WEEK 1

This Notebook will be mainly used for the capstone project

WEEK 1

Problem: To identify how the commodities around affect the HDB resale prices in Singapore

Background: Today, Singapore is one of the most expensive city/country to live in. As an Asian financial hub, Singapore is home to many high networth people from all around the world. With its population close to 6 million, housing and living spaces are always on high demand. With its limited land on demand, Singapore's Housing & Development Board (HDB) is Singapore's pulic housing authority. The high storey public housing blocks have a lease of 99 years, and when the lease is up, the owners will have to give up their houses for redevelopment. This is to ensure that Singapore can continue to meet its economic growth and housing needs. As such, with the increasing economic growth, Housing in Singapore continue to increase over the years.

Data description: The dataset was retrieved from https://data.gov.sg/dataset/resale-flat-prices. The dataset contains Month, Town, Flat type, Block, Street name, Storey range, Floor area sqm, Flat model, Lease commence date, Remaining lease and Resale price. To work along with Foursquare API, it is essential to have postal code, longitude and latitude data for each of the resale flats. As such, Onemap API was used to find out and retrieve the required data, and then collated with the HDB resale price dataset as one. This data will help to identify the areas with different resale prices, are there a lot of flats in that area? The location of the town with more flats, commodities and etc. Foursquare API will be used to help identify the commdities around the resale flats, and possibly help to differentiate and understand if the amount of commdities affect the resale prices.

WEEK 2

Imports

```python
In [1]:
# importing libraries
import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analsysis
#pd.set_option('display.max_columns', None)
#pd.set_option('display.max_rows', None)
pd.reset_option('^display.', silent=True)

import json # library to handle JSON files

#!conda install -c conda-forge geopy --yes # uncomment this line if you haven't comp
from geopy.geocoders import Nominatim # convert an address into latitude and longitu

import requests # library to handle requests
from pandas.io.json import json_normalize # tranform JSON file into a pandas datafra

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

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

#!conda install -c conda-forge folium=0.5.0 --yes # uncomment this line if you haven
import folium # map rendering library
import urllib.request

# API requests
import requests
from typing import Union
from types import SimpleNamespace
import logging
#from concurrent.futures import as_completed
#from requests_futures.sessions import FuturesSession
import time
from tqdm import tqdm

# map/plotting
import folium # map rendering library
import matplotlib.cm as cm # Matplotlib and associated plotting modules
import matplotlib.colors as colors # Matplotlib and associated plotting modules
from matplotlib import pyplot as plt
print('Libraries imported.')
```

```
Libraries imported.
```

Set display settings (optional)

In [2]:
```python
#pd.set_option('display.max_rows',None) #setting how the pd is displayed
#pd.set_option('display.max_columns',None)#setting how the pd is displayed
#pd.set_option('display.width',None)#setting how the pd is displayed
##pd.reset_option('^display.', silent=True)
```

Read onemap_data

As the data was not completed with latitude and longitude, with the other columns in the HDB resale price data set, I have performed data gathering at another notebook using onemap API and collated to "onemap_data_completed_dropped.csv" dataset

In [3]:
```python
df = pd.read_csv('onemap_data_completed_dropped.csv')
```

In [4]:
```python
df=df.dropna(subset=['longitude'])
df=df.dropna(subset=['latitude'])
```

In [5]:
```python
df.shape
```

Out[5]: (29169, 16)

Foursquare API Credentials

In [6]:
```python
CLIENT_ID = 'RHF1QS0PPCHHV5HL4FQX3SB3YV2JQMHJY41W5LKLP4NL4VX1' # your Foursquare ID
CLIENT_SECRET = 'C5FHQRAVHHJ3CZYTXPTPGSBNGP1XA2FVLNF25PNBCI3IYQCN' # your Foursquare
ACCESS_TOKEN = '5ZZRRUYXNIE1KWRJEZWRLOXZT0RINRE2K0ROZ5AMKQSFQXU2' # your FourSquare
VERSION = '20180605'
LIMIT = 100
radius = 500
print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: RHF1QS0PPCHHV5HL4FQX3SB3YV2JQMHJY41W5LKLP4NL4VX1
CLIENT_SECRET:C5FHQRAVHHJ3CZYTXPTPGSBNGP1XA2FVLNF25PNBCI3IYQCN
```

Geopy Library to get latitude and longitude values of Singapore

In [7]:
```python
address = 'Singapore'

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

```
The geograpical coordinate of Singapore are 1.357107, 103.8194992.
```

Create a map of Singapore with the HDBs superimposed on top

In [8]:
```python
# create map of Toronto using latitude and longitude values
map_singapore = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers to map
for town,flat_type,blk,street,storey,floor_sqm,flat,lease_start,lease_left,resale_pr
    label = 'Town:{}, Flat type:{},Blk no.:{},Street:{},Floor:{},Floor SQM:{},Flat M
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, long],
        radius=4,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#87cefa',
        fill_opacity=0.5,
        parse_html=False).add_to(map_singapore)
```

In [9]:
```python
map_singapore
```

Out[9]: Make this Notebook Trusted to load map: File -> Trust Notebook

```
In [10]: df_high = df.sort_values(by=['resale_price'],ascending=False)
         df_high
```

Out[10]:

	month	town	flat_type	block	street_name	storey_range	floor_area_sqm	flat_mo
7874	2020-09	CENTRAL AREA	5 ROOM	1B	CANTONMENT RD	43 TO 45	107.0	Typ
24291	2021-04	BISHAN	5 ROOM	273B	BISHAN ST 24	31 TO 33	120.0	D
12727	2020-11	CENTRAL AREA	5 ROOM	1A	CANTONMENT RD	49 TO 51	105.0	Typ
21849	2021-03	BISHAN	5 ROOM	273B	BISHAN ST 24	28 TO 30	120.0	D
14776	2020-12	BISHAN	5 ROOM	273B	BISHAN ST 24	25 TO 27	120.0	D
...	...	...	...	...	...	...	...	
2782	2020-07	BUKIT MERAH	2 ROOM	48	LOWER DELTA RD	10 TO 12	43.0	Stanc
19200	2021-01	WOODLANDS	2 ROOM	218	MARSILING CRES	07 TO 09	45.0	Impro
2480	2020-07	ANG MO KIO	3 ROOM	507	ANG MO KIO AVE 8	10 TO 12	67.0	Genera
2778	2020-07	BUKIT MERAH	1 ROOM	7	TELOK BLANGAH CRES	07 TO 09	31.0	Impro
3193	2020-07	GEYLANG	2 ROOM	72	CIRCUIT RD	10 TO 12	42.0	Stanc

29169 rows × 16 columns

# Checking the dataframe and have a better visualisation at the resale dataset

```
In [11]: df_size = df.groupby(['town','flat_type','flat_model']).size().unstack(fill_value=0)
         #df_group.sort_values(by=['resale_price'],ascending=False)
         df_size
```

Out[11]:

flat_model	2-room	Adjoined flat	Apartment	DBSS	Improved	Improved-Maisonette	Maisonette	Mc

town	flat_type flat_model	2-room	Adjoined flat	Apartment	DBSS	Improved	Improved-Maisonette	Maisonette	Mo
town	**flat_type**								
ANG MO KIO	**2 ROOM**	0	0	0	0	17	0	0	
	3 ROOM	0	0	0	0	10	0	0	
	4 ROOM	0	0	0	14	0	0	0	
	5 ROOM	0	4	0	19	142	0	0	
	EXECUTIVE	0	6	10	0	0	0	2	
...	**...**	...	...	...	...	...	...	...	
YISHUN	**3 ROOM**	0	0	0	17	2	0	0	
	4 ROOM	0	0	0	38	0	0	0	
	5 ROOM	0	0	0	10	331	0	0	
	EXECUTIVE	0	0	38	0	0	0	52	
	MULTI-GENERATION	0	0	0	0	0	0	0	

129 rows × 20 columns
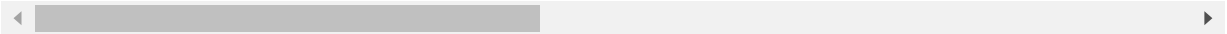
Counting the total number of resale flats

In [12]:
```python
df_type_total = df.groupby(['town']).count().drop(columns=['flat_model','month','blo
df_type_total = pd.DataFrame(df_type_total)
df_type_total = df_type_total.sort_values(by=['flat_type'],ascending=False)
df_type_total
```

Out[12]:

	flat_type
town	
SENGKANG	2712
PUNGGOL	2580
TAMPINES	2157
YISHUN	1760
BEDOK	1678
JURONG WEST	1677
WOODLANDS	1617
HOUGANG	1552
CHOA CHU KANG	1282
BUKIT PANJANG	1278
ANG MO KIO	1174
BUKIT MERAH	1081

	flat_type
town	
PASIR RIS	1031
QUEENSTOWN	950
TOA PAYOH	914
BUKIT BATOK	788
GEYLANG	744
CLEMENTI	724
KALLANG/WHAMPOA	707
JURONG EAST	630
BISHAN	599
SERANGOON	522
SEMBAWANG	511
CENTRAL AREA	243
MARINE PARADE	179
BUKIT TIMAH	79

Average out the resale price for each town

In [13]:
```
df_type_mean = df.groupby(['town'])['resale_price'].mean().drop(columns=['flat_model
df_type_mean = pd.DataFrame(df_type_mean)
df_type_mean
```

Out[13]:

	resale_price
town	
ANG MO KIO	416730.610733
BEDOK	438674.366508
BISHAN	639197.325543
BUKIT BATOK	424843.312183
BUKIT MERAH	574217.536540
BUKIT PANJANG	458597.487387
BUKIT TIMAH	725184.506329
CENTRAL AREA	656206.666667
CHOA CHU KANG	440150.135725
CLEMENTI	505541.120166
GEYLANG	469569.998656
HOUGANG	471484.032861
JURONG EAST	443861.566667
JURONG WEST	426541.358974

	resale_price
town	
KALLANG/WHAMPOA	503805.431231
MARINE PARADE	522873.078212
PASIR RIS	524453.310378
PUNGGOL	484676.693752
QUEENSTOWN	629281.137895
SEMBAWANG	414785.373777
SENGKANG	467865.748850
SERANGOON	512808.605364
TAMPINES	497083.508577
TOA PAYOH	483833.208972
WOODLANDS	422230.498380
YISHUN	400778.442614

Combine the total number of units and its average price, and calculate the ratio to find which town to use for analysis

In [14]:
```python
from functools import reduce
dfs = [df_type_mean,df_type_total]
df_type_combine = reduce(lambda left,right: pd.merge(left,right,on='town'), dfs)
#df_final = pd.concat([df_R, df_F,df_M])
df_type_combine = df_type_combine.rename(columns={'resale_price':'Town average resal
df_type_combine['Ratio'] = df_type_combine['Town average resale price']/df_type_comb
df_type_combine = df_type_combine.sort_values(by=['Ratio'],ascending=False)
df_type_combine
```

Out[14]:

	Town average resale price	Total no. of units	Ratio
town			
BUKIT TIMAH	725184.506329	79	9179.550713
MARINE PARADE	522873.078212	179	2921.078649
CENTRAL AREA	656206.666667	243	2700.438957
BISHAN	639197.325543	599	1067.107388
SERANGOON	512808.605364	522	982.391964
SEMBAWANG	414785.373777	511	811.713060
KALLANG/WHAMPOA	503805.431231	707	712.596084
JURONG EAST	443861.566667	630	704.542169
CLEMENTI	505541.120166	724	698.261216
QUEENSTOWN	629281.137895	950	662.401198
GEYLANG	469569.998656	744	631.142471

town	Town average resale price	Total no. of units	Ratio
BUKIT BATOK	424843.312183	788	539.141259
BUKIT MERAH	574217.536540	1081	531.191061
TOA PAYOH	483833.208972	914	529.357997
PASIR RIS	524453.310378	1031	508.684103
BUKIT PANJANG	458597.487387	1278	358.839974
ANG MO KIO	416730.610733	1174	354.966449
CHOA CHU KANG	440150.135725	1282	343.330839
HOUGANG	471484.032861	1552	303.791258
BEDOK	438674.366508	1678	261.426917
WOODLANDS	422230.498380	1617	261.119665
JURONG WEST	426541.358974	1677	254.347859
TAMPINES	497083.508577	2157	230.451325
YISHUN	400778.442614	1760	227.715024
PUNGGOL	484676.693752	2580	187.859184
SENGKANG	467865.748850	2712	172.516869

Average the average resale price to find the optimum point

In [15]:
```python
average_resale_price = df_type_combine['Town average resale price'].mean()
average_resale_price
```
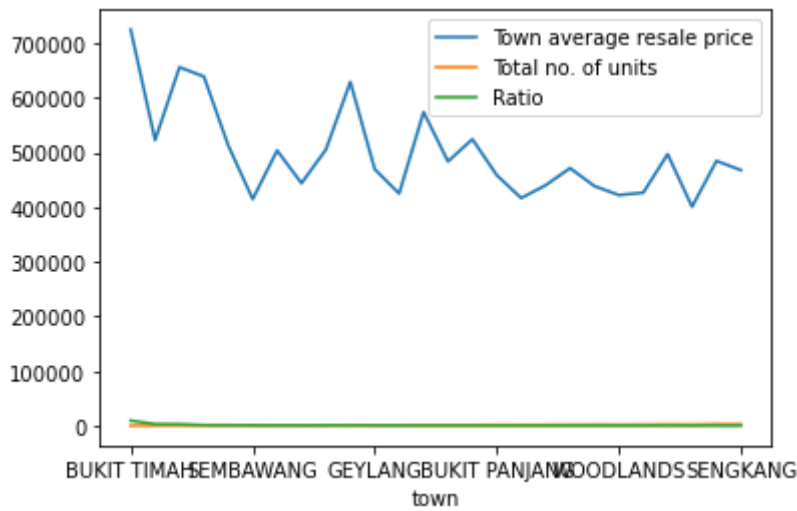
Out[15]: 498279.8101129606

Plotting

In [16]:
```python
#plot_data=df_type_combine['Town average resale price']
#plot_data.plot(kind='line')
#plt.title("HDB Resale price on Average S")
#plt.xlabel("<Towns>")
#plt.ylabel("<Resale Price S>")

#plt.xticks(rotation=30, horizontalalignment="center")
df_type_combine.plot()
```

Out[16]: <AxesSubplot:xlabel='town'>

```
In [17]:  df_group_mean = df.groupby(['town']).mean().sort_values(by='resale_price',ascending=
          df_group_mean
          #df_R = df.groupby("Customer ID")[["Recency"]].min()
```

Out[17]:

town	floor_area_sqm	lease_commence_date	resale_price	longitude	latitude	
BUKIT TIMAH	111.607595	1983.873418	725184.506329	103.785128	1.332127	4
CENTRAL AREA	83.794239	1992.086420	656206.666667	103.846800	1.290004	1
BISHAN	108.373957	1989.562604	639197.325543	103.846367	1.352677	5
QUEENSTOWN	83.521053	1996.703158	629281.137895	103.801074	1.300195	1
BUKIT MERAH	87.580944	1990.642923	574217.536540	103.822387	1.281547	1
PASIR RIS	117.373424	1997.859360	524453.310378	103.950423	1.371769	5
MARINE PARADE	88.067039	1975.357542	522873.078212	103.912677	1.303891	4
SERANGOON	102.844828	1987.984674	512808.605364	103.871987	1.360292	5
CLEMENTI	86.566298	1989.828729	505541.120166	103.766178	1.314275	1
KALLANG/WHAMPOA	88.097595	1986.033946	503805.431231	103.860704	1.319421	3
TAMPINES	105.012517	1993.560037	497083.508577	103.945363	1.353300	5
PUNGGOL	95.284884	2012.667829	484676.693752	103.906242	1.402742	8
TOA PAYOH	86.664114	1985.199125	483833.208972	103.853911	1.336431	3
HOUGANG	101.831186	1996.210696	471484.032861	103.890207	1.371704	5
GEYLANG	84.864247	1987.549731	469569.998656	103.890543	1.321621	3
SENGKANG	99.614307	2009.523599	467865.748850	103.889821	1.391528	6
BUKIT PANJANG	100.728482	2004.845853	458597.487387	103.766988	1.384039	6
JURONG EAST	100.973016	1990.944444	443861.566667	103.739380	1.336880	6
CHOA CHU KANG	107.148206	2003.791732	440150.135725	103.745084	1.383858	6
BEDOK	90.530393	1986.901073	438674.366508	103.927546	1.329694	4
JURONG WEST	104.483005	1995.958259	426541.358974	103.708128	1.342920	6
BUKIT BATOK	101.489848	1989.112944	424843.312183	103.750820	1.352820	6
WOODLANDS	108.839208	1997.894867	422230.498380	103.790953	1.438566	7

town	floor_area_sqm	lease_commence_date	resale_price	longitude	latitude	
ANG MO KIO	86.040034	1984.329642	416730.610733	103.847532	1.370554	5
SEMBAWANG	104.160470	2003.743640	414785.373777	103.818964	1.451019	7
YISHUN	94.255682	1997.578977	400778.442614	103.839783	1.426814	7

In [18]:
```
#df_group_mean = df_group_mean.drop(columns=['longitude','latitude','postal_code'])
df_group_mean
```

Out[18]:

town	floor_area_sqm	lease_commence_date	resale_price	longitude	latitude	
BUKIT TIMAH	111.607595	1983.873418	725184.506329	103.785128	1.332127	4
CENTRAL AREA	83.794239	1992.086420	656206.666667	103.846800	1.290004	1
BISHAN	108.373957	1989.562604	639197.325543	103.846367	1.352677	5
QUEENSTOWN	83.521053	1996.703158	629281.137895	103.801074	1.300195	1
BUKIT MERAH	87.580944	1990.642923	574217.536540	103.822387	1.281547	1
PASIR RIS	117.373424	1997.859360	524453.310378	103.950423	1.371769	5
MARINE PARADE	88.067039	1975.357542	522873.078212	103.912677	1.303891	4
SERANGOON	102.844828	1987.984674	512808.605364	103.871987	1.360292	5
CLEMENTI	86.566298	1989.828729	505541.120166	103.766178	1.314275	1
KALLANG/WHAMPOA	88.097595	1986.033946	503805.431231	103.860704	1.319421	3
TAMPINES	105.012517	1993.560037	497083.508577	103.945363	1.353300	5
PUNGGOL	95.284884	2012.667829	484676.693752	103.906242	1.402742	8
TOA PAYOH	86.664114	1985.199125	483833.208972	103.853911	1.336431	3
HOUGANG	101.831186	1996.210696	471484.032861	103.890207	1.371704	5
GEYLANG	84.864247	1987.549731	469569.998656	103.890543	1.321621	3
SENGKANG	99.614307	2009.523599	467865.748850	103.889821	1.391528	6
BUKIT PANJANG	100.728482	2004.845853	458597.487387	103.766988	1.384039	6
JURONG EAST	100.973016	1990.944444	443861.566667	103.739380	1.336880	6
CHOA CHU KANG	107.148206	2003.791732	440150.135725	103.745084	1.383858	6
BEDOK	90.530393	1986.901073	438674.366508	103.927546	1.329694	4
JURONG WEST	104.483005	1995.958259	426541.358974	103.708128	1.342920	6
BUKIT BATOK	101.489848	1989.112944	424843.312183	103.750820	1.352820	6
WOODLANDS	108.839208	1997.894867	422230.498380	103.790953	1.438566	7
ANG MO KIO	86.040034	1984.329642	416730.610733	103.847532	1.370554	5
SEMBAWANG	104.160470	2003.743640	414785.373777	103.818964	1.451019	7
YISHUN	94.255682	1997.578977	400778.442614	103.839783	1.426814	7

# Use only Tampines as the town for this exploration

In [19]:
```python
tam_df=df[df['town']=='TAMPINES'].reset_index(drop=True)
tam_df
```

Out[19]:

	month	town	flat_type	block	street_name	storey_range	floor_area_sqm	flat_mode
0	2020-06	TAMPINES	2 ROOM	499A	TAMPINES AVE 9	04 TO 06	46.0	Model A
1	2020-06	TAMPINES	2 ROOM	299A	TAMPINES ST 22	07 TO 09	45.0	Model A
2	2020-06	TAMPINES	3 ROOM	890A	TAMPINES AVE 1	04 TO 06	69.0	Model A
3	2020-06	TAMPINES	3 ROOM	890B	TAMPINES AVE 1	07 TO 09	69.0	Model A
4	2020-06	TAMPINES	3 ROOM	890A	TAMPINES AVE 1	04 TO 06	69.0	Model A
...	...	...	...	...	...	...	...	..
2152	2021-06	TAMPINES	EXECUTIVE	477	TAMPINES ST 43	04 TO 06	159.0	Apartment
2153	2021-06	TAMPINES	EXECUTIVE	495A	TAMPINES ST 43	13 TO 15	146.0	Apartment
2154	2021-06	TAMPINES	EXECUTIVE	894	TAMPINES ST 81	04 TO 06	146.0	Maisonette

	month	town	flat_type	block	street_name	storey_range	floor_area_sqm	flat_mode
2155	2021-06	TAMPINES	EXECUTIVE	856C	TAMPINES ST 82	07 TO 09	145.0	Apartment
2156	2021-06	TAMPINES	MULTI-GENERATION	460	TAMPINES ST 42	04 TO 06	166.0	Mult Generation

2157 rows × 16 columns
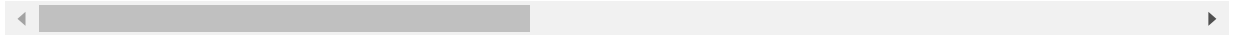
The number of resale flats under Tampines town

In [20]:
```python
tam_df.shape
```

Out[20]: (2157, 16)

In [21]:
```python
address = 'Tampines, Singapore'

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

The geograpical coordinate of Tampines are 1.3546528, 103.9435712.

Let's get the geographical coordinates of Tampines. As we did with all of Ang Mo Kio, let's visualize on the map.

In [22]:
```python
# create map of Toronto using latitude and longitude values
map_tam = folium.Map(location=[latitude, longitude], zoom_start=11)

# add markers to map
for town,flat_type,blk,street,storey,floor_sqm,flat,lease_start,lease_left,resale_pr
    label = 'Town:{}, Flat type:{},Blk no.:{},Street:{},Floor:{},Floor SQM:{},Flat M
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, long],
        radius=4,
        popup=label,
        color='green',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.5,
        parse_html=False).add_to(map_tam)
```

In [23]:
```python
map_tam
```

Out[23]: Make this Notebook Trusted to load map: File -> Trust Notebook

In [24]:
```python
plot=tam_df['resale_price']
plot.plot(kind='line')
plt.title("Tampines plot")
plt.xlabel("<Towns>")
plt.ylabel("<Resale Price S>")
```

Out[24]: Text(0, 0.5, '<Resale Price S>')
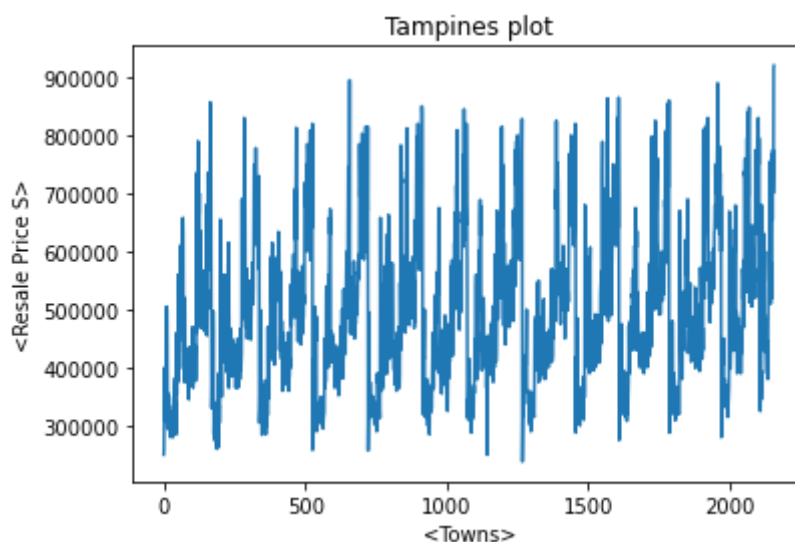
In [25]:
```python
url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    latitude,
    longitude,
    radius,
    LIMIT)
url # display URL
```

Out[25]: 'https://api.foursquare.com/v2/venues/explore?&client_id=RHF1QS0PPCHHV5HL4FQX3SB3YV2
    JQMHJY41W5LKLP4NL4VX1&client_secret=C5FHQRAVHHJ3CZYTXPTPGSBNGP1XA2FVLNF25PNBCI3IYQCN
    &v=20180605&ll=1.3546528,103.9435712&radius=500&limit=100'

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

Out[26]:
```
{'meta': {'code': 200, 'requestId': '60ed0ec8efa50d53995a58a4'},
 'response': {'suggestedFilters': {'header': 'Tap to show:',
   'filters': [{'name': 'Open now', 'key': 'openNow'}]},
  'headerLocation': 'Tampines',
```

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                'headerFullLocation': 'Tampines, Singapore',
                'headerLocationGranularity': 'neighborhood',
                'totalResults': 81,
                'suggestedBounds': {'ne': {'lat': 1.3591528045000045,
                  'lng': 103.94806405816894},
                 'sw': {'lat': 1.3501527954999955, 'lng': 103.93907834183105}},
                'groups': [{'type': 'Recommended Places',
                  'name': 'recommended',
                  'items': [{'reasons': {'count': 0,
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                       'type': 'general',
                       'reasonName': 'globalInteractionReason'}]},
                    'venue': {'id': '4fa52c8ce4b0b487cdd077f8',
                     'name': 'Barcook Bakery',
                     'location': {'address': '10 Tampines Central 1, B1-K7',
                      'lat': 1.3538072041280098,
                      'lng': 103.94501915901034,
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                      'cc': 'SG',
                      'country': 'Singapore',
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                       'Singapore']},
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                       'shortName': 'Bakery',
                       'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bakery_',
                        'suffix': '.png'},
                       'primary': True}],
                     'photos': {'count': 0, 'groups': []}},
                    'referralId': 'e-0-4fa52c8ce4b0b487cdd077f8-0'},
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                     'items': [{'summary': 'This spot is popular',
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                       'reasonName': 'globalInteractionReason'}]},
                    'venue': {'id': '4be2b0b01dd22d7f7e8894bd',
                     'name': 'Amore Fitness',
                     'location': {'address': 'Tampines One Mall',
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                      'lng': 103.9449614361113,
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                       'shortName': 'Gym',
                       'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/building/gym_',
                        'suffix': '.png'},
                       'primary': True}],
                     'photos': {'count': 0, 'groups': []}},
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                     'items': [{'summary': 'This spot is popular',
                       'type': 'general',
                       'reasonName': 'globalInteractionReason'}]},
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                     'name': 'Lao Ban Soya Beancurd 老伴豆花',
                     'location': {'address': '#01-31 Tampines MRT Station',
                      'crossStreet': '20 Tampines Central 1',
```

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          'lat': 1.3529827887643098,
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          'country': 'Singapore',
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            'suffix': '.png'},
           'primary': True}],
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         'name': 'Nakhon Kitchen',
         'location': {'address': '2 Tampines Central 5 01-42',
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            'lng': 103.943451}],
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          'city': 'Singapore',
          'country': 'Singapore',
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```

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                         'suffix': '.png'},
                        'primary': True}],
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                     'location': {'address': 'Our Tampines Hub',
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                       'Singapore']},
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                        'suffix': '.png'},
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                        'suffix': '.png'},
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               'reasonName': 'globalInteractionReason'}]},
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              'lng': 103.94493272900279,
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              'country': 'Singapore',
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              'Singapore']},
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               'pluralName': 'Chinese Restaurants',
               'shortName': 'Chinese',
               'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/asian_',
                'suffix': '.png'},
               'primary': True}],
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```

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            'lng': 103.94570074035958,
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            'cc': 'SG',
            'city': 'Singapore',
            'country': 'Singapore',
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            'shortName': 'Skate Park',
            'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/parks_outdoors/s
        kate_park_',
            'suffix': '.png'},
            'primary': True}],
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       'venue': {'id': '4b5c4824f964a520882929e3',
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        'location': {'address': '#03-17 Tampines Mall',
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           'Singapore']},
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          'shortName': 'Bookstore',
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          'suffix': '.png'},
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          'city': 'Singapore',
          'country': 'Singapore',
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                        'suffix': '.png'},
                       'primary': True}],
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                       'Singapore']},
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                       'primary': True}],
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                       'Singapore']},
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                   'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/bubble_',
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                 'location': {'address': '#B1-01, Our Tampines Hub',
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                   'city': 'Singapore',
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                     'Singapore']},
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         ry_',
                     'suffix': '.png'},
                   'primary': True}],
                 'photos': {'count': 0, 'groups': []}},
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               'items': [{'summary': 'This spot is popular',
                   'type': 'general',
                   'reasonName': 'globalInteractionReason'}]},
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                 'name': 'Toys"R"Us',
                 'location': {'address': '#03-17A Tampines Mall',
                   'crossStreet': '4 Tampines Central 5',
                   'lat': 1.3525552812245238,
                   'lng': 103.94425749778748,
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                   'country': 'Singapore',
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                     '529510',
                     'Singapore']},
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                   'shortName': 'Toys & Games',
                   'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/shops/toys_',
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                   'primary': True}],
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                          'name': 'Dessert Shop',
                          'pluralName': 'Dessert Shops',

```
                     'shortName': 'Desserts',
                     'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/dessert_',
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                     'primary': True}],
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                {'reasons': {'count': 0,
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                 'venue': {'id': '4ee5f6146c25be9631cd0cca',
                   'name': 'Sakura Family Halal Thai Chinese Cuisine',
                   'location': {'address': '506 Tampines Central 1 #01-361',
                     'lat': 1.356309390520125,
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                     'city': 'Singapore',
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                      'Singapore']},
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                     'shortName': 'Restaurant',
                     'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/default_',
                      'suffix': '.png'},
                     'primary': True}],
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                      'Singapore']},
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                     'pluralName': 'Electronics Stores',
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                      'suffix': '.png'},
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```

```
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                 'city': 'Singapore',
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                  'shortName': 'Café',
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```

```
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             'suffix': '.png'},
             'primary': True}],
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```

```
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utique_',
                      'suffix': '.png'},
                    'primary': True}],
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                  'location': {'address': 'Our Tampines Hub #01-101',
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                      'Singapore']},
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                    'shortName': 'Noodles',
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                    'primary': True}],
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```

```
              'location': {'address': '#B1-K5, Our Tampines Hub',
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                '528523',
                'Singapore']},
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                'name': 'Wings Joint',
                'pluralName': 'Wings Joints',
                'shortName': 'Wings',
                'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/wings_',
                 'suffix': '.png'},
                'primary': True}],
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              'name': 'The Salad Box',
              'location': {'lat': 1.353671,
               'lng': 103.940618,
               'labeledLatLngs': [{'label': 'display',
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                 'lng': 103.940618}],
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                'icon': {'prefix': 'https://ss3.4sqi.net/img/categories_v2/food/salad_',
                 'suffix': '.png'},
                'primary': True}],
              'photos': {'count': 0, 'groups': []}},
             'referralId': 'e-0-5845275f158bbb646741fba8-80'}]}]}}
```

In [27]:
```python
# 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']
```

Nearby shops

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

nearby_venues = json_normalize(venues) # flatten JSON
```

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

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

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

nearby_venues
```

```
<ipython-input-28-4243e3e1ab9c>:3: FutureWarning: pandas.io.json.json_normalize is d
eprecated, use pandas.json_normalize instead
  nearby_venues = json_normalize(venues) # flatten JSON
```

Out[28]:

	name	categories	lat	lng
0	Barcook Bakery	Bakery	1.353807	103.945019
1	Amore Fitness	Gym	1.354303	103.944961
2	Lao Ban Soya Beancurd 老伴豆花	Dessert Shop	1.352983	103.945129
3	Nakhon Kitchen	Thai Restaurant	1.352511	103.943451
4	Healing Touch	Spa	1.353554	103.943642
...	...	...	...	...
76	Harry's Bar	Bar	1.355592	103.941907
77	Love & bravery	Boutique	1.354081	103.945095
78	Nuodle 牛一嘴 @ Our Tampines Hub	Noodle House	1.353644	103.940779
79	Wing Stop	Wings Joint	1.353739	103.940690
80	The Salad Box	Salad Place	1.353671	103.940618

81 rows × 4 columns

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

```
81 venues were returned by Foursquare.
```

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

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

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_sec
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

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

        # return only relevant information for each nearby venue
```

```
            venues_list.append([(
                name,
                lat,
                lng,
                v['venue']['name'],
                v['venue']['location']['lat'],
                v['venue']['location']['lng'],
                v['venue']['categories'][0]['name']) for v in results])

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

        return(nearby_venues)
```

In [42]:
```
try:
    northYork_venues1=getNearbyVenues(names=tam_df['town'],
                                latitudes=tam_df['latitude'],
                                longitudes=tam_df['longitude']
                                )
except:
    print('Error')
```

TAMPINES
Error

In [41]:
```
venues_list
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-41-02106e463d8a> in <module>
----> 1 venues_list

NameError: name 'venues_list' is not defined
```

In conclusion, it appears that not all expensive houses are located in the center of Singapore, and it appears that the most expensive HDB in Singapore are located in Bukit Timah, however, theres not alot of HDB at that area. This is concluded that Bukit Timah are the most expensive HDB in singapore. The more popular places are usually places with more commodities than other areas. It can be seen that Tampines does have sufficient commodities for its nearby residents.