Capstone Project - Week 5

Visit notebook on IBM Watson Studio via this link >>
https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/2da2c5b8-ce12-42e9-a1a8-23f4abaf7a15/view?access_token=69e8a02e7955f690439536e4503c6ab8827a389484474ae48403ac3cbb79b295
(https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/2da2c5b8-ce12-42e9-a1a8-23f4abaf7a15/view?access_token=69e8a02e7955f690439536e4503c6ab8827a389484474ae48403ac3cbb79b295)

1. Introduction

The 2019 Thai general election was held in Thailand on 24 March 2019. The elections selected the five hundred members of the new House of Representatives, the previous House having been dissolved by the coup. The 350 constituency seats are won by first-past-the-post voting as in previous elections. However, the 150 party list seats act as levelling seats, and are allocated so as to give each party a total number of seats proportional to the nationwide number of votes they received.

In 2018, the Election Commission (ECT) was tasked with drawing up new district boundaries. The move sparked outrage from the Pheu Thai and Democrat parties and the watchdog organisation Open Forum for Democracy Foundation. They argued the purpose of the delay was to enable the ECT to draw constituency boundaries that favoured PM Prayut's Palang Pracharath Party.

Therefore, the objective of this project is to investigate the boundary issue by studying correlations between neighborhoods in Thailand and voters' behavior. In this project, we may measure voters' behavior using the most popular party for each constituency. To simplify the analysis, we will focus only on the 350 constituency seats.

Target Audience

People who are interested in 2019 Election fever and wondered about the constituency boundary controversy

2. Data

2.1 Constituency Data

It was the first election since the 2014 Thai coup d'état that installed coup leader General Prayut Chan-o-cha as prime minister, and the first held in accordance with the 2017 constitution, which was drafted under the ruling military junta. Therefore, several news agencies had developed real-time election monitoring website. For example:

- https://elect.thematter.co/ (https://elect.thematter.co/)
- https://vote.workpointnews.com/ (https://vote.workpointnews.com/)
- https://web.facebook.com/thestandardth/photos/a.172554116107210 2/2074459142846967/?type=3&theater (https://web.facebook.com/thestandardth/photos/a.172554116107210 2/2074459142846967/?type=3&theater)
- https://vote62.com/ (https://vote62.com/)

In this project, we will use JSON data file from https://github.com/codeforthailand/dataset-election-62-candidates/blob/master/data/election-zones.json (https://github.com/codeforthailand/dataset-election-62-candidates/blob/master/data/election-zones.json) which was used to produce constituency query service page (https://elect.in.th/candidates/ (https://elect.in.th/candidates/)) Below is the example of JSON file.

In [32]:

```
import requests
```

In [132]:

```
url_zone = 'https://raw.githubusercontent.com/pornvutp/Coursera_Capstone/master/
election-zones.json'
result_zone = requests.get(url_zone).json()
result_zone[0:10]
```

Out[132]:


```
[{'areas': [{'area': 'ปลายพระยา',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'อาวลึก', 'exterior': [], 'interior': [], 'subinterior':
[]},
   {'area': 'เขาพนม',
    'exterior': [],
    'interior': ['หน้าเขา', 'เขาดิน'],
    'subinterior': []},
   {'area': 'เมืองกระบี่', 'exterior': [], 'interior': [], 'subinterio
r': []}],
  'prefixes': {'area': 'อำเภอ', 'sub_area': 'ตำบล'},
  'province': 'กระบี่',
  'zone': 1},
 {'areas': [{'area': 'คลองท่อม',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'ลำทับ', 'exterior': [], 'interior': [], 'subinterior':
[]},
   {'area': 'เกาะลันตา', 'exterior': [], 'interior': [], 'subinterio
r': []},
   {'area': 'เขาพนม',
    'exterior': ['หน้าเขา', 'เขาดิน'],
    'interior': [],
    'subinterior': []},
   {'area': 'เหนือคลอง', 'exterior': [], 'interior': [], 'subinterio
r': []}],
  'prefixes': {'area': 'อำเภอ', 'sub_area': 'ตำบล'},
  'province': 'กระบี่',
  'zone': 2},
 {'areas': [{'area': 'ดุสิต',
    'exterior': ['ถนนนครไชยศรี'],
    'interior': [],
    'subinterior': []},
   {'area': 'ป้อมปราบศัตรูพาย',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'พระนคร', 'exterior': [], 'interior': [], 'subinterior':
[]},
   {'area': 'สัมพันธวงศ์', 'exterior': [], 'interior': [], 'subinterio
r': []}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 1},
 {'areas': [{'area': 'บางรัก',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'ปทุมวัน', 'exterior': [], 'interior': [], 'subinterior':
[]},
   {'area': 'สาทร', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 2},
 {'areas': [{'area': 'บางคอแหลม',
```

```
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'ยานนาวา', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 3},
 {'areas': [{'area': 'คลองเตย',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'วัฒนา', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 4},
 {'areas': [{'area': 'ดินแดง',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'ห้วยขวาง', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 5},
 {'areas': [{'area': 'จตุจักร',
    'exterior': [],
    'interior': ['จตุจักร', 'จอมพล'],
    'subinterior': []},
   {'area': 'พญาไท', 'exterior': [], 'interior': [], 'subinterior':
[]},
   {'area': 'ราชเทวี', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 6},
 {'areas': [{'area': 'ดุสิต',
    'exterior': [],
    'interior': ['ถนนนครไชยศรี'],
    'subinterior': []},
   {'area': 'บางซื่อ', 'exterior': [], 'interior': [], 'subinterior':
[]}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 7},
 {'areas': [{'area': 'ลาดพร้าว',
    'exterior': [],
    'interior': [],
    'subinterior': []},
   {'area': 'วังทองหลาง',
    'exterior': ['พลับพลา'],
    'interior': [],
    'subinterior': []}],
  'prefixes': {'area': 'เขต', 'sub_area': 'แขวง'},
  'province': 'กรุงเทพมหานคร',
  'zone': 8}]
```

Geospatial Data (Latitude/Longitude)

For each constituency (zone), area (AMPHOE) and province (CHANGWAT) parameters will be used as a key for extracting latitude and longitude from Thailand Open Government Data (Link (https://www.data.go.th/DatasetDetail.aspx?id=c6d42e1b-3219-47e1-b6b7-dfe914f27910)).

	A	B	C	D	E	F	G	H	I	J	K	L
1	AD_LEVEL	TA_ID	TAMBON_T	TAMBON_E	AM_ID	AMPHOE_T	AMPHOE_E	CH_ID	CHANGWAT_T	CHANGWAT_E	LAT	LONG
2	4	910106	ต. เกาะสาหร่าย	Ko Sarai	9101	อ. เมืองสตูล	Mueang Satun	91	จ. สตูล	Satun	6.546	99.706
3	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21	จ. ระยอง	Rayong	12.646	101.171
4	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21	จ. ระยอง	Rayong	12.645	101.170
5	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21	จ. ระยอง	Rayong	12.649	101.174
6	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21	จ. ระยอง	Rayong	12.644	101.169
7	4	860116	ต. หาดทรายรี	Hat Sai Ri	8601	อ. เมืองชุมพร	Mueang Chumphon	86	จ. ชุมพร	Chumphon	10.459	99.403
8	4	860706	ต. ด่านสวี	Dan Sawi	8607	อ. สวี	Sawi	86	จ. ชุมพร	Chumphon	10.291	99.241
9	4	440103	ต. ท่าตูม	Tha Tum	4401	อ. เมืองมหาสารคาม	Mueang Maha Sarakham	44	จ. มหาสารคาม	Maha Sarakham	16.162	103.484
10	4	840401	ต. อ่างทอง	Ang Thong	8404	อ. เกาะสมุย	Ko Samui	84	จ. สุราษฎร์ธานี	Surat Thani	9.708	99.675
11	4	840401	ต. อ่างทอง	Ang Thong	8404	อ. เกาะสมุย	Ko Samui	84	จ. สุราษฎร์ธานี	Surat Thani	9.796	99.713
12	4	840401	ต. อ่างทอง	Ang Thong	8404	อ. เกาะสมุย	Ko Samui	84	จ. สุราษฎร์ธานี	Surat Thani	9.677	99.659
13	4	200901	ต. สัตหีบ	Sattahip	2009	อ. สัตหีบ	Sattahip	20	จ. ชลบุรี	Chon Buri	12.611	100.889
14	4	921003	ต. ตะเสะ	Tase	9210	อ. หาดสำราญ	Hat Samran	92	จ. ตรัง	Trang	7.033	99.449
15	4	860116	ต. หาดทรายรี	Hat Sai Ri	8601	อ. เมืองชุมพร	Mueang Chumphon	86	จ. ชุมพร	Chumphon	10.477	99.369
16	4	860306	ต. ปากคลอง	Pak Khlong	8603	อ. ปะทิว	Pathio	86	จ. ชุมพร	Chumphon	10.862	99.486
17	4	860801	ต. ปากตะโก	Pak Tako	8608	อ. ทุ่งตะโก	Thung Tako	86	จ. ชุมพร	Chumphon	10.165	99.176
18	4	860306	ต. ปากคลอง	Pak Khlong	8603	อ. ปะทิว	Pathio	86	จ. ชุมพร	Chumphon	10.800	99.538

2.2 Neighborhood Data

We apply Foursquare API to explore the nearby venues according to the latitude/longitude data of each constituency. Then, venue categories are used as a main feature to cluster neighborhoods in Thailand (similar analysis as Manhattan and Toronto examples).

2.3 Election Result

We use the election result from The Election Commission of Thailand (ECT) official website (Link (https://www.ect.go.th/ewt/ewt/ect_th/download/article/article_20190328165029.pdf)). The election result is sorted by constituency and popularity of candidate as the picture below (translation in red color). However, data preparation is needed since the file is in PDF format.

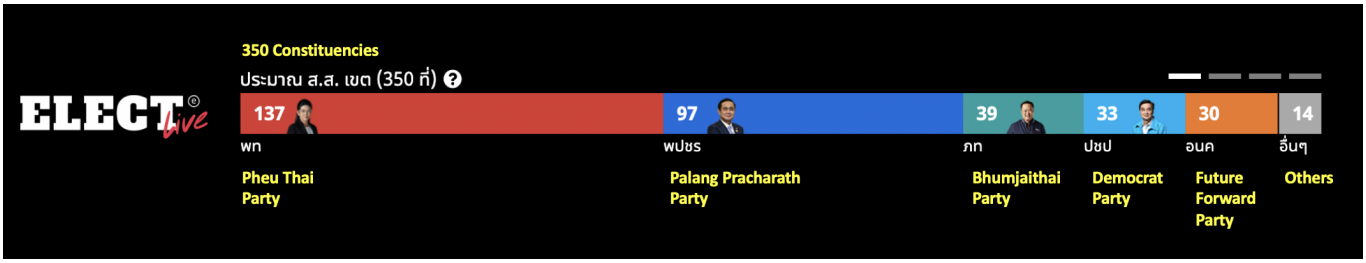
คะแนนผู้สมัครรายเขต

Province	Constituency	Number	Candidate Name	Party	Score
จังหวัด	เขตเลือกตั้ง	หมายเลข	ชื่อ-สกุลผู้สมัคร	พรรคการเมือง	คะแนน
กระบี่	1	18	นายสาคร เกี่ยวข้อง	ประชาธิปัตย์	44,346
กระบี่	1	2	นายแสงชัย วสุนธรา	พลังประชารัฐ	30,381
กระบี่	1	15	นายยุทธนา อ่าวลึกน้อย	อนาคตใหม่	17,783
กระบี่	1	16	นายทวีเกียรติ ใจดี	ประชาชาติ	8,484
กระบี่	1	10	ว่าที่ พ.ต.กิตติศักดิ์ กิตติสิทโธ	ภูมิใจไทย	4,784
กระบี่	1	5	นายวศิน สิริเกียรติกุล	เสรีรวมไทย	3,474
กระบี่	1	11	นายจักรพรรดิ สุคนธกนิษฐ	รวมพลังประชาชาติไทย	2,032
กระบี่	1	8	นางวิชญาดา บุญฤทธิ์	แทนคุณแผ่นดิน	1,986
กระบี่	1	24	นางสาววรฤทัย ชัยภักดี	เศรษฐกิจใหม่	1,596
กระบี่	1	7	นายไชยา ดำดี	ชาติไทยพัฒนา	1,128

After converting PDF into XLSX format using Adobe Acrobat Pro with some Microsoft Excel functions, the file will be like this below.

province	zone	party	num_votes	rank
กรุงเทพมหานคร	1	พลังประชารัฐ	23,246	1
กรุงเทพมหานคร	2	พลังประชารัฐ	26,909	1
กรุงเทพมหานคร	3	อนาคตใหม่	28,444	1
กรุงเทพมหานคร	4	พลังประชารัฐ	27,620	1
กรุงเทพมหานคร	5	เพื่อไทย	27,897	1
กรุงเทพมหานคร	6	พลังประชารัฐ	28,690	1
กรุงเทพมหานคร	7	พลังประชารัฐ	25,180	1
กรุงเทพมหานคร	8	พลังประชารัฐ	29,090	1
กรุงเทพมหานคร	9	พลังประชารัฐ	34,907	1
กรุงเทพมหานคร	10	เพื่อไทย	30,800	1
กรุงเทพมหานคร	11	เพื่อไทย	34,679	1
กรุงเทพมหานคร	12	เพื่อไทย	30,254	1
กรุงเทพมหานคร	13	พลังประชารัฐ	27,489	1
กรุงเทพมหานคร	14	เพื่อไทย	31,445	1
กรุงเทพมหานคร	15	พลังประชารัฐ	31,551	1

For further analysis, this result may be modelled using classification algorithm since there are a few parties holding majority from 350 constituencies.



3. Methodologies

3.1 Import Libraries

In [34]:

```
from bs4 import BeautifulSoup

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)

import json # library to handle JSON files

#!conda install -c conda-forge geopy --yes # uncomment this line if you haven't
 completed the Foursquare API lab
from geopy.geocoders import Nominatim # convert an address into latitude and lon
gitude values

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

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

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

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

import statistics

print('Libraries imported.')
```

```
Requirement already satisfied: folium in /opt/conda/envs/DSX-Python3
5/lib/python3.5/site-packages (0.9.0)
Requirement already satisfied: jinja2>=2.9 in /opt/conda/envs/DSX-Py
thon35/lib/python3.5/site-packages (from folium) (2.9.6)
Requirement already satisfied: requests in /opt/conda/envs/DSX-Pytho
n35/lib/python3.5/site-packages (from folium) (2.18.4)
Requirement already satisfied: branca>=0.3.0 in /opt/conda/envs/DSX-
Python35/lib/python3.5/site-packages (from folium) (0.3.1)
Requirement already satisfied: numpy in /opt/conda/envs/DSX-Python3
5/lib/python3.5/site-packages (from folium) (1.13.3)
Requirement already satisfied: MarkupSafe>=0.23 in /opt/conda/envs/D
SX-Python35/lib/python3.5/site-packages (from jinja2>=2.9->folium)
(1.0)
Requirement already satisfied: chardet<3.1.0,>=3.0.2 in /opt/conda/e
nvs/DSX-Python35/lib/python3.5/site-packages (from requests->folium)
(3.0.4)
Requirement already satisfied: idna<2.7,>=2.5 in /opt/conda/envs/DSX
-Python35/lib/python3.5/site-packages (from requests->folium) (2.6)
Requirement already satisfied: urllib3<1.23,>=1.21.1 in /opt/conda/e
nvs/DSX-Python35/lib/python3.5/site-packages (from requests->folium)
(1.22)
Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/env
s/DSX-Python35/lib/python3.5/site-packages (from requests->folium)
(2019.3.9)
Requirement already satisfied: six in /opt/conda/envs/DSX-Python35/l
ib/python3.5/site-packages (from branca>=0.3.0->folium) (1.11.0)
tensorflow 1.3.0 requires tensorflow-tensorboard<0.2.0,>=0.1.0, whic
h is not installed.
Libraries imported.
```

3.2 Data Preprocessing

3.2.1 Geospatial Data (Latitude/Longitude)

In [35]:

```
# Import XLSX data and convert into dataframe format

df_coord = pd.read_excel('https://github.com/pornvutp/Coursera_Capstone/blob/mas
ter/area_coord.xlsx?raw=true')
df_coord.head()
```

Out[35]:

	AD_LEVEL	TA_ID	TAMBON_T	TAMBON_E	AM_ID	AMPHOE_T	AMPHOE_E	CH_
0	4	910106	ต. เกาะสาหร่าย	Ko Sarai	9101	อ. เมืองสตูล	Mueang Satun	91
1	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21
2	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21
3	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21
4	4	210114	ต. มาบตาพุด	Maptaphut	2101	อ. เมืองระยอง	Mueang Rayong	21

In [36]:

```
# Select some useful columns

df_coord = df_coord[['CHANGWAT_T','CHANGWAT_E','AMPHOE_T','AMPHOE_E','LAT','LON
G']]

df_coord = df_coord.replace(r'จ. ', '',regex=True)
df_coord = df_coord.replace(r'อ. ', '',regex=True)
df_coord = df_coord.replace(r'เขต ', '',regex=True)

df_coord.head()
```

Out[36]:

	CHANGWAT_T	CHANGWAT_E	AMPHOE_T	AMPHOE_E	LAT	LONG
0	สตูล	Satun	เมืองสตูล	Mueang Satun	6.546	99.706
1	ระยอง	Rayong	เมืองระยอง	Mueang Rayong	12.646	101.171
2	ระยอง	Rayong	เมืองระยอง	Mueang Rayong	12.645	101.170
3	ระยอง	Rayong	เมืองระยอง	Mueang Rayong	12.649	101.174
4	ระยอง	Rayong	เมืองระยอง	Mueang Rayong	12.644	101.169

In [37]:

```
df_coord_dict = df_coord.copy()

df_coord_dict = df_coord_dict.drop_duplicates(subset="AMPHOE_E").reset_index()

df_coord_dict = df_coord_dict[['CHANGWAT_T','CHANGWAT_E','AMPHOE_T','AMPHOE_E']]

df_coord_dict.head(10)
```

Out[37]:

	CHANGWAT_T	CHANGWAT_E	AMPHOE_T	AMPHOE_E
0	สตูล	Satun	เมืองสตูล	Mueang Satun
1	ระยอง	Rayong	เมืองระยอง	Mueang Rayong
2	ชุมพร	Chumphon	เมืองชุมพร	Mueang Chumphon
3	ชุมพร	Chumphon	สวี	Sawi
4	มหาสารคาม	Maha Sarakham	เมืองมหาสารคาม	Mueang Maha Sarakham
5	สุราษฎร์ธานี	Surat Thani	เกาะสมุย	Ko Samui
6	ชลบุรี	Chon Buri	สัตหีบ	Sattahip
7	ตรัง	Trang	หาดสำราญ	Hat Samran
8	ชุมพร	Chumphon	ปะทิว	Pathio
9	ชุมพร	Chumphon	ทุ่งตะโก	Thung Tako

In [38]:

```
# Group dataframe by province (CHANGWAT) and area (AMPHOE)

df_coord_gr = df_coord.groupby(['CHANGWAT_E','AMPHOE_E']).mean()
df_coord_gr.head(350)
```

Out[38]:

		LAT	LONG
CHANGWAT_E	**AMPHOE_E**		
Amnat Charoen	**Chanuman**	16.130000	104.938400
	Hua Taphan	15.688750	104.524750
	Lue Amnat	15.714857	104.693286
	Mueang Amnat Charoen	15.874000	104.630684
	Pathum Ratchawongsa	15.885429	104.899571
	Phana	15.691250	104.870750
	Senangkhanikhom	16.053000	104.680500
Ang Thong	**Chaiyo**	14.674667	100.468222
	Mueang Ang Thong	14.583000	100.449000
	Pa Mok	14.490250	100.453250
	Pho Thong	14.670067	100.369000
	Samko	14.598600	100.261000
	Sawaeng Ha	14.747714	100.300143
	Wiset Chai Chan	14.554867	100.323400
Bangkok	**Bang Bon**	13.646000	100.370000
	Bang Kapi	13.771000	100.647500
	Bang Khae	13.710500	100.397500
	Bang Khen	13.867000	100.628000
	Bang Kho Laem	13.698667	100.506000
	Bang Khun Thian	13.580000	100.414500
	Bang Na	13.672000	100.616000
	Bang Phlat	13.787000	100.493250
	Bang Rak	13.728000	100.523200
	Bang Su	13.820000	100.529000
	Bangkok Noi	13.763400	100.472800
	Bangkok Yai	13.738000	100.480500
	Bung Kum	13.808000	100.650000
	Chatuchak	13.826000	100.565000
	Chom Thong	13.690250	100.465500
	Din Daeng	13.778000	100.567000
	Don Mueang	13.925000	100.593000
	Dusit	13.772800	100.515400

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Huai Khwang	13.772333	100.580667
	Khanna Yao	13.821000	100.677000
	Khlong Sam Wa	13.867800	100.739800
	Khlong San	13.726500	100.502500
	Khlong Toei	13.713333	100.578667
	Lak Si	13.877000	100.572000
	Lat Krabang	13.743000	100.789167
	Lat Phrao	13.825500	100.606000
	Min Buri	13.808000	100.748500
	Nong Chok	13.851250	100.856125
	Nong Khaem	13.697000	100.354500
	Pathum Wan	13.740500	100.531750
	Phasi Charoen	13.726714	100.445571
	Phaya Thai	13.782000	100.545000
	Phra Khanong	13.692000	100.626000
	Phra Nakhon	13.756417	100.499250
	Pom Prap Sattruphai	13.751200	100.511400
	Prawet	13.695333	100.669667
	Rat Burana	13.672500	100.500500
	Rat Thewi	13.756000	100.538750
	Sa Thon	13.714000	100.529000
	Sai Mai	13.905000	100.652000
	Samphanthawong	13.738000	100.509333
	Saphan Sung	13.761000	100.688000
	Suan Luang	13.726000	100.628000
	Taling Chan	13.767500	100.439833
	Thawi Watthana	13.770500	100.369000
	Thon Buri	13.722000	100.484800
	Thung Khu	13.632500	100.503500
	Wang Thong Lang	13.779000	100.609000
	Watthana	13.732667	100.577333
	Yannawa	13.689500	100.538500
Bueng Kan	Bueng Kan	18.318417	103.581167
	Bueng Khong Long	18.024750	104.077750

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Bung Khla	18.254667	103.965667
	Pak Khat	18.283833	103.333333
	Phon Charoen	18.063429	103.659429
	Seka	17.979556	103.898000
	Si Wilai	18.161000	103.778400
	So Phisai	18.136571	103.433000
Buri Ram	Ban Dan	15.130500	103.188750
	Ban Kruat	14.412667	103.125111
	Ban Mai Chaiyaphot	15.571000	102.848000
	Chaloem Phra Kiet	14.561200	102.901600
	Chamni	14.777667	102.830000
	Huai Rat	15.001250	103.222000
	Khaen Dong	15.306250	103.138000
	Khu Mueang	15.260571	103.040714
	Krasang	14.953273	103.321455
	Lahan Sai	14.375167	102.855000
	Lam Plai Mat	15.020687	102.868875
	Mueang Buri Ram	14.959684	103.064211
	Na Pho	15.699200	102.936600
	Nang Rong	14.635133	102.764400
	Non Din Daeng	14.449429	102.642714
	Nong Hong	14.864286	102.671857
	Nong Ki	14.723900	102.559900
	Pakham	14.422600	102.673800
	Phlapphla Chai	14.732400	103.166200
	Phutthaisong	15.540286	102.987714
	Prakhon Chai	14.615563	103.056687
	Satuek	15.222083	103.322667
Chachoengsao	Ban Pho	13.608412	101.076824
	Bang Khla	13.725000	101.196889
	Bang Nam Priao	13.882200	101.025700
	Bang Pakong	13.540167	100.965167
	Khlong Khuean	13.763600	101.154600
	Mueang Chachoengsao	13.711263	101.034579

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Phanom Sarakham	13.748000	101.376000
	Pleang Yao	13.565750	101.336500
	Ratchasan	13.779667	101.282333
	Sanam Chai Khet	13.621250	101.597750
	Tha Takiap	13.403500	101.689000
Chai Nat	Hankha	15.038000	99.987875
	Manorom	15.321286	100.149714
	Mueang Chai Nat	15.188556	100.132889
	Noen Kham	14.987000	99.848333
	Nong Mamong	15.233000	99.823750
	Sankhaburi	15.031125	100.189125
	Sapphaya	15.139571	100.251571
	Wat Sing	15.234143	99.993286
Chaiyaphum	Bamnet Narong	15.460857	101.661000
	Ban Khwao	15.795667	101.872167
	Ban Thaen	16.373600	102.364400
	Chatturat	15.567222	101.836111
	Kaeng Khro	16.137100	102.215800
	Kaset Sombun	16.273091	101.913455
	Khon San	16.564000	101.859500
	Khon Sawan	15.929444	102.282889
	Mueang Chaiyaphum	15.835053	102.052895
	Noen Sa-nga	15.551250	101.993500
	Nong Bua Daeng	16.142500	101.645000
	Nong Bua Rawe	15.800800	101.680600
	Phakdi Chumphon	15.956500	101.380750
	Phu Khiao	16.360636	102.174636
	Sap Yai	15.596667	101.650333
	Thep Sathit	15.587400	101.485000
Chanthaburi	Kaeng Hang Maeo	13.022800	101.869200
	Khao Khitchakut	12.898400	102.088600
	Khlung	12.479714	102.265929
	Laem Sing	12.458000	102.109500
	Makham	12.722833	102.202000

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Mueang Chanthaburi	12.593636	102.115818
	Na Yai Am	12.711333	101.873000
	Pong Nam Ron	12.964800	102.387800
	Soi Dao	13.185400	102.248400
	Tha Mai	12.647000	101.991467
Chiang Mai	**Chai Prakan**	19.715000	99.160750
	Chiang Dao	19.473143	98.906286
	Chom Thong	18.365667	98.642667
	Doi Lo	18.533250	98.775750
	Doi Saket	18.855214	99.149571
	Doi Tao	17.939167	98.670500
	Fang	19.908833	99.165500
	Hang Dong	18.692727	98.930636
	Hot	18.112167	98.486333
	Kanlayaniwatthana	19.019000	98.293000
	Mae Ai	19.998333	99.303667
	Mae Chaem	18.532571	98.308571
	Mae On	18.758833	99.289500
	Mae Rim	18.929818	98.921818
	Mae Taeng	19.150538	98.892154
	Mae Wang	18.628000	98.759800
	Mueang Chiang Mai	18.788533	98.994200
	Omkoi	17.657167	98.332500
	Phrao	19.333727	99.202545
	Samoeng	18.907400	98.632400
	San Kamphaeng	18.746400	99.141800
	San Pa Tong	18.601909	98.883091
	San Sai	18.882636	99.048182
	Saraphi	18.698417	99.021750
	Wiang Haeng	19.607333	98.654667
Chiang Rai	**Chiang Khong**	20.155286	100.343286
	Chiang Saen	20.278167	100.112500
	Doi Luang	20.139667	100.128333
	Khun Tan	19.858333	100.270333

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Mae Chan	20.189583	99.886583
	Mae Fa Luang	20.232250	99.686500
	Mae Lao	19.780200	99.710600
	Mae Sai	20.363375	99.917750
	Mae Suai	19.659857	99.485571
	Mueang Chiang Rai	19.898600	99.807000
	Pa Daet	19.496200	99.975400
	Phan	19.568333	99.764267
	Phaya Mengrai	19.889800	100.166000
	Thoeng	19.664300	100.147700
	Wiang Chai	19.877800	99.975400
	Wiang Chiang Rung	20.024333	100.058333
	Wiang Kaen	20.051750	100.497000
	Wiang Pa Pao	19.262000	99.454143
Chon Buri	**Ban Bueng**	13.294375	101.150375
	Bang Lamung	12.943500	100.917917
	Bo Thong	13.274167	101.462000
	Ko Chan	13.396000	101.354500
	Ko Sichang	13.151000	100.809000
	Mueang Chon Buri	13.348833	100.987833
	Nong Yai	13.139600	101.380200
	Phan Thong	13.470273	101.089000
	Phanat Nikhom	13.467105	101.200737
	Sattahip	12.638625	100.903583
	Si Racha	13.133778	101.000556
Chumphon	**Lamae**	9.755750	99.029500
	Lang Suan	9.951714	99.087357
	Mueang Chumphon	10.446559	99.243059
	Pathio	10.799933	99.414133
	Phato	9.840000	98.823000
	Sawi	10.241409	99.144136
	Tha Sae	10.736800	99.133400
	Thung Tako	10.120385	99.144846
Kalasin	**Don Chan**	16.476400	103.702400

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Huai Mek	16.612222	103.241778
	Huai Phueng	16.660500	103.906750
	Kamalasai	16.292625	103.600125
	Kham Muang	16.908167	103.662667
	Khao Wong	16.694333	104.094000
	Khong Chai	16.264600	103.474800
	Kuchinarai	16.522500	104.049917
	Mueang Kalasin	16.510529	103.551294
	Na Khu	16.756200	104.017200
	Na Mon	16.578400	103.795800
	Nong Kung Si	16.728889	103.326889
	Rong Kham	16.279333	103.719333
	Sahatsakhan	16.717571	103.561857
	Sam Chai	16.873750	103.529750
	Somdet	16.754125	103.748750
	Tha Khantho	16.866667	103.245333
	Yang Talat	16.431200	103.367667
Kamphaeng Phet	Bueng Samakkhi	16.214500	99.941500
	Khanu Woralaksaburi	16.044455	99.731364
	Khlong Khlung	16.229600	99.705900
	Khlong Lan	16.241500	99.250500
	Kosamphi Nakhon	16.554000	99.335000
	Lan Krabue	16.596143	99.861571
	Mueang Kamphaeng Phet	16.435750	99.512750
	Pang Sila Thong	16.059667	99.372333
	Phran Kratai	16.704100	99.580700
	Sai Ngam	16.444286	99.856143
	Sai Thong Watthana	16.311000	99.892000
Kanchanaburi	Bo Phloi	14.389400	99.440400
	Dan Makham Tia	13.833750	99.369500
	Huai Krachao	14.348750	99.670000
	Lao Khwan	14.601857	99.696429
	Mueang Kanchanaburi	14.055545	99.414545
	Nong Prue	14.667333	99.439667

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Phanom Thuan	14.128500	99.698375
	Sai Yok	14.178429	99.023429
	Sangkhla Buri	15.152000	98.516667
	Si Sawat	14.638000	99.099000
	Tha Maka	13.933353	99.783706
	Tha Muang	13.932308	99.622692
	Thong Pha Phum	14.728429	98.682714
Khon Kaen	**Ban Fang**	16.473286	102.616000
	Ban Haet	16.208750	102.771250
	Ban Phai	16.047333	102.759750
	Chonnabot	16.023750	102.576250
	Chum Phae	16.581333	102.123250
	Khao Suan Kwang	16.899800	102.793400
	Khok Pho Chai	16.072750	102.394500
	Kranuan	16.743889	103.082111
	Mancha Khiri	16.208125	102.528250
	Mueang Khon Kaen	16.453000	102.818056
	Nam Phong	16.699833	102.878083
	Non Sila	15.980200	102.671400
	Nong Na Kham	16.799667	102.343333
	Nong Ruea	16.490400	102.447700
	Nong Song Hong	15.766333	102.778083
	Phon	15.810583	102.587250
	Phra Yuen	16.296200	102.691000
	Phu Phaman	16.696800	101.888400
	Phu Wiang	16.671909	102.445818
	Pueai Noi	15.887750	102.875500
	Sam Sung	16.560000	103.064200
	Si Chomphu	16.760900	102.119800
	Ubolratana	16.783500	102.669333
	Waeng Noi	15.804833	102.408667
	Waeng Yai	15.933000	102.462400
	Wiang Kao	16.696667	102.265000
Krabi	**Ao Luek**	8.308500	98.714750

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Khao Phanom	8.272500	99.142167
	Khlong Thom	7.904714	99.190286
	Ko Lanta	7.614000	99.105095
	Lam Thap	8.018750	99.347500
	Mueang Krabi	8.053903	98.768710
	Nuea Khlong	7.927947	99.018632
	Plai Phraya	8.545250	98.814250
Lampang	**Chae Hom**	18.742286	99.633571
	Hang Chat	18.337000	99.313429
	Ko kha	18.166778	99.355444
	Mae Mo	18.344000	99.790600
	Mae Phrik	17.507000	99.098000
	Mae Tha	18.105700	99.549000
	Mueang Lampang	18.365375	99.510437
	Mueang Pan	18.767200	99.485800
	Ngao	18.766200	99.930800
	Soem Ngam	18.079000	99.173000
	Sop Prap	17.898750	99.346000
	Thoen	17.595750	99.248125
	Wang Nuea	19.137625	99.629625
Lamphun	**Ban Hong**	18.315200	98.784600
	Ban Thi	18.646500	99.176500
	Li	17.809250	98.925000
	Mae Tha	18.388833	99.065667
	Mueang Lamphun	18.569133	99.019600
	Pa Sang	18.473000	98.902111
	Thung Hua Chang	17.986333	99.054000
	Wiang Nong Long	18.413667	98.752000
Loei	**Chiang Khan**	17.810625	101.710375
	Dan Sai	17.275700	101.205900
	Erawan	17.274250	101.978500
	Mueang Loei	17.535143	101.712643
	Na Duang	17.505000	101.972500
	Na Haeo	17.445600	100.998600

		LAT	LONG
CHANGWAT_E	AMPHOE_E		
	Nong Hin	17.058667	101.826667
	Pak Chom	17.894833	101.958833
	Pha Khao	17.044600	102.005000
	Phu Kradueng	16.921000	101.886500
	Phu Luang	17.109800	101.659400
	Phu Ruea	17.411000	101.395500
	Tha Li	17.618500	101.418833
	Wang Saphung	17.277900	101.753200
Lop Buri	Ban Mi	15.045850	100.553600
	Chai Badan	15.186176	101.133353
	Khok Charoen	15.420400	100.842400
	Khok Samrong	15.065846	100.740923
	Lam Sonthi	15.304167	101.349667
	Mueang Lop Buri	14.780208	100.624458
	Nong Muang	15.273167	100.694833
	Phatthana Nikhom	14.903444	101.019889
	Sa Bot	15.206800	100.844200
	Tha Luang	15.047000	101.187000
	Tha Wung	14.828000	100.502000
Mae Hong Son	Khun Yuam	18.804833	97.911000
	Mae La Noi	18.487500	98.011875
	Mae Sariang	18.218143	97.880429
	Mueang Mae Hong Son	19.264000	97.984667
	Pai	19.328857	98.418714
	Pang Mapha	19.577250	98.199000
	Sop Moei	17.954000	97.997833
Maha Sarakham	Borabue	15.975933	103.138067
	Chiang Yuen	16.401625	103.083875
	Chuen Chom	16.526500	103.137750
	Kae Dam	16.051400	103.405000
	Kantharawichai	16.284600	103.281100
	Kosum Phisai	16.249588	103.015882
	Kut Rang	16.049200	102.970200
	Mueang Maha Sarakham	16.119867	103.326667

		LAT	LONG
CHANGWAT_E	**AMPHOE_E**		
	Na Chueak	15.801500	103.038600
	Na Dun	15.722667	103.243667
	Phayakkhaphum Phisai	15.533357	103.232500
	Wapi Pathum	15.865067	103.355667
	Yang Sisurat	15.656571	103.104571
Mukdahan	**Don Tan**	16.537462	104.655538
	Khamcha-i	16.607222	104.394778
	Mueang Mukdahan	16.561385	104.618846
	Nikhom Kham Soi	16.355286	104.551000
	Nong Sung	16.448833	104.360833
	Wan Yai	16.726600	104.721000
Nakhon Nayok	**Ban Na**	14.255600	101.055600

3.2.2 Constituency Data

In [39]:

```
# Convert from json file into dataframe

zone = result_zone

df_zone = json_normalize(zone)

df_zone.head()
```

Out[39]:

	areas	prefixes.area	prefixes.sub_area	province	zone
0	[{'exterior': [], 'subinterior': [], 'area': '...	อำเภอ	ตำบล	กระบี่	1
1	[{'exterior': [], 'subinterior': [], 'area': '...	อำเภอ	ตำบล	กระบี่	2
2	[{'exterior': ['ถนนนครไชยศรี'], 'subinterior':...	เขต	แขวง	กรุงเทพมหานคร	1
3	[{'exterior': [], 'subinterior': [], 'area': '...	เขต	แขวง	กรุงเทพมหานคร	2
4	[{'exterior': [], 'subinterior': [], 'area': '...	เขต	แขวง	กรุงเทพมหานคร	3

In [40]:

```
# Drop unnecessary columns and rearrange column order
df_temp = df_zone.copy()
df_zone = df_temp[["province","areas"]].copy()
df_zone_2 = df_temp[["zone"]].copy()

df_zone.head()
```

Out[40]:

	province	areas
0	กระบี่	[{'exterior': [], 'subinterior': [], 'area': '...
1	กระบี่	[{'exterior': [], 'subinterior': [], 'area': '...
2	กรุงเทพมหานคร	[{'exterior': ['ถนนนครไชยศรี'], 'subinterior':...
3	กรุงเทพมหานคร	[{'exterior': [], 'subinterior': [], 'area': '...
4	กรุงเทพมหานคร	[{'exterior': [], 'subinterior': [], 'area': '...

In [41]:

```
# Flatten 'areas' from json format into comma-separated format
# Translate province and area names from Thai to English

for i in range(len(df_zone)):
    temp = ''
    for j in range(len(df_zone.loc[i,"areas"])):
        try:
            temp2 = df_coord_dict[df_coord_dict['AMPHOE_T'] == df_zone.loc[i,"ar
eas"][j]['area']].reset_index().loc[0,'AMPHOE_E']
        except:
            if(df_zone.loc[i,"areas"][j]['area']=='ทั้งจังหวัด'):
                temp2 = 'all'
            else:
                temp2 = 'Not Found'
        if j < len(df_zone.loc[i,"areas"])-1:
            temp = temp + temp2 + ','
        else:
            temp = temp + temp2 + ''
    try:
        df_zone.loc[i,"areas"] = temp.split(',').remove('Not Found')
    except:
        df_zone.loc[i,"areas"] = temp.split(',')

    df_zone.loc[i,"province"] = df_coord_dict[df_coord_dict['CHANGWAT_T'] == df_
zone.loc[i,"province"]].reset_index().loc[0,'CHANGWAT_E']

df_zone.head()
```

Out[41]:

	province	areas
0	Krabi	[Plai Phraya, Ao Luek, Khao Phanom, Mueang Krabi]
1	Krabi	[Khlong Thom, Lam Thap, Ko Lanta, Khao Phanom,...
2	Bangkok	[Dusit, Pom Prap Sattruphai, Phra Nakhon, Samp...
3	Bangkok	[Bang Rak, Pathum Wan, Sa Thon]
4	Bangkok	[Bang Kho Laem, Yannawa]

In [42]:

```
# Find average coordinate for each row

for i in range(len(df_zone)):
    df_zone.loc[i,"lat"]=['']
    df_zone.loc[i,"long"]=['']
    lat = ''
    long = ''
    if df_zone.loc[i,"areas"] is not None:

        for j in range(len(df_zone.loc[i,"areas"])):

            try:
                temp_lat = df_coord_gr.loc[(df_zone.loc[i,"province"],df_zone.lo
c[i,"areas"][j]),'LAT']
                temp_long = df_coord_gr.loc[(df_zone.loc[i,"province"],df_zone.l
oc[i,"areas"][j]),'LONG']

            except:

                temp_lat = df_coord_gr.loc[df_zone.loc[i,"province"],'LAT'].mean
()
                temp_long = df_coord_gr.loc[df_zone.loc[i,"province"],'LONG'].me
an()

            if j < len(df_zone.loc[i,"areas"])-1:
                lat = lat + str(temp_lat) + ','
                long = long + str(temp_long) + ','
            else:
                lat = lat + str(temp_lat)
                long = long + str(temp_long)

        df_zone.loc[i,"lat"] = np.mean(list(map(float, lat.split(','))))
        df_zone.loc[i,"long"] = np.mean(list(map(float, long.split(','))))
    else:
        df_zone.loc[i,"lat"] = df_coord_gr.loc[df_zone.loc[i,"province"],'LAT'].
mean()
        df_zone.loc[i,"long"] = df_coord_gr.loc[df_zone.loc[i,"province"],'LONG'
].mean()

df_zone.head(350)
```

Out[42]:

	province	areas	lat	long
0	Krabi	[Plai Phraya, Ao Luek, Khao Phanom, Mueang Krabi]	8.29504	98.86
1	Krabi	[Khlong Thom, Lam Thap, Ko Lanta, Khao Phanom,...	7.94758	99.1607
2	Bangkok	[Dusit, Pom Prap Sattruphai, Phra Nakhon, Samp...	13.7546	100.509
3	Bangkok	[Bang Rak, Pathum Wan, Sa Thon]	13.7275	100.528
4	Bangkok	[Bang Kho Laem, Yannawa]	13.6941	100.522
5	Bangkok	[Khlong Toei, Watthana]	13.723	100.578
6	Bangkok	[Din Daeng, Huai Khwang]	13.7752	100.574
7	Bangkok	[Chatuchak, Phaya Thai, Rat Thewi]	13.788	100.55
8	Bangkok	[Dusit, Bang Su]	13.7964	100.522
9	Bangkok	[Lat Phrao, Wang Thong Lang]	13.8023	100.607
10	Bangkok	[Chatuchak, Lak Si]	13.8515	100.569
11	Bangkok	[Don Mueang]	13.925	100.593
12	Bangkok	[Sai Mai]	13.905	100.652
13	Bangkok	[Bang Khen]	13.867	100.628
14	Bangkok	[Bang Kapi, Wang Thong Lang]	13.775	100.628
15	Bangkok	[Khanna Yao, Bung Kum]	13.8145	100.663
16	Bangkok	[Khanna Yao, Min Buri]	13.8145	100.713
17	Bangkok	[Khlong Sam Wa]	13.8678	100.74
18	Bangkok	[Nong Chok]	13.8513	100.856
19	Bangkok	[Lat Krabang]	13.743	100.789
20	Bangkok	[Prawet, Saphan Sung]	13.7282	100.679
21	Bangkok	[Prawet, Suan Luang]	13.7107	100.649
22	Bangkok	[Bang Na, Phra Khanong]	13.682	100.621
23	Bangkok	[Khlong San, Thon Buri, Bangkok Yai]	13.7288	100.489
24	Bangkok	[Chom Thong, Thon Buri]	13.7061	100.475
25	Bangkok	[Thung Khu, Rat Burana]	13.6525	100.502
26	Bangkok	[Bang Khun Thian]	13.58	100.415
27	Bangkok	[Bang Bon, Nong Khaem]	13.6715	100.362
28	Bangkok	[Taling Chan, Thawi Watthana, Nong Khaem]	13.745	100.388
29	Bangkok	[Bang Khae]	13.7105	100.397

	province	areas	lat	long
30	Bangkok	[Taling Chan, Phasi Charoen]	13.7471	100.443
31	Bangkok	[Bangkok Noi, Bang Phlat]	13.7752	100.483
32	Kanchanaburi	[Si Sawat, Mueang Kanchanaburi]	14.3468	99.2568
33	Kanchanaburi	[Dan Makham Tia, Tha Muang]	13.883	99.4961
34	Kanchanaburi	[Tha Maka, Phanom Thuan]	14.0309	99.741
35	Kanchanaburi	[Bo Phloi, Nong Prue, Huai Krachao, Lao Khwan]	14.5018	99.5616
36	Kanchanaburi	[Thong Pha Phum, Sangkhla Buri, Sai Yok]	14.6863	98.7409
37	Kalasin	[Kamalasai, Rong Kham, Mueang Kalasin]	16.3608	103.624
38	Kalasin	[Kamalasai, Khong Chai, Yang Talat]	16.3295	103.481
39	Kalasin	[Tha Khantho, Sahatsakhan, Nong Kung Si, Huai ...	16.7313	103.344
40	Kalasin	[Kham Muang, Don Chan, Na Mon, Somdet, Sam Chai]	16.7182	103.688
41	Kalasin	[Kuchinarai, Na Khu, Huai Phueng, Khao Wong]	16.6584	104.017
42	Kamphaeng Phet	[Mueang Kamphaeng Phet]	16.4357	99.5127
43	Kamphaeng Phet	[Phran Kratai, Lan Krabue, Mueang Kamphaeng Ph...	16.5469	99.6292
44	Kamphaeng Phet	[Khlong Khlung, Khlong Lan, Pang Sila Thong, M...	16.2416	99.4604
45	Kamphaeng Phet	[Khanu Woralaksaburi, Sai Thong Watthana, Buen...	16.2536	99.8553
46	Khon Kaen	[Mueang Khon Kaen]	16.453	102.818
47	Khon Kaen	[Sam Sung, Mueang Khon Kaen]	16.5065	102.941
48	Khon Kaen	[Kranuan, Nam Phong]	16.7219	102.98
49	Khon Kaen	[Ban Fang, Ubolratana, Khao Suan Kwang, Mueang...	16.6524	102.724
50	Khon Kaen	[Phu Wiang, Si Chomphu, Nong Na Kham, Wiang Kao]	16.7323	102.293
51	Khon Kaen	[Chum Phae, Phu Phaman, Si Chomphu]	16.6797	102.044
52	Khon Kaen	[Mancha Khiri, Nong Ruea]	16.3493	102.488
53	Khon Kaen	[Phon, Waeng Noi, Waeng Yai, Khok Pho Chai]	15.9053	102.463
54	Khon Kaen	[Chonnabot, Nong Song Hong, Pueai Noi, Non Sila]	15.9145	102.725
55	Khon Kaen	[Ban Haet, Ban Phai, Phra Yuen]	16.1841	102.741
56	Chanthaburi	[Mueang Chanthaburi, Laem Sing]	12.5258	102.113

	province	areas	lat	long
57	Chanthaburi	[Tha Mai, Na Yai Am, Khao Khitchakut, Kaeng Ha...	12.8199	101.956
58	Chanthaburi	[Khlung, Makham, Soi Dao, Pong Nam Ron]	12.8382	102.276
59	Chachoengsao	[Bang Nam Priao, Mueang Chachoengsao]	13.7967	101.03
60	Chachoengsao	[Khlong Khuean, Bang Khla, Bang Nam Priao, Pha...	13.7797	101.207
61	Chachoengsao	None	13.6681	101.249
62	Chachoengsao	[Bang Pakong, Ban Pho, Pleang Yao]	13.5714	101.126
63	Chon Buri	[Mueang Chon Buri]	13.3488	100.988
64	Chon Buri	[Phan Thong, Mueang Chon Buri]	13.4096	101.038
65	Chon Buri	[Phanat Nikhom, Phan Thong, Ko Chan]	13.4445	101.215
66	Chon Buri	[Bo Thong, Ban Bueng, Nong Yai]	13.236	101.331
67	Chon Buri	[Si Racha, Ko Sichang]	13.1424	100.905
68	Chon Buri	[Bang Lamung, Si Racha]	13.0386	100.959
69	Chon Buri	[Bang Lamung]	12.9435	100.918
70	Chon Buri	[Sattahip]	12.6386	100.904
71	Chai Nat	[Manorom, Wat Sing, Sapphaya, Mueang Chai Nat]	15.2209	100.132
72	Chai Nat	[Wat Sing, Sankhaburi, Nong Mamong, Hankha, No...	15.1047	99.9685
73	Chaiyaphum	[Mueang Chaiyaphum]	15.8351	102.053
74	Chaiyaphum	[Chatturat, Ban Khwao, Nong Bua Rawe, Noen Sa-...	15.6787	101.846
75	Chaiyaphum	[Sap Yai, Bamnet Narong, Phakdi Chumphon, Thep...	15.6504	101.544
76	Chaiyaphum	[Nong Bua Daeng, Kaset Sombun]	16.2078	101.779
77	Chaiyaphum	[Khon San, Phu Khiao]	16.4623	102.017
78	Chaiyaphum	[Khon Sawan, Ban Thaen, Kaeng Khro]	16.1467	102.288
79	Chumphon	[Sawi, Mueang Chumphon]	10.344	99.1936
80	Chumphon	[Tha Sae, Pathio, Mueang Chumphon]	10.6611	99.2635
81	Chumphon	[Thung Tako, Phato, Lamae, Sawi, Lang Suan]	9.98185	99.0458
82	Trang	[Na Yong, Yan Ta Khao, Mueang Trang]	7.5211	99.6882
83	Trang	[Kantang, Ratsada, Wang Wiset, Sikao, Huai Yot]	7.68253	99.4916
84	Trang	[Kantang, Palian, Yan Ta Khao, Hat Samran]	7.28544	99.5977
85	Trat	[all]	12.1602	102.506

	province	areas	lat	long
86	Tak	[Ban Tak, Wang Chao, Sam Ngao, Mueang Tak]	16.9756	99.1071
87	Tak	[Phop Phra, Um Phang, Mae Sot]	16.369	98.7616
88	Tak	[Tha Song Yang, Ban Tak, Mae Ramat, Mae Sot]	17.0735	98.6119
89	Nakhon Nayok	[all]	14.183	101.139
90	Nakhon Pathom	[mueang Nakhon Pathom]	13.8219	100.032
91	Nakhon Pathom	[Kamphaeng Saen, mueang Nakhon Pathom]	13.9239	100.002
92	Nakhon Pathom	[Don Tum, Bang Len, Phutthamonthon]	13.9354	100.188
93	Nakhon Pathom	[Nakhon Chai Si, Sam Phran, mueang Nakhon Pathom]	13.7899	100.151
94	Nakhon Pathom	[Sam Phran]	13.7317	100.235
95	Nakhon Phanom	[Na Thom, Na Wa, Ban Phaeng, Si Songkhram]	17.7221	104.154
96	Nakhon Phanom	[Tha Uthen, Mueang Nakhon Phanom, Phon Sawan]	17.4684	104.536
97	Nakhon Phanom	[That Phanom, Mueang Nakhon Phanom, Renu Nakhon]	17.1197	104.684
98	Nakhon Phanom	[Na Kae, Pla Pak, Wang Yang, Mueang Nakhon Pha...	17.1333	104.542
99	Nakhon Ratchasima	[Mueang Nakhon Ratchasima]	14.9814	102.103
100	Nakhon Ratchasima	[Mueang Nakhon Ratchasima]	14.9814	102.103
101	Nakhon Ratchasima	[Kham Thale So, Si Khio, Sung Noen]	14.9538	101.8
102	Nakhon Ratchasima	[Phimai, Non Sung, Non Thai]	15.2085	102.274
103	Nakhon Ratchasima	[Bua Lai, Bua Yai, Ban Lueam, Sida, Kaeng Sana...	15.618	102.367
104	Nakhon Ratchasima	[Khong, Prathai, Lamtaman Chai, Mueang Yang, N...	15.4384	102.672
105	Nakhon Ratchasima	[Chum Phuang, Phimai]	15.2543	102.638
106	Nakhon Ratchasima	[Chakkarat, Huai Thalaeng, Chaloem Phra Kiet]	14.9995	102.458
107	Nakhon Ratchasima	[Nong Bunmak, Mueang Nakhon Ratchasima, Chok C...	14.8226	102.223
108	Nakhon Ratchasima	[Khon Buri, Wang Nam Khiao, Soeng Sang]	14.4361	102.189
109	Nakhon Ratchasima	[Pak Thong Chai, Pak Chong, Wang Nam Khiao, Mu...	14.6847	101.853
110	Nakhon Ratchasima	[Pak Chong]	14.6237	101.469
111	Nakhon Ratchasima	[Dan Khun Thot, Si Khio, Thepharak]	15.1614	101.623

	province	areas	lat	long
112	Nakhon Ratchasima	[Kham Sakaesaeng, Khong, Phra Thong Kham, Non ...	15.3357	102.124
113	Nakhon Si Thammarat	[Mueang Nakhon Si Thammarat]	8.4305	99.9612
114	Nakhon Si Thammarat	[Pak Phanang, Hua Sai, Chian Yai]	8.15637	100.197
115	Nakhon Si Thammarat	[Chulabhorn, Cha-uat, Phra Phrom, Chaloem Phra...	8.13612	99.9526
116	Nakhon Si Thammarat	[Thung Song, Bang Khan]	8.06006	99.5623
117	Nakhon Si Thammarat	[Chawang, Tham Phannara, Thung Yai, Phipun]	8.45027	99.467
118	Nakhon Si Thammarat	[Chang Klang, Na Bon, Ron Phibun, Lan Saka]	8.3009	99.7083
119	Nakhon Si Thammarat	[Tha Sala, Mueang Nakhon Si Thammarat]	8.5545	99.9247
120	Nakhon Si Thammarat	[Khanom, Nopphitam, Phrom Khiri, Sichon]	8.85688	99.8019
121	Nakhon Sawan	[Lat Yao, Kao Liao, Mueang Nakhon Sawan]	15.776	100.004
122	Nakhon Sawan	[Chum Saeng, Phayuha Hkiri, Mueang Nakhon Sawa...	15.6568	100.148
123	Nakhon Sawan	[Chum Saeng, Banphot Phisai, Kao Liao]	15.8993	100.121
124	Nakhon Sawan	[Tha Tako, Nong Bua, Phaisali]	15.7045	100.566
125	Nakhon Sawan	[Tak Fa, Takhli, Phaisali]	15.3918	100.519
126	Nakhon Sawan	[Chum Ta Bong, Lat Yao, Mae Wong, Mae Pern]	15.7469	99.5428
127	Nonthaburi	[Pak Kret, Mueang Nonthaburi]	13.8849	100.489
128	Nonthaburi	[Mueang Nonthaburi]	13.8508	100.485
129	Nonthaburi	[Bang Kruai, Bang Yai]	13.834	100.415
130	Nonthaburi	[Pak Kret]	13.9191	100.494
131	Nonthaburi	[Bang Bua Thong, Bang Yai]	13.8906	100.394
132	Nonthaburi	[Bang Bua Thong, Sai Noi]	13.9632	100.356
133	Narathiwat	None	6.19452	101.756
134	Narathiwat	None	6.19452	101.756
135	Narathiwat	[Chanae, Ra-ngae, Sukhirin, Cho-airong]	6.12828	101.735
136	Narathiwat	[Tak Bai, Yi-ngo, Rueso, Si Sakhon]	6.3431	101.647
137	Nan	[Tha Wang Pha, Phu Phiang, Mueang Nan]	18.8907	100.775

	province	areas	lat	long
138	Nan	[Na Noi, Na Muen, Ban Luang, Santi Suk, Wiang ...	18.5854	100.74
139	Nan	[Thung Chang, Bo Kluea, Pua, Song Khwae, Chalo...	19.3318	100.936
140	Bueng Kan	None	18.1528	103.716
141	Bueng Kan	[Bueng Khong Long, Phon Charoen, Si Wilai, Seka]	18.0572	103.853
142	Buri Ram	[Mueang Buri Ram]	14.9597	103.064
143	Buri Ram	[Ban Dan, Satuek, Mueang Buri Ram, Khaen Dong]	15.1546	103.178
144	Buri Ram	[Khu Mueang, Na Pho, Ban Mai Chaiyaphot, Phutt...	15.4183	102.936
145	Buri Ram	[Chamni, Lam Plai Mat, Nong Hong]	14.8875	102.79
146	Buri Ram	[Krasang, Prakhon Chai, Phlapphla Chai, Huai Rat]	14.8256	103.192
147	Buri Ram	None	14.9198	102.963
148	Buri Ram	[Ban Kruat, Prakhon Chai]	14.5141	103.091
149	Buri Ram	[Nang Rong, Pakham, Lahan Sai, Chaloem Phra Ki...	14.4887	102.768
150	Pathum Thani	[Lat Lum Kaeo, Mueang Pathum Thani]	14.0201	100.478
151	Pathum Thani	[khlong Luang, Sam Khok, Mueang Pathum Thani]	14.0558	100.585
152	Pathum Thani	[khlong Luang]	14.0967	100.685
153	Pathum Thani	[Thanyaburi, Lam Luk Ka]	14.0015	100.77
154	Pathum Thani	[Thanyaburi, Lam Luk Ka]	14.0015	100.77
155	Pathum Thani	[khlong Luang, Thanyaburi, Nong Suea]	14.0969	100.76
156	Prachuap Khiri Khan	[Kui Buri, Sam Roi Yot, Mueang Prachuap Khiri ...	12.069	99.7625
157	Prachuap Khiri Khan	[Pran Buri, Hua Hin]	12.4574	99.8148
158	Prachuap Khiri Khan	[Thap Sakae, Bang Saphan, Bang Saphan Noi]	11.2929	99.4699
159	Prachin Buri	[Ban Sang, Si Mahosot, Mueang Prachin Buri]	13.9711	101.344
160	Prachin Buri	[Kabin Buri, Prachantakham, Si Maha Phot]	13.9825	101.612
161	Prachin Buri	[Kabin Buri, Na Di]	14.0458	101.797
162	Pattani	[Yaring, Mueang Pattani]	6.84026	101.332
163	Pattani	[Nong Chik, Mae Lan, Khok Pho]	6.72558	101.181
164	Pattani	[Kapho, Panare, Yaring, Sai Buri, Mai Kaen]	6.71073	101.539

	province	areas	lat	long
165	Pattani	[Thung Yang Daeng, Mayo, Yarang]	6.69425	101.384
166	Phra Nakhon Si Ayutthaya	[Phra Nakhon Si Ayutthaya, Uthai]	14.3552	100.626
167	Phra Nakhon Si Ayutthaya	[Tha Ruea, Nakhon Luang, Bang Pahan, Ban Phrae...	14.521	100.617
168	Phra Nakhon Si Ayutthaya	[Bang Pa-in, Bang Sai, Wang Noi]	14.2454	100.587
169	Phra Nakhon Si Ayutthaya	None	14.3929	100.551
170	Phayao	None	19.2878	100.094
171	Phayao	None	19.2878	100.094
172	Phayao	None	19.2878	100.094
173	Phang-nga	[all]	8.54259	98.3883
174	Phatthalung	[Khao Chaison, Mueang Phatthalung]	7.54237	100.104
175	Phatthalung	None	7.5125	100.048
176	Phatthalung	[Kong Ra, Tamot, Bang Kaeo, Pak Phayun, Pa Bon]	7.34706	100.129
177	Phichit	[Wachirabarami, Sam Ngam, Mueang Phichit]	16.4728	100.206
178	Phichit	[Dong Charoen, Taphan Hin, Tap Khlo, Wang Sai ...	16.2579	100.542
179	Phichit	[Bang Mun Nak, Bueng Na Rang, Pho Thale, Pho P...	16.1488	100.258
180	Phitsanulok	[Mueang Phitsanulok]	16.8216	100.254
181	Phitsanulok	[Phrom Phiram, Mueang Phitsanulok]	16.9409	100.203
182	Phitsanulok	[Wang Thong, Noen Maprang]	16.6559	100.572
183	Phitsanulok	[Bang Krathum, Bang Rakam, Mueang Phitsanulok]	16.7069	100.211
184	Phitsanulok	[Chat Trakan, Nakhon Thai, Wat Bot]	17.1815	100.608
185	Phuket	[Mueang Phuket]	7.80083	98.3649
186	Phuket	[Kathu, Thalang, Mueang Phuket]	7.92903	98.3531
187	Maha Sarakham	[Mueang Maha Sarakham, Kae Dam, Kosum Phisai]	16.1403	103.249
188	Maha Sarakham	[Borabue, Wapi Pathum]	15.9205	103.247
189	Maha Sarakham	[Na Dun, Na Chueak, Phayakkhaphum Phisai, Yang...	15.6785	103.155
190	Maha Sarakham	[Kut Rang, Na Chueak, Borabue, Kosum Phisai]	16.0191	103.041

	province	areas	lat	long
191	Maha Sarakham	[Kantharawichai, Chuen Chom, Chiang Yuen, Kosu...	16.3656	103.13
192	Mukdahan	None	16.5395	104.55
193	Mukdahan	None	16.5395	104.55
194	Yala	[Yaha, Mueang Yala]	6.51382	101.183
195	Yala	[Kabang, Yaha, Raman, Mueang Yala]	6.47424	101.199
196	Yala	None	6.31173	101.213
197	Yasothon	[Kham Khuean Kaeo, Sai Mun, Pa Tio, Mueang Yas...	15.8272	104.268
198	Yasothon	[Kham Khuean Kaeo, Kho Wang, Pa Tio, Maha Chan...	15.6897	104.35
199	Yasothon	[Kut Chum, Loeng Nok Tha, Thai Charoen]	16.1076	104.415
200	Ranong	[all]	9.8859	98.6212
201	Rayong	[Mueang Rayong]	12.6796	101.302
202	Rayong	[Wang Chan, Khao Chamao, Klaeng]	12.8768	101.614
203	Rayong	[Nikhom Phatthana, Ban Khai, Pluak Daeng]	12.878	101.24
204	Rayong	[Ban Chang, Mueang Rayong]	12.7105	101.179
205	Ratchaburi	[Mueang Ratchaburi]	13.5438	99.8045
206	Ratchaburi	[Ban Kha, Pak Tho, Wat Phleng, Suan Phueng, Mu...	13.4582	99.6407
207	Ratchaburi	[Chom Bueng, Photharam]	13.6742	99.6711
208	Ratchaburi	[Ban Pong]	13.8131	99.8535
209	Ratchaburi	[Damnoen Saduak, Bang Phae, Photharam]	13.6423	99.9188
210	Roi Et	[Si Somdet, Mueang Roi Et]	16.0103	103.563
211	Roi Et	[Changhan, Thawat Buri, Chiang Khwan, Pho Chai]	16.1596	103.73
212	Roi Et	[Nong Phok, Moei Wadi, Phon Thong]	16.3209	104.095
213	Roi Et	[Thung Khao Luang, Thawat Buri, Nong Phok, At ...	16.0486	103.942
214	Roi Et	[Phanom Phrai, Nong Hi, At Samat, Phon Sai]	15.6499	103.974
215	Roi Et	[Chaturaphak Phiman, Suwannaphum, Mueang Suang]	15.7458	103.712
216	Roi Et	[Chaturaphak Phiman, Pathum Rat, Kaset Wisai]	15.6926	103.5
217	Lop Buri	[Mueang Lop Buri]	14.7802	100.624
218	Lop Buri	[Tha Wung, Ban Mi, Mueang Lop Buri]	14.8847	100.56

	province	areas	lat	long
219	Lop Buri	[Phatthana Nikhom, Nong Muang, Khok Samrong]	15.0808	100.819
220	Lop Buri	[Chai Badan, Tha Luang, Lam Sonthi, Sa Bot, Kh...	15.2329	101.071
221	Lampang	[Hang Chat, Mueang Lampang]	18.3512	99.4119
222	Lampang	[Ngao, Wang Nuea, Mueang Pan, Chae Hom]	18.8533	99.6699
223	Lampang	[Mueang Lampang, Mae Tha, Mae Mo]	18.2717	99.6167
224	Lampang	[Sop Prap, Ko kha, Thoen, Soem Ngam, Mae Phrik]	17.8495	99.2441
225	Lamphun	None	18.3252	98.9599
226	Lamphun	[Thung Hua Chang, Ban Hong, Pa Sang, Li, Wiang...	18.1995	98.8835
227	Si Sa Ket	[Wang Hin, Mueang Si Sa Ket]	15.017	104.284
228	Si Sa Ket	[Kanthararom, Nam Kliang, Non Khun]	14.9833	104.59
229	Si Sa Ket	[Kantharalak, Phayu, Si Rattana, Benchalak, Ph...	14.7778	104.513
230	Si Sa Ket	[Kantharalak]	14.6005	104.675
231	Si Sa Ket	[Khukhan, Khun Han, Phu Sing]	14.6241	104.247
232	Si Sa Ket	[Khukhan, Prang Ku]	14.7954	104.115
233	Si Sa Ket	[Prang Ku, Huai Thap Than, Uthumphon Phisai, M...	15.0463	104.063
234	Si Sa Ket	[Bueng Bun, Yang Chum Noi, Rasi Salai, Sila La...	15.3254	104.158
235	Sakon Nakhon	[Mueang Sakon Nakhon]	17.1665	104.145
236	Sakon Nakhon	[Kusuman, Phu Phan, Tao Ngoi, Khok Si Suphan, ...	17.0991	104.206
237	Sakon Nakhon	[Kut Bak, Nikhom Nam un, Phanh khon, Waritchap...	17.2446	103.664
238	Sakon Nakhon	[Sawang Daen Din, Charoen Sin]	17.5326	103.495
239	Sakon Nakhon	[Ban Muang, Wanon Niwat]	17.7707	103.63
240	Sakon Nakhon	[Kham Ta Kla, Phanna Nikhom, Akat Amnuai]	17.6	103.887
241	Songkhla	[Muaeng Songkhla]	7.13886	100.593
242	Songkhla	[Hat Yai]	7.00569	100.464
243	Songkhla	[Na Mom, Hat Yai]	6.97735	100.511
244	Songkhla	[Krasae Sin, Ranot, Sathing Phra, Singhanakhon]	7.53419	100.386

	province	areas	lat	long
245	Songkhla	[Khuan Niang, Bang Klam, Rattaphum, Singhanakhon]	7.16834	100.381
246	Songkhla	[Khlong Hoi Khong, Sadao, Hat Yai]	6.85831	100.418
247	Songkhla	[Na Thawi, Saba Yoi, Sadao]	6.642	100.679
248	Songkhla	[Chana, Thepha]	6.84918	100.809
249	Satun	[Khuan Kalong, Khuan Don, Mueang Satun]	6.76697	99.9339
250	Satun	[Khuan Kalong, Thung Wa, Tha Phae, Manang, La...	6.93238	99.8825
251	Samut Prakarn	[Mueang Samut Prakan]	13.587	100.629
252	Samut Prakarn	[Mueang Samut Prakan]	13.587	100.629
253	Samut Prakarn	[Mueang Samut Prakan]	13.587	100.629
254	Samut Prakarn	[Bang Phli]	13.6338	100.722
255	Samut Prakarn	[Bang Bo, Bang Phli, Bang Sao Thong]	13.6272	100.803
256	Samut Prakarn	[Phra Pradaeng]	13.6584	100.554
257	Samut Prakarn	[Phra Pradaeng, Phra Samut Chedi]	13.6126	100.541
258	Samut Songkhram	[all]	13.4284	99.9567
259	Samut Sakhon	[Mueang Samut Sakhon]	13.5378	100.251
260	Samut Sakhon	[Krathum Baen, Mueang Samut Sakhon]	13.5966	100.259
261	Samut Sakhon	[Krathum Baen, Ban Phaeo, Mueang Samut Sakhon]	13.5986	100.215
262	Saraburi	[Phra Phutthabat, Chaloem Phra Kiet, Mueang Sa...	14.6199	100.879
263	Saraburi	[Muak Lek, Wang Muang, Wihan Daeng, Kaeng Khoi]	14.6355	101.108
264	Saraburi	[Don Phut, Ban Mo, Nong Khae, Nong Saeng, Nong...	14.557	100.755
265	Sa kaeo	[Wang Nam Yen, Khao Chakan, Mueang Sa Kaeo]	13.6843	102.083
266	Sa kaeo	[Khlong Hat, Wang Nam Yen, Wang Sombun, Wattha...	13.5555	102.21
267	Sa kaeo	[Ta Phraya, Watthana Nakhon, Aranyaprathet, Kh...	13.8475	102.558
268	Sing Buri	[all]	14.868	100.361
269	Suphan Buri	[Bang Pla Ma, Mueang Saphan Buri]	14.4169	100.118
270	Suphan Buri	[Bang Pla Ma, Song Phi Nong, U Thong]	14.3107	100.024
271	Suphan Buri	[Don Chedi, Si Prachan, Sam Chuk, U Thong]	14.6019	100.009

	province	areas	lat	long
272	Suphan Buri	[Don Chedi, Dan Chang, Nong Ya Sai, Doem Bang ...	14.7934	99.8416
273	Surat Thani	[Mueang Surat Thani]	9.12873	99.3176
274	Surat Thani	[Kanchanadit, Don Sak, Ko Pha-ngan, Ko Samui]	9.43133	99.7263
275	Surat Thani	None	9.07586	99.2527
276	Surat Thani	[Khiri Rat Nikhom, Ban Na Doem, Phunphin, Khia...	8.9406	99.1409
277	Surat Thani	[Chai Buri, Ban Ta Khun, Phanom, Phrasaeng, Kh...	8.75898	98.987
278	Surat Thani	None	9.07586	99.2527
279	Surin	[Prasat, Lamduan, Mueang Surin]	14.7554	103.54
280	Surin	[Sikhoraphum, Khwao Sinarin, Mueang Surin]	14.9522	103.639
281	Surin	[Chom Phra, Tha Tum, Rattanaburi, Sanom, Non N...	15.2273	103.762
282	Surin	[Chumphon Buri, Tha Tum, Rattanaburi, Sanom]	15.2956	103.667
283	Surin	[Lamduan, Si Narong, Sikhoraphum, Sanom, Samro...	14.9336	103.82
284	Surin	[Buachet, Si Narong, Sangkha]	14.6323	103.9
285	Surin	[Kap Choeng, Prasat, Phanom Dong Rak]	14.5203	103.433
286	Sukhothai	[Kong Krailat, Si Samrong, Mueang Sukhothai]	17.0399	99.865
287	Sukhothai	[Kong Krailat, Khiri Mat, Thung Saliam, Ban Da...	17.0321	99.7119
288	Sukhothai	[Si Nakhon, Si Satchanalai, Sawankhalok]	17.3963	99.8535
289	Nong Khai	[Sakhrai, Mueang Nong Khai, Phon Phisai]	17.8184	102.868
290	Nong Khai	[Rattanawapi, Fao Rai, Phon Phisai]	18.0502	103.212
291	Nong Khai	[Tha Bo, Si Chiang Mai, Sangkhom, Mueang Nong ...	17.9102	102.496
292	Nong Bua Lam Phu	[Mueang Nong Bua Lam Phu, Non Sang]	17.0341	102.466
293	Nong Bua Lam Phu	[Na Wang, Si Bun Rueang, Non Sang]	17.084	102.28
294	Nong Bua Lam Phu	[Na Klang, Na Wang, Suwannakhuha]	17.4057	102.177
295	Amnat Charoen	[Hua Taphan, Mueang Amnat Charoen]	15.7814	104.578
296	Amnat Charoen	[Chanuman, Pathum Ratchawongsa, Phana, Lue Amn...	15.8949	104.817
297	Udon Thani	[Mueang Udon Thani]	17.4017	102.778

	province	areas	lat	long
298	Udon Thani	[Phibun Rak, Phen, Mueang Udon Thani]	17.5262	102.929
299	Udon Thani	[Thung Fon, Ban Dung, Phibun Rak, Sang Khom]	17.6342	103.147
300	Udon Thani	None	17.3992	102.906
301	Udon Thani	[Kumphawapi, Ku Kaeo, Wang Sam Mo, Si That, Ch...	17.1026	103.212
302	Udon Thani	None	17.3992	102.906
303	Udon Thani	[Kut Chap, Nong Wua So, Mueang Udon Thani]	17.3464	102.632
304	Udon Thani	[Na Yung, Nam Som, Ban Phue]	17.7746	102.268
305	Uttaradit	[Tron, Laplae, Mueang Uttaradit]	17.5839	100.111
306	Uttaradit	[Thong Saen Khan, Tha Pla, Nam Pat, Ban Khok, ...	17.7325	100.581
307	Uthai Thani	[Thap Than, Sawang Arom, Nong Khayang, Nong Ch...	15.4425	99.8832
308	Uthai Thani	[Ban Rai, Lan Sak, Nong Chang, Huai Khot]	15.3187	99.617
309	Ubon Ratchathani	[Mueang Ubon Ratchathani]	15.2988	104.845
310	Ubon Ratchathani	[Muang Sam Sip, Khueang Nai]	15.4575	104.623
311	Ubon Ratchathani	[Na Yia, Warin Chamrap]	15.0863	104.963
312	Ubon Ratchathani	[Det Udom]	14.8539	105.048
313	Ubon Ratchathani	[Kut Khaopun, Trakan Phuet Phon, Lao Suea Kok]	15.6189	105.005
314	Ubon Ratchathani	[Na Tan, Si Mueang Mai, Khemarat, Pho Sai]	15.8059	105.27
315	Ubon Ratchathani	[Don Mot Daeng, Tan Sum, Si Mueang Mai, Mueang...	15.3986	105.163
316	Ubon Ratchathani	[Phibun Mangsahan, Sawang Wirawong, Sirindhorn]	15.1807	105.239
317	Ubon Ratchathani	[Na Chaluai, Boontharik, Sirindhorn]	14.8494	105.331
318	Ubon Ratchathani	[Thung Si Udom, Nam Khun, Nam Yuen, Samrong, D...	14.7316	104.932
319	Ang Thong	[all]	14.617	100.375
320	Chiang Rai	[Mueang Chiang Rai]	19.8986	99.807
321	Chiang Rai	[Wiang Pa Pao, Mae Lao, Mae Suai]	19.5674	99.5501
322	Chiang Rai	[Phan, Mueang Chiang Rai]	19.7335	99.7856
323	Chiang Rai	[Pa Daet, Thoeng, Wiang Chai, Wiang Chiang Rung]	19.7657	100.039

	province	areas	lat	long
324	Chiang Rai	[Khun Tan, Phaya Mengrai, Chiang Khong, Chiang...	20.0467	100.278
325	Chiang Rai	[Doi Luang, Chiang Saen, Mae Sai]	20.2604	100.053
326	Chiang Rai	[Mae Chan, Mae Fa Luang]	20.2109	99.7865
327	Chiang Mai	[Mueang Chiang Mai]	18.7885	98.9942
328	Chiang Mai	[Saraphi, Hang Dong]	18.6956	98.9762
329	Chiang Mai	[Doi Saket, San Kamphaeng, Mae On]	18.7868	99.1936
330	Chiang Mai	[Phrao, San Sai, Mae Taeng]	19.1223	99.0476
331	Chiang Mai	[Kanlayaniwatthana, Samoeng, Mae Rim, Mae Taeng]	19.0017	98.6848
332	Chiang Mai	[Chiang Dao, Wiang Haeng, Chai Prakan]	19.5985	98.9072
333	Chiang Mai	[Fang, Mae Ai]	19.9536	99.2346
334	Chiang Mai	[Chom Thong, Doi Lo, San Pa Tong, Mae Wang]	18.5322	98.7653
335	Chiang Mai	[Doi Tao, Omkoi, Hot, Mae Chaem]	18.0603	98.4495
336	Phetchaburi	[Ban Laem, Mueang Phetchaburi]	13.1315	99.9736
337	Phetchaburi	[Cha-am, Tha Yang]	12.8469	99.8883
338	Phetchaburi	[Ban Lat, Ban Laem, Nong Ya Plong, Khao Yoi, K...	13.0962	99.771
339	Phetchabun	[Lom Sak, Khao kho, Mueang Phetchabun]	16.594	101.134
340	Phetchabun	[Nam Nao, Lom Sak, Lom Kao]	16.8418	101.367
341	Phetchabun	[Chon Daen, Wang Pong, Mueang Phetchabun]	16.2775	100.92
342	Phetchabun	[Bueng Sam Phan, Wichian Buri, Nong Phai, Muea...	15.9687	101.083
343	Phetchabun	[Wichian Buri, Si Thep]	15.5473	101.088
344	Loei	[Na Duang, Pak Chom, Mueang Loei, Erawan]	17.5523	101.906
345	Loei	[Pha Khao, Phu Kradueng, Phu Luang, Wang Saph...	17.1144	101.852
346	Loei	[Dan Sai, Tha Li, Na Haeo, Phu Ruea, Wang Saph...	17.4732	101.414
347	Phrae	None	18.1338	100.031
348	Phrae	[Long, Wang Chin, Sung Men, Den Chai]	17.9918	99.897
349	Mae Hong Son	[all]	18.8049	98.0576

In [43]:

```
# Join back with zone columns
df_zone = pd.concat([df_zone, df_zone_2], axis=1, join='inner')
df_zone.head()
```

Out[43]:

	province	areas	lat	long	zone
0	Krabi	[Plai Phraya, Ao Luek, Khao Phanom, Mueang Krabi]	8.29504	98.86	1
1	Krabi	[Khlong Thom, Lam Thap, Ko Lanta, Khao Phanom,...	7.94758	99.1607	2
2	Bangkok	[Dusit, Pom Prap Sattruphai, Phra Nakhon, Samp...	13.7546	100.509	1
3	Bangkok	[Bang Rak, Pathum Wan, Sa Thon]	13.7275	100.528	2
4	Bangkok	[Bang Kho Laem, Yannawa]	13.6941	100.522	3

In [44]:

```
# Finalize neighborhood coordinate dataframe
neigh = df_zone[["province","zone","lat","long"]]
neigh = neigh.sort_values(['province', 'zone']).reset_index(drop=True)
neigh.head()
```

Out[44]:

	province	zone	lat	long
0	Amnat Charoen	1	15.7814	104.578
1	Amnat Charoen	2	15.8949	104.817
2	Ang Thong	1	14.617	100.375
3	Bangkok	1	13.7546	100.509
4	Bangkok	2	13.7275	100.528

3.2.3 Election Result

In [45]:

```
# Import XLSX data and convert into dataframe format

df_result = pd.read_excel('https://github.com/pornvutp/Coursera_Capstone/blob/ma
ster/election_result.xlsx?raw=true')
df_result.head()
```

Out[45]:

	province	zone	party	num_votes	rank
0	กรุงเทพมหานคร	1	พลังประชารัฐ	23246	1
1	กรุงเทพมหานคร	2	พลังประชารัฐ	26909	1
2	กรุงเทพมหานคร	3	อนาคตใหม่	28444	1
3	กรุงเทพมหานคร	4	พลังประชารัฐ	27620	1
4	กรุงเทพมหานคร	5	เพื่อไทย	27897	1

In [46]:

```
# Eliminate 'rank' and 'num_votes' column since we focus only on the winner for
 each constituency
df_result = df_result[['province','zone','party']]
df_result.head()
```

Out[46]:

	province	zone	party
0	กรุงเทพมหานคร	1	พลังประชารัฐ
1	กรุงเทพมหานคร	2	พลังประชารัฐ
2	กรุงเทพมหานคร	3	อนาคตใหม่
3	กรุงเทพมหานคร	4	พลังประชารัฐ
4	กรุงเทพมหานคร	5	เพื่อไทย

In [47]:

```
# Translate province from Thai to English

for i in range(len(df_result)):

    df_result.loc[i,"province"] = df_coord_dict[df_coord_dict['CHANGWAT_T'] == d
f_result.loc[i,"province"]].reset_index().loc[0,'CHANGWAT_E']

df_result.head()
```

Out[47]:

	province	zone	party
0	Bangkok	1	พลังประชารัฐ
1	Bangkok	2	พลังประชารัฐ
2	Bangkok	3	อนาคตใหม่
3	Bangkok	4	พลังประชารัฐ
4	Bangkok	5	เพื่อไทย

In [48]:

```
df_result = df_result.sort_values(['province', 'zone']).reset_index(drop=True)
df_result.head()
```

Out[48]:

	province	zone	party
0	Amnat Charoen	1	เพื่อไทย
1	Amnat Charoen	2	เพื่อไทย
2	Ang Thong	1	ภูมิใจไทย
3	Bangkok	1	พลังประชารัฐ
4	Bangkok	2	พลังประชารัฐ

In [49]:

```
df_final = pd.concat([neigh, df_result], axis=1, join='inner')
df_final = df_final.loc[:,~df_final.columns.duplicated()]
df_final.head()
```

Out[49]:

	province	zone	lat	long	party
0	Amnat Charoen	1	15.7814	104.578	เพื่อไทย
1	Amnat Charoen	2	15.8949	104.817	เพื่อไทย
2	Ang Thong	1	14.617	100.375	ภูมิใจไทย
3	Bangkok	1	13.7546	100.509	พลังประชารัฐ
4	Bangkok	2	13.7275	100.528	พลังประชารัฐ

In [50]:

```
# Create new 'key' column

for i in range(len(df_final)):

    df_final.loc[i,"key"] = str(df_final.loc[i,"province"]) + " " + str(df_final
.loc[i,"zone"])

df_final.head()
```

Out[50]:

	province	zone	lat	long	party	key
0	Amnat Charoen	1	15.7814	104.578	เพื่อไทย	Amnat Charoen 1
1	Amnat Charoen	2	15.8949	104.817	เพื่อไทย	Amnat Charoen 2
2	Ang Thong	1	14.617	100.375	ภูมิใจไทย	Ang Thong 1
3	Bangkok	1	13.7546	100.509	พลังประชารัฐ	Bangkok 1
4	Bangkok	2	13.7275	100.528	พลังประชารัฐ	Bangkok 2

3.3 Exploring Dataset

In [51]:

```
address = 'Thailand'

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

```
The geograpical coordinate of Thailand are 14.8971921, 100.83273.
```

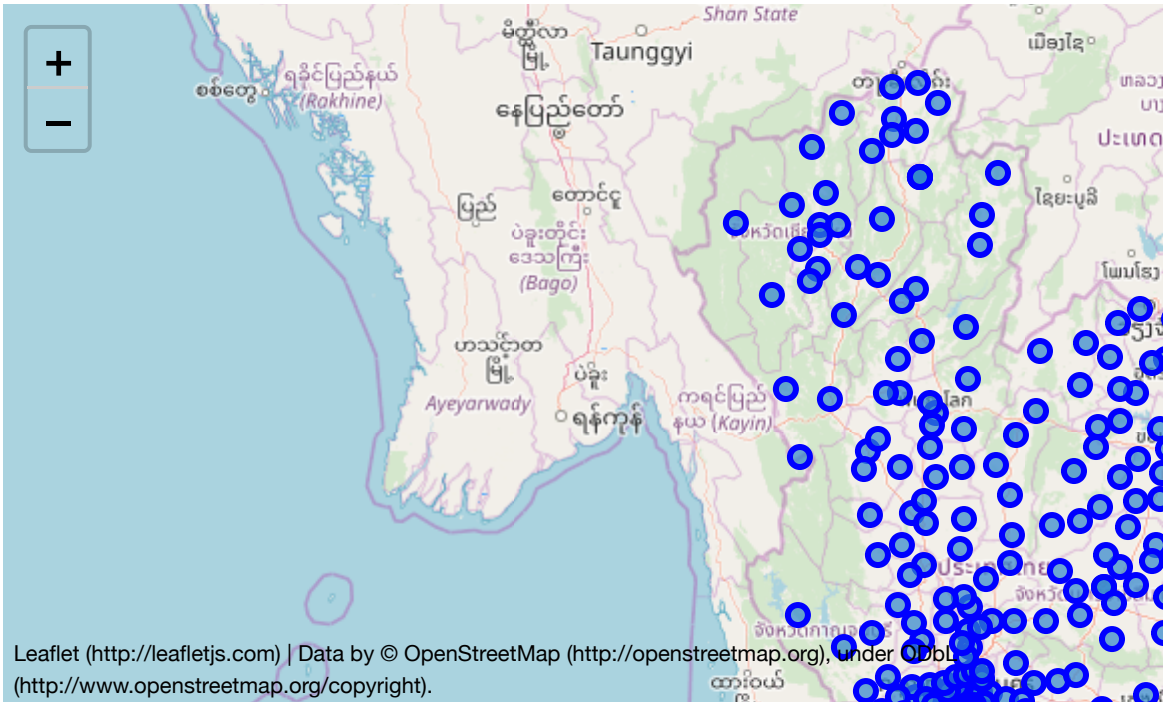
In [52]:

```
# create map using latitude and longitude values
map_th = folium.Map(location=[latitude, longitude], zoom_start=6)

# add markers to map
for lat, lng, province, zone, party in zip(df_final['lat'], df_final['long'], df
_final['province'], df_final['zone'], df_final['party']):
    label = '{}, {}'.format(province, zone)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_th)

map_th
```

Out[52]:



In [53]:

```
# Define function to get nearby venues for each constituency


CLIENT_ID = '1IIMSWR54DHDW1TBJCVEUPJRMUOOT1V12EAVAKGQ3VVQTVA0' # your Foursquare
ID
CLIENT_SECRET = 'UWVK2RNVMJBJC2GQWGZEKHAGSFRENRU4M5YJGJ35LBRR1UXE' # your Foursq
uare Secret
VERSION = '20180605' # Foursquare API version

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


LIMIT = 100 # limit of number of venues returned by Foursquare API


def getNearbyVenues(names, latitudes, longitudes, radius=500):

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

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

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

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

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

    return(nearby_venues)
```

Your credentails:
CLIENT_ID: 1IIMSWR54DHDW1TBJCVEUPJRMUOOT1V12EAVAKGQ3VVQTVA0
CLIENT_SECRET:UWVK2RNVMJBJC2GQWGZEKHAGSFRENRU4M5YJGJ35LBRR1UXE

In [54]:

```
# Use the defined function

th_venues = getNearbyVenues(names=df_final['key'],
                                    latitudes=df_final['lat'],
                                    longitudes=df_final['long']
                                   )
```

Amnat Charoen 1
Amnat Charoen 2
Ang Thong 1
Bangkok 1
Bangkok 2
Bangkok 3
Bangkok 4
Bangkok 5
Bangkok 6
Bangkok 7
Bangkok 8
Bangkok 9
Bangkok 10
Bangkok 11
Bangkok 12
Bangkok 13
Bangkok 14
Bangkok 15
Bangkok 16
Bangkok 17
Bangkok 18
Bangkok 19
Bangkok 20
Bangkok 21
Bangkok 22
Bangkok 23
Bangkok 24
Bangkok 25
Bangkok 26
Bangkok 27
Bangkok 28
Bangkok 29
Bangkok 30
Bueng Kan 1
Bueng Kan 2
Buri Ram 1
Buri Ram 2
Buri Ram 3
Buri Ram 4
Buri Ram 5
Buri Ram 6
Buri Ram 7
Buri Ram 8
Chachoengsao 1
Chachoengsao 2
Chachoengsao 3
Chachoengsao 4
Chai Nat 1
Chai Nat 2
Chaiyaphum 1
Chaiyaphum 2
Chaiyaphum 3
Chaiyaphum 4
Chaiyaphum 5
Chaiyaphum 6
Chanthaburi 1
Chanthaburi 2
Chanthaburi 3
Chiang Mai 1
Chiang Mai 2
Chiang Mai 3

Chiang Mai 4
Chiang Mai 5
Chiang Mai 6
Chiang Mai 7
Chiang Mai 8
Chiang Mai 9
Chiang Rai 1
Chiang Rai 2
Chiang Rai 3
Chiang Rai 4
Chiang Rai 5
Chiang Rai 6
Chiang Rai 7
Chon Buri 1
Chon Buri 2
Chon Buri 3
Chon Buri 4
Chon Buri 5
Chon Buri 6
Chon Buri 7
Chon Buri 8
Chumphon 1
Chumphon 2
Chumphon 3
Kalasin 1
Kalasin 2
Kalasin 3
Kalasin 4
Kalasin 5
Kamphaeng Phet 1
Kamphaeng Phet 2
Kamphaeng Phet 3
Kamphaeng Phet 4
Kanchanaburi 1
Kanchanaburi 2
Kanchanaburi 3
Kanchanaburi 4
Kanchanaburi 5
Khon Kaen 1
Khon Kaen 2
Khon Kaen 3
Khon Kaen 4
Khon Kaen 5
Khon Kaen 6
Khon Kaen 7
Khon Kaen 8
Khon Kaen 9
Khon Kaen 10
Krabi 1
Krabi 2
Lampang 1
Lampang 2
Lampang 3
Lampang 4
Lamphun 1
Lamphun 2
Loei 1
Loei 2
Loei 3
Lop Buri 1
Lop Buri 2

Lop Buri 3
Lop Buri 4
Mae Hong Son 1
Maha Sarakham 1
Maha Sarakham 2
Maha Sarakham 3
Maha Sarakham 4
Maha Sarakham 5
Mukdahan 1
Mukdahan 2
Nakhon Nayok 1
Nakhon Pathom 1
Nakhon Pathom 2
Nakhon Pathom 3
Nakhon Pathom 4
Nakhon Pathom 5
Nakhon Phanom 1
Nakhon Phanom 2
Nakhon Phanom 3
Nakhon Phanom 4
Nakhon Ratchasima 1
Nakhon Ratchasima 2
Nakhon Ratchasima 3
Nakhon Ratchasima 4
Nakhon Ratchasima 5
Nakhon Ratchasima 6
Nakhon Ratchasima 7
Nakhon Ratchasima 8
Nakhon Ratchasima 9
Nakhon Ratchasima 10
Nakhon Ratchasima 11
Nakhon Ratchasima 12
Nakhon Ratchasima 13
Nakhon Ratchasima 14
Nakhon Sawan 1
Nakhon Sawan 2
Nakhon Sawan 3
Nakhon Sawan 4
Nakhon Sawan 5
Nakhon Sawan 6
Nakhon Si Thammarat 1
Nakhon Si Thammarat 2
Nakhon Si Thammarat 3
Nakhon Si Thammarat 4
Nakhon Si Thammarat 5
Nakhon Si Thammarat 6
Nakhon Si Thammarat 7
Nakhon Si Thammarat 8
Nan 1
Nan 2
Nan 3
Narathiwat 1
Narathiwat 2
Narathiwat 3
Narathiwat 4
Nong Bua Lam Phu 1
Nong Bua Lam Phu 2
Nong Bua Lam Phu 3
Nong Khai 1
Nong Khai 2
Nong Khai 3

Nonthaburi 1
Nonthaburi 2
Nonthaburi 3
Nonthaburi 4
Nonthaburi 5
Nonthaburi 6
Pathum Thani 1
Pathum Thani 2
Pathum Thani 3
Pathum Thani 4
Pathum Thani 5
Pathum Thani 6
Pattani 1
Pattani 2
Pattani 3
Pattani 4
Phang-nga 1
Phatthalung 1
Phatthalung 2
Phatthalung 3
Phayao 1
Phayao 2
Phayao 3
Phetchabun 1
Phetchabun 2
Phetchabun 3
Phetchabun 4
Phetchabun 5
Phetchaburi 1
Phetchaburi 2
Phetchaburi 3
Phichit 1
Phichit 2
Phichit 3
Phitsanulok 1
Phitsanulok 2
Phitsanulok 3
Phitsanulok 4
Phitsanulok 5
Phra Nakhon Si Ayutthaya 1
Phra Nakhon Si Ayutthaya 2
Phra Nakhon Si Ayutthaya 3
Phra Nakhon Si Ayutthaya 4
Phrae 1
Phrae 2
Phuket 1
Phuket 2
Prachin Buri 1
Prachin Buri 2
Prachin Buri 3
Prachuap Khiri Khan 1
Prachuap Khiri Khan 2
Prachuap Khiri Khan 3
Ranong 1
Ratchaburi 1
Ratchaburi 2
Ratchaburi 3
Ratchaburi 4
Ratchaburi 5
Rayong 1
Rayong 2

Rayong 3
Rayong 4
Roi Et 1
Roi Et 2
Roi Et 3
Roi Et 4
Roi Et 5
Roi Et 6
Roi Et 7
Sa kaeo 1
Sa kaeo 2
Sa kaeo 3
Sakon Nakhon 1
Sakon Nakhon 2
Sakon Nakhon 3
Sakon Nakhon 4
Sakon Nakhon 5
Sakon Nakhon 6
Samut Prakarn 1
Samut Prakarn 2
Samut Prakarn 3
Samut Prakarn 4
Samut Prakarn 5
Samut Prakarn 6
Samut Prakarn 7
Samut Sakhon 1
Samut Sakhon 2
Samut Sakhon 3
Samut Songkhram 1
Saraburi 1
Saraburi 2
Saraburi 3
Satun 1
Satun 2
Si Sa Ket 1
Si Sa Ket 2
Si Sa Ket 3
Si Sa Ket 4
Si Sa Ket 5
Si Sa Ket 6
Si Sa Ket 7
Si Sa Ket 8
Sing Buri 1
Songkhla 1
Songkhla 2
Songkhla 3
Songkhla 4
Songkhla 5
Songkhla 6
Songkhla 7
Songkhla 8
Sukhothai 1
Sukhothai 2
Sukhothai 3
Suphan Buri 1
Suphan Buri 2
Suphan Buri 3
Suphan Buri 4
Surat Thani 1
Surat Thani 2
Surat Thani 3

Surat Thani 4
Surat Thani 5
Surat Thani 6
Surin 1
Surin 2
Surin 3
Surin 4
Surin 5
Surin 6
Surin 7
Tak 1
Tak 2
Tak 3
Trang 1
Trang 2
Trang 3
Trat 1
Ubon Ratchathani 1
Ubon Ratchathani 2
Ubon Ratchathani 3
Ubon Ratchathani 4
Ubon Ratchathani 5
Ubon Ratchathani 6
Ubon Ratchathani 7
Ubon Ratchathani 8
Ubon Ratchathani 9
Ubon Ratchathani 10
Udon Thani 1
Udon Thani 2
Udon Thani 3
Udon Thani 4
Udon Thani 5
Udon Thani 6
Udon Thani 7
Udon Thani 8
Uthai Thani 1
Uthai Thani 2
Uttaradit 1
Uttaradit 2
Yala 1
Yala 2
Yala 3
Yasothon 1
Yasothon 2
Yasothon 3

In [140]:

```
# View example of venues nearby the constituencies

print(th_venues.shape)
th_venues.head(10)
```

```
(8610, 7)
```

Out[140]:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Ca
0	Amnat Charoen 1	15.781375	104.577717	Fai Kid Hotel (โรงแรมฝ้ายชิด)	15.860842	104.620121	Hote
1	Amnat Charoen 1	15.781375	104.577717	แผ่นดินทอง ฟาร์มฟิชชิ่งปาร์ค	15.834809	104.606749	Ame Rest
2	Amnat Charoen 1	15.781375	104.577717	ก๋วยเตี๋ยวเป็ดชิตี้	15.863962	104.584794	Noo Hou
3	Amnat Charoen 1	15.781375	104.577717	Shell (หอมกาแฟ)	15.862201	104.599185	Café
4	Amnat Charoen 1	15.781375	104.577717	Sirin Cafe	15.853887	104.631146	Coff Sho
5	Amnat Charoen 1	15.781375	104.577717	ส้มตำยายพัน	15.858168	104.625800	Thai Rest
6	Amnat Charoen 2	15.894907	104.816501	ผาชื่นวารินชล	15.910299	104.796067	Nati Park
7	Amnat Charoen 2	15.894907	104.816501	ภูเปาะ จ.อำนาจเจริญ	15.940458	104.850145	Mou
8	Amnat Charoen 2	15.894907	104.816501	ห้วยสีโท	15.886124	104.740519	Trav Tran
9	Amnat Charoen 2	15.894907	104.816501	วัดดอยนกยูงทอง	15.954864	104.872673	Fore

In [139]:

```
# Group venues by 'Neighborhood' and count number of venues

th_venues.groupby('Neighborhood').count().head()
```

Out[139]:

	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Neighborhood						
Amnat Charoen 1	6	6	6	6	6	6
Amnat Charoen 2	4	4	4	4	4	4
Ang Thong 1	30	30	30	30	30	30
Bangkok 1	95	95	95	95	95	95
Bangkok 10	56	56	56	56	56	56

In [57]:

```
# Find number of unique categories in the data extracted
print('There are {} uniques categories.'.format(len(th_venues['Venue Category'].
unique())))
```

```
There are 335 uniques categories.
```

3.4 Analyze each neighborhood

3.4.1 Use One Hot Encoding to create dummie variables

In [58]:

```
# one hot encoding
th_onehot = pd.get_dummies(th_venues[['Venue Category']], prefix="", prefix_sep=
"")

# add neighborhood column back to dataframe
th_onehot['Neighborhood'] = th_venues['Neighborhood']

# move neighborhood column to the first column
fixed_columns = [th_onehot.columns[-1]] + list(th_onehot.columns[:-1])
th_onehot = th_onehot[fixed_columns]

th_onehot.head()

th_grouped = th_onehot.groupby('Neighborhood').mean().reset_index()
```

In [59]:

```
th_grouped.shape
```

Out[59]:

```
(348, 336)
```

In [78]:

```
th_grouped.head(10)
```

Out[78]:

	Neighborhood	Airport	Airport Lounge	Airport Terminal	American Restaurant	Antique Shop	Aquarium	Arcade	
0	Amnat Charoen 1	0.0	0.0	0.0	0.166667	0.0	0.0	0.0	
1	Amnat Charoen 2	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	
2	Ang Thong 1	0.0	0.0	0.0	0.033333	0.0	0.0	0.0	
3	Bangkok 1	0.0	0.0	0.0	0.010526	0.0	0.0	0.0	
4	Bangkok 10	0.0	0.0	0.0	0.017857	0.0	0.0	0.0	
5	Bangkok 11	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	
6	Bangkok 12	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	
7	Bangkok 13	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	
8	Bangkok 14	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	
9	Bangkok 15	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	

3.4.2 Extract top 10 most frequent venue categories

In [60]:

```
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)

    return row_categories_sorted.index.values[0:num_top_venues]

num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = th_grouped['Neighborhood']

for ind in np.arange(th_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] = return_most_common_venues(th_gro
uped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

Out[60]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th M Comr Ve
0	Amnat Charoen 1	Coffee Shop	Noodle House	American Restaurant	Thai Restaurant	Hotel	Café
1	Amnat Charoen 2	Forest	National Park	Travel & Transport	Mountain	Flea Market	Farm
2	Ang Thong 1	Thai Restaurant	Market	Coffee Shop	Noodle House	Convenience Store	Flea Market
3	Bangkok 1	Noodle House	Café	Chinese Restaurant	Thai Restaurant	Hotel	Asian Restau
4	Bangkok 10	Noodle House	Thai Restaurant	Convenience Store	Coffee Shop	Restaurant	Flea Market

3.5 Clustering Neighborhoods

In [61]:

```
# set number of clusters
kclusters = 5

th_grouped_clustering = th_grouped.drop('Neighborhood', 1)

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

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

Out[61]:

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int32)
```

In [ ]:

```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
```

In [64]:

```
neighborhoods_venues_sorted.head()
```

Out[64]:

	Cluster Labels	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Mos Commo Venu
0	0	Amnat Charoen 1	Coffee Shop	Noodle House	American Restaurant	Thai Restaurant	Hotel
1	0	Amnat Charoen 2	Forest	National Park	Travel & Transport	Mountain	Flea Market
2	0	Ang Thong 1	Thai Restaurant	Market	Coffee Shop	Noodle House	Convenienc Store
3	0	Bangkok 1	Noodle House	Café	Chinese Restaurant	Thai Restaurant	Hotel
4	0	Bangkok 10	Noodle House	Thai Restaurant	Convenience Store	Coffee Shop	Restaurant

In [65]:

```
th_merged = df_final

# merge toronto_grouped with toronto_data to add latitude/longitude for each nei
ghborhood
th_merged = th_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'
), on='key')

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

Out[65]:

	province	zone	lat	long	party	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3 C
0	Amnat Charoen	1	15.7814	104.578	เพื่อไทย	Amnat Charoen 1	0.0	Coffee Shop	Noodle House	An Re
1	Amnat Charoen	2	15.8949	104.817	เพื่อไทย	Amnat Charoen 2	0.0	Forest	National Park	Tra Tra
2	Ang Thong	1	14.617	100.375	ภูมิใจไทย	Ang Thong 1	0.0	Thai Restaurant	Market	Co Sh
3	Bangkok	1	13.7546	100.509	พลังประชารัฐ	Bangkok 1	0.0	Noodle House	Café	Ch Re
4	Bangkok	2	13.7275	100.528	พลังประชารัฐ	Bangkok 2	0.0	Café	Hotel	Co Sh

In [66]:

```
th_merged.dropna(axis=0,inplace=True)
```

In [68]:

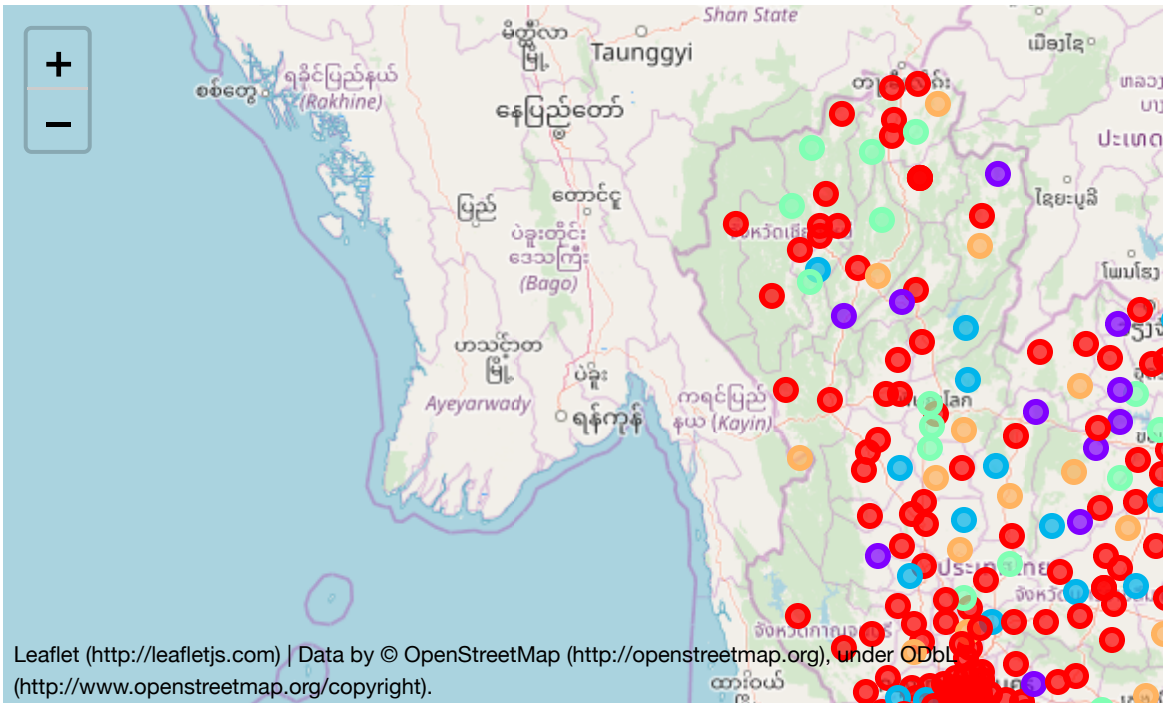
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=6)

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

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

map_clusters
```

Out[68]:



3.6 Classification Algorithm of Constituency Winner

3.6.1 Test/Train Split

In [92]:

```
from sklearn.model_selection import train_test_split

df_y = df_final
y = th_grouped.join(df_y.set_index('key'), on='Neighborhood')
```

In [93]:

```
X_train, X_test, y_train, y_test = train_test_split(th_grouped.drop('Neighborhoo
d', 1), y['party'], test_size=0.2, random_state=4)
print ('Train set:', X_train.shape,  y_train.shape)
print ('Test set:', X_test.shape,  y_test.shape)
```

```
Train set: (278, 335) (278,)
Test set: (70, 335) (70,)
```

3.6.2 Apply Classification Algorithm

In [127]:

```
from sklearn.neighbors import KNeighborsClassifier

k = 5

#Train Model and Predict
neigh = KNeighborsClassifier(n_neighbors = k).fit(X_train,y_train)
```

In [128]:

```
yhat = neigh.predict(X_test)
yhat[0:5]
```

Out[128]:

```
array(['พลังประชารัฐ', 'เพื่อไทย', 'เพื่อไทย', 'พลังประชารัฐ',
       'พลังประชารัฐ'], dtype=object)
```

3.6.3 Accuracy Evaluation

In [129]:

```
from sklearn import metrics
print("Train set Accuracy: ", metrics.accuracy_score(y_train, neigh.predict(X_tr
ain)))
print("Test set Accuracy: ", metrics.accuracy_score(y_test, yhat))
```

```
Train set Accuracy:  0.503597122302
Test set Accuracy:  0.342857142857
```

4. Result

4.1 Cluster of Each Constituency (Neighborhood)

We can see that each cluster have different most common venue. Let's explore!

4.1.1 Cluster 1

In [138]:

```
th_merged.loc[th_merged['Cluster Labels'] == 0, th_merged.columns[[1] + list(range(5, th_merged.shape[1]))]].head(10)
```

Out[138]:

	zone	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th M Comm Ver
0	1	Amnat Charoen 1	0.0	Coffee Shop	Noodle House	American Restaurant	Thai Restaurant	Hotel
1	2	Amnat Charoen 2	0.0	Forest	National Park	Travel & Transport	Mountain	Flea Mark
2	1	Ang Thong 1	0.0	Thai Restaurant	Market	Coffee Shop	Noodle House	Convenie Store
3	1	Bangkok 1	0.0	Noodle House	Café	Chinese Restaurant	Thai Restaurant	Hotel
4	2	Bangkok 2	0.0	Café	Hotel	Coffee Shop	Chinese Restaurant	Asian Restaurar
5	3	Bangkok 3	0.0	Convenience Store	Coffee Shop	Chinese Restaurant	Thai Restaurant	Badminto Court
6	4	Bangkok 4	0.0	Thai Restaurant	Café	Hotel	Coffee Shop	Noodle House
7	5	Bangkok 5	0.0	Hotel	Thai Restaurant	Som Tum Restaurant	Chinese Restaurant	Asian Restaurar
8	6	Bangkok 6	0.0	Noodle House	Asian Restaurant	Som Tum Restaurant	Restaurant	Thai Restaurar
9	7	Bangkok 7	0.0	Thai Restaurant	Convenience Store	Coffee Shop	Noodle House	BBQ Join

4.1.2 Cluster 2

In [137]:

```
th_merged.loc[th_merged['Cluster Labels'] == 1, th_merged.columns[[1] + list(ran
ge(5, th_merged.shape[1]))]].head(10)
```

Out[137]:

	zone	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th M Com Ve
50	2	Chaiyaphum 2	1.0	River	Farm	Flea Market	Food Stand	Food Servic
53	5	Chaiyaphum 5	1.0	Restaurant	Bus Station	Flea Market	Fair	Farm
86	2	Kalasin 2	1.0	Flea Market	Furniture / Home Store	Plaza	Historic Site	Coffe Shop
89	5	Kalasin 5	1.0	Restaurant	Asian Restaurant	Market	Deli / Bodega	Fair
103	5	Khon Kaen 5	1.0	Scenic Lookout	Science Museum	Restaurant	National Park	Park
114	4	Lampang 4	1.0	Restaurant	Market	Thai Restaurant	Juice Bar	Moun
127	3	Maha Sarakham 3	1.0	Restaurant	Café	Resort	Convenience Store	Flea Marke
139	2	Nakhon Phanom 2	1.0	Restaurant	Flea Market	BBQ Joint	Thai Restaurant	Racet
141	4	Nakhon Phanom 4	1.0	Restaurant	Flea Market	Food Truck	Fish Market	Exhib
163	2	Nakhon Si Thammarat 2	1.0	Farm	Resort	Breakfast Spot	Bistro	Flea Marke

4.1.3 Cluster 3

In [136]:

```
th_merged.loc[th_merged['Cluster Labels'] == 2, th_merged.columns[[1] + list(ran
ge(5, th_merged.shape[1]))]].head(10)
```

Out[136]:

	zone	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th M Comm Ve
39	5	Buri Ram 5	2.0	Thai Restaurant	Hotel	Historic Site	Som Tum Restaurant	Zoo Exhib
41	7	Buri Ram 7	2.0	Restaurant	Historic Site	Thai Restaurant	Noodle House	Cruise
48	2	Chai Nat 2	2.0	Thai Restaurant	Pharmacy	Soccer Field	Asian Restaurant	Event Space
51	3	Chaiyaphum 3	2.0	Cave	Department Store	Thai Restaurant	Zoo Exhibit	Fishin Spot
93	4	Kamphaeng Phet 4	2.0	Thai Restaurant	Resort	Diner	Comfort Food Restaurant	Fruit & Veget Store
100	2	Khon Kaen 2	2.0	Thai Restaurant	Convenience Store	Seafood Restaurant	Café	Coffe Shop
107	9	Khon Kaen 9	2.0	Thai Restaurant	Restaurant	Coffee Shop	Noodle House	Food Truck
110	2	Krabi 2	2.0	Thai Restaurant	Hot Spring	Dim Sum Restaurant	Gourmet Shop	Water
115	1	Lamphun 1	2.0	Thai Restaurant	Zoo Exhibit	Fishing Spot	Fair	Farm
130	1	Mukdahan 1	2.0	Thai Restaurant	Zoo Exhibit	Fishing Spot	Fair	Farm

4.1.4 Cluster 4

In [135]:

```
th_merged.loc[th_merged['Cluster Labels'] == 3, th_merged.columns[[1] + list(ran
ge(5, th_merged.shape[1]))]].head(10)
```

Out[135]:

	zone	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5t Co
11	9	Bangkok 9	3.0	Coffee Shop	Café	Convenience Store	Art Museum	Soc Fiel
54	6	Chaiyaphum 6	3.0	Coffee Shop	Convenience Store	Food Court	Café	Fish Spo
62	5	Chiang Mai 5	3.0	Hot Spring	Coffee Shop	Buddhist Temple	Flea Market	Fair
63	6	Chiang Mai 6	3.0	Resort	National Park	Historic Site	Coffee Shop	Fish Spo
68	2	Chiang Rai 2	3.0	Coffee Shop	Convenience Store	Diner	Noodle House	Bak
70	4	Chiang Rai 4	3.0	Coffee Shop	Food Truck	Market	Pedestrian Plaza	Tha Res
77	4	Chon Buri 4	3.0	Coffee Shop	Convenience Store	Zoo Exhibit	Flea Market	Fair
84	3	Chumphon 3	3.0	Coffee Shop	Market	Thai Restaurant	Intersection	Trai Stat
88	4	Kalasin 4	3.0	Coffee Shop	Restaurant	Fried Chicken Joint	Buffet	Farr Mar
102	4	Khon Kaen 4	3.0	Coffee Shop	Convenience Store	Campground	Fishing Spot	Fair

4.1.5 Cluster 5

In [134]:

```
th_merged.loc[th_merged['Cluster Labels'] == 4, th_merged.columns[[1] + list(ran
ge(5, th_merged.shape[1]))]].head(10)
```

Out[134]:

	zone	key	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	
33	1	Bueng Kan 1	4.0	Resort	Asian Restaurant	Farm	Coffee Shop	Cc St
42	8	Buri Ram 8	4.0	Convenience Store	Farm	Market	Garden Center	Zo
52	4	Chaiyaphum 4	4.0	Convenience Store	National Park	Coffee Shop	Mountain	Sc Lo
71	5	Chiang Rai 5	4.0	Convenience Store	Rental Car Location	Bar	Outlet Store	Zo
87	3	Kalasin 3	4.0	Convenience Store	Coffee Shop	Night Market	Food Truck	Ca
101	3	Khon Kaen 3	4.0	Convenience Store	Campground	Zoo	Hotel	Pu
113	3	Lampang 3	4.0	Convenience Store	Intersection	Asian Restaurant	Gift Shop	Fle
118	2	Loei 2	4.0	Noodle House	Garden	Flea Market	Sculpture Garden	Cc St
129	5	Maha Sarakham 5	4.0	Convenience Store	Intersection	Coffee Shop	Jewelry Store	Nc Hc
146	5	Nakhon Ratchasima 5	4.0	Convenience Store	Coffee Shop	Supermarket	Shopping Mall	Nc Hc

4.2 Accuracy of Classification Model

As seen below, train and test set accuracy is 0.50 and 0.34 respectively.

In [130]:

```
from sklearn import metrics
print("Train set Accuracy: ", metrics.accuracy_score(y_train, neigh.predict(X_tr
ain)))
print("Test set Accuracy: ", metrics.accuracy_score(y_test, yhat))
```

```
Train set Accuracy:  0.503597122302
Test set Accuracy:  0.342857142857
```

5. Discussion

From the result of exploring each cluster, we can notice some observations for each clusters:

- Cluster 1: Famous landmark, Downtown, High venue density
- Cluster 2 and 5: Countryside, Low venue density
- Cluster 3: Lake, River, and restaurant/hotel around them
- Cluster 4: Mountain and restaurant/hotel around them

Each neighborhood environment may affect election result. To investigate this issue, we can measure accuracy of classification model. Train and test set accuracy is only 0.50 and 0.34, respectively. Low accuracy can indicate that neighborhood may not affect which party people choose.

Recommendation

- Vary number of cluster (K) using in the K-Means algorithm
- Plotting number of neighbors (K) using in the KNN algorithm to optimize accuracy
- Select different number of venues' categories using in the K-Means (may be more than 10 most common categories

6. Conclusion

We observe weak correlations between neighborhoods in Thailand and voters' behavior. From classification model, the most popular party for each constituency doesn't depend on neighborhood environment.