

code-final-week2

October 7, 2019

1 Data science / Capstone project – code (week 2)

1.0.1 The battle of the neighbourhoods: which one is more multicultural? Southampton vs Portsmouth

1.0.2 Step 1 - gather data from each neighbourhood

In this case, the starting point is the train station from each city. We will use Foursquare for that.

1.0.3 Step 2 - group by category using the mean

For that, we need to group the lists

1.0.4 Step 3 - add to a dataframe

By adding to the dataframe then we can use to cluster them. There will be 2 dataframes, one for each city.

1.0.5 Step 4 - use k-means to cluster the neighbourhoods

Cluster the dataframes first.

1.0.6 Step 5 - compare the clusters

Now compare the dataframes + clusters from each. Might use a map for that.

1.0.7 Import libraries

```
[1]: import requests # library to handle requests
import pandas as pd # library for data analysis
import numpy as np # library to handle data in a vectorized manner
import random # library for random number generation

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

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

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

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

print('Folium installed')
print('Libraries imported.')
```

Solving environment: done

```
==> WARNING: A newer version of conda exists. <==
current version: 4.5.11
latest version: 4.7.12
```

Please update conda by running

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

Package Plan

environment location: /home/jupyterlab/conda/envs/python

added / updated specs:

```
- geopy
```

The following packages will be downloaded:

package	build		
geopy-1.20.0	py_0	57 KB	conda-forge
geographiclib-1.50	py_0	34 KB	conda-forge
certifi-2019.9.11	py36_0	147 KB	conda-forge
Total:		238 KB	

The following NEW packages will be INSTALLED:

geographiclib:	1.50-py_0	conda-forge
geopy:	1.20.0-py_0	conda-forge

The following packages will be UPDATED:

```
certifi:          2019.6.16-py36_1 conda-forge --> 2019.9.11-py36_0 conda-forge
```

Downloading and Extracting Packages

```
geopy-1.20.0      | 57 KB      | ##### | 100%
geographiclib-1.50 | 34 KB      | ##### | 100%
certifi-2019.9.11 | 147 KB     | ##### | 100%
```

Preparing transaction: done

Verifying transaction: done

Executing transaction: done

Solving environment: done

==> WARNING: A newer version of conda exists. <==

current version: 4.5.11

latest version: 4.7.12

Please update conda by running

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

All requested packages already installed.

Folium installed

Libraries imported.

1.0.8 Define Foursquare Credentials and Version

```
[2]: CLIENT_ID = '2I3LPFIYIHKOKRDUERZD4BGMBG1MBLDRH51BJVRROQ1LA220' # your
      ↪Foursquare ID
CLIENT_SECRET = 'FD1DZORVTNISU5UKUBDQBFQIYLKXIVZQJ23IILFJFTNA4A2U' # your
      ↪Foursquare Secret
VERSION = '20180604'
LIMIT = 100
print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET: ' + CLIENT_SECRET)
```

Your credentails:

CLIENT_ID: 2I3LPFIYIHKOKRDUERZD4BGMBG1MBLDRH51BJVRROQ1LA220

CLIENT_SECRET: FD1DZORVTNISU5UKUBDQBFQIYLKXIVZQJ23IILFJFTNA4A2U

1.0.9 Define an instance of the geocoder - Southampton

```
[3]: address = 'Southampton Central station, Southampton, UK'

geolocator = Nominatim(user_agent="foursquare_agent")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print(latitude, longitude)
```

50.9077175 -1.4140262

1.0.10 Search for a specific venue category

```
[4]: search_query = 'restaurant'
radius = 8000
print(search_query + ' .... OK!')
```

restaurant ... OK!

1.0.11 Define the corresponding URL

```
[5]: url = 'https://api.foursquare.com/v2/venues/search?
    ↪client_id={} & client_secret={} & ll={}, {} & v={} & query={} & radius={} & limit={} '.
    ↪format(CLIENT_ID, CLIENT_SECRET, latitude, longitude, VERSION, search_query,
    ↪radius, LIMIT)
url
```

```
[5]: 'https://api.foursquare.com/v2/venues/search?client_id=2I3LPFIYIHKOKRDUERZD4BGMB
G1MBLDRH51BJVRRQ1LA220&client_secret=FD1DZORVTNISU5UKUBDQBFQIYLKXIVZQJ23IILFJFT
NA4A2U&ll=50.9077175,-1.4140262&v=20180604&query=restaurant&radius=8000&limit=10
0'
```

1.0.12 Send the GET Request and examine the results

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

```
[6]: {'meta': {'code': 200, 'requestId': '5d9ac4606f0aa2002ceb6b4e'},
      'response': {'venues': [{'id': '5421f381498ec9dfd2b8af7a',
                                'name': 'Boardwalk Restaurant',
                                'location': {'address': 'Grand Harbour Hotel',
                                              'crossStreet': '5 West Quay Rd',
                                              'lat': 50.899460258402144,
                                              'lng': -1.407923698425293,
                                              'labeledLatLngs': [{'label': 'display',
                                                                'lat': 50.899460258402144,
```

```

    'lng': -1.407923698425293]],
    'distance': 1014,
    'postalCode': 'S014 1AG',
    'cc': 'GB',
    'city': 'Southampton',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['Grand Harbour Hotel (5 West Quay Rd)',
        'Southampton',
        'Hampshire',
        'S014 1AG',
        'United Kingdom']],
    'categories': [{ 'id': '4bf58dd8d48988d1c4941735',
        'name': 'Restaurant',
        'pluralName': 'Restaurants',
        'shortName': 'Restaurant',
        'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
            'suffix': '.png'},
        'primary': True}],
    'referralId': 'v-1570423904',
    'hasPerk': False},
{ 'id': '4d557f409e508cfafade009b',
    'name': "Bellini's Italian Restaurant & Lounge Bar",
    'location': { 'address': 'Latimer St.',
        'crossStreet': 'Oxford St.',
        'lat': 50.89755698952178,
        'lng': -1.4007924997266352,
        'labeledLatLngs': [{ 'label': 'display',
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            'lng': -1.4007924997266352}],
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        'cc': 'GB',
        'city': 'Southampton',
        'state': 'Hampshire',
        'country': 'United Kingdom',
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            'Hampshire',
            'S014 3BQ',
            'United Kingdom']],
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            'name': 'Italian Restaurant',
            'pluralName': 'Italian Restaurants',
            'shortName': 'Italian',
            'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/italian_',
                'suffix': '.png'},

```

```

    'primary': True]],
    'referralId': 'v-1570423904',
    'hasPerk': False},
{'id': '4dee63158877aa0c3cb563a9',
 'name': 'Orchid Chinese Restaurant',
 'location': {'address': '9 Commerce road',
 'lat': 50.908541679380846,
 'lng': -1.4159488677978105,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.908541679380846,
 'lng': -1.4159488677978105}]},
 'distance': 163,
 'postalCode': 'SO1 4 7',
 'cc': 'GB',
 'city': 'Southampton',
 'state': 'Hampshire',
 'country': 'United Kingdom',
 'formattedAddress': ['9 Commerce road',
 'Southampton',
 'Hampshire',
 'SO1 4 7',
 'United Kingdom']},
 'categories': [{'id': '4bf58dd8d48988d145941735',
 'name': 'Chinese Restaurant',
 'pluralName': 'Chinese Restaurants',
 'shortName': 'Chinese',
 'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
 'suffix': '.png'},
 'primary': True}]},
 'referralId': 'v-1570423904',
 'hasPerk': False},
{'id': '5471ed6c498eac135acfef5e',
 'name': 'IKEA Restaurant',
 'location': {'address': 'West Quay Road',
 'lat': 50.90338188125466,
 'lng': -1.4116343337929713,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.90338188125466,
 'lng': -1.4116343337929713}]},
 'distance': 511,
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 'cc': 'GB',
 'neighborhood': 'City Centre',
 'city': 'Southampton',
 'state': 'Hampshire',
 'country': 'United Kingdom',
 'formattedAddress': ['West Quay Road',

```

```

    'Southampton',
    'Hampshire',
    'SO15 1GY',
    'United Kingdom']},
    'categories': [{ 'id': '4bf58dd8d48988d1c6941735',
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        'pluralName': 'Scandinavian Restaurants',
        'shortName': 'Scandinavian',
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        'suffix': '.png'},
        'primary': True}],
    'referralId': 'v-1570423904',
    'hasPerk': False},
    { 'id': '5b7578f933e11800393e1954',
        'name': 'The Restaurant',
        'location': { 'address': 'Lower Ground Floor',
            'lat': 50.902386,
            'lng': -1.399283,
            'labeledLatLngs': [{ 'label': 'display',
                'lat': 50.902386,
                'lng': -1.399283}],
            'distance': 1193,
            'postalCode': 'SO14 1NH',
            'cc': 'GB',
            'city': 'Southampton',
            'state': 'Hampshire',
            'country': 'United Kingdom',
            'formattedAddress': ['Lower Ground Floor',
                'Southampton',
                'Hampshire',
                'SO14 1NH',
                'United Kingdom']},
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            'name': 'Restaurant',
            'pluralName': 'Restaurants',
            'shortName': 'Restaurant',
            'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
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            'primary': True}],
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        'hasPerk': False},
    { 'id': '5a28267e67a9fe1cb715f327',
        'name': 'Restaurant Transilvania',
        'location': { 'lat': 50.914586,
            'lng': -1.423566,
            'labeledLatLngs': [{ 'label': 'display',

```

```

    'lat': 50.914586,
    'lng': -1.423566}],
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    'city': 'Southampton',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['Southampton',
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        'S015 3FL',
        'United Kingdom']],
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        'pluralName': 'Restaurants',
        'shortName': 'Restaurant',
        'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
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        'primary': True}],
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{ 'id': '4d08b748304460fcfeb8d963',
    'name': 'Ovation Restaurant',
    'location': { 'address': 'The Mayflower Theatre, Commercial Rd',
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        'distance': 291,
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        'cc': 'GB',
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        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['The Mayflower Theatre, Commercial Rd',
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            'Hampshire',
            'S015 1GE',
            'United Kingdom']],
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        'hasPerk': False},
{ 'id': '513246b0e4b02bbf4c99fae3',
    'name': 'Leelawadee Thai Restaurant',
    'location': { 'address': 'Commercial Road',
        'lat': 50.908964,

```



```

'lng': -1.40935,
'labeledLatLngs': [{'label': 'display',
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'country': 'United Kingdom',
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  'Hampshire',
  'United Kingdom']],
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  'pluralName': 'Thai Restaurants',
  'shortName': 'Thai',
  'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/thai_',
  'suffix': '.png'},
  'primary': True}],
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'hasPerk': False},
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'lng': -1.4063516538864063,
'labeledLatLngs': [{'label': 'display',
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  'lng': -1.4063516538864063}],
'distance': 548,
'cc': 'GB',
'city': 'Southampton',
'state': 'Hampshire',
'country': 'United Kingdom',
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  'pluralName': 'Indian Restaurants',
  'shortName': 'Indian',
  'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/indian_',
  'suffix': '.png'},
  'primary': True}],
'referralId': 'v-1570423904',
'hasPerk': False},
{'id': '56b8a828498e29ef0d041238',
'name': 'Poppins Restaurant',
'location': {'address': '181 High Street',

```

```

'lat': 50.9023538143245,
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'labeledLatLngs': [{ 'label': 'display',
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'cc': 'GB',
'city': 'Southampton',
'state': 'Hampshire',
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  'Southampton',
  'Hampshire',
  'United Kingdom']],
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  'name': 'Diner',
  'pluralName': 'Diners',
  'shortName': 'Diner',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/diner_',
    'suffix': '.png'},
  'primary': True}],
'referralId': 'v-1570423904',
'hasPerk': False},
{ 'id': '4f92bddce4b03330a9c616ec',
  'name': "Christina's Restaurant",
  'location': { 'lat': 50.904109954833984,
    'lng': -1.4055571556091309,
    'labeledLatLngs': [{ 'label': 'display',
      'lat': 50.904109954833984,
      'lng': -1.4055571556091309}],
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    'cc': 'GB',
    'country': 'United Kingdom',
    'formattedAddress': ['United Kingdom']},
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    'pluralName': 'Restaurants',
    'shortName': 'Restaurant',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
      'suffix': '.png'},
    'primary': True}],
  'referralId': 'v-1570423904',
  'hasPerk': False},
{ 'id': '4d4057a7915a3704f184147f',
  'name': "Tang's Chinese Restaurant",
  'location': { 'address': '127 Above Bar Street',
    'crossStreet': 'New Road',

```

```

'lat': 50.9071291,
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  'lng': -1.404462}],
'distance': 674,
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'cc': 'GB',
'city': 'Southampton',
'state': 'Hampshire',
'country': 'United Kingdom',
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  'Southampton',
  'Hampshire',
  'SO14 7FH',
  'United Kingdom']},
'categories': [{ 'id': '4bf58dd8d48988d145941735',
  'name': 'Chinese Restaurant',
  'pluralName': 'Chinese Restaurants',
  'shortName': 'Chinese',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
    'suffix': '.png' },
  'primary': True}],
'referralId': 'v-1570423904',
'hasPerk': False},
{ 'id': '4db958766a2334682da584b8',
  'name': 'The Boathouse Restaurant',
  'location': { 'address': 'Hythe Marina',
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    'lng': -1.4007510934156486,
    'labeledLatLngs': [{ 'label': 'display',
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    'distance': 3974,
    'cc': 'GB',
    'city': 'Southampton',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['Hythe Marina',
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      'Hampshire',
      'United Kingdom']},
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    'name': 'English Restaurant',
    'pluralName': 'English Restaurants',
    'shortName': 'English',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',

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      'suffix': '.png'},
      'primary': True]],
      'referralId': 'v-1570423904',
      'hasPerk': False},
    {'id': '54b5123c498e16364a32cd80',
      'name': '88 chinese restaurant',
      'location': {'lat': 50.911926,
        'lng': -1.403879,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -1.403879}],
        'distance': 852,
        'cc': 'GB',
        'country': 'United Kingdom',
        'formattedAddress': ['United Kingdom']},
      'categories': [{'id': '52af3a7c3cf9994f4e043bed',
        'name': 'Cantonese Restaurant',
        'pluralName': 'Cantonese Restaurants',
        'shortName': 'Cantonese',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
          'suffix': '.png'},
        'primary': True}],
      'referralId': 'v-1570423904',
      'hasPerk': False},
    {'id': '5b72e3e2a2c00b002c1cfda8',
      'name': 'Beity Lebanese Restaurant',
      'location': {'address': '123-124 High Street',
        'lat': 50.90241796892794,
        'lng': -1.4042383432388303,
        'labeledLatLngs': [{'label': 'display',
          'lat': 50.90241796892794,
          'lng': -1.4042383432388303}],
        'distance': 905,
        'postalCode': 'S014 2DJ',
        'cc': 'GB',
        'city': 'Southampton',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['123-124 High Street',
          'Southampton',
          'Hampshire',
          'S014 2DJ',
          'United Kingdom']},
      'categories': [{'id': '58daa1558bbb0b01f18ec1cd',
        'name': 'Lebanese Restaurant',
        'pluralName': 'Lebanese Restaurants',
        'shortName': 'Lebanese',

```

```

      'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/middleeastern_',
      'suffix': '.png'},
      'primary': True}],
      'referralId': 'v-1570423904',
      'hasPerk': False},
    {'id': '570b464c498e9c41fef9e56b',
      'name': 'Hotel Restaurant',
      'location': {'lat': 50.911256123954594,
        'lng': -1.4013774746415846,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -1.4013774746415846}]},
      'distance': 971,
      'cc': 'GB',
      'country': 'United Kingdom',
      'formattedAddress': ['United Kingdom']},
      'categories': [{'id': '4bf58dd8d48988d143941735',
        'name': 'Breakfast Spot',
        'pluralName': 'Breakfast Spots',
        'shortName': 'Breakfast',
        'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/breakfast_',
          'suffix': '.png'},
          'primary': True}],
          'referralId': 'v-1570423904',
          'hasPerk': False},
        {'id': '518513c4498ee03b38df34b6',
          'name': 'Casanova Italian Restaurant',
          'location': {'address': '85-87 Queensway',
            'lat': 50.90219323186157,
            'lng': -1.4008783739775905,
            'labeledLatLngs': [{'label': 'display',
              'lat': 50.90219323186157,
              'lng': -1.4008783739775905}]},
            'distance': 1109,
            'postalCode': 'SO14 3HJ',
            'cc': 'GB',
            'city': 'Southampton',
            'state': 'Hampshire',
            'country': 'United Kingdom',
            'formattedAddress': ['85-87 Queensway',
              'Southampton',
              'Hampshire',
              'SO14 3HJ',
              'United Kingdom']},
            'categories': [{'id': '4bf58dd8d48988d110941735',

```

```

    'name': 'Italian Restaurant',
    'pluralName': 'Italian Restaurants',
    'shortName': 'Italian',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/italian_',
      'suffix': '.png'},
    'primary': True}],
    'referralId': 'v-1570423904',
    'hasPerk': False},
    {'id': '4b2a8febf964a5206aab24e3',
      'name': 'The Chambeli Restaurant',
      'location': {'address': 'Southampton Rd.',
        'lat': 50.91762163308047,
        'lng': -1.4084957989641234,
        'labeledLatLngs': [{'label': 'display',
          'lat': 50.91762163308047,
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        'distance': 1168,
        'cc': 'GB',
        'city': 'London',
        'country': 'United Kingdom',
        'formattedAddress': ['Southampton Rd.', 'London', 'United Kingdom']},
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        'name': 'Restaurant',
        'pluralName': 'Restaurants',
        'shortName': 'Restaurant',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
          'suffix': '.png'},
        'primary': True}],
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        'hasPerk': False},
        {'id': '5b522d7cdd70c5003958f86e',
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          'location': {'lat': 50.91289,
            'lng': -1.3998874,
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    'crossStreet': 'Woolston',
    'lat': 50.89724032473285,
    'lng': -1.3798021451729332,
    'labeledLatLngs': [{ 'label': 'display',

```

```

    'lat': 50.89724032473285,
    'lng': -1.3798021451729332]],
    'distance': 2670,
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    'cc': 'GB',
    'city': 'Southampton',
    'state': 'Hampshire',
    'country': 'United Kingdom',
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        'Hampshire',
        'SO19 9DX',
        'United Kingdom']],
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        'shortName': 'Coffee Shop',
        'icon': { 'prefix':
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        'suffix': '.png'},
        'primary': True}],
    'referralId': 'v-1570423904',
    'hasPerk': False},
{ 'id': '4b7c4fcdf964a520958b2fe3',
    'name': 'Ceno Restaurant',
    'location': { 'address': '119 Highfield Lane',
        'lat': 50.92761612838817,
        'lng': -1.3916179964930693,
        'labeledLatLngs': [{ 'label': 'display',
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        'cc': 'GB',
        'city': 'Southampton',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['119 Highfield Lane',
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            'Hampshire',
            'SO17 1AQ',
            'United Kingdom']},
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        'pluralName': 'Bars',
        'shortName': 'Bar',
        'icon': { 'prefix':

```

```

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  'primary': True]],
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{'id': '4bae6b43f964a520e2af3be3',
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 'lng': -1.382201}],
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 'formattedAddress': ['United Kingdom']},
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 'primary': True}],
 'referralId': 'v-1570423904',
 'hasPerk': False},
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 'lng': -1.4188134822202523,
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 'lng': -1.4188134822202523}],
 'distance': 2977,
 'postalCode': 'SO16 7DJ',
 'cc': 'GB',
 'city': 'Southampton',
 'state': 'Hampshire',
 'country': 'United Kingdom',
 'formattedAddress': ['347 Winchester Rd.',
 'Southampton',
 'Hampshire',
 'SO16 7DJ',
 'United Kingdom']},
 'categories': [{'id': '4bf58dd8d48988d10f941735',
 'name': 'Indian Restaurant',
 'pluralName': 'Indian Restaurants',

```

```

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      'primary': True}],
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    'hasPerk': False},
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        'lng': -1.397369,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -1.397369}]},
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        'postalCode': 'SO15 3DS',
        'cc': 'GB',
        'city': 'Southampton',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['35-36 Oxford St.',
          'Southampton',
          'Hampshire',
          'SO15 3DS',
          'United Kingdom']},
        'categories': [{'id': '4bf58dd8d48988d155941735',
          'name': 'Gastropub',
          'pluralName': 'Gastropubs',
          'shortName': 'Gastropub',
          'icon': {'prefix':
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              'suffix': '.png'},
            'primary': True}],
            'referralId': 'v-1570423904',
            'hasPerk': False},
            {'id': '50850171e4b0290494560b4f',
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              'location': {'lat': 50.925086,
                'lng': -1.446289,
                'labeledLatLngs': [{'label': 'display',
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                  'lng': -1.446289}]},
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```

```

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    'shortName': 'Restaurant',
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    'primary': True}],
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    'hasPerk': False},
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    'cc': 'GB',
    'city': 'Southampton',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['134 High St',
      'Southampton',
      'Hampshire',
      'SO14 2BR',
      'United Kingdom']},
  'categories': [{'id': '4bf58dd8d48988d149941735',
    'name': 'Thai Restaurant',
    'pluralName': 'Thai Restaurants',
    'shortName': 'Thai',
    'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/thai_',
      'suffix': '.png'},
    'primary': True}],
    'referralId': 'v-1570423904',
    'hasPerk': False},
{'id': '5072abefe4b0e1b65f24d189',
  'name': "Zara's Restaurant",
  'location': {'address': 'Level E, Coxford Road',
    'lat': 50.93548756087531,
    'lng': -1.4348342295816454,
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      'lng': -1.4348342295816454}],
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    'cc': 'GB',

```

```

'city': 'Southampton',
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'country': 'United Kingdom',
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'Southampton',
'Hampshire',
'SO16 5YA',
'United Kingdom']],
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'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/cafe_',
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'primary': True}],
'referralId': 'v-1570423904',
'hasPerk': False},
{ 'id': '4fbd27a1e4b00902117e2cca',
'name': 'Merchants Blue Moon',
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'lat': 50.897308341259766,
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'lat': 50.897308341259766,
'lng': -1.3918743373658355}],
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'cc': 'GB',
'city': 'Southampton',
'state': 'Hampshire',
'country': 'United Kingdom',
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'Southampton',
'Hampshire',
'SO14 3TN',
'United Kingdom']],
'categories': [{ 'id': '4bf58dd8d48988d1cc941735',
'name': 'Steakhouse',
'pluralName': 'Steakhouses',
'shortName': 'Steakhouse',
'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/steakhouse_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570423904',
'hasPerk': False}}}]

```

Get relevant part of JSON and transform it into a *pandas* dataframe

```
[7]: # assign relevant part of JSON to venues
venues = results['response']['venues']

# transform venues into a dataframe
dataframe = json_normalize(venues)
dataframe.head()
```

```
[7]:
```

	id	name \
0	5421f381498ec9dfd2b8af7a	Boardwalk Restaurant
1	4d557f409e508cfafade009b	Bellini's Italian Restaurant & Lounge Bar
2	4dee63158877aa0c3cb563a9	Orchid Chinese Restaurant
3	5471ed6c498eac135acfe5e	IKEA Restaurant
4	5b7578f933e11800393e1954	The Restaurant

	categories	referralId	hasPerk \
0	[{'id': '4bf58dd8d48988d1c4941735', 'name': 'R...}	v-1570423904	False
1	[{'id': '4bf58dd8d48988d110941735', 'name': 'I...}	v-1570423904	False
2	[{'id': '4bf58dd8d48988d145941735', 'name': 'C...}	v-1570423904	False
3	[{'id': '4bf58dd8d48988d1c6941735', 'name': 'S...}	v-1570423904	False
4	[{'id': '4bf58dd8d48988d1c4941735', 'name': 'R...}	v-1570423904	False

	location.address	location.crossStreet	location.lat	location.lng \
0	Grand Harbour Hotel	5 West Quay Rd	50.899460	-1.407924
1	Latimer St.	Oxford St.	50.897557	-1.400792
2	9 Commerce road	NaN	50.908542	-1.415949
3	West Quay Road	NaN	50.903382	-1.411634
4	Lower Ground Floor	NaN	50.902386	-1.399283

	location.labeledLatLngs	location.distance \
0	[{'label': 'display', 'lat': 50.89946025840214...}	1014
1	[{'label': 'display', 'lat': 50.89755698952178...}	1463
2	[{'label': 'display', 'lat': 50.90854167938084...}	163
3	[{'label': 'display', 'lat': 50.90338188125466...}	511
4	[{'label': 'display', 'lat': 50.902386, 'lng':...}	1193

	location.postalCode	location.cc	location.city	location.state \
0	S014 1AG	GB	Southampton	Hampshire
1	S014 3BQ	GB	Southampton	Hampshire
2	S01 4 7	GB	Southampton	Hampshire
3	S015 1GY	GB	Southampton	Hampshire
4	S014 1NH	GB	Southampton	Hampshire

	location.country	location.formattedAddress \
0	United Kingdom	[Grand Harbour Hotel (5 West Quay Rd), Southam...
1	United Kingdom	[Latimer St. (Oxford St.), Southampton, Hampsh...
2	United Kingdom	[9 Commerce road, Southampton, Hampshire, S01 ...


```

3    United Kingdom    [West Quay Road, Southampton, Hampshire, S015 ...
4    United Kingdom    [Lower Ground Floor, Southampton, Hampshire, S...

```

```

location.neighborhood
0          NaN
1          NaN
2          NaN
3    City Centre
4          NaN

```

Define information of interest and filter dataframe

```

[8]: # keep only columns that include venue name, and anything that is associated
    ↪with location
filtered_columns = ['name', 'categories'] + [col for col in dataframe.columns
    ↪if col.startswith('location.')] + ['id']
dataframe_filtered = dataframe.loc[:, filtered_columns]

# 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']

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

# clean column names by keeping only last term
dataframe_filtered.columns = [column.split('.')[ -1] for column in
    ↪dataframe_filtered.columns]

dataframe_filtered

```

```

[8]:

```

	name	categories \
0	Boardwalk Restaurant	Restaurant
1	Bellini's Italian Restaurant & Lounge Bar	Italian Restaurant
2	Orchid Chinese Restaurant	Chinese Restaurant
3	IKEA Restaurant	Scandinavian Restaurant
4	The Restaurant	Restaurant
5	Restaurant Transilvania	Restaurant

6	Ovation Restaurant	None
7	Leelawadee Thai Restaurant	Thai Restaurant
8	Taj Restaurant	Indian Restaurant
9	Poppins Restaurant	Diner
10	Christina's Restaurant	Restaurant
11	Tang's Chinese Restaurant	Chinese Restaurant
12	The Boathouse Restaurant	English Restaurant
13	88 chinese restaurant	Cantonese Restaurant
14	Beity Lebanese Restaurant	Lebanese Restaurant
15	Hotel Restaurant	Breakfast Spot
16	Casanova Italian Restaurant	Italian Restaurant
17	The Chambeli Restaurant	Restaurant
18	Shire Restaurant	Polish Restaurant
19	Zen Japanese Restaurant	Japanese Restaurant
20	Elias Restaurant	Greek Restaurant
21	George's Restaurant	Greek Restaurant
22	Sam's Bar And Restaurant	Breakfast Spot
23	Christina's Restaurant	Café
24	Jury's Inn	Hotel
25	Balkh Afgan Restaurant	Afghan Restaurant
26	Lupa Restaurant	Italian Restaurant
27	Simons at Oxfords Wine Bar Restaurant	Food
28	kisna	Indian Restaurant
29	Aspire Restaurant	Restaurant
30	The Restaurant at HASKINS	Café
31	Shwan Restaurant & Takeaway	Middle Eastern Restaurant
32	Thyme Restaurant	Restaurant
33	The Restaurant	Restaurant
34	Posh Indian Restaurant	Indian Restaurant
35	Pilgrim House Chinese Restaurant	None
36	Ventura Bay Tree Restaurant	Restaurant
37	Dahlia Restaurant	Restaurant
38	Sainsburys Restaurant	Café
39	Taps Restaurant	Restaurant
40	Number 10	Mediterranean Restaurant
41	Piggy's Coffee Shop & Restaurant	Coffee Shop
42	Ceno Restaurant	Bar
43	Special Thai Restaurant	Thai Restaurant
44	Jehangir Indian & Bangladeshi Restaurant	Indian Restaurant
45	Oxfords	Gastropub
46	The Grove Restaurant	Restaurant
47	The King and I	Thai Restaurant
48	Zara's Restaurant	Café
49	Merchants Blue Moon	Steakhouse

	address	crossStreet	lat \
0	Grand Harbour Hotel	5 West Quay Rd	50.899460

1	Latimer St.	Oxford St.	50.897557
2	9 Commerce road	NaN	50.908542
3	West Quay Road	NaN	50.903382
4	Lower Ground Floor	NaN	50.902386
5	NaN	NaN	50.914586
6	The Mayflower Theatre, Commercial Rd	NaN	50.908916
7	Commercial Road	NaN	50.908964
8	NaN	NaN	50.908668
9	181 High Street	NaN	50.902354
10	NaN	NaN	50.904110
11	127 Above Bar Street	New Road	50.907129
12	Hythe Marina	NaN	50.873014
13	NaN	NaN	50.911926
14	123-124 High Street	NaN	50.902418
15	NaN	NaN	50.911256
16	85-87 Queensway	NaN	50.902193
17	Southampton Rd.	NaN	50.917622
18	NaN	NaN	50.912890
19	42 High Street	NaN	50.899392
20	Canal Walk	NaN	50.901328
21	NaN	NaN	50.899319
22	NaN	NaN	50.901869
23	NaN	NaN	50.901725
24	1 Charlotte Pl	NaN	50.910702
25	NaN	NaN	50.906039
26	23-124 High Street, Below Bar	NaN	50.899299
27	35 Oxford Street	NaN	50.897970
28	NaN	NaN	50.909669
29	Southampton City College	NaN	50.903397
30	Mansbridge Road	NaN	50.935547
31	113 Derby Road	NaN	50.911502
32	NaN	NaN	50.948523
33	Bracken Pl	Hilton Southampton	50.953019
34	1 Queensway	NaN	50.897559
35	Canute Rd.	NaN	50.896879
36	NaN	NaN	50.892814
37	NaN	NaN	50.921105
38	NaN	NaN	50.923381
39	Shamrock Quay	NaN	50.910118
40	10 Bedford Place	Parallel to London Road	50.911667
41	26 Victoria Rd	Woolston	50.897240
42	119 Highfield Lane	NaN	50.927616
43	NaN	NaN	50.982491
44	347 Winchester Rd.	NaN	50.934292
45	35-36 Oxford St.	NaN	50.898041
46	NaN	NaN	50.925086
47	134 High St	NaN	50.899915

48	Level E, Coxford Road	NaN	50.935488
49	Ocean Village	NaN	50.897308

	lng	labeledLatLngs	distance \
0	-1.407924	[{'label': 'display', 'lat': 50.89946025840214...	1014
1	-1.400792	[{'label': 'display', 'lat': 50.89755698952178...	1463
2	-1.415949	[{'label': 'display', 'lat': 50.90854167938084...	163
3	-1.411634	[{'label': 'display', 'lat': 50.90338188125466...	511
4	-1.399283	[{'label': 'display', 'lat': 50.902386, 'lng':...	1193
5	-1.423566	[{'label': 'display', 'lat': 50.914586, 'lng':...	1016
6	-1.410328	[{'label': 'display', 'lat': 50.90891561976527...	291
7	-1.409350	[{'label': 'display', 'lat': 50.908964, 'lng':...	356
8	-1.406352	[{'label': 'display', 'lat': 50.90866806251364...	548
9	-1.404234	[{'label': 'display', 'lat': 50.9023538143245,...	910
10	-1.405557	[{'label': 'display', 'lat': 50.90410995483398...	717
11	-1.404462	[{'label': 'display', 'lat': 50.9071291, 'lng'...	674
12	-1.400751	[{'label': 'display', 'lat': 50.87301427312694...	3974
13	-1.403879	[{'label': 'display', 'lat': 50.911926, 'lng':...	852
14	-1.404238	[{'label': 'display', 'lat': 50.90241796892794...	905
15	-1.401377	[{'label': 'display', 'lat': 50.91125612395459...	971
16	-1.400878	[{'label': 'display', 'lat': 50.90219323186157...	1109
17	-1.408496	[{'label': 'display', 'lat': 50.91762163308047...	1168
18	-1.399887	[{'label': 'display', 'lat': 50.91289, 'lng': ...	1147
19	-1.403511	[{'label': 'display', 'lat': 50.8993925, 'lng'...	1184
20	-1.401199	[{'label': 'display', 'lat': 50.90132824854898...	1147
21	-1.404839	[{'label': 'display', 'lat': 50.8993188315396,...	1135
22	-1.400223	[{'label': 'display', 'lat': 50.90186926168592...	1167
23	-1.399647	[{'label': 'display', 'lat': 50.901725, 'lng':...	1209
24	-1.401491	[{'label': 'display', 'lat': 50.91070195823153...	940
25	-1.396637	[{'label': 'display', 'lat': 50.906039, 'lng':...	1234
26	-1.403771	[{'label': 'display', 'lat': 50.89929932913499...	1181
27	-1.397420	[{'label': 'display', 'lat': 50.89796968080836...	1592
28	-1.413217	[{'label': 'display', 'lat': 50.9096691781579,...	224
29	-1.394277	[{'label': 'display', 'lat': 50.903397, 'lng':...	1467
30	-1.355345	[{'label': 'display', 'lat': 50.93554704101988...	5153
31	-1.393604	[{'label': 'display', 'lat': 50.91150152749674...	1494
32	-1.364439	[{'label': 'display', 'lat': 50.948523, 'lng':...	5721
33	-1.401949	[{'label': 'display', 'lat': 50.9530193172855,...	5113
34	-1.400780	[{'label': 'display', 'lat': 50.8975589545427,...	1464
35	-1.393762	[{'label': 'display', 'lat': 50.896879, 'lng':...	1865
36	-1.399620	[{'label': 'display', 'lat': 50.89281423091862...	1943
37	-1.431816	[{'label': 'display', 'lat': 50.921105, 'lng':...	1944
38	-1.434393	[{'label': 'display', 'lat': 50.92338081601199...	2254
39	-1.381725	[{'label': 'display', 'lat': 50.910118, 'lng':...	2282
40	-1.405727	[{'label': 'display', 'lat': 50.91166685734257...	729
41	-1.379802	[{'label': 'display', 'lat': 50.89724032473285...	2670
42	-1.391618	[{'label': 'display', 'lat': 50.92761612838817...	2716

43	-1.382201	[{'label': 'display', 'lat': 50.982491, 'lng':...	8617
44	-1.418813	[{'label': 'display', 'lat': 50.93429216842349...	2977
45	-1.397369	[{'label': 'display', 'lat': 50.898041, 'lng':...	1589
46	-1.446289	[{'label': 'display', 'lat': 50.925086, 'lng':...	2977
47	-1.403626	[{'label': 'display', 'lat': 50.89991516999714...	1134
48	-1.434834	[{'label': 'display', 'lat': 50.93548756087531...	3418
49	-1.391874	[{'label': 'display', 'lat': 50.89730834125976...	1939

	postalCode	cc	city	state	country \
0	S014 1AG	GB	Southampton	Hampshire	United Kingdom
1	S014 3BQ	GB	Southampton	Hampshire	United Kingdom
2	S01 4 7	GB	Southampton	Hampshire	United Kingdom
3	S015 1GY	GB	Southampton	Hampshire	United Kingdom
4	S014 1NH	GB	Southampton	Hampshire	United Kingdom
5	S015 3FL	GB	Southampton	Hampshire	United Kingdom
6	S015 1GE	GB	Southampton	Hampshire	United Kingdom
7	NaN	GB	Southampton	Hampshire	United Kingdom
8	NaN	GB	Southampton	Hampshire	United Kingdom
9	NaN	GB	Southampton	Hampshire	United Kingdom
10	NaN	GB	NaN	NaN	United Kingdom
11	S014 7FH	GB	Southampton	Hampshire	United Kingdom
12	NaN	GB	Southampton	Hampshire	United Kingdom
13	NaN	GB	NaN	NaN	United Kingdom
14	S014 2DJ	GB	Southampton	Hampshire	United Kingdom
15	NaN	GB	NaN	NaN	United Kingdom
16	S014 3HJ	GB	Southampton	Hampshire	United Kingdom
17	NaN	GB	London	NaN	United Kingdom
18	S014 0JD	GB	Southampton	Hampshire	United Kingdom
19	S014 2NS	GB	Southampton	Hampshire	United Kingdom
20	S01 4 3	GB	Southampton	Hampshire	United Kingdom
21	NaN	GB	NaN	NaN	United Kingdom
22	NaN	GB	NaN	NaN	United Kingdom
23	NaN	GB	NaN	NaN	United Kingdom
24	S014 0TB	GB	Southampton	Hampshire	United Kingdom
25	NaN	GB	NaN	NaN	United Kingdom
26	S014 2AA	GB	Southampton	Hampshire	United Kingdom
27	S014 3DS	GB	Southampton	Hampshire	United Kingdom
28	NaN	GB	Southampton	Hampshire	United Kingdom
29	NaN	GB	Southampton	Hampshire	United Kingdom
30	S018 3HW	GB	Southampton	Hampshire	United Kingdom
31	S014 ODR	GB	Southampton	Hampshire	United Kingdom
32	NaN	GB	NaN	NaN	United Kingdom
33	S016 3RB	GB	Chilworth	Hampshire	United Kingdom
34	S014 3AQ	GB	Southampton	Hampshire	United Kingdom
35	S014 3FJ	GB	Southampton	Hampshire	United Kingdom
36	NaN	GB	NaN	NaN	United Kingdom
37	S 015	GB	Southampton	Hampshire	United Kingdom

38		NaN	GB		NaN		NaN	United Kingdom
39		NaN	GB	Southampton	Hampshire			United Kingdom
40	S015	2DB	GB	Southampton	Hampshire			United Kingdom
41	S019	9DX	GB	Southampton	Hampshire			United Kingdom
42	S017	1AQ	GB	Southampton	Hampshire			United Kingdom
43		NaN	GB		NaN		NaN	United Kingdom
44	S016	7DJ	GB	Southampton	Hampshire			United Kingdom
45	S015	3DS	GB	Southampton	Hampshire			United Kingdom
46		NaN	GB		NaN		NaN	United Kingdom
47	S014	2BR	GB	Southampton	Hampshire			United Kingdom
48	S016	5YA	GB	Southampton	Hampshire			United Kingdom
49	S014	3TN	GB	Southampton	Hampshire			United Kingdom

					formattedAddress	neighborhood	\
0	[Grand Harbour Hotel (5 West Quay Rd), Southam...					NaN	
1	[Latimer St. (Oxford St.), Southampton, Hampsh...					NaN	
2	[9 Commerce road, Southampton, Hampshire, S01 ...					NaN	
3	[West Quay Road, Southampton, Hampshire, S015 ...				City Centre		
4	[Lower Ground Floor, Southampton, Hampshire, S...					NaN	
5	[Southampton, Hampshire, S015 3FL, United King...					NaN	
6	[The Mayflower Theatre, Commercial Rd, Southam...					NaN	
7	[Commercial Road, Southampton, Hampshire, Unit...					NaN	
8	[Southampton, Hampshire, United Kingdom]					NaN	
9	[181 High Street, Southampton, Hampshire, Unit...					NaN	
10	[United Kingdom]					NaN	
11	[127 Above Bar Street (New Road), Southampton,...					NaN	
12	[Hythe Marina, Southampton, Hampshire, United ...					NaN	
13	[United Kingdom]					NaN	
14	[123-124 High Street, Southampton, Hampshire, ...					NaN	
15	[United Kingdom]					NaN	
16	[85-87 Queensway, Southampton, Hampshire, S014...					NaN	
17	[Southampton Rd., London, United Kingdom]					NaN	
18	[Southampton, Hampshire, S014 OJD, United King...					NaN	
19	[42 High Street, Southampton, Hampshire, S014 ...					NaN	
20	[Canal Walk, Southampton, Hampshire, S01 4 3, ...					NaN	
21	[United Kingdom]					NaN	
22	[United Kingdom]					NaN	
23	[United Kingdom]					NaN	
24	[1 Charlotte Pl, Southampton, Hampshire, S014 ...					NaN	
25	[United Kingdom]					NaN	
26	[23-124 High Street, Below Bar, Southampton, H...					NaN	
27	[35 Oxford Street, Southampton, Hampshire, S01...					NaN	
28	[Southampton, Hampshire, United Kingdom]					NaN	
29	[Southampton City College, Southampton, Hampsh...					NaN	
30	[Mansbridge Road, Southampton, Hampshire, S018...					NaN	
31	[113 Derby Road, Southampton, Hampshire, S014 ...					NaN	
32	[United Kingdom]					NaN	

33	[Bracken Pl (Hilton Southampton), Chilworth, H...	NaN
34	[1 Queensway, Southampton, Hampshire, SO14 3AQ...	NaN
35	[Canute Rd., Southampton, Hampshire, SO14 3FJ,...	NaN
36	[United Kingdom]	NaN
37	[Southampton, Hampshire, S 015, United Kingdom]	NaN
38	[United Kingdom]	NaN
39	[Shamrock Quay, Southampton, Hampshire, United...	NaN
40	[10 Bedford Place (Parallel to London Road), S...	NaN
41	[26 Victoria Rd (Woolston), Southampton, Hamps...	NaN
42	[119 Highfield Lane, Southampton, Hampshire, S...	NaN
43	[United Kingdom]	NaN
44	[347 Winchester Rd., Southampton, Hampshire, S...	NaN
45	[35-36 Oxford St., Southampton, Hampshire, SO1...	NaN
46	[United Kingdom]	NaN
47	[134 High St, Southampton, Hampshire, SO14 2BR...	NaN
48	[Level E, Coxford Road, Southampton, Hampshire...	NaN
49	[Ocean Village, Southampton, Hampshire, SO14 3...	NaN

	id
0	5421f381498ec9dfd2b8af7a
1	4d557f409e508cfafade009b
2	4dee63158877aa0c3cb563a9
3	5471ed6c498eac135acfef5e
4	5b7578f933e11800393e1954
5	5a28267e67a9fe1cb715f327
6	4d08b748304460fcfeb8d963
7	513246b0e4b02bbf4c99fae3
8	4e0f57deb0fb59de67df89a5
9	56b8a828498e29ef0d041238
10	4f92bddce4b03330a9c616ec
11	4d4057a7915a3704f184147f
12	4db958766a2334682da584b8
13	54b5123c498e16364a32cd80
14	5b72e3e2a2c00b002c1cfda8
15	570b464c498e9c41fef9e56b
16	518513c4498ee03b38df34b6
17	4b2a8febf964a5206aab24e3
18	5b522d7cdd70c5003958f86e
19	57cffd0f498e98e8575aaef5
20	4ccc805cc0378cfa0e248748
21	4c9539bef244b1f7bed8291d
22	4ea1f18dbe7ba4918e0aca4e
23	522b5340498ea7a6b6fc4aa9
24	4bc5cb52ccbcef3bd5f3e6d2
25	54d67028498ee595408d325c
26	4b99705cf964a520977b35e3
27	4e73a3dcd4c0c01bf848ddcd

```

28 4e92d2f49adf18f8829cbe18
29 4dc2fe57ae608779d0fde30c
30 56ae11ba498ecac5674a5728
31 4f0c795de4b0c67b44f0153a
32 5772ab6b498e80d8dcee6790
33 50ca02c1245f2d4aa8c2b90d
34 4c69840735d3be9a17861f06
35 5384f6a2498ec1985aa33311
36 4e2a764cd22d3f83c8847e76
37 5a74820e1ffe971ebc0c31e8
38 520b5b5411d214f5f28b7d85
39 4dd4136b18384691b9b86fd0
40 4dc135180f2c14a8450cde21
41 4e50d390d22daf51d2899a54
42 4b7c4fcdf964a520958b2fe3
43 4bae6b43f964a520e2af3be3
44 4bf82aeb5efe2d7f78466a34
45 4b900cbbf964a520737233e3
46 50850171e4b0290494560b4f
47 4cb0b60acbab236acbe2a273
48 5072abefe4b0e1b65f24d189
49 4fbd27a1e4b00902117e2cca

```

Visualize the restaurants that are nearby

```
[9]: dataframe_filtered.name
```

```

[9]: 0          Boardwalk Restaurant
    1  Bellini's Italian Restaurant & Lounge Bar
    2          Orchid Chinese Restaurant
    3          IKEA Restaurant
    4          The Restaurant
    5      Restaurant Transilvania
    6          Ovation Restaurant
    7      Leelawadee Thai Restaurant
    8          Taj Restaurant
    9      Poppins Restaurant
   10      Christina's Restaurant
   11      Tang's Chinese Restaurant
   12      The Boathouse Restaurant
   13      88 chinese restaurant
   14      Beity Lebanese Restaurant
   15          Hotel Restaurant
   16      Casanova Italian Restaurant
   17      The Chambeli Restaurant
   18          Shire Restaurant
   19      Zen Japanese Restaurant

```



```

20             Elias Restaurant
21             George's Restaurant
22             Sam's Bar And Restaurant
23             Christina's Restaurant
24             Jury's Inn
25             Balkh Afgan Restaurant
26             Lupa Restaurant
27             Simons at Oxfords Wine Bar Restaurant
28             kisna
29             Aspire Restaurant
30             The Restaurant at HASKINS
31             Shwan Restaurant & Takeaway
32             Thyme Restaurant
33             The Restaurant
34             Posh Indian Restaurant
35             Pilgrim House Chinese Restaurant
36             Ventura Bay Tree Restaurant
37             Dahlia Restaurant
38             Sainsburys Restaurant
39             Taps Restaurant
40             Number 10
41             Piggy's Coffee Shop & Restaurant
42             Ceno Restaurant
43             Special Thai Restaurant
44             Jehangir Indian & Bangladeshi Restaurant
45             Oxfords
46             The Grove Restaurant
47             The King and I
48             Zara's Restaurant
49             Merchants Blue Moon
Name: name, dtype: object

```

```

[10]: venues_map = folium.Map(location=[latitude, longitude], zoom_start=13) #
      ↪ generate map

# add a red circle marker
folium.features.CircleMarker(
    [latitude, longitude],
    radius=10,
    color='red',
    popup='Southampton Central',
    fill = True,
    fill_color = 'red',
    fill_opacity = 0.6
).add_to(venues_map)

```

```

for lat, lng, label in zip(dataframe_filtered.lat, dataframe_filtered.lng,
↳dataframe_filtered.categories):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,
        color='blue',
        popup=label,
        fill = True,
        fill_color='blue',
        fill_opacity=0.6
    ).add_to(venues_map)

# display map
venues_map

```

[10]: <folium.folium.Map at 0x7f8c26170278>

[11]: dataframe_filtered.categories

```

[11]: 0          Restaurant
      1      Italian Restaurant
      2      Chinese Restaurant
      3  Scandinavian Restaurant
      4          Restaurant
      5          Restaurant
      6              None
      7      Thai Restaurant
      8      Indian Restaurant
      9              Diner
     10          Restaurant
     11      Chinese Restaurant
     12      English Restaurant
     13  Cantonese Restaurant
     14      Lebanese Restaurant
     15      Breakfast Spot
     16      Italian Restaurant
     17          Restaurant
     18      Polish Restaurant
     19  Japanese Restaurant
     20      Greek Restaurant
     21      Greek Restaurant
     22      Breakfast Spot
     23              Café
     24              Hotel
     25      Afghan Restaurant
     26      Italian Restaurant
     27              Food

```

```

28         Indian Restaurant
29         Restaurant
30         Café
31     Middle Eastern Restaurant
32         Restaurant
33         Restaurant
34         Indian Restaurant
35         None
36         Restaurant
37         Restaurant
38         Café
39         Restaurant
40     Mediterranean Restaurant
41         Coffee Shop
42         Bar
43         Thai Restaurant
44         Indian Restaurant
45         Gastropub
46         Restaurant
47         Thai Restaurant
48         Café
49         Steakhouse
Name: categories, dtype: object

```

```
[12]: dataframe_filtered.categories.value_counts()
```

```

[12]: Restaurant          12
      Indian Restaurant    4
      Café                4
      Thai Restaurant      3
      Italian Restaurant   3
      Greek Restaurant     2
      Chinese Restaurant   2
      Breakfast Spot       2
      Bar                  1
      Hotel                1
      English Restaurant   1
      Coffee Shop          1
      Diner                1
      Food                 1
      Japanese Restaurant  1
      Lebanese Restaurant  1
      Polish Restaurant    1
      Gastropub            1
      Steakhouse           1
      Middle Eastern Restaurant 1
      Cantonese Restaurant  1

```

```

Scandinavian Restaurant      1
Mediterranean Restaurant     1
Afghan Restaurant            1
Name: categories, dtype: int64

```

```
[13]: soton_grouped = dataframe_filtered.groupby('categories').mean().reset_index()
soton_grouped
```

```
[13]:
```

	categories	lat	lng	distance
0	Afghan Restaurant	50.906039	-1.396637	1234.000000
1	Bar	50.927616	-1.391618	2716.000000
2	Breakfast Spot	50.906563	-1.400800	1069.000000
3	Café	50.924035	-1.406055	3008.500000
4	Cantonese Restaurant	50.911926	-1.403879	852.000000
5	Chinese Restaurant	50.907835	-1.410205	418.500000
6	Coffee Shop	50.897240	-1.379802	2670.000000
7	Diner	50.902354	-1.404234	910.000000
8	English Restaurant	50.873014	-1.400751	3974.000000
9	Food	50.897970	-1.397420	1592.000000
10	Gastropub	50.898041	-1.397369	1589.000000
11	Greek Restaurant	50.900324	-1.403019	1141.000000
12	Hotel	50.910702	-1.401491	940.000000
13	Indian Restaurant	50.912547	-1.409791	1303.250000
14	Italian Restaurant	50.899683	-1.401814	1251.000000
15	Japanese Restaurant	50.899392	-1.403511	1184.000000
16	Lebanese Restaurant	50.902418	-1.404238	905.000000
17	Mediterranean Restaurant	50.911667	-1.405727	729.000000
18	Middle Eastern Restaurant	50.911502	-1.393604	1494.000000
19	Polish Restaurant	50.912890	-1.399887	1147.000000
20	Restaurant	50.916019	-1.405412	2212.916667
21	Scandinavian Restaurant	50.903382	-1.411634	511.000000
22	Steakhouse	50.897308	-1.391874	1939.000000
23	Thai Restaurant	50.930457	-1.398392	3369.000000

```
[14]: soton_grouped_sorted = soton_grouped.sort_values('distance',ascending=True)
soton_grouped_sorted
```

```
[14]:
```

	categories	lat	lng	distance
5	Chinese Restaurant	50.907835	-1.410205	418.500000
21	Scandinavian Restaurant	50.903382	-1.411634	511.000000
17	Mediterranean Restaurant	50.911667	-1.405727	729.000000
4	Cantonese Restaurant	50.911926	-1.403879	852.000000
16	Lebanese Restaurant	50.902418	-1.404238	905.000000
7	Diner	50.902354	-1.404234	910.000000
12	Hotel	50.910702	-1.401491	940.000000
2	Breakfast Spot	50.906563	-1.400800	1069.000000
11	Greek Restaurant	50.900324	-1.403019	1141.000000

19	Polish Restaurant	50.912890	-1.399887	1147.000000
15	Japanese Restaurant	50.899392	-1.403511	1184.000000
0	Afghan Restaurant	50.906039	-1.396637	1234.000000
14	Italian Restaurant	50.899683	-1.401814	1251.000000
13	Indian Restaurant	50.912547	-1.409791	1303.250000
18	Middle Eastern Restaurant	50.911502	-1.393604	1494.000000
10	Gastropub	50.898041	-1.397369	1589.000000
9	Food	50.897970	-1.397420	1592.000000
22	Steakhouse	50.897308	-1.391874	1939.000000
20	Restaurant	50.916019	-1.405412	2212.916667
6	Coffee Shop	50.897240	-1.379802	2670.000000
1	Bar	50.927616	-1.391618	2716.000000
3	Café	50.924035	-1.406055	3008.500000
23	Thai Restaurant	50.930457	-1.398392	3369.000000
8	English Restaurant	50.873014	-1.400751	3974.000000

```
[15]: print('There are {} uniques categories.'.
        ↪format(len(soton_grouped_sorted['categories'].unique())))
```

There are 24 uniques categories.

1.0.13 Adding marker cluster to map

```
[16]: from folium.plugins import MarkerCluster
```

```
[17]: venues_map3 = folium.Map(location=[latitude, longitude], zoom_start=13) # ↵
        ↪generate map

# add a red circle marker
folium.features.CircleMarker(
    [latitude, longitude],
    radius=10,
    color='red',
    popup='Southampton Central',
    fill = True,
    fill_color = 'red',
    fill_opacity = 0.6
).add_to(venues_map3)

marker_cluster = MarkerCluster().add_to(venues_map3)

for lat, lng, label in zip(dataframe_filtered.lat, dataframe_filtered.lng, ↵
        ↪dataframe_filtered.categories):
    folium.Marker(
        location=[lat, lng],
        popup=label,
```

```

        icon=None,
    ).add_to(marker_cluster)

venues_map3

```

[17]: <folium.folium.Map at 0x7f8c2484fda0>

1.0.14 Creating clusters using k-means - Southampton

```

[18]: import random # library for random number generation
import numpy as np # library for vectorized computation
import pandas as pd # library to process data as dataframes

import matplotlib.pyplot as plt # plotting library
# backend for rendering plots within the browser
%matplotlib inline

from sklearn.cluster import KMeans
from sklearn.datasets.samples_generator import make_blobs

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

print('Libraries imported.')

```

Libraries imported.

```

[19]: # set number of clusters
kclusters = 5

soton_grouped_clustering = soton_grouped.drop('categories', 1)

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

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

```

[19]: array([2, 4, 2, 4, 0, 0, 4, 0, 1, 2], dtype=int32)

```

[20]: # add clustering labels
soton_grouped_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

soton_grouped_sorted.head() # check the last columns!

```

```
[20]:
```

	Cluster Labels	categories	lat	lng	distance
5	2	Chinese Restaurant	50.907835	-1.410205	418.5
21	4	Scandinavian Restaurant	50.903382	-1.411634	511.0
17	2	Mediterranean Restaurant	50.911667	-1.405727	729.0
4	4	Cantonese Restaurant	50.911926	-1.403879	852.0
16	0	Lebanese Restaurant	50.902418	-1.404238	905.0

```
[21]: soton_grouped_sorted.loc[soton_grouped_sorted['Cluster Labels'] == 0,
↳soton_grouped_sorted.columns[[1] + list(range(5, soton_grouped_sorted.
↳shape[1]))]]
```

```
[21]:
```

	categories
16	Lebanese Restaurant
7	Diner
2	Breakfast Spot
14	Italian Restaurant
9	Food
22	Steakhouse
3	Café

```
[22]: soton_grouped_sorted.loc[soton_grouped_sorted['Cluster Labels'] == 1,
↳soton_grouped_sorted.columns[[1] + list(range(5, soton_grouped_sorted.
↳shape[1]))]]
```

```
[22]:
```

	categories
11	Greek Restaurant
8	English Restaurant

```
[23]: soton_grouped_sorted.loc[soton_grouped_sorted['Cluster Labels'] == 2,
↳soton_grouped_sorted.columns[[1] + list(range(5, soton_grouped_sorted.
↳shape[1]))]]
```

```
[23]:
```

	categories
5	Chinese Restaurant
17	Mediterranean Restaurant
19	Polish Restaurant
15	Japanese Restaurant
0	Afghan Restaurant
13	Indian Restaurant
18	Middle Eastern Restaurant
10	Gastropub
20	Restaurant
6	Coffee Shop

```
[24]: soton_grouped_sorted.loc[soton_grouped_sorted['Cluster Labels'] == 3,
↳soton_grouped_sorted.columns[[1] + list(range(5, soton_grouped_sorted.
↳shape[1]))]]
```

```
[24]:          categories
      1          Bar
      23 Thai Restaurant
```

```
[25]: soton_grouped_sorted.loc[soton_grouped_sorted['Cluster Labels'] == 4,
      ↪soton_grouped_sorted.columns[[1] + list(range(5, soton_grouped_sorted.
      ↪shape[1]))]]
```

```
[25]:          categories
      19   Polish Restaurant
      15   Japanese Restaurant
      6       Coffee Shop
      3       Café
```

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

# add markers to the map
markers_colors = []
for lat, lng, poi, cluster in zip(soton_grouped_sorted['lat'],
      ↪soton_grouped_sorted['lng'],soton_grouped_sorted['categories'],
      ↪soton_grouped_sorted['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(venues_map3)

venues_map3
```

```
[25]: <folium.folium.Map at 0x7f8c2484fda0>
```

1.0.15 Now, let's explore Portsmouth

```
[26]: address2 = 'The Hard Interchange, Portsmouth, UK'

geolocator = Nominatim(user_agent="foursquare_agent")
location = geolocator.geocode(address2)
latitude = location.latitude
longitude = location.longitude
```



```
print(latitude, longitude)
```

50.7975618 -1.10687856484868

```
[27]: search_query = 'restaurant'
      radius = 8000
      print(search_query + ' .... OK!')
```

restaurant ... OK!

```
[28]: url = 'https://api.foursquare.com/v2/venues/search?
      ↪client_id={}&client_secret={}&ll={},{}&v={}&query={}&radius={}&limit={}'.
      ↪format(CLIENT_ID, CLIENT_SECRET, latitude, longitude, VERSION, search_query,
      ↪radius, LIMIT)
      url
```

```
[28]: 'https://api.foursquare.com/v2/venues/search?client_id=2I3LPFIYIHKOKRDUERZD4BGMB
      G1MBLDRH51BJVRROQ1LA220&client_secret=FD1DZORVTNISU5UKUBDQBFQIYLLKXIVZQJ23IILFJFT
      NA4A2U&ll=50.7975618,-1.10687856484868&v=20180604&query=restaurant&radius=8000&l
      imit=100'
```

```
[29]: results2 = requests.get(url).json()
      results2
```

```
[29]: {'meta': {'code': 200, 'requestId': '5d9ac4c7cf72a0002ce31feb'},
      'response': {'venues': [{'id': '503a3e2be4b0451d7d6b7522',
      'name': 'İstanbul Turkish & Kurdish Restaurant',
      'location': {'lat': 50.785119049882326,
      'lng': -1.091370731163266,
      'labeledLatLngs': [{'label': 'display',
      'lat': 50.785119049882326,
      'lng': -1.091370731163266}]},
      'distance': 1763,
      'cc': 'GB',
      'country': 'United Kingdom',
      'formattedAddress': ['United Kingdom']},
      'categories': [{'id': '4f04af1f2fb6e1c99f3db0bb',
      'name': 'Turkish Restaurant',
      'pluralName': 'Turkish Restaurants',
      'shortName': 'Turkish',
      'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/turkish_',
      'suffix': '.png'},
      'primary': True}],
      'referralId': 'v-1570424008',
      'hasPerk': False},
      {'id': '53e91514498e60742355bbf6',
      'name': 'restaurant holliday inn',
```

```

'location': {'lat': 50.78972349930224,
'lng': -1.0854107564172486,
'labeledLatLngs': [{'label': 'display',
'lat': 50.78972349930224,
'lng': -1.0854107564172486}]},
'distance': 1744,
'cc': 'GB',
'country': 'United Kingdom',
'formattedAddress': ['United Kingdom']},
'categories': [{'id': '52e81612bcbc57f1066b7a05',
'name': 'English Restaurant',
'pluralName': 'English Restaurants',
'shortName': 'English',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{'id': '50129224e4b09075800fd10d',
'name': 'The Restaurant',
'location': {'address': 'Knight & Lee',
'lat': 50.785065,
'lng': -1.088306,
'labeledLatLngs': [{'label': 'display',
'lat': 50.785065,
'lng': -1.088306}]},
'distance': 1908,
'cc': 'GB',
'country': 'United Kingdom',
'formattedAddress': ['Knight & Lee', 'United Kingdom']},
'categories': [{'id': '4bf58dd8d48988d16d941735',
'name': 'Café',
'pluralName': 'Cafés',
'shortName': 'Café',
'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/cafe_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{'id': '4c225f589085d13acb3a86cc',
'name': 'Restaurant 27',
'location': {'address': '27A South Parade',
'crossStreet': 'Burgoyne Road',
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        'suffix': '.png'},
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    'referralId': 'v-1570424008',
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    { 'id': '4cd6a2addfb4a1cdd212605c',
    'name': 'Sarah turkish Restaurant',
    'location': { 'address': 'Fawcett road',
        'lat': 50.79373,
        'lng': -1.076356,
        'labeledLatLngs': [{ 'label': 'display',
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            'lng': -1.076356}],
        'distance': 2189,
        'cc': 'GB',
        'city': 'Southsea',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['Fawcett road',
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            'Hampshire',
            'United Kingdom']},
        'categories': [],
        'referralId': 'v-1570424008',
        'hasPerk': False},
    { 'id': '4e3320fd62845cff5a3ba9f4',
    'name': 'Great Wall',
    'location': { 'address': '78A High St.',
        'lat': 50.79489097656714,
        'lng': -1.1164597985275935,

```

```

'latitude': 50.79489097656714,
'longitude': -1.1164597985275935}],
'distance': 736,
'postalCode': 'PO12 1DS',
'cc': 'GB',
'city': 'Gosport',
'state': 'Hampshire',
'country': 'United Kingdom',
'formattedAddress': ['78A High St.',
'Gosport',
'Hampshire',
'PO12 1DS',
'United Kingdom']},
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'name': 'Chinese Restaurant',
'pluralName': 'Chinese Restaurants',
'shortName': 'Chinese',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{ 'id': '58456efdebf0284fe76380bd',
'name': 'J Mart Japanese & Korean Restaurant',
'location': { 'address': '206 Kingston Road',
'lat': 50.812054,
'lng': -1.0798,
'labeledLatLngs': [{ 'label': 'display',
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'lng': -1.0798}],
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'postalCode': 'PO2 7LR',
'cc': 'GB',
'city': 'Portsmouth',
'state': 'Hampshire',
'country': 'United Kingdom',
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'Portsmouth',
'Hampshire',
'PO2 7LR',
'United Kingdom']},
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'pluralName': 'Japanese Restaurants',
'shortName': 'Japanese',
'icon': { 'prefix':

```



```

'https://ss3.4sqi.net/img/categories_v2/food/japanese_',
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  'primary': True]],
  'referralId': 'v-1570424008',
  'hasPerk': False},
{'id': '4f3aaf46e4b0e724f17f15f1',
 'name': 'Pitch Side Restaurant, Fratton Park',
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 'lat': 50.797236,
 'lng': -1.064455,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.797236,
 'lng': -1.064455}]},
 'distance': 2985,
 'cc': 'GB',
 'city': 'Portsmouth',
 'state': 'Hampshire',
 'country': 'United Kingdom',
 'formattedAddress': ['Fratton Park',
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 'Hampshire',
 'United Kingdom']},
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 'pluralName': 'Soccer Stadiums',
 'shortName': 'Soccer',
 'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/arts_entertainment/stadium_soccer_',
 'suffix': '.png'},
 'primary': True]],
  'referralId': 'v-1570424008',
  'hasPerk': False},
{'id': '4e8f24edb80369c969bf1872',
 'name': 'Twins Chinese Hot Pot Restaurant',
 'location': {'address': '255 Albert Road',
 'crossStreet': 'Southsea',
 'lat': 50.786522,
 'lng': -1.070801,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.786522,
 'lng': -1.070801}]},
 'distance': 2820,
 'postalCode': 'PO4 0JR',
 'cc': 'GB',
 'city': 'Portsmouth',
 'state': 'Hampshire',
 'country': 'United Kingdom',

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'formattedAddress': ['255 Albert Road (Southsea)',
'Portsmouth',
'Hampshire',
'PO4 OJR',
'United Kingdom']],
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'name': 'Chinese Restaurant',
'pluralName': 'Chinese Restaurants',
'shortName': 'Chinese',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{'id': '4c193e87fe5a76b0fb4a0315',
'name': 'T & J Mahal',
'location': { 'address': '39 Elm Grove',
'lat': 50.79043076764807,
'lng': -1.0891236253702576,
'labeledLatLngs': [{ 'label': 'display',
'lat': 50.79043076764807,
'lng': -1.0891236253702576}],
'distance': 1480,
'postalCode': 'PO5 1JF',
'cc': 'GB',
'city': 'Portsmouth',
'state': 'Hampshire',
'country': 'United Kingdom',
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'Portsmouth',
'Hampshire',
'PO5 1JF',
'United Kingdom']],
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'name': 'Indian Restaurant',
'pluralName': 'Indian Restaurants',
'shortName': 'Indian',
'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/indian_',
'suffix': '.png'},
'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{'id': '4e7df9b0775b53d25b7dcd93',
'name': 'Dubai Restaurant',
'location': { 'address': '134 Albert Road',
'lat': 50.78665659682888,
'lng': -1.0751671440877153,

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    'labeledLatLngs': [{ 'label': 'display',
        'lat': 50.78665659682888,
        'lng': -1.0751671440877153}],
    'distance': 2540,
    'cc': 'GB',
    'city': 'Portsmouth',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['134 Albert Road',
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        'Hampshire',
        'United Kingdom']],
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        'name': 'Middle Eastern Restaurant',
        'pluralName': 'Middle Eastern Restaurants',
        'shortName': 'Middle Eastern',
        'icon': { 'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/middleeastern_',
        'suffix': '.png'},
        'primary': True}],
    'referralId': 'v-1570424008',
    'hasPerk': False},
    { 'id': '521d01ba11d21a1bbd0810f0',
    'name': "Bobby's",
    'location': { 'address': '18 Stoke Road',
        'lat': 50.79457644302583,
        'lng': -1.13038357738322,
        'labeledLatLngs': [{ 'label': 'display',
            'lat': 50.79457644302583,
            'lng': -1.13038357738322}],
        'distance': 1686,
        'postalCode': 'PO12 1JB',
        'cc': 'GB',
        'city': 'Gosport',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['18 Stoke Road',
            'Gosport',
            'Hampshire',
            'PO12 1JB',
            'United Kingdom']],
        'categories': [{ 'id': '4bf58dd8d48988d110941735',
            'name': 'Italian Restaurant',
            'pluralName': 'Italian Restaurants',
            'shortName': 'Italian',
            'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/italian_',
                'suffix': '.png'},

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    'primary': True]],
    'referralId': 'v-1570424008',
    'hasPerk': False},
    {'id': '4b6c62fef964a520d4352ce3',
     'name': 'Sakura',
     'location': {'address': '9 Albert Rd',
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                  'lng': -1.0822074071407584,
                  'labeledLatLngs': [{'label': 'display',
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                                       'lng': -1.0822074071407584}]},
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     'cc': 'GB',
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     'city': 'Portsmouth',
     'state': 'Hampshire',
     'country': 'United Kingdom',
     'formattedAddress': ['9 Albert Rd',
                          'Portsmouth',
                          'Hampshire',
                          'PO5 2SE',
                          'United Kingdom']},
     'categories': [{'id': '4bf58dd8d48988d111941735',
                      'name': 'Japanese Restaurant',
                      'pluralName': 'Japanese Restaurants',
                      'shortName': 'Japanese',
                      'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/japanese_',
                              'suffix': '.png'}},
                     {'primary': True}],
     'referralId': 'v-1570424008',
     'hasPerk': False},
    {'id': '54fb3fe3498eb4382582da5b',
     'name': 'Pebbles Fish And Wine Restaurant',
     'location': {'lat': 50.78662210541675,
                  'lng': -1.1614795347061415,
                  'labeledLatLngs': [{'label': 'display',
                                       'lat': 50.78662210541675,
                                       'lng': -1.1614795347061415}]},
     'distance': 4030,
     'cc': 'GB',
     'country': 'United Kingdom',
     'formattedAddress': ['United Kingdom']},
     'categories': [{'id': '4bf58dd8d48988d1c4941735',
                      'name': 'Restaurant',
                      'pluralName': 'Restaurants',

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      'shortName': 'Restaurant',
      'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
        'suffix': '.png'},
      'primary': True}],
    'referralId': 'v-1570424008',
    'hasPerk': False},
    {'id': '4ed1601f2c5bc3505829a791',
      'name': 'Bodrum',
      'location': {'address': '165-167 Albert Rd',
        'lat': 50.786733443188645,
        'lng': -1.0748723011423849,
        'labeledLatLngs': [{'label': 'display',
          'lat': 50.786733443188645,
          'lng': -1.0748723011423849}],
        'distance': 2554,
        'postalCode': 'PO4 0JW',
        'cc': 'GB',
        'city': 'Portsmouth',
        'state': 'Hampshire',
        'country': 'United Kingdom',
        'formattedAddress': ['165-167 Albert Rd',
          'Portsmouth',
          'Hampshire',
          'PO4 0JW',
          'United Kingdom']},
      'categories': [{'id': '4f04af1f2fb6e1c99f3db0bb',
        'name': 'Turkish Restaurant',
        'pluralName': 'Turkish Restaurants',
        'shortName': 'Turkish',
        'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/turkish_',
          'suffix': '.png'},
        'primary': True}],
      'referralId': 'v-1570424008',
      'hasPerk': False},
    {'id': '507aabbfe4b0ce42c6fc7182',
      'name': 'Poppins restaurants',
      'location': {'lat': 50.795184,
        'lng': -1.120104,
        'labeledLatLngs': [{'label': 'display',
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          'lng': -1.120104}],
        'distance': 967,
        'cc': 'GB',
        'country': 'United Kingdom',
        'formattedAddress': ['United Kingdom']},
      'categories': [{'id': '4bf58dd8d48988d143941735',
        'name': 'Breakfast Spot',

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        'pluralName': 'Breakfast Spots',
        'shortName': 'Breakfast',
        'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/breakfast_',
        'suffix': '.png'},
        'primary': True}],
        'referralId': 'v-1570424008',
        'hasPerk': False},
{'id': '510ecdd3e4b0607cf4a3dd3c',
 'name': 'Twins Korean BBQ',
 'location': {'address': '221 Albert Road',
 'lat': 50.78947146955999,
 'lng': -1.072914628201136,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.78947146955999,
 'lng': -1.072914628201136}],
 'distance': 2553,
 'cc': 'GB',
 'country': 'United Kingdom',
 'formattedAddress': ['221 Albert Road', 'United Kingdom']},
 'categories': [{'id': '4bf58dd8d48988d113941735',
 'name': 'Korean Restaurant',
 'pluralName': 'Korean Restaurants',
 'shortName': 'Korean',
 'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/korean_',
 'suffix': '.png'},
 'primary': True}],
 'referralId': 'v-1570424008',
 'hasPerk': False},
{'id': '4be5a6392457a593d7c3ab15',
 'name': 'Bombay Bay Indian Restaurant',
 'location': {'address': 'Southsea marina',
 'lat': 50.791666,
 'lng': -1.033407,
 'labeledLatLngs': [{'label': 'display',
 'lat': 50.791666,
 'lng': -1.033407}],
 'distance': 5211,
 'cc': 'GB',
 'city': 'Portsmouth',
 'state': 'Hampshire',
 'country': 'United Kingdom',
 'formattedAddress': ['Southsea marina',
 'Portsmouth',
 'Hampshire',
 'United Kingdom']},
 'categories': [{'id': '4bf58dd8d48988d10f941735',

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      'name': 'Indian Restaurant',
      'pluralName': 'Indian Restaurants',
      'shortName': 'Indian',
      'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/indian_',
        'suffix': '.png'},
      'primary': True}],
    'referralId': 'v-1570424008',
    'hasPerk': False},
  {'id': '4be2aabad27a20a1fd00905b',
    'name': 'Debenhams',
    'location': {'address': '134-142 Commercial Rd',
      'lat': 50.80004029496772,
      'lng': -1.0900820381561314,
      'labeledLatLngs': [{'label': 'display',
        'lat': 50.80004029496772,
        'lng': -1.0900820381561314}],
      'distance': 1213,
      'postalCode': 'PO1 1ET',
      'cc': 'GB',
      'city': 'Portsmouth',
      'state': 'Hampshire',
      'country': 'United Kingdom',
      'formattedAddress': ['134-142 Commercial Rd',
        'Portsmouth',
        'Hampshire',
        'PO1 1ET',
        'United Kingdom']},
    'categories': [{'id': '4bf58dd8d48988d1f6941735',
      'name': 'Department Store',
      'pluralName': 'Department Stores',
      'shortName': 'Department Store',
      'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/shops/departmentstore_',
        'suffix': '.png'},
      'primary': True}],
    'referralId': 'v-1570424008',
    'hasPerk': False},
  {'id': '4dc7a274e4cd169dc6810582',
    'name': 'Highbury Cafe & Restaurant',
    'location': {'lat': 50.840269,
      'lng': -1.068249,
      'labeledLatLngs': [{'label': 'display',
        'lat': 50.840269,
        'lng': -1.068249}],
      'distance': 5475,
      'cc': 'GB',
      'city': 'Portsmouth',

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```

    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['Portsmouth', 'Hampshire', 'United Kingdom']],
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        'name': 'Café',
        'pluralName': 'Cafés',
        'shortName': 'Café',
        'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/cafe_',
            'suffix': '.png'},
        'primary': True}],
    'referralId': 'v-1570424008',
    'hasPerk': False},
    { 'id': '5041bf8ce4b0a10506b579ae',
        'name': 'Sealevel Restaurant & Bar',
        'location': { 'lat': 50.845879,
            'lng': -1.090393,
            'labeledLatLngs': [{ 'label': 'display',
                'lat': 50.845879,
                'lng': -1.090393}],
            'distance': 5502,
            'cc': 'GB',
            'country': 'United Kingdom',
            'formattedAddress': ['United Kingdom']],
        'categories': [{ 'id': '4bf58dd8d48988d1c4941735',
            'name': 'Restaurant',
            'pluralName': 'Restaurants',
            'shortName': 'Restaurant',
            'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
                'suffix': '.png'},
            'primary': True}],
        'referralId': 'v-1570424008',
        'hasPerk': False},
    { 'id': '4e01d3f062843b639cfc96af',
        'name': "Nino's Cafe & Restaurant",
        'location': { 'address': '38 High Street',
            'lat': 50.847340625724485,
            'lng': -1.0618497222923355,
            'labeledLatLngs': [{ 'label': 'display',
                'lat': 50.847340625724485,
                'lng': -1.0618497222923355}],
            'distance': 6382,
            'postalCode': 'PO6 3BZ',
            'cc': 'GB',
            'city': 'Portsmouth',
            'state': 'Hampshire',
            'country': 'United Kingdom',
            'formattedAddress': ['38 High Street',

```



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    'Portsmouth',
    'Hampshire',
    'PO6 3BZ',
    'United Kingdom']},
    'categories': [],
    'referralId': 'v-1570424008',
    'hasPerk': False},
    {'id': '57efae33498ed8b7dbc03127',
     'name': "Tony's Café and Restaurant",
     'location': {'address': '83 High Street',
                  'lat': 50.80121,
                  'lng': -1.201279,
                  'labeledLatLngs': [{'label': 'display',
                                       'lat': 50.80121,
                                       'lng': -1.201279}]},
     'distance': 6654,
     'postalCode': 'PO13 9BU',
     'cc': 'GB',
     'city': 'Lee-on-the-Solent',
     'state': 'Hampshire',
     'country': 'United Kingdom',
     'formattedAddress': ['83 High Street',
                          'Lee-on-the-Solent',
                          'Hampshire',
                          'PO13 9BU',
                          'United Kingdom']},
     'categories': [{'id': '4bf58dd8d48988d143941735',
                      'name': 'Breakfast Spot',
                      'pluralName': 'Breakfast Spots',
                      'shortName': 'Breakfast',
                      'icon': {'prefix':
'https://ss3.4sqi.net/img/categories_v2/food/breakfast_',
                              'suffix': '.png'},
                      'primary': True}],
     'referralId': 'v-1570424008',
     'hasPerk': False},
    {'id': '5b41fe2373fe25002c0cc20c',
     'name': 'Chef's Delight Cafe & Restaurant',
     'location': {'lat': 50.800994,
                  'lng': -1.201262,
                  'labeledLatLngs': [{'label': 'display',
                                       'lat': 50.800994,
                                       'lng': -1.201262}]},
     'distance': 6651,
     'cc': 'GB',
     'country': 'United Kingdom',
     'formattedAddress': ['United Kingdom']},

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'categories': [{ 'id': '4bf58dd8d48988d1c4941735',
  'name': 'Restaurant',
  'pluralName': 'Restaurants',
  'shortName': 'Restaurant',
  'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
    'suffix': '.png' },
  'primary': True }],
'referralId': 'v-1570424008',
'hasPerk': False },
{ 'id': '4e770f9062e12635171d3a83',
  'name': 'The Solent Restaurant',
  'location': { 'lat': 50.80194688670608,
    'lng': -1.2024388579569492,
    'labeledLatLngs': [ { 'label': 'display',
      'lat': 50.80194688670608,
      'lng': -1.2024388579569492 } ],
    'distance': 6741,
    'cc': 'GB',
    'country': 'United Kingdom',
    'formattedAddress': [ 'United Kingdom' ] },
  'categories': [ { 'id': '4bf58dd8d48988d16d941735',
    'name': 'Café',
    'pluralName': 'Cafés',
    'shortName': 'Café',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/cafe_',
      'suffix': '.png' },
    'primary': True } ],
  'referralId': 'v-1570424008',
  'hasPerk': False },
{ 'id': '57ab0ecf498ed701ee3c5dc0',
  'name': 'Kung Fu Restaurant',
  'location': { 'address': '54 West Street',
    'lat': 50.852276,
    'lng': -1.1775578,
    'labeledLatLngs': [ { 'label': 'display',
      'lat': 50.852276,
      'lng': -1.1775578 } ],
    'distance': 7861,
    'postalCode': 'PO16 0JN',
    'cc': 'GB',
    'city': 'Fareham',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': [ '54 West Street',
      'Fareham',
      'Hampshire',
      'PO16 0JN',

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```

    'United Kingdom']},
'categories': [{ 'id': '4bf58dd8d48988d1c4941735',
    'name': 'Restaurant',
    'pluralName': 'Restaurants',
    'shortName': 'Restaurant',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
    'suffix': '.png'},
    'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False},
{ 'id': '50ca02c1245f2d4aa8c2b906',
    'name': 'Tradewinds Restaurant',
    'location': { 'address': 'Eastern Rd',
    'crossStreet': 'Hilton Portsmouth',
    'lat': 50.83614927527139,
    'lng': -1.0409949329344765,
    'labeledLatLngs': [{ 'label': 'display',
    'lat': 50.83614927527139,
    'lng': -1.0409949329344765}],
    'distance': 6318,
    'postalCode': 'PO6 1UN',
    'cc': 'GB',
    'city': 'Farlington',
    'state': 'Hampshire',
    'country': 'United Kingdom',
    'formattedAddress': ['Eastern Rd (Hilton Portsmouth)',
    'Farlington',
    'Hampshire',
    'PO6 1UN',
    'United Kingdom']},
'categories': [{ 'id': '4bf58dd8d48988d1c4941735',
    'name': 'Restaurant',
    'pluralName': 'Restaurants',
    'shortName': 'Restaurant',
    'icon': { 'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
    'suffix': '.png'},
    'primary': True}],
'referralId': 'v-1570424008',
'hasPerk': False}}}]

```

```

[30]: # assign relevant part of JSON to venues
venues2 = results2['response']['venues']

# transform venues into a dataframe
dataframe2 = json_normalize(venues2)
dataframe2.head()

```

```

[30]:
      id
0 503a3e2be4b0451d7d6b7522 İstanbul Turkish & Kurdish Restaurant
1 53e91514498e60742355bbf6 restaurant holliday inn
2 50129224e4b09075800fd10d The Restaurant
3 4c225f589085d13acb3a86cc Restaurant 27
4 5c4076dc3183940025890474 113 Restaurant And Bar

      categories referralId hasPerk \
0 [{'id': '4f04af1f2fb6e1c99f3db0bb', 'name': 'T... v-1570424008 False
1 [{'id': '52e81612bcbc57f1066b7a05', 'name': 'E... v-1570424008 False
2 [{'id': '4bf58dd8d48988d16d941735', 'name': 'C... v-1570424008 False
3 [{'id': '4bf58dd8d48988d10c941735', 'name': 'F... v-1570424008 False
4 [{'id': '4bf58dd8d48988d1c4941735', 'name': 'R... v-1570424008 False

location.lat location.lng \
0 50.785119 -1.091371
1 50.789723 -1.085411
2 50.785065 -1.088306
3 50.780903 -1.080822
4 50.795143 -1.095090

location.labeledLatLngs location.distance \
0 [{'label': 'display', 'lat': 50.78511904988232... 1763
1 [{'label': 'display', 'lat': 50.78972349930224... 1744
2 [{'label': 'display', 'lat': 50.785065, 'lng':... 1908
3 [{'label': 'display', 'lat': 50.78090256249381... 2607
4 [{'label': 'display', 'lat': 50.795143, 'lng':... 872

location.cc location.country \
0 GB United Kingdom
1 GB United Kingdom
2 GB United Kingdom
3 GB United Kingdom
4 GB United Kingdom

location.formattedAddress location.address \
0 [United Kingdom] NaN
1 [United Kingdom] NaN
2 [Knight & Lee, United Kingdom] Knight & Lee
3 [27A South Parade (Burgoyne Road), Southsea, H... 27A South Parade
4 [Portsmouth, Hampshire, PO1 2AH, United Kingdom] NaN

location.crossStreet location.postalCode location.city location.state \
0 NaN NaN NaN NaN
1 NaN NaN NaN NaN
2 NaN NaN NaN NaN
3 Burgoyne Road P05 2JF Southsea Hampshire

```

4	NaN	P01 2AH	Portsmouth	Hampshire
---	-----	---------	------------	-----------

	location.neighborhood	venuePage.id
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	Guildhall	NaN

```
[31]: # keep only columns that include venue name, and anything that is associated
      ↪with location
filtered_columns2 = ['name', 'categories'] + [col for col in dataframe2.columns
      ↪if col.startswith('location.')] + ['id']
dataframe_filtered2 = dataframe2.loc[:, filtered_columns2]

# 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']

# filter the category for each row
dataframe_filtered2['categories'] = dataframe_filtered2.
      ↪apply(get_category_type, axis=1)

# clean column names by keeping only last term
dataframe_filtered2.columns = [column.split('.')[0] for column in
      ↪dataframe_filtered2.columns]

dataframe_filtered2
```

```
[31]:
```

	name	categories \
0	İstanbul Turkish & Kurdish Restaurant	Turkish Restaurant
1	restaurant holliday inn	English Restaurant
2	The Restaurant	Café
3	Restaurant 27	French Restaurant
4	113 Restaurant And Bar	Restaurant
5	Chimes Restaurant At Highbury College	Restaurant
6	Victoriana's Restaurant	Breakfast Spot
7	Cedar Lebanese Restaurant	Lebanese Restaurant
8	Golden Emperor Chinese Restaurant	Chinese Restaurant

9	Po-Young Chinese Restaurant	Chinese Restaurant
10	The George Hotel	Restaurant
11	G's Winebar & Restaurant	Winery
12	Loch Fyne	Seafood Restaurant
13	G's Winebar & Restaurant	Wine Bar
14	Gandhi Indian Restaurant	Asian Restaurant
15	Deep Blue Restaurant, Southsea Pier	English Restaurant
16	Agora Restaurant	Greek Restaurant
17	@Asia Japanese Restaurant	Japanese Restaurant
18	Touareg restaurant	None
19	Debenhams Restaurant/Café	Café
20	Nirvana Restaurant Southsea	Indian Restaurant
21	Penang Laksa Restaurant	Malay Restaurant
22	Buffalo Cafe Restaurant	Mediterranean Restaurant
23	Goa Indian Restaurant	Indian Restaurant
24	sandip's restaurant	Restaurant
25	sarah restaurant	Middle Eastern Restaurant
26	Jmart Japanese and Korean Restaurant	Japanese Restaurant
27	Sarah turkish Restaurant	None
28	Great Wall	Chinese Restaurant
29	J Mart Japanese & Korean Restaurant	Japanese Restaurant
30	Pitch Side Restaurant, Fratton Park	Soccer Stadium
31	Twins Chinese Hot Pot Restaurant	Chinese Restaurant
32	T & J Mahal	Indian Restaurant
33	Dubai Restaurant	Middle Eastern Restaurant
34	Bobby's	Italian Restaurant
35	Sakura	Japanese Restaurant
36	Pebbles Fish And Wine Restaurant	Restaurant
37	Bodrum	Turkish Restaurant
38	Poppins restaurants	Breakfast Spot
39	Twins Korean BBQ	Korean Restaurant
40	Bombay Bay Indian Restaurant	Indian Restaurant
41	Debenhams	Department Store
42	Highbury Cafe & Restaurant	Café
43	Sealevel Restaurant & Bar	Restaurant
44	Nino's Cafe & Restaurant	None
45	Tony's Café and Restaurant	Breakfast Spot
46	Chef's Delight Cafe & Restaurant	Restaurant
47	The Solent Restaurant	Café
48	Kung Fu Restaurant	Restaurant
49	Tradewinds Restaurant	Restaurant

	lat	lng	labeledLatLngs \
0	50.785119	-1.091371	[{'label': 'display', 'lat': 50.78511904988232...
1	50.789723	-1.085411	[{'label': 'display', 'lat': 50.78972349930224...
2	50.785065	-1.088306	[{'label': 'display', 'lat': 50.785065, 'lng':...
3	50.780903	-1.080822	[{'label': 'display', 'lat': 50.78090256249381...

4	50.795143	-1.095090	[{'label': 'display', 'lat': 50.795143, 'lng':...
5	50.795530	-1.092101	[{'label': 'display', 'lat': 50.79552996037177...
6	50.794795	-1.120833	[{'label': 'display', 'lat': 50.794795, 'lng':...
7	50.787354	-1.080876	[{'label': 'display', 'lat': 50.787354, 'lng':...
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9	50.802022	-1.087335	[{'label': 'display', 'lat': 50.802022, 'lng':...
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11	50.802148	-1.124063	[{'label': 'display', 'lat': 50.80214771170987...
12	50.794419	-1.106634	[{'label': 'display', 'lat': 50.79441866955099...
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14	50.810489	-1.078856	[{'label': 'display', 'lat': 50.81048945133884...
15	50.778313	-1.075911	[{'label': 'display', 'lat': 50.778313, 'lng':...
16	50.784693	-1.088026	[{'label': 'display', 'lat': 50.78469275804901...
17	50.784824	-1.091536	[{'label': 'display', 'lat': 50.78482367465177...
18	50.789170	-1.083345	[{'label': 'display', 'lat': 50.78917, 'lng': ...
19	50.807706	-1.083844	[{'label': 'display', 'lat': 50.80770640512597...
20	50.788147	-1.081917	[{'label': 'display', 'lat': 50.78814719838939...
21	50.804248	-1.078895	[{'label': 'display', 'lat': 50.80424845747774...
22	50.787947	-1.082008	[{'label': 'display', 'lat': 50.78794723297043...
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25	50.793835	-1.076306	[{'label': 'display', 'lat': 50.793835, 'lng':...
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29	50.812054	-1.079800	[{'label': 'display', 'lat': 50.812054, 'lng':...
30	50.797236	-1.064455	[{'label': 'display', 'lat': 50.797236, 'lng':...
31	50.786522	-1.070801	[{'label': 'display', 'lat': 50.786522, 'lng':...
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37	50.786733	-1.074872	[{'label': 'display', 'lat': 50.78673344318864...
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3	2607	GB	United Kingdom	
4	872	GB	United Kingdom	
5	1064	GB	United Kingdom	
6	1029	GB	United Kingdom	
7	2153	GB	United Kingdom	
8	1048	GB	United Kingdom	
9	1461	GB	United Kingdom	
10	275	GB	United Kingdom	
11	1312	GB	United Kingdom	
12	350	GB	United Kingdom	
13	1363	GB	United Kingdom	
14	2440	GB	United Kingdom	
15	3056	GB	United Kingdom	
16	1952	GB	United Kingdom	
17	1782	GB	United Kingdom	
18	1901	GB	United Kingdom	
19	1975	GB	United Kingdom	
20	2045	GB	United Kingdom	
21	2104	GB	United Kingdom	
22	2051	GB	United Kingdom	
23	2091	GB	United Kingdom	
24	2666	GB	United Kingdom	
25	2190	GB	United Kingdom	
26	2490	GB	United Kingdom	
27	2189	GB	United Kingdom	
28	736	GB	United Kingdom	
29	2496	GB	United Kingdom	
30	2985	GB	United Kingdom	
31	2820	GB	United Kingdom	
32	1480	GB	United Kingdom	
33	2540	GB	United Kingdom	
34	1686	GB	United Kingdom	
35	2024	GB	United Kingdom	
36	4030	GB	United Kingdom	
37	2554	GB	United Kingdom	
38	967	GB	United Kingdom	
39	2553	GB	United Kingdom	
40	5211	GB	United Kingdom	
41	1213	GB	United Kingdom	
42	5475	GB	United Kingdom	
43	5502	GB	United Kingdom	
44	6382	GB	United Kingdom	
45	6654	GB	United Kingdom	

46 6651 GB United Kingdom
 47 6741 GB United Kingdom
 48 7861 GB United Kingdom
 49 6318 GB United Kingdom

formattedAddress \
 0 [United Kingdom]
 1 [United Kingdom]
 2 [Knight & Lee, United Kingdom]
 3 [27A South Parade (Burgoyne Road), Southsea, H...
 4 [Portsmouth, Hampshire, PO1 2AH, United Kingdom]
 5 [United Kingdom]
 6 [Bemister's Lane, Gosport, Hampshire, United K...
 7 [49 Albert Road, Portsmouth, Hampshire, PO5 2S...
 8 [Portsmouth, Hampshire, United Kingdom]
 9 [5A Commercial Place, Portsmouth, Hampshire, P...
 10 [84 Queen Street, Portsmouth, Hampshire, PO1 3...
 11 [Royal Clarence Marina, Gosport, Hampshire, Po...
 12 [Gunwharf Quays (Unit 2 Vulcan Buildings), Por...
 13 [Weevil Lane, Gosport, Hampshire, Po12 1fx, Un...
 14 [United Kingdom]
 15 [Southsea Pier, (Eastney Esplanade), Portsmout...
 16 [9 Clarendon Rd., Portsmouth, Hampshire, Unite...
 17 [United Kingdom]
 18 [Nettlestone, Isle of Wight, United Kingdom]
 19 [Commercial Road, Portsmouth, Hampshire, Unite...
 20 [17 Albert Road Southsea, Southsea, Hampshire,...
 21 [3, Unicorn Road, United Kingdom]
 22 [United Kingdom]
 23 [United Kingdom]
 24 [United Kingdom]
 25 [United Kingdom]
 26 [206 (Kingston Road), Portsmouth, Hampshire, P...
 27 [Fawcett road, Southsea, Hampshire, United Kin...
 28 [78A High St., Gosport, Hampshire, PO12 1DS, U...
 29 [206 Kingston Road, Portsmouth, Hampshire, PO2...
 30 [Fratton Park, Portsmouth, Hampshire, United K...
 31 [255 Albert Road (Southsea), Portsmouth, Hamps...
 32 [39 Elm Grove, Portsmouth, Hampshire, PO5 1JF,...
 33 [134 Albert Road, Portsmouth, Hampshire, Unite...
 34 [18 Stoke Road, Gosport, Hampshire, PO12 1JB, ...
 35 [9 Albert Rd, Portsmouth, Hampshire, PO5 2SE, ...
 36 [United Kingdom]
 37 [165-167 Albert Rd, Portsmouth, Hampshire, PO4...
 38 [United Kingdom]
 39 [221 Albert Road, United Kingdom]
 40 [Southsea marina, Portsmouth, Hampshire, Unite...

41 [134-142 Commercial Rd, Portsmouth, Hampshire,...
 42 [Portsmouth, Hampshire, United Kingdom]
 43 [United Kingdom]
 44 [38 High Street, Portsmouth, Hampshire, PO6 3B...
 45 [83 High Street, Lee-on-the-Solent, Hampshire,...
 46 [United Kingdom]
 47 [United Kingdom]
 48 [54 West Street, Fareham, Hampshire, PO16 0JN,...
 49 [Eastern Rd (Hilton Portsmouth), Farlington, H...

	address	crossStreet	postalCode	\
0	NaN	NaN	NaN	
1	NaN	NaN	NaN	
2	Knight & Lee	NaN	NaN	
3	27A South Parade	Burgoyne Road	P05 2JF	
4	NaN	NaN	P01 2AH	
5	NaN	NaN	NaN	
6	Bemister's Lane	NaN	NaN	
7	49 Albert Road	NaN	P05 2SF	
8	NaN	NaN	NaN	
9	5A Commercial Place	NaN	P01 4DT	
10	84 Queen Street	NaN	P01 3HU	
11	Royal Clarence Marina	NaN	Po12 1fx	
12	Gunwharf Quays	Unit 2 Vulcan Buildings	P01 3BF	
13	Weevil Lane	NaN	Po12 1fx	
14	NaN	NaN	NaN	
15	Southsea Pier,	Eastney Esplanade	NaN	
16	9 Clarendon Rd.	NaN	NaN	
17	NaN	NaN	NaN	
18	NaN	NaN	NaN	
19	Commercial Road	NaN	NaN	
20	17 Albert Road Southsea	NaN	P05 2SE	
21	3, Unicorn Road	NaN	NaN	
22	NaN	NaN	NaN	
23	NaN	NaN	NaN	
24	NaN	NaN	NaN	
25	NaN	NaN	NaN	
26	206	Kingston Road	P02 7LR	
27	Fawcett road	NaN	NaN	
28	78A High St.	NaN	P012 1DS	
29	206 Kingston Road	NaN	P02 7LR	
30	Fratton Park	NaN	NaN	
31	255 Albert Road	Southsea	P04 0JR	
32	39 Elm Grove	NaN	P05 1JF	
33	134 Albert Road	NaN	NaN	
34	18 Stoke Road	NaN	P012 1JB	
35	9 Albert Rd	NaN	P05 2SE	

36		NaN		NaN		NaN
37	165-167	Albert Rd		NaN	P04	OJW
38		NaN		NaN		NaN
39	221	Albert Road		NaN		NaN
40		Southsea marina		NaN		NaN
41	134-142	Commercial Rd		NaN	P01	1ET
42		NaN		NaN		NaN
43		NaN		NaN		NaN
44	38	High Street		NaN	P06	3BZ
45	83	High Street		NaN	P013	9BU
46		NaN		NaN		NaN
47		NaN		NaN		NaN
48	54	West Street		NaN	P016	OJN
49		Eastern Rd	Hilton Portsmouth		P06	1UN

	city	state	neighborhood	id
0	NaN	NaN	NaN	503a3e2be4b0451d7d6b7522
1	NaN	NaN	NaN	53e91514498e60742355bbf6
2	NaN	NaN	NaN	50129224e4b09075800fd10d
3	Southsea	Hampshire	NaN	4c225f589085d13acb3a86cc
4	Portsmouth	Hampshire	Guildhall	5c4076dc3183940025890474
5	NaN	NaN	NaN	51fb9b79498e49e9f8a62140
6	Gosport	Hampshire	NaN	57a8584c498e213efeee342b
7	Portsmouth	Hampshire	NaN	5bfabdbb8a6f17002c1169f9
8	Portsmouth	Hampshire	NaN	4cc96789b3f5224b9a61f420
9	Portsmouth	Hampshire	NaN	4e9d6eac5c5c1734ef85664a
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11	Gosport	Hampshire	NaN	4c893f84da5da1cd0bea3ae9
12	Portsmouth	Hampshire	NaN	4ba66817f964a520164f39e3
13	Gosport	Hampshire	NaN	4c8941d697828cfa1dd5a2aa
14	NaN	NaN	NaN	4ec4375b61af4438d0bca5f9
15	Portsmouth	Hampshire	NaN	59a33abf535d6f722961a86d
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19	Portsmouth	Hampshire	NaN	52e3ca0b498e59e408b1a0dc
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21	NaN	NaN	NaN	5124c3d0e4b06a37a4173e98
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24	NaN	NaN	NaN	4f8c3706e4b0e6f34b1710fd
25	NaN	NaN	NaN	5259b0b111d26f015ea65608
26	Portsmouth	Hampshire	NaN	5817430938fa51e55205a5c6
27	Southsea	Hampshire	NaN	4cd6a2addfb4a1cdd212605c
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43	NaN	NaN	NaN	5041bf8ce4b0a10506b579ae
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45	Lee-on-the-Solent	Hampshire	NaN	57efae33498ed8b7dbc03127
46	NaN	NaN	NaN	5b41fe2373fe25002c0cc20c
47	NaN	NaN	NaN	4e770f9062e12635171d3a83
48	Fareham	Hampshire	NaN	57ab0ecf498ed701ee3c5dc0
49	Farlington	Hampshire	NaN	50ca02c1245f2d4aa8c2b906

```
[32]: dataframe_filtered2.name
```

```
[32]: 0      İstanbul Turkish & Kurdish Restaurant
      1      restaurant holliday inn
      2      The Restaurant
      3      Restaurant 27
      4      113 Restaurant And Bar
      5      Chimes Restaurant At Highbury College
      6      Victoriana's Restaurant
      7      Cedar Lebanese Restaurant
      8      Golden Emperor Chinese Restaurant
      9      Po-Young Chinese Restaurant
     10      The George Hotel
     11      G's Winebar & Restaurant
     12      Loch Fyne
     13      G's Winebar & Restaurant
     14      Gandhi Indian Restaurant
     15      Deep Blue Restaurant, Southsea Pier
     16      Agora Restaurant
     17      @Asia Japanese Restaurant
     18      Touareg restaurant
     19      Debenhams Restaurant/Café
     20      Nirvana Restaurant Southsea
     21      Penang Laksa Restaurant
     22      Buffalo Cafe Restaurant
     23      Goa Indian Restaurant
     24      sandip's restaurant
```

```

25             sarah restaurant
26     Jmart Japanese and Korean Restaurant
27             Sarah turkish Restaurant
28             Great Wall
29     J Mart Japanese & Korean Restaurant
30             Pitch Side Restaurant, Fratton Park
31             Twins Chinese Hot Pot Restaurant
32             T & J Mahal
33             Dubai Restaurant
34             Bobby's
35             Sakura
36             Pebbles Fish And Wine Restaurant
37             Bodrum
38             Poppins restaurants
39             Twins Korean BBQ
40             Bombay Bay Indian Restaurant
41             Debenhams
42             Highbury Cafe & Restaurant
43             Sealevel Restaurant & Bar
44             Nino's Cafe & Restaurant
45             Tony's Café and Restaurant
46             Chef's Delight Cafe & Restaurant
47             The Solent Restaurant
48             Kung Fu Restaurant
49             Tradewinds Restaurant
Name: name, dtype: object

```

```

[33]: venues_map4 = folium.Map(location=[latitude, longitude], zoom_start=13) #
      ↪ generate map

# add a red circle marker
folium.features.CircleMarker(
    [latitude, longitude],
    radius=10,
    color='red',
    popup='Portsmouth Harbour',
    fill = True,
    fill_color = 'red',
    fill_opacity = 0.6
).add_to(venues_map4)

# add restaurants as blue circle markers
for lat, lng, label in zip(dataframe_filtered2.lat, dataframe_filtered2.lng,
      ↪ dataframe_filtered2.categories):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,

```

```

        color='blue',
        popup=label,
        fill = True,
        fill_color='blue',
        fill_opacity=0.6
    ).add_to(venues_map4)

```

```

# display map
venues_map4

```

[33]: <folium.folium.Map at 0x7f8c1938b630>

[34]: dataframe_filtered2.categories

```

[34]: 0      Turkish Restaurant
      1      English Restaurant
      2      Café
      3      French Restaurant
      4      Restaurant
      5      Restaurant
      6      Breakfast Spot
      7      Lebanese Restaurant
      8      Chinese Restaurant
      9      Chinese Restaurant
     10      Restaurant
     11      Winery
     12      Seafood Restaurant
     13      Wine Bar
     14      Asian Restaurant
     15      English Restaurant
     16      Greek Restaurant
     17      Japanese Restaurant
     18      None
     19      Café
     20      Indian Restaurant
     21      Malay Restaurant
     22      Mediterranean Restaurant
     23      Indian Restaurant
     24      Restaurant
     25      Middle Eastern Restaurant
     26      Japanese Restaurant
     27      None
     28      Chinese Restaurant
     29      Japanese Restaurant
     30      Soccer Stadium
     31      Chinese Restaurant
     32      Indian Restaurant

```

```

33 Middle Eastern Restaurant
34 Italian Restaurant
35 Japanese Restaurant
36 Restaurant
37 Turkish Restaurant
38 Breakfast Spot
39 Korean Restaurant
40 Indian Restaurant
41 Department Store
42 Café
43 Restaurant
44 None
45 Breakfast Spot
46 Restaurant
47 Café
48 Restaurant
49 Restaurant
Name: categories, dtype: object

```

```

[35]: port_grouped = dataframe_filtered2.groupby('categories').mean().reset_index()
port_grouped

```

```

[35]:
      categories  lat  lng  distance
0  Asian Restaurant  50.810489 -1.078856  2440.000000
1  Breakfast Spot  50.797063 -1.147405  2883.333333
2  Café  50.808747 -1.110709  4024.750000
3  Chinese Restaurant  50.795314 -1.091644  1516.250000
4  Department Store  50.800040 -1.090082  1213.000000
5  English Restaurant  50.784018 -1.080661  2400.000000
6  French Restaurant  50.780903 -1.080822  2607.000000
7  Greek Restaurant  50.784693 -1.088026  1952.000000
8  Indian Restaurant  50.789473 -1.071518  2706.750000
9  Italian Restaurant  50.794576 -1.130384  1686.000000
10 Japanese Restaurant  50.799260 -1.083330  2198.000000
11 Korean Restaurant  50.789471 -1.072915  2553.000000
12 Lebanese Restaurant  50.787354 -1.080876  2153.000000
13 Malay Restaurant  50.804248 -1.078895  2104.000000
14 Mediterranean Restaurant  50.787947 -1.082008  2051.000000
15 Middle Eastern Restaurant  50.790246 -1.075737  2365.000000
16 Restaurant  50.814250 -1.116265  3915.444444
17 Seafood Restaurant  50.794419 -1.106634  350.000000
18 Soccer Stadium  50.797236 -1.064455  2985.000000
19 Turkish Restaurant  50.785926 -1.083122  2158.500000
20 Wine Bar  50.804035 -1.090426  1363.000000
21 Winery  50.802148 -1.124063  1312.000000

```

```
[36]: venues_map5 = folium.Map(location=[latitude, longitude], zoom_start=13) #  

↳ generate map

# add a red circle marker
folium.features.CircleMarker(
    [latitude, longitude],
    radius=10,
    color='red',
    popup='Portsmouth Harbour',
    fill = True,
    fill_color = 'red',
    fill_opacity = 0.6
).add_to(venues_map5)

marker_cluster = MarkerCluster().add_to(venues_map5)

for lat, lng, label in zip(dataframe_filtered2.lat, dataframe_filtered2.lng,
↳ dataframe_filtered2.categories):
    folium.Marker(
        location=[lat, lng],
        popup=label,
        icon=None,
    ).add_to(marker_cluster)

venues_map5
```

```
[36]: <folium.folium.Map at 0x7f8c1929a0f0>
```

```
[37]: port_grouped_sorted = port_grouped.sort_values('distance', ascending=True)
port_grouped_sorted
```

```
[37]:
```

	categories	lat	lng	distance
17	Seafood Restaurant	50.794419	-1.106634	350.000000
4	Department Store	50.800040	-1.090082	1213.000000
21	Winery	50.802148	-1.124063	1312.000000
20	Wine Bar	50.804035	-1.090426	1363.000000
3	Chinese Restaurant	50.795314	-1.091644	1516.250000
9	Italian Restaurant	50.794576	-1.130384	1686.000000
7	Greek Restaurant	50.784693	-1.088026	1952.000000
14	Mediterranean Restaurant	50.787947	-1.082008	2051.000000
13	Malay Restaurant	50.804248	-1.078895	2104.000000
12	Lebanese Restaurant	50.787354	-1.080876	2153.000000
19	Turkish Restaurant	50.785926	-1.083122	2158.500000
10	Japanese Restaurant	50.799260	-1.083330	2198.000000
15	Middle Eastern Restaurant	50.790246	-1.075737	2365.000000

5	English Restaurant	50.784018	-1.080661	2400.000000
0	Asian Restaurant	50.810489	-1.078856	2440.000000
11	Korean Restaurant	50.789471	-1.072915	2553.000000
6	French Restaurant	50.780903	-1.080822	2607.000000
8	Indian Restaurant	50.789473	-1.071518	2706.750000
1	Breakfast Spot	50.797063	-1.147405	2883.333333
18	Soccer Stadium	50.797236	-1.064455	2985.000000
16	Restaurant	50.814250	-1.116265	3915.444444
2	Café	50.808747	-1.110709	4024.750000

```
[38]: print('There are {} uniques categories.'.
        ↪format(len(port_grouped_sorted['categories'].unique()))
```

There are 22 uniques categories.

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

port_grouped_clustering = port_grouped.drop('categories', 1)

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

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

```
[39]: array([2, 1, 4, 3, 3, 2, 1, 2, 1, 3], dtype=int32)
```

```
[40]: # add clustering labels
port_grouped_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

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

	Cluster Labels	categories	lat	lng	distance
17	2	Seafood Restaurant	50.794419	-1.106634	350.00
4	1	Department Store	50.800040	-1.090082	1213.00
21	4	Winery	50.802148	-1.124063	1312.00
20	3	Wine Bar	50.804035	-1.090426	1363.00
3	3	Chinese Restaurant	50.795314	-1.091644	1516.25

```
[41]: port_grouped_sorted.loc[port_grouped_sorted['Cluster Labels'] == 0,
        ↪port_grouped_sorted.columns[[1] + list(range(5, port_grouped_sorted.
        ↪shape[1]))]]
```

```
[41]: categories
8 Indian Restaurant
```

```
[42]: port_grouped_sorted.loc[port_grouped_sorted['Cluster Labels'] == 1,
↳port_grouped_sorted.columns[[1] + list(range(5, port_grouped_sorted.
↳shape[1]))]]
```

```
[42]:          categories
4      Department Store
7      Greek Restaurant
13     Malay Restaurant
10    Japanese Restaurant
1      Breakfast Spot
```

```
[43]: port_grouped_sorted.loc[port_grouped_sorted['Cluster Labels'] == 2,
↳port_grouped_sorted.columns[[1] + list(range(5, port_grouped_sorted.
↳shape[1]))]]
```

```
[43]:          categories
17     Seafood Restaurant
9      Italian Restaurant
14    Mediterranean Restaurant
19     Turkish Restaurant
15    Middle Eastern Restaurant
5      English Restaurant
0      Asian Restaurant
11     Korean Restaurant
18     Soccer Stadium
```

```
[44]: port_grouped_sorted.loc[port_grouped_sorted['Cluster Labels'] == 3,
↳port_grouped_sorted.columns[[1] + list(range(5, port_grouped_sorted.
↳shape[1]))]]
```

```
[44]:          categories
20           Wine Bar
3      Chinese Restaurant
12    Lebanese Restaurant
16           Restaurant
2           Café
```

```
[45]: port_grouped_sorted.loc[port_grouped_sorted['Cluster Labels'] == 4,
↳port_grouped_sorted.columns[[1] + list(range(5, port_grouped_sorted.
↳shape[1]))]]
```

```
[45]:          categories
21           Winery
6    French Restaurant
```

```
[46]: # set color scheme for the clusters
x = np.arange(kclusters)
```

```

ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lng, poi, cluster in zip(port_grouped_sorted['lat'],
    ↳port_grouped_sorted['lng'], port_grouped_sorted['categories'],
    ↳port_grouped_sorted['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(venues_map5)

venues_map5

```

[46]: <folium.folium.Map at 0x7f8c1929a0f0>

[]: