 1106 of venues are found

In [29]: `# check the shape of data`  
`df_venues.shape`

Out[29]: (1106, 9)

```
In [30]: # check some data  
df_venues.head(100)
```

Out[30]:

|    | Category | IT Park Name      | IT park Name | Latitude  | Longitude | Name                                      | Tips | Users | Visits |
|----|----------|-------------------|--------------|-----------|-----------|---|------|-------|--------|
| 0  | Food     | Bagmane Tech Park | NaN          | 12.978229 | 77.657765 | Punjabi Food House                        | 0    | 0     | 0      |
| 1  | Food     | Bagmane Tech Park | NaN          | 12.978632 | 77.658313 | Escape Mall Food Court                    | 0    | 0     | 0      |
| 2  | Food     | Bagmane Tech Park | NaN          | 12.983570 | 77.656688 | Food Palette                              | 0    | 0     | 0      |
| 3  | Food     | Bagmane Tech Park | NaN          | 12.973529 | 77.645863 | food                                      | 0    | 0     | 0      |
| 4  | Food     | Bagmane Tech Park | NaN          | 12.975077 | 77.666170 | Mayur Fast Food                           | 0    | 0     | 0      |
| 5  | Food     | Bagmane Tech Park | NaN          | 12.985092 | 77.663324 | DRDO Veg Fast Food Joint                  | 0    | 0     | 0      |
| 6  | Food     | Bagmane Tech Park | NaN          | 12.972141 | 77.664124 | nandhini fast food centre                 | 0    | 0     | 0      |
| 7  | Food     | Bagmane Tech Park | NaN          | 12.971797 | 77.664023 | Bengal Food Corner                        | 0    | 0     | 0      |
| 8  | Food     | Bagmane Tech Park | NaN          | 12.972309 | 77.665427 | MAGIC Food Market                         | 0    | 0     | 0      |
| 9  | Food     | Bagmane Tech Park | NaN          | 12.993113 | 77.661132 | Food Court - Gopalan Signature Mall       | 0    | 0     | 0      |
| 10 | Food     | Bagmane Tech Park | NaN          | 12.986170 | 77.645133 | Food Trucks Under the Metro               | 0    | 0     | 0      |
| 11 | Food     | Bagmane Tech Park | NaN          | 12.993684 | 77.660360 | Google Bangalore's Dining Hall/Food Court | 0    | 0     | 0      |

|    | Category | IT Park Name      | IT park Name | Latitude  | Longitude | Name                                   | Tips | Users | Visits |
|----|----------|-------------------|--------------|-----------|-----------|--|------|-------|--------|
| 12 | Food     | Bagmane Tech Park | NaN          | 12.970459 | 77.646372 | Moulis True South Indian Food          | 0    | 0     | 0      |
| 13 | Food     | Bagmane Tech Park | NaN          | 12.968700 | 77.649100 | Nandini Nandana spicy fast food corner | 0    | 0     | 0      |
| 14 | Food     | Bagmane Tech Park | NaN          | 12.984895 | 77.675459 | Street Food                            | 0    | 0     | 0      |
| 15 | Food     | Bagmane Tech Park | NaN          | 12.975721 | 77.676337 | R.R FAST Food                          | 0    | 0     | 0      |
| 16 | Food     | Bagmane Tech Park | NaN          | 12.970719 | 77.647183 | Get Inn Food Court                     | 0    | 0     | 0      |
| 17 | Food     | Bagmane Tech Park | NaN          | 12.970551 | 77.676102 | TOSS Food lounge                       | 0    | 0     | 0      |
| 18 | Food     | Bagmane Tech Park | NaN          | 12.973510 | 77.678101 | Dua's Food Paradise                    | 0    | 0     | 0      |
| 19 | Food     | Bagmane Tech Park | NaN          | 12.973334 | 77.678291 | Duaa's Food Court                      | 0    | 0     | 0      |
| 20 | Food     | Bagmane Tech Park | NaN          | 12.988542 | 77.645338 | Moses Food Caterers                    | 0    | 0     | 0      |
| 21 | Food     | Bagmane Tech Park | NaN          | 12.979360 | 77.642177 | sea food place                         | 0    | 0     | 0      |
| 22 | Food     | Bagmane Tech Park | NaN          | 12.971966 | 77.654924 | Foodingz                               | 0    | 0     | 0      |
| 23 | Food     | Bagmane Tech Park | NaN          | 12.979462 | 77.664135 | Meghana Foods                          | 0    | 0     | 0      |

|     | Category | IT Park Name      | IT park Name | Latitude  | Longitude | Name                          | Tips | Users | Visits |
|-----|----------|-------------------|--------------|-----------|-----------|-------------------------------|------|-------|--------|
| 24  | Food     | Bagmane Tech Park | NaN          | 12.972556 | 77.649012 | Foodipa                       | 0    | 0     | 0      |
| 25  | Food     | Bagmane Tech Park | NaN          | 12.978443 | 77.657397 | Embassy Prime                 | 0    | 0     | 0      |
| 26  | Food     | Bagmane Tech Park | NaN          | 12.967252 | 77.657902 | Sagar Foods bakery            | 0    | 0     | 0      |
| 27  | Food     | Bagmane Tech Park | NaN          | 12.971149 | 77.654051 | Serendipity Foods Pvt Ltd     | 0    | 0     | 0      |
| 28  | Food     | Bagmane Tech Park | NaN          | 12.973067 | 77.678093 | Dolphin Sea Foods             | 0    | 0     | 0      |
| 29  | Food     | Bagmane Tech Park | NaN          | 12.979050 | 77.642261 | Sue's Kitchen                 | 0    | 0     | 0      |
| ... | ...      | ...               | ...          | ...       | ...       | ...                           | ...  | ...   | ...    |
| 1   | Bus Stop | Bagmane Tech Park | NaN          | 12.959106 | 77.657144 | Murgeshpallya Bus Stop        | 0    | 0     | 0      |
| 2   | Bus Stop | Bagmane Tech Park | NaN          | 12.985845 | 77.679030 | DRDO Phase 2 Bus stop         | 0    | 0     | 0      |
| 3   | Bus Stop | Bagmane Tech Park | NaN          | 12.996921 | 77.669179 | Tin Factory Bus Stop          | 0    | 0     | 0      |
| 0   | Office   | Bagmane Tech Park | NaN          | 12.959288 | 77.651524 | Fastrack Head Office.         | 0    | 0     | 0      |
| 1   | Office   | Bagmane Tech Park | NaN          | 12.996701 | 77.668603 | Office                        | 0    | 0     | 0      |
| 2   | Office   | Bagmane Tech Park | NaN          | 12.965852 | 77.657636 | LIC office Jeevan Bhima Nagar | 0    | 0     | 0      |

|    | Category | IT Park Name      | IT park Name | Latitude  | Longitude | Name  | Tips | Users | Visits |
|----|----------|-------------------|--------------|-----------|-----------|---|------|-------|--------|
| 3  | Office   | Bagmane Tech Park | NaN          | 12.974281 | 77.671349 | councilor's office                                | 0    | 0     | 0      |
| 4  | Office   | Bagmane Tech Park | NaN          | 12.969289 | 77.651339 | Orbis Office                                      | 0    | 0     | 0      |
| 5  | Office   | Bagmane Tech Park | NaN          | 12.979102 | 77.644985 | Aadhaar Enrolment Office                          | 0    | 0     | 0      |
| 6  | Office   | Bagmane Tech Park | NaN          | 12.978341 | 77.644079 | BNI Office  | 0    | 0     | 0      |
| 7  | Office   | Bagmane Tech Park | NaN          | 12.977953 | 77.643693 | Puma Corporate Office - India                     | 0    | 0     | 0      |
| 8  | Office   | Bagmane Tech Park | NaN          | 12.971801 | 77.644918 | INK office  | 0    | 0     | 0      |
| 9  | Office   | Bagmane Tech Park | NaN          | 12.959756 | 77.648102 | Jubilant Retail Head Office                       | 0    | 0     | 0      |
| 10 | Office   | Bagmane Tech Park | NaN          | 12.959848 | 77.648716 | Nova Corporate Office                             | 0    | 0     | 0      |
| 11 | Office   | Bagmane Tech Park | NaN          | 12.959805 | 77.649329 | redBus.in (Corporate Office - Pilani Soft Labs... | 0    | 0     | 0      |
| 12 | Office   | Bagmane Tech Park | NaN          | 12.970343 | 77.642264 | Zivame office                                     | 0    | 0     | 0      |
| 13 | Office   | Bagmane Tech Park | NaN          | 12.968086 | 77.645737 | officespac.es                                     | 0    | 0     | 0      |
| 14 | Office   | Bagmane Tech Park | NaN          | 12.975249 | 77.646936 | MMoser Associates                                 | 0    | 0     | 0      |

|   | Category | IT Park Name                    | IT park Name | Latitude  | Longitude | Name                                   | Tips | Users | Visits |
|---|----------|---------------------------------|--------------|-----------|-----------|--|------|-------|--------|
| 0 | Food     | Embassy GolfLinks Business Park | NaN          | 12.949063 | 77.644009 | Pyramid Food Court                     | 0    | 0     | 0      |
| 1 | Food     | Embassy GolfLinks Business Park | NaN          | 12.948475 | 77.645516 | Ministry of Food                       | 0    | 0     | 0      |
| 2 | Food     | Embassy GolfLinks Business Park | NaN          | 12.952143 | 77.643465 | Riviera Food Court                     | 0    | 0     | 0      |
| 3 | Food     | Embassy GolfLinks Business Park | NaN          | 12.956630 | 77.644880 | Knight Rider Food/Chai                 | 0    | 0     | 0      |
| 4 | Food     | Embassy GolfLinks Business Park | NaN          | 12.960263 | 77.643636 | Soul Food                              | 0    | 0     | 0      |
| 5 | Food     | Embassy GolfLinks Business Park | NaN          | 12.947835 | 77.643616 | Tuckin Restaurant - Pyramid Food Court | 0    | 0     | 0      |
| 6 | Food     | Embassy GolfLinks Business Park | NaN          | 12.946924 | 77.645314 | [24]7 Food Court                       | 0    | 0     | 0      |
| 7 | Food     | Embassy GolfLinks Business Park | NaN          | 12.956033 | 77.643145 | Food Paradise                          | 0    | 0     | 0      |
| 8 | Food     | Embassy GolfLinks Business Park | NaN          | 12.946401 | 77.649164 | Healthy Food Land                      | 0    | 0     | 0      |
| 9 | Food     | Embassy GolfLinks Business Park | NaN          | 12.953002 | 77.640102 | Sri Manjutha Food Corner               | 0    | 0     | 0      |

|    | Category | IT Park Name                    | IT park Name | Latitude  | Longitude | Name                 | Tips | Users | Visits |
|----|----------|---------------------------------|--------------|-----------|-----------|----------------------|------|-------|--------|
| 10 | Food     | Embassy GolfLinks Business Park | NaN          | 12.949086 | 77.643835 | KFC                  | 0    | 0     | 0      |
| 11 | Food     | Embassy GolfLinks Business Park | NaN          | 12.953195 | 77.640018 | Manjunatha Food Cart | 0    | 0     | 0      |

100 rows × 9 columns

Number of venues in each category

```
In [31]: df_venues['Category'].value_counts().to_frame(name='Count')
```

Out[31]:

|                      | Count |
|----------------------|-------|
| Food                 | 453   |
| Bus Station          | 196   |
| Shop & Service       | 191   |
| Office               | 185   |
| Bus Stop             | 23    |
| Arts & Entertainment | 17    |
| Business Center      | 15    |
| Train Station        | 12    |
| Residence            | 6     |
| Metro Station        | 6     |
| Airport              | 2     |

```
In [32]: df_venues[(df_venues.Tips > 0)|(df_venues.Users > 0)|(df_venues.Visits > 0)]
```

Out[32]:

| Category | IT Park Name | IT park Name | Latitude | Longitude | Name | Tips | Users | Visits |
|----------|--------------|--------------|----------|-----------|------|------|-------|--------|
|----------|--------------|--------------|----------|-----------|------|------|-------|--------|

```
In [33]: df_venues.drop(columns=['Tips','Users','Visits'], inplace=True)
```

```
In [34]: df_venues.shape
```

Out[34]: (1106, 6)



```
In [35]: df_target_venues = pd.DataFrame(columns=['Location', 'Category', 'Name', 'Latitude', 'Longitude', 'Tips', 'Users', 'Visits'])
for (location, address, latitude, longitude) in df_possible_locations.itertuples(index=False):
    for cat, cat_id in fs_categories.items():
        df = venues_nearby(latitude, longitude, cat, verbose=False)
        df['Location'] = location
        df['Category'] = cat
        df_target_venues = df_target_venues.append(df)
df_target_venues.head(100)
```

Out[35]:

|    | Category       | Latitude  | Location | Longitude | Name   | Tips | Users | Visits |
|----|----------------|-----------|----------|-----------|--|------|-------|--------|
| 0  | Food           | 12.973132 | L1       | 77.746124 | Food Zone  | 0    | 0     | 0      |
| 1  | Food           | 12.959597 | L1       | 77.747970 | Food Court@ Forum Value Mall                     | 0    | 0     | 0      |
| 2  | Food           | 12.957297 | L1       | 77.743551 | Food Court@ Delta,Sigma Soft Tech Park           | 0    | 0     | 0      |
| 3  | Food           | 12.984898 | L1       | 77.737314 | ITPL Food Court                                  | 0    | 0     | 0      |
| 4  | Food           | 12.980583 | L1       | 77.743507 | Wheely Good Food                                 | 0    | 0     | 0      |
| 5  | Food           | 12.982536 | L1       | 77.740690 | Xerox Food Court                                 | 0    | 0     | 0      |
| 6  | Food           | 12.984630 | L1       | 77.743874 | Xerox Food Court                                 | 0    | 0     | 0      |
| 7  | Food           | 12.979109 | L1       | 77.728892 | Food Court @ Inorbit Mall                        | 0    | 0     | 0      |
| 8  | Food           | 12.984212 | L1       | 77.738290 | Flavours - The Food Court @ Ascendas Park Square | 0    | 0     | 0      |
| 9  | Food           | 12.974305 | L1       | 77.729205 | Tesco Lower food court                           | 0    | 0     | 0      |
| 10 | Food           | 12.979242 | L1       | 77.728820 | Purnabramha Maharashtrian Food                   | 0    | 0     | 0      |
| 11 | Food           | 12.979171 | L1       | 77.728780 | Subway @ Inorbit Food Court                      | 0    | 0     | 0      |
| 12 | Food           | 12.967084 | L1       | 77.738784 | Atthamma Foods - Chettinadu Style                | 0    | 0     | 0      |
| 13 | Food           | 12.985554 | L1       | 77.743708 | Sai Foods  | 0    | 0     | 0      |
| 0  | Shop & Service | 12.967653 | L1       | 77.749389 | Puncture Shop                                    | 0    | 0     | 0      |
| 1  | Shop & Service | 12.959310 | L1       | 77.748098 | The Body Shop Forum Value Mall                   | 0    | 0     | 0      |
| 2  | Shop & Service | 12.959757 | L1       | 77.747463 | The Body Shop                                    | 0    | 0     | 0      |
| 3  | Shop & Service | 12.958600 | L1       | 77.747600 | Favourite Shop                                   | 0    | 0     | 0      |
| 4  | Shop & Service | 12.967963 | L1       | 77.730999 | Corner Paan Shop                                 | 0    | 0     | 0      |
| 5  | Shop & Service | 12.956932 | L1       | 77.741405 | DADDUS SWEET SHOP                                | 0    | 0     | 0      |

|     | Category       | Latitude  | Location | Longitude | Name                               | Tips | Users | Visits |
|-----|----------------|-----------|----------|-----------|------------------------------------|------|-------|--------|
| 6   | Shop & Service | 12.957049 | L1       | 77.736571 | Pete's Detailing Shop              | 0    | 0     | 0      |
| 7   | Shop & Service | 12.979221 | L1       | 77.751439 | Kartik's Mithai Shoppe             | 0    | 0     | 0      |
| 0   | Residence      | 12.957613 | L1       | 77.737283 | Aviva Residence                    | 0    | 0     | 0      |
| 0   | Bus Station    | 12.969564 | L1       | 77.749899 | Whitefield Bus Stop                | 0    | 0     | 0      |
| 1   | Bus Station    | 12.964010 | L1       | 77.748653 | Brookbond bus stop                 | 0    | 0     | 0      |
| 2   | Bus Station    | 12.957733 | L1       | 77.745876 | Varthur Kodi Bus Stop              | 0    | 0     | 0      |
| 3   | Bus Station    | 12.964704 | L1       | 77.740500 | Ramagondanahalli Bus Stop          | 0    | 0     | 0      |
| 4   | Bus Station    | 12.956977 | L1       | 77.740282 | Ramgondanahalli Bus Stop           | 0    | 0     | 0      |
| 5   | Bus Station    | 12.984667 | L1       | 77.741422 | ITPL Bus Depot                     | 0    | 0     | 0      |
| 6   | Bus Station    | 12.983830 | L1       | 77.752151 | Hope Farm bus stop                 | 0    | 0     | 0      |
| ... | ...            | ...       | ...      | ...       | ...                                | ...  | ...   | ...    |
| 4   | Office         | 12.931750 | L2       | 77.694536 | xactly bangalore office            | 0    | 0     | 0      |
| 5   | Office         | 12.937563 | L2       | 77.690958 | L1 Identity Solutions India Office | 0    | 0     | 0      |
| 6   | Office         | 12.942169 | L2       | 77.687956 | Landmark Group Corporate Office    | 0    | 0     | 0      |
| 7   | Office         | 12.917782 | L2       | 77.671069 | Hexaware Technologies              | 0    | 0     | 0      |
| 8   | Office         | 12.925848 | L2       | 77.681032 | Northern Trust                     | 0    | 0     | 0      |
| 9   | Office         | 12.923837 | L2       | 77.670627 | Akamai Technologies                | 0    | 0     | 0      |
| 0   | Food           | 12.996456 | L3       | 77.695465 | Food Box                           | 0    | 0     | 0      |
| 1   | Food           | 12.997803 | L3       | 77.689240 | Shameera Food Palace               | 0    | 0     | 0      |
| 2   | Food           | 12.995700 | L3       | 77.684500 | Vinayaka Fast Food                 | 0    | 0     | 0      |
| 3   | Food           | 12.996711 | L3       | 77.693980 | Chandranna Hotel & Fast Food       | 0    | 0     | 0      |
| 4   | Food           | 12.991877 | L3       | 77.688699 | Infinity Food Service              | 0    | 0     | 0      |

|   | Category           | Latitude  | Location | Longitude | Name  | Tips | Users | Visits |
|---|--------------------|-----------|----------|-----------|---|------|-------|--------|
| 5 | Food               | 12.994892 | L3       | 77.678452 | Mummy food  | 0    | 0     | 0      |
| 6 | Food               | 12.989124 | L3       | 77.689091 | Srilakshmi fast food                              | 0    | 0     | 0      |
| 7 | Food               | 12.985979 | L3       | 77.694275 | Food Court  | 0    | 0     | 0      |
| 8 | Food               | 12.989168 | L3       | 77.695319 | Megabite Food court                               | 0    | 0     | 0      |
| 9 | Food               | 12.997594 | L3       | 77.696617 | Foodcourt @<br>Phoenix Marketcity                 | 0    | 0     | 0      |
| 0 | Shop &<br>Service  | 12.997456 | L3       | 77.696845 | Raymond Shop                                      | 0    | 0     | 0      |
| 1 | Shop &<br>Service  | 12.997602 | L3       | 77.696560 | Om Book Shop                                      | 0    | 0     | 0      |
| 2 | Shop &<br>Service  | 12.996154 | L3       | 77.696415 | The Body Shop                                     | 0    | 0     | 0      |
| 3 | Shop &<br>Service  | 13.016904 | L3       | 77.678174 | Shakthi Fresh<br>Chicken Shop                     | 0    | 0     | 0      |
| 4 | Shop &<br>Service  | 13.011424 | L3       | 77.675358 | Biba Baby Shop                                    | 0    | 0     | 0      |
| 5 | Shop &<br>Service  | 13.013267 | L3       | 77.699545 | crackers shop                                     | 0    | 0     | 0      |
| 6 | Shop &<br>Service  | 13.017663 | L3       | 77.704778 | LG Brand Shop                                     | 0    | 0     | 0      |
| 7 | Shop &<br>Service  | 13.010848 | L3       | 77.696230 | Manchester United<br>Shoppe                       | 0    | 0     | 0      |
| 0 | Train<br>Station   | 13.000319 | L3       | 77.675828 | Krishnarajapuram<br>(KR Puram) Railway<br>Station | 0    | 0     | 0      |
| 1 | Train<br>Station   | 12.993629 | L3       | 77.703067 | Kadugodi station                                  | 0    | 0     | 0      |
| 0 | Business<br>Center | 12.983676 | L3       | 77.694234 | Bagmane World<br>Technology Center                | 0    | 0     | 0      |
| 0 | Bus<br>Station     | 13.008387 | L3       | 77.695973 | KR Puram Bus Stand                                | 0    | 0     | 0      |
| 1 | Bus<br>Station     | 12.987429 | L3       | 77.694514 | mahadevpura bus<br>stop                           | 0    | 0     | 0      |
| 2 | Bus<br>Station     | 12.996381 | L3       | 77.683466 | B Narayanapura Bus<br>Stop                        | 0    | 0     | 0      |

100 rows × 8 columns

```
In [36]: df_target_venues[(df_target_venues.Tips > 0)|(df_target_venues.Users > 0)|(df_target_venues.Visits > 0)]
```

Out[36]:

| Category | Latitude | Location | Longitude | Name | Tips | Users | Visits |
|----------|----------|----------|-----------|------|------|-------|--------|
|----------|----------|----------|-----------|------|------|-------|--------|

```
In [37]: df_target_venues.drop(columns=['Tips','Users','Visits'], inplace=True)
```

```
In [38]: df_target_venues['Category'].value_counts().to_frame(name='Count')
```

Out[38]:

|                           | Count |
|---------------------------|-------|
| <b>Food</b>               | 70    |
| <b>Bus Station</b>        | 35    |
| <b>Shop &amp; Service</b> | 29    |
| <b>Office</b>             | 27    |
| <b>Bus Stop</b>           | 4     |
| <b>Train Station</b>      | 4     |
| <b>Business Center</b>    | 2     |
| <b>Residence</b>          | 1     |

```
In [39]: df_target_venues.shape
```

Out[39]: (172, 5)

```
In [40]: df_venues_count = df_venues.groupby(['IT Park Name','Category'], as_index=False).count()
df_venues_count.drop(columns=['Latitude','Longitude'], inplace=True)
df_venues_count.rename(columns={'Name':'Count'}, inplace=True)
df_venues_count.head()
```

Out[40]:

|          | IT Park Name      | Category             | IT park Name | Count |
|----------|-------------------|----------------------|--------------|-------|
| <b>0</b> | Bagmane Tech Park | Airport              | 0            | 1     |
| <b>1</b> | Bagmane Tech Park | Arts & Entertainment | 0            | 1     |
| <b>2</b> | Bagmane Tech Park | Bus Station          | 0            | 16    |
| <b>3</b> | Bagmane Tech Park | Bus Stop             | 0            | 4     |
| <b>4</b> | Bagmane Tech Park | Food                 | 0            | 30    |

```
In [41]: df_venues_count = df_venues_count.pivot(index='IT Park Name', columns='Category',
values='Count').fillna(0)
df_venues_count.head()
```

Out[41]:

| Category                 | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office | Residence |
|--------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|--------|-----------|
| IT Park Name             |         |                      |             |          |                 |      |               |        |           |
| Bagmane Tech Park        | 1.0     | 1.0                  | 16.0        | 4.0      | 0.0             | 30.0 | 1.0           | 15.0   | 0.0       |
| Bhoruka Park Pvt Limited | 0.0     | 4.0                  | 19.0        | 2.0      | 0.0             | 30.0 | 5.0           | 30.0   | 1.0       |
| Brigade Tech Park        | 0.0     | 0.0                  | 7.0         | 0.0      | 0.0             | 28.0 | 0.0           | 0.0    | 0.0       |
| Divyasree Techno Park    | 0.0     | 0.0                  | 13.0        | 2.0      | 0.0             | 30.0 | 0.0           | 3.0    | 1.0       |
| Eco Space                | 0.0     | 0.0                  | 9.0         | 0.0      | 3.0             | 24.0 | 0.0           | 11.0   | 0.0       |

```
In [42]: # Do the same process on target locations
df_target_venues_count = df_target_venues.groupby(['Location', 'Category']).size().reset_index(name='Count')
df_target_venues_count = df_target_venues_count.pivot(index='Location', columns='Category', values='Count').fillna(0)
```

In [43]: df\_target\_venues\_count

Out[43]:

| Category | Bus Station | Bus Stop | Business Center | Food | Office | Residence | Shop & Service | Train Station |
|----------|-------------|----------|-----------------|------|--------|-----------|----------------|---------------|
| Location |             |          |                 |      |        |           |                |               |
| L1       | 7.0         | 0.0      | 0.0             | 14.0 | 3.0    | 1.0       | 8.0            | 0.0           |
| L2       | 7.0         | 0.0      | 1.0             | 22.0 | 10.0   | 0.0       | 2.0            | 1.0           |
| L3       | 4.0         | 3.0      | 1.0             | 10.0 | 6.0    | 0.0       | 8.0            | 2.0           |
| L4       | 17.0        | 1.0      | 0.0             | 24.0 | 8.0    | 0.0       | 11.0           | 1.0           |

In [44]: `boss_favorite`

Out[44]: `[{'IT Park Name': 'Prestige Tech Park', 'Rating': 4.5},  
{'IT Park Name': 'Electronic City', 'Rating': 4.5},  
{'IT Park Name': 'Embassy GolfLinks Business Park', 'Rating': 4.3},  
{'IT Park Name': 'Sigma Soft Tech Park', 'Rating': 3.4}]`

In [45]: `names = [ITPark['IT Park Name'] for ITPark in boss_favorite ]  
df_itparks[df_itparks.Name.isin(names)]`

Out[45]:

|    | Name                            | Address   | Latitude | Longitude |
|----|---------------------------------|---|----------|-----------|
| 1  | Embassy GolfLinks Business Park | Off Intermediate Ring Road,Bengaluru, Karnatak... | 12.9491  | 77.6443   |
| 4  | Electronic City                 | Electronic City,Bengaluru, Karnataka, India       | 12.8399  | 77.677    |
| 7  | Prestige Tech Park              | Sarjapur Ring Road, Marathahalli,Bengaluru, Ka... | 12.9425  | 77.6927   |
| 11 | Sigma Soft Tech Park            | Whitefield Main Road, Bangalore - 560066, Oppo... | 12.9576  | 77.7442   |

In [46]: `df_boss_favorite = pd.DataFrame(boss_favorite, columns=['IT Park Name','Rating'])  
df_boss_favorite`

Out[46]:

|   | IT Park Name                    | Rating |
|---|---------------------------------|--------|
| 0 | Prestige Tech Park              | 4.5    |
| 1 | Electronic City                 | 4.5    |
| 2 | Embassy GolfLinks Business Park | 4.3    |
| 3 | Sigma Soft Tech Park            | 3.4    |

I only interested in number of venues in each category of dataframe.

## Data Analysis

In [47]: `!conda install seaborn=0.9 --yes`

Fetching package metadata .....

Solving package specifications: .

Package plan for installation in environment /opt/conda/envs/DSX-Python35:

The following packages will be UPDATED:

seaborn: 0.8.0-py35h15a2772\_0 --> 0.9.0-py35\_0

seaborn-0.9.0- 100% |#####| Time: 0:00:00 48.32 M  
B/s

In [48]: `import matplotlib  
import matplotlib.pyplot as plt  
import seaborn as sns  
%matplotlib inline`

Check the data type of variables

In [49]: `df_venues_count = df_venues.groupby(['IT Park Name', 'Category'], as_index=False).count()  
df_venues_count.drop(columns=['Latitude', 'Longitude', 'IT park Name'], inplace=True)  
df_venues_count.rename(columns={'Name': 'Count'}, inplace=True)  
df_venues_count.head()`

Out[49]:

|   | IT Park Name      | Category             | Count |
|---|-------------------|----------------------|-------|
| 0 | Bagmane Tech Park | Airport              | 1     |
| 1 | Bagmane Tech Park | Arts & Entertainment | 1     |
| 2 | Bagmane Tech Park | Bus Station          | 16    |
| 3 | Bagmane Tech Park | Bus Stop             | 4     |
| 4 | Bagmane Tech Park | Food                 | 30    |

All datatype is numeric

Generates descriptive statistics that summarize the central tendency, dispersion and shape of a dataset's distribution



```
In [50]: df_venues_count.describe()
```

Out[50]:

|       | Count      |
|-------|------------|
| count | 114.000000 |
| mean  | 9.701754   |
| std   | 10.124823  |
| min   | 1.000000   |
| 25%   | 2.000000   |
| 50%   | 4.500000   |
| 75%   | 15.750000  |
| max   | 30.000000  |

```
In [51]: df_venues_count = df_venues.groupby(['IT Park Name', 'Category'], as_index=False).count()
df_venues_count.drop(columns=['Latitude', 'Longitude'], inplace=True)
df_venues_count.rename(columns={'Name': 'Count'}, inplace=True)
df_venues_count = df_venues_count.pivot(index='IT Park Name', columns='Category', values='Count').fillna(0)
df_venues_count.head(100)
```

Out[51]:

| Category                        | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office | Res |
|---------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|--------|-----|
| IT Park Name                    |         |                      |             |          |                 |      |               |        |     |
| Bagmane Tech Park               | 1.0     | 1.0                  | 16.0        | 4.0      | 0.0             | 30.0 | 1.0           | 15.0   | 0.0 |
| Bhoruka Park Pvt Limited        | 0.0     | 4.0                  | 19.0        | 2.0      | 0.0             | 30.0 | 5.0           | 30.0   | 1.0 |
| Brigade Tech Park               | 0.0     | 0.0                  | 7.0         | 0.0      | 0.0             | 28.0 | 0.0           | 0.0    | 0.0 |
| Divyasree Techno Park           | 0.0     | 0.0                  | 13.0        | 2.0      | 0.0             | 30.0 | 0.0           | 3.0    | 1.0 |
| Eco Space                       | 0.0     | 0.0                  | 9.0         | 0.0      | 3.0             | 24.0 | 0.0           | 11.0   | 0.0 |
| Electronic City                 | 0.0     | 0.0                  | 5.0         | 0.0      | 0.0             | 30.0 | 0.0           | 3.0    | 0.0 |
| Embassy GolfLinks Business Park | 1.0     | 1.0                  | 14.0        | 3.0      | 0.0             | 30.0 | 0.0           | 25.0   | 3.0 |
| Embassy TechVillage             | 0.0     | 1.0                  | 7.0         | 1.0      | 3.0             | 20.0 | 0.0           | 10.0   | 0.0 |
| IBC Knowledge Park              | 0.0     | 4.0                  | 23.0        | 1.0      | 1.0             | 30.0 | 0.0           | 30.0   | 0.0 |
| International Tech Park         | 0.0     | 0.0                  | 5.0         | 0.0      | 0.0             | 30.0 | 0.0           | 3.0    | 0.0 |
| Kalyani Magnum Tech Park        | 0.0     | 3.0                  | 15.0        | 1.0      | 0.0             | 30.0 | 0.0           | 17.0   | 0.0 |
| Manyata Embassy Business Park   | 0.0     | 0.0                  | 2.0         | 1.0      | 0.0             | 13.0 | 0.0           | 3.0    | 0.0 |
| Prasad Technology Park          | 0.0     | 0.0                  | 13.0        | 2.0      | 0.0             | 30.0 | 0.0           | 2.0    | 0.0 |
| Prestige Tech Park              | 0.0     | 1.0                  | 13.0        | 2.0      | 2.0             | 18.0 | 0.0           | 9.0    | 0.0 |

| Category                      | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office | Res |
|-------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|--------|-----|
| IT Park Name                  |         |                      |             |          |                 |      |               |        |     |
| <b>RMZ Ecoworld</b>           | 0.0     | 1.0                  | 9.0         | 1.0      | 3.0             | 25.0 | 0.0           | 11.0   | 0.0 |
| <b>Shailendra Tech Park</b>   | 0.0     | 0.0                  | 12.0        | 2.0      | 0.0             | 30.0 | 0.0           | 2.0    | 0.0 |
| <b>Sigma Soft Tech Park</b>   | 0.0     | 0.0                  | 7.0         | 0.0      | 0.0             | 5.0  | 0.0           | 3.0    | 1.0 |
| <b>Vrindavan Tech Village</b> | 0.0     | 1.0                  | 7.0         | 1.0      | 3.0             | 20.0 | 0.0           | 8.0    | 0.0 |



In [52]: `df_venues_count.dtypes.to_frame(name='Data Type')`

Out[52]:

|                                 | Data Type |
|---------------------------------|-----------|
| Category                        |           |
| <b>Airport</b>                  | float64   |
| <b>Arts &amp; Entertainment</b> | float64   |
| <b>Bus Station</b>              | float64   |
| <b>Bus Stop</b>                 | float64   |
| <b>Business Center</b>          | float64   |
| <b>Food</b>                     | float64   |
| <b>Metro Station</b>            | float64   |
| <b>Office</b>                   | float64   |
| <b>Residence</b>                | float64   |
| <b>Shop &amp; Service</b>       | float64   |
| <b>Train Station</b>            | float64   |

All datatype is numeric

Generates descriptive statistics that summarize the central tendency, dispersion and shape of a dataset's distribution

In [53]: `df_venues_count.describe()`

Out[53]:

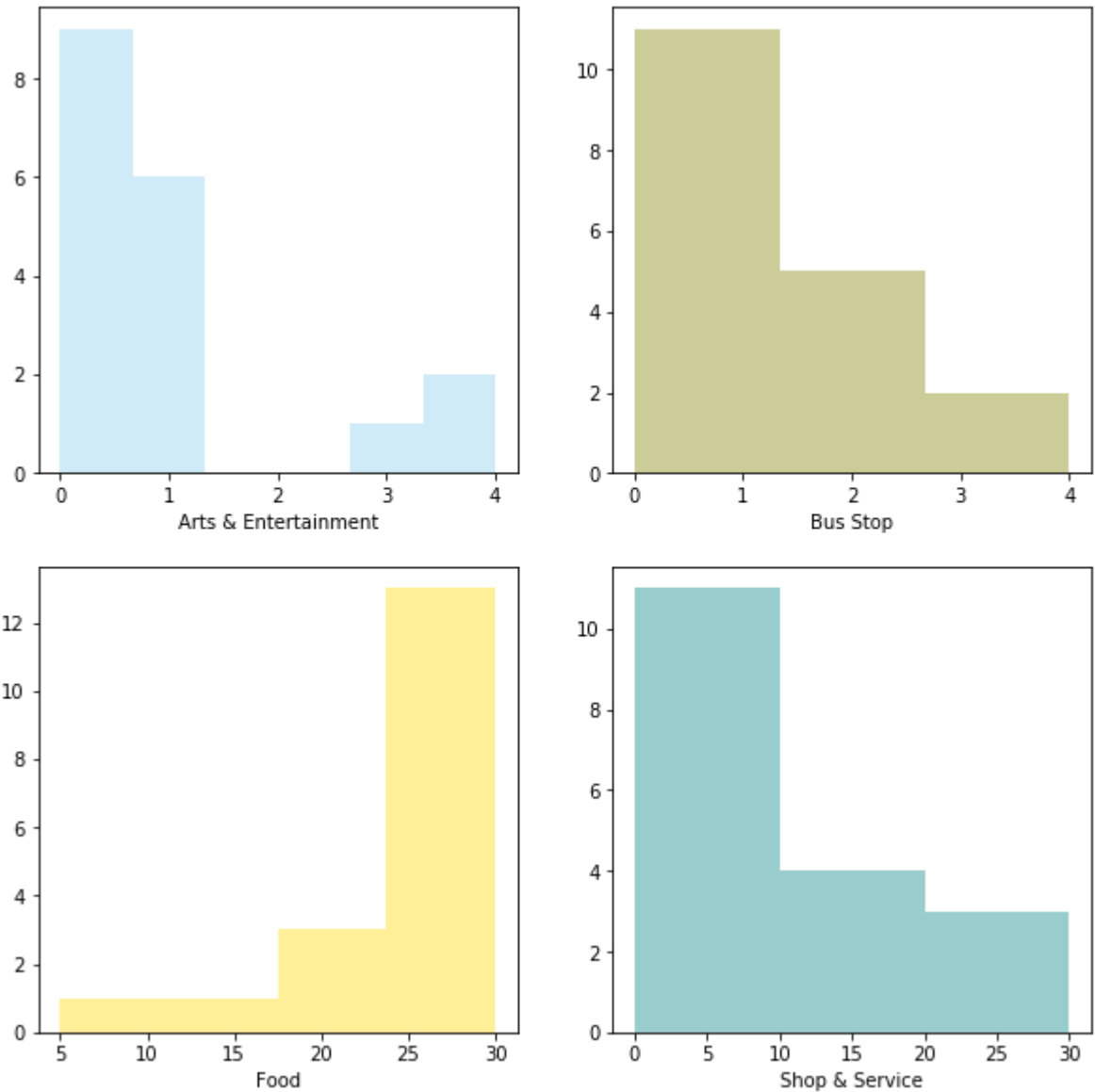
| Category     | Airport   | Arts & Entertainment | Bus Station | Bus Stop  | Business Center | Food      | Metro Station |
|--------------|-----------|----------------------|-------------|-----------|-----------------|-----------|---------------|
| <b>count</b> | 18.000000 | 18.000000            | 18.000000   | 18.000000 | 18.000000       | 18.000000 | 18.000000     |
| <b>mean</b>  | 0.111111  | 0.944444             | 10.888889   | 1.277778  | 0.833333        | 25.166667 | 0.333333      |
| <b>std</b>   | 0.323381  | 1.349171             | 5.400315    | 1.127494  | 1.294786        | 7.286167  | 1.188111      |
| <b>min</b>   | 0.000000  | 0.000000             | 2.000000    | 0.000000  | 0.000000        | 5.000000  | 0.000000      |
| <b>25%</b>   | 0.000000  | 0.000000             | 7.000000    | 0.250000  | 0.000000        | 21.000000 | 0.000000      |
| <b>50%</b>   | 0.000000  | 0.500000             | 10.500000   | 1.000000  | 0.000000        | 30.000000 | 0.000000      |
| <b>75%</b>   | 0.000000  | 1.000000             | 13.750000   | 2.000000  | 1.750000        | 30.000000 | 0.000000      |
| <b>max</b>   | 1.000000  | 4.000000             | 23.000000   | 4.000000  | 3.000000        | 30.000000 | 5.000000      |

IT Park really has many 'Bus Stop', 'Food', 'Shop & Service' venues around. But there is no any Metro Station

Plot the distribution of other variables

```
In [54]: f, axes = plt.subplots(2, 2, figsize=(10, 10))
sns.distplot(df_venues_count['Arts & Entertainment'], color="skyblue", ax=axes[0, 0], kde=False)
sns.distplot(df_venues_count['Bus Stop'], color="olive", ax=axes[0, 1], kde=False)
sns.distplot(df_venues_count['Food'], color="gold", ax=axes[1, 0], kde=False)
sns.distplot(df_venues_count['Shop & Service'], color="teal", ax=axes[1, 1], kde=False)
```

Out[54]: <matplotlib.axes.\_subplots.AxesSubplot at 0x7f6119d87e10>



In [55]: `df_venues_count.corr()`

Out[55]:

| Category                        | Airport   | Arts & Entertainment | Bus Station | Bus Stop  | Business Center | Food      | Metro Station |
|---------------------------------|-----------|----------------------|-------------|-----------|-----------------|-----------|---------------|
| Category                        |           |                      |             |           |                 |           |               |
| <b>Airport</b>                  | 1.000000  | 0.014981             | 0.276954    | 0.717035  | -0.234146       | 0.241332  | 0.051031      |
| <b>Arts &amp; Entertainment</b> | 0.014981  | 1.000000             | 0.758018    | 0.204090  | 0.028061        | 0.270273  | 0.562652      |
| <b>Bus Station</b>              | 0.276954  | 0.758018             | 1.000000    | 0.565700  | -0.154232       | 0.492344  | 0.418649      |
| <b>Bus Stop</b>                 | 0.717035  | 0.204090             | 0.565700    | 1.000000  | -0.208185       | 0.323412  | 0.278092      |
| <b>Business Center</b>          | -0.234146 | 0.028061             | -0.154232   | -0.208185 | 1.000000        | -0.277469 | -0.191180     |
| <b>Food</b>                     | 0.241332  | 0.270273             | 0.492344    | 0.323412  | -0.277469       | 1.000000  | 0.197047      |
| <b>Metro Station</b>            | 0.051031  | 0.562652             | 0.418649    | 0.278092  | -0.191180       | 0.197047  | 1.000000      |
| <b>Office</b>                   | 0.367161  | 0.879289             | 0.766128    | 0.376999  | 0.065239        | 0.301004  | 0.533399      |
| <b>Residence</b>                | 0.553399  | 0.075796             | 0.222502    | 0.362794  | -0.296174       | 0.042105  | 0.197047      |
| <b>Shop &amp; Service</b>       | 0.270867  | 0.846206             | 0.926615    | 0.504391  | -0.312058       | 0.376790  | 0.521004      |
| <b>Train Station</b>            | 0.133631  | 0.704654             | 0.592152    | 0.325781  | 0.300376        | 0.133445  | 0.704654      |

It seems that 'Bus Stop', 'Shop & Service' and 'Food' category are highly correlated. Find P-Value of the variables

By convention, when the p-value is:

< 0.001 we say there is strong evidence that the correlation is significant, < 0.05; there is moderate evidence that the correlation is significant, < 0.1; there is weak evidence that the correlation is significant, and is > 0.1; there is no evidence that the correlation is significant.

In [56]: `from scipy import stats`

```
In [57]: p_value_data = []
for left in df_venues_count.columns:
    p_values = [left]
    for right in df_venues_count.columns:
        pearson_coef, p_value = stats.pearsonr(df_venues_count[left], df_venues_count[right])
        if(p_value < 0.001):
            p_values.append('strong')
        elif(p_value < 0.05):
            p_values.append('moderate')
        elif(p_value < 0.1):
            p_values.append('weak')
        else:
            p_values.append('no')
    p_value_data.append(p_values)
```

```
In [58]: df_p_values = pd.DataFrame(p_value_data, columns=['Category'] + df_venues_count.columns.tolist())
```

```
In [59]: df_p_values
```

```
Out[59]:
```

|    | Category             | Airport  | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food     | Office   |
|----|----------------------|----------|----------------------|-------------|----------|-----------------|----------|----------|
| 0  | Airport              | strong   | no                   | no          | strong   | no              | no       | no       |
| 1  | Arts & Entertainment | no       | strong               | strong      | no       | no              | no       | moderate |
| 2  | Bus Station          | no       | strong               | strong      | moderate | no              | moderate | weak     |
| 3  | Bus Stop             | strong   | no                   | moderate    | strong   | no              | no       | no       |
| 4  | Business Center      | no       | no                   | no          | no       | strong          | no       | no       |
| 5  | Food                 | no       | no                   | moderate    | no       | no              | strong   | no       |
| 6  | Metro Station        | no       | moderate             | weak        | no       | no              | no       | strong   |
| 7  | Office               | no       | strong               | strong      | no       | no              | no       | moderate |
| 8  | Residence            | moderate | no                   | no          | no       | no              | no       | no       |
| 9  | Shop & Service       | no       | strong               | strong      | moderate | no              | no       | moderate |
| 10 | Train Station        | no       | moderate             | moderate    | no       | no              | no       | strong   |



In [60]: `df_boss_favorite`

Out[60]:

|   | IT Park Name                    | Rating |
|---|---------------------------------|--------|
| 0 | Prestige Tech Park              | 4.5    |
| 1 | Electronic City                 | 4.5    |
| 2 | Embassy GolfLinks Business Park | 4.3    |
| 3 | Sigma Soft Tech Park            | 3.4    |

The correlation between 'Bus Stop', 'Food', and 'Shop & Service' are statistically significant, and the coefficient of > 0.5 shows that the relationship is positive

In [61]: `!conda install -c conda-forge folium=0.5 --yes  
import folium`

`print('Folium installed and imported!')`

Fetching package metadata .....

Solving package specifications: .

Package plan for installation in environment /opt/conda/envs/DSX-Python35:

The following NEW packages will be INSTALLED:

```
altair: 2.2.2-py35_1 conda-forge
branca: 0.3.1-py_0 conda-forge
folium: 0.5.0-py_0 conda-forge
vincent: 0.4.4-py_1 conda-forge
```

```
altair-2.2.2-p 100% |#####| Time: 0:00:00 53.41 M
B/s
```

```
branca-0.3.1-p 100% |#####| Time: 0:00:00 35.77 M
B/s
```

```
vincent-0.4.4- 100% |#####| Time: 0:00:00 39.71 M
B/s
```

```
folium-0.5.0-p 100% |#####| Time: 0:00:00 46.69 M
B/s
```

Folium installed and imported!

In [62]: `blr_coords = getLatLng('Bangalore')  
blr_coords`

Out[62]: (12.9715987, 77.5945627)

```

In [63]: blr_map = folium.Map(location=blr_coords, zoom_start=12, tiles='Stamen Toner')

itpark_fg = folium.FeatureGroup()
targets_fg = folium.FeatureGroup()

for(location, address, latitude, longitude) in df_possible_locations.itertuples(index=False):

    targets_fg.add_child(
        folium.features.CircleMarker(
            location=(float(latitude), float(longitude)),
            popup=location,
            radius=10,
            fill=True,
            color='yellow',
            fill_opacity=1.
        )
    )

boss_ratings = df_boss_favorite.set_index('IT Park Name')
name_list = boss_ratings.index.tolist()

for (name, address, latitude, longitude ) in df_itparks.itertuples(index=False):

    color = 'blue'
    popup = name

    if( name in name_list ):
        color = 'red'
        popup = '{} - Rating: {}'.format(name, boss_ratings.loc[name,'Rating'])

    itpark_fg.add_child(
        folium.features.CircleMarker(
            location=(float(latitude), float(longitude)),
            popup=location,
            radius=10,
            fill=True,
            color=color,
            fill_opacity=1.
        )
    )

blr_map.add_child(itpark_fg)
blr_map.add_child(targets_fg)

```

Out[63]:



Most of Bangalore IT Park (blue circle) and stakeholder's favorite IT Park (red circle) location are built near main road, and centralized in urban area of Bangalore. The target locations (yellow circle) of new ODC are not near to main road.

Machine Learning Now, let's use Content-Based or Item-Item recommendation systems. In this case, I am going to try to figure out the boss's favorite new ODC location by counting number of nearby venues and ratings given.

Normalize the values of venues dataframe by using MinMaxScaler method

In [64]: `df_venues_count.head()`

Out[64]:

| Category                 | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office | Reside |
|--------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|--------|--------|
| IT Park Name             |         |                      |             |          |                 |      |               |        |        |
| Bagmane Tech Park        | 1.0     | 1.0                  | 16.0        | 4.0      | 0.0             | 30.0 | 1.0           | 15.0   | 0.0    |
| Bhoruka Park Pvt Limited | 0.0     | 4.0                  | 19.0        | 2.0      | 0.0             | 30.0 | 5.0           | 30.0   | 1.0    |
| Brigade Tech Park        | 0.0     | 0.0                  | 7.0         | 0.0      | 0.0             | 28.0 | 0.0           | 0.0    | 0.0    |
| Divyasree Techno Park    | 0.0     | 0.0                  | 13.0        | 2.0      | 0.0             | 30.0 | 0.0           | 3.0    | 1.0    |
| Eco Space                | 0.0     | 0.0                  | 9.0         | 0.0      | 3.0             | 24.0 | 0.0           | 11.0   | 0.0    |



In [65]: `from sklearn.preprocessing import MinMaxScaler  
scaler = MinMaxScaler()`

In [66]: `venues_normalized = scaler.fit_transform(df_venues_count)`

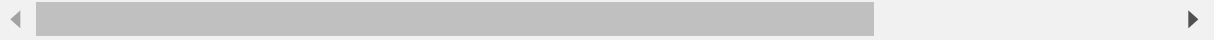
In [67]: `df_venues_normalized = pd.DataFrame(  
 venues_normalized,  
 index=df_venues_count.index,  
 columns=df_venues_count.columns  
)`

In [68]: df\_venues\_normalized

Out[68]:

| Category                        | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office   |
|---------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|----------|
| IT Park Name                    |         |                      |             |          |                 |      |               |          |
| Bagmane Tech Park               | 1.0     | 0.25                 | 0.666667    | 1.00     | 0.000000        | 1.00 | 0.2           | 0.500000 |
| Bhoruka Park Pvt Limited        | 0.0     | 1.00                 | 0.809524    | 0.50     | 0.000000        | 1.00 | 1.0           | 1.000000 |
| Brigade Tech Park               | 0.0     | 0.00                 | 0.238095    | 0.00     | 0.000000        | 0.92 | 0.0           | 0.000000 |
| Divyasree Techno Park           | 0.0     | 0.00                 | 0.523810    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Eco Space                       | 0.0     | 0.00                 | 0.333333    | 0.00     | 1.000000        | 0.76 | 0.0           | 0.366667 |
| Electronic City                 | 0.0     | 0.00                 | 0.142857    | 0.00     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Embassy GolfLinks Business Park | 1.0     | 0.25                 | 0.571429    | 0.75     | 0.000000        | 1.00 | 0.0           | 0.833333 |
| Embassy TechVillage             | 0.0     | 0.25                 | 0.238095    | 0.25     | 1.000000        | 0.60 | 0.0           | 0.333333 |
| IBC Knowledge Park              | 0.0     | 1.00                 | 1.000000    | 0.25     | 0.333333        | 1.00 | 0.0           | 1.000000 |
| International Tech Park         | 0.0     | 0.00                 | 0.142857    | 0.00     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Kalyani Magnum Tech Park        | 0.0     | 0.75                 | 0.619048    | 0.25     | 0.000000        | 1.00 | 0.0           | 0.566667 |
| Manyata Embassy Business Park   | 0.0     | 0.00                 | 0.000000    | 0.25     | 0.000000        | 0.32 | 0.0           | 0.100000 |
| Prasad Technology Park          | 0.0     | 0.00                 | 0.523810    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.066667 |
| Prestige Tech Park              | 0.0     | 0.25                 | 0.523810    | 0.50     | 0.666667        | 0.52 | 0.0           | 0.300000 |

| Category                      | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office   |
|-------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|----------|
| IT Park Name                  |         |                      |             |          |                 |      |               |          |
| <b>RMZ Ecoworld</b>           | 0.0     | 0.25                 | 0.333333    | 0.25     | 1.000000        | 0.80 | 0.0           | 0.366667 |
| <b>Shailendra Tech Park</b>   | 0.0     | 0.00                 | 0.476190    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.066667 |
| <b>Sigma Soft Tech Park</b>   | 0.0     | 0.00                 | 0.238095    | 0.00     | 0.000000        | 0.00 | 0.0           | 0.100000 |
| <b>Vrindavan Tech Village</b> | 0.0     | 0.25                 | 0.238095    | 0.25     | 1.000000        | 0.60 | 0.0           | 0.266667 |



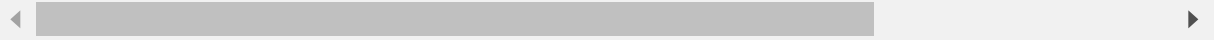
```
In [69]: df_venues_normalized.head(100)
```



Out[69]:

| Category                        | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office   |
|---------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|----------|
| IT Park Name                    |         |                      |             |          |                 |      |               |          |
| Bagmane Tech Park               | 1.0     | 0.25                 | 0.666667    | 1.00     | 0.000000        | 1.00 | 0.2           | 0.500000 |
| Bhoruka Park Pvt Limited        | 0.0     | 1.00                 | 0.809524    | 0.50     | 0.000000        | 1.00 | 1.0           | 1.000000 |
| Brigade Tech Park               | 0.0     | 0.00                 | 0.238095    | 0.00     | 0.000000        | 0.92 | 0.0           | 0.000000 |
| Divyasree Techno Park           | 0.0     | 0.00                 | 0.523810    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Eco Space                       | 0.0     | 0.00                 | 0.333333    | 0.00     | 1.000000        | 0.76 | 0.0           | 0.366667 |
| Electronic City                 | 0.0     | 0.00                 | 0.142857    | 0.00     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Embassy GolfLinks Business Park | 1.0     | 0.25                 | 0.571429    | 0.75     | 0.000000        | 1.00 | 0.0           | 0.833333 |
| Embassy TechVillage             | 0.0     | 0.25                 | 0.238095    | 0.25     | 1.000000        | 0.60 | 0.0           | 0.333333 |
| IBC Knowledge Park              | 0.0     | 1.00                 | 1.000000    | 0.25     | 0.333333        | 1.00 | 0.0           | 1.000000 |
| International Tech Park         | 0.0     | 0.00                 | 0.142857    | 0.00     | 0.000000        | 1.00 | 0.0           | 0.100000 |
| Kalyani Magnum Tech Park        | 0.0     | 0.75                 | 0.619048    | 0.25     | 0.000000        | 1.00 | 0.0           | 0.566667 |
| Manyata Embassy Business Park   | 0.0     | 0.00                 | 0.000000    | 0.25     | 0.000000        | 0.32 | 0.0           | 0.100000 |
| Prasad Technology Park          | 0.0     | 0.00                 | 0.523810    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.066667 |
| Prestige Tech Park              | 0.0     | 0.25                 | 0.523810    | 0.50     | 0.666667        | 0.52 | 0.0           | 0.300000 |

| Category                      | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office   |
|-------------------------------|---------|----------------------|-------------|----------|-----------------|------|---------------|----------|
| IT Park Name                  |         |                      |             |          |                 |      |               |          |
| <b>RMZ Ecoworld</b>           | 0.0     | 0.25                 | 0.333333    | 0.25     | 1.000000        | 0.80 | 0.0           | 0.366667 |
| <b>Shailendra Tech Park</b>   | 0.0     | 0.00                 | 0.476190    | 0.50     | 0.000000        | 1.00 | 0.0           | 0.066667 |
| <b>Sigma Soft Tech Park</b>   | 0.0     | 0.00                 | 0.238095    | 0.00     | 0.000000        | 0.00 | 0.0           | 0.100000 |
| <b>Vrindavan Tech Village</b> | 0.0     | 0.25                 | 0.238095    | 0.25     | 1.000000        | 0.60 | 0.0           | 0.266667 |



Merge the data with boss's favorite list

In [70]: `df_boss_favorite.head()`

Out[70]:

|   | IT Park Name                    | Rating |
|---|---------------------------------|--------|
| 0 | Prestige Tech Park              | 4.5    |
| 1 | Electronic City                 | 4.5    |
| 2 | Embassy GolfLinks Business Park | 4.3    |
| 3 | Sigma Soft Tech Park            | 3.4    |

```
In [71]: boss_rating_table = pd.merge(
        df_boss_favorite,
        df_venues_normalized,
        how='inner',
        left_on='IT Park Name',
        right_index=True
    )
    boss_rating_table.drop(['IT Park Name', 'Rating'], axis=1, inplace=True)
    boss_rating_table
```

Out[71]:

|   | Airport | Arts & Entertainment | Bus Station | Bus Stop | Business Center | Food | Metro Station | Office   | Residence |
|---|---------|----------------------|-------------|----------|-----------------|------|---------------|----------|-----------|
| 0 | 0.0     | 0.25                 | 0.523810    | 0.50     | 0.666667        | 0.52 | 0.0           | 0.300000 | 0.000000  |
| 1 | 0.0     | 0.00                 | 0.142857    | 0.00     | 0.000000        | 1.00 | 0.0           | 0.100000 | 0.000000  |
| 2 | 1.0     | 0.25                 | 0.571429    | 0.75     | 0.000000        | 1.00 | 0.0           | 0.833333 | 1.000000  |
| 3 | 0.0     | 0.00                 | 0.238095    | 0.00     | 0.000000        | 0.00 | 0.0           | 0.100000 | 0.333333  |

Dot product to get the weight of rating on each category according to boss's favorite

```
In [72]: boss_profile = boss_rating_table.transpose().dot(df_boss_favorite['Rating'])
```

```
In [73]: boss_profile
```

```
Out[73]: Airport          4.300000
Arts & Entertainment      2.200000
Bus Station              6.266667
Bus Stop                5.475000
Business Center          3.000000
Food                   11.140000
Metro Station           0.000000
Office                  5.723333
Residence               5.433333
Shop & Service           6.223333
Train Station           1.500000
dtype: float64
```

Normalize the values of target venues

```
In [77]: df_targets_normalized = df_target_venues_count.T
```

In [78]: `df_targets_normalized`

Out[78]:

| Location        | L1   | L2   | L3   | L4   |
|-----------------|------|------|------|------|
| Category        |      |      |      |      |
| Bus Station     | 7.0  | 7.0  | 4.0  | 17.0 |
| Bus Stop        | 0.0  | 0.0  | 3.0  | 1.0  |
| Business Center | 0.0  | 1.0  | 1.0  | 0.0  |
| Food            | 14.0 | 22.0 | 10.0 | 24.0 |
| Office          | 3.0  | 10.0 | 6.0  | 8.0  |
| Residence       | 1.0  | 0.0  | 0.0  | 0.0  |
| Shop & Service  | 8.0  | 2.0  | 8.0  | 11.0 |
| Train Station   | 0.0  | 1.0  | 2.0  | 1.0  |

## Results

Results section where you discuss the results.

With the boss's profile and the complete list of IT Park and their venues count in hand, I am going to take the weighted average of every location based on the profile and recommend the top location that most satisfy it.

In [79]: `df_recommend = (df_targets_normalized*boss_profile).sum(axis=1)/boss_profile.sum()  
df_recommend = df_recommend.reset_index(name='Rating')`

In [83]: `df_recommend`

Out[83]:

|   | Category        | Rating |
|---|-----------------|--------|
| 0 | Bus Station     | NaN    |
| 1 | Bus Stop        | NaN    |
| 2 | Business Center | NaN    |
| 3 | Food            | NaN    |
| 4 | Office          | NaN    |
| 5 | Residence       | NaN    |
| 6 | Shop & Service  | NaN    |
| 7 | Train Station   | NaN    |

In [84]: `df_possible_locations`

Out[84]:

|   | Location | Address                     | Latitude  | Longitude |
|---|----------|-----------------------------|-----------|-----------|
| 0 | L1       | Whitefield, Bangalore       | 12.969800 | 77.749947 |
| 1 | L2       | Bellandure, Bangalore       | 12.926031 | 77.676246 |
| 2 | L3       | Krishnarajapuram, Bangalore | 13.004017 | 77.687776 |
| 3 | L4       | Hebal, Bangalore            | 13.035770 | 77.597022 |

In [86]: `df_recommend.sort_values('Rating', ascending=False, inplace=True)`

In [88]: `print('I should recommend the location "{}" of address "{}" to the stackholder'.format(df_recommend.iat[0,0], df_recommend.iat[0,1]))`

I should recommend the location "Bus Station" of address "nan" to the stackholder

The result is reasonable. Location "L3" has the most number of venues in category "Bus Stop", "Food", "Metro Station" and "Shop & Service".

In [89]: `df_target_venues_count.head()`

Out[89]:

| Category | Bus Station | Bus Stop | Business Center | Food | Office | Residence | Shop & Service | Train Station |
|----------|-------------|----------|-----------------|------|--------|-----------|----------------|---------------|
| Location |             |          |                 |      |        |           |                |               |
| L1       | 7.0         | 0.0      | 0.0             | 14.0 | 3.0    | 1.0       | 8.0            | 0.0           |
| L2       | 7.0         | 0.0      | 1.0             | 22.0 | 10.0   | 0.0       | 2.0            | 1.0           |
| L3       | 4.0         | 3.0      | 1.0             | 10.0 | 6.0    | 0.0       | 8.0            | 2.0           |
| L4       | 17.0        | 1.0      | 0.0             | 24.0 | 8.0    | 0.0       | 11.0           | 1.0           |

Moreover, these categories are most concerned by the stakeholder according to profile rating

```
In [90]: boss_profile.sort_values(ascending=False)
```

```
Out[90]: Food                11.140000
Bus Station                6.266667
Shop & Service             6.223333
Office                    5.723333
Bus Stop                  5.475000
Residence                 5.433333
Airport                   4.300000
Business Center           3.000000
Arts & Entertainment       2.200000
Train Station             1.500000
Metro Station             0.000000
dtype: float64
```

Therefore, Location "L5" should be recommended to the stakeholder

## Discussion

Discussion section where you discuss any observations you noted and any recommendations you can make based on the results.

Number of venues of 5 target locations are actually below the average

```
In [91]: df_venues_count.mean().to_frame(name='Average Count')
```

```
Out[91]:
```

|                                 | Average Count |
|---------------------------------|---------------|
| Category                        |               |
| <b>Airport</b>                  | 0.111111      |
| <b>Arts &amp; Entertainment</b> | 0.944444      |
| <b>Bus Station</b>              | 10.888889     |
| <b>Bus Stop</b>                 | 1.277778      |
| <b>Business Center</b>          | 0.833333      |
| <b>Food</b>                     | 25.166667     |
| <b>Metro Station</b>            | 0.333333      |
| <b>Office</b>                   | 10.277778     |
| <b>Residence</b>                | 0.333333      |
| <b>Shop &amp; Service</b>       | 10.611111     |
| <b>Train Station</b>            | 0.666667      |

```
In [92]: df_target_venues_count.mean().to_frame('Average Count')
```

```
Out[92]:
```

|                 | Average Count |
|-----------------|---------------|
| Category        |               |
| Bus Station     | 8.75          |
| Bus Stop        | 1.00          |
| Business Center | 0.50          |
| Food            | 17.50         |
| Office          | 6.75          |
| Residence       | 0.25          |
| Shop & Service  | 7.25          |
| Train Station   | 1.00          |

I should contact local commercial property agents to find more suitable locations. Moreover, FourSquare may not be providing 100% accurate data for the city like Banhalore, the data maybe out-dated or unreliable, the report should gather more data from other location data source such as Google Place API.

## Conclusion

Conclusion section where you conclude the report.

The stakeholder's problem is resolved. Stakeholder wants to find the best place to Set up new ODC for the product development and 24/7 supports, and the factors of "best location" is based on the number of venues in eating, shopping, transportation category around the location. Stakeholder also provide his favorite list of IT Parks to further explain what the "best location" is. Content-based filtering machine learning technique is the most suitable method to resolve the problem. It combines stakeholder's preference and IT Park profile to make the recommendation result.

The 5 target locations of new ODC may not be a good choices. As the weighting matrix is developed, I can quickly pick other locations and make the recommendation again.