Lab 1: Calculating the geodesic distance among cities

In this lab, you will use Python and two libraries, folium and geopy, to calculate the geodesic distance among cities.

We have 106 US cities with their latitudes and longitudes in the file "cities.txt" from UBlearns. Each row of the file contains a city name with its lat and lng separated by "|". For example:

las vegas,nv|36.17497|-115.13722

Please complete the following tasks. Please feel free to use either Jupyter Notebook or Google Colab to complete this lab. If you use Google Colab, please download your completed notebook into a *.ipynb file and submit the *.ipynb file.

Task 1: Write a cell of code to read the "cities.txt" file, and save the data into a Python dictionary. (20 pts)

Your dictionary should have a format as below:

{"city name":[latitude, longitude]}

Task 2: Study the folium library here: https://python-visualization.github.io/folium/index.html , and visualize the cities on a map using the folium library. (30 pts)

Tips:

- If you are using Jupyter Notebook, you will need to install folium in your virtual environment first. You can find how to install folium here: https://python-visualization.github.io/folium/installing.html
- Here are some examples to get started with folium: https://python-visualization.github.io/folium/quickstart.html#Getting-Started
- Please don't spend a whole lot of time learning how to use the entire folium library. Keep in mind that your task is only to show a map with these cities on it.

Task 3: Study the geopy library here: https://geopy.readthedocs.io/en/stable/# . Use the geopy library to calculate the distances (in kilometers) between all possible city pairs, and save the result into an output file called "city_distance.txt". (50 pts)

Your output file should have the following format:

cityA|cityB|distance

Tips:

- If you are using Jupyter Notebook, you will need to install geopy in your virtual environment first.
- Study "Calculating Distance" section of geopy: https://geopy.readthedocs.io/en/stable/#module-geopy.distance
- In total, your output file should contain (106*105)/2 lines of data. (why?)
- Depending on your solution, you might need to convert data types. For example, you might need to convert the latitude and longitude originally stored in a *list* to a *tuple*.

Tips for completing this and future lab assignments:

- You are encouraged to use Google to find answers to any technical issues that you encounter. However, feel free to ask me if you still can't find an answer after searching online.
- There are often multiple ways to complete a task. Use your creativity.
- In your code, please clearly comment the task that is addressed by the code ("Code for Task 1", "Code for Task 2", …)

Please submit your Jupyter notebook file to UBLearns:

- Lab1_FirstName_LastName.ipynb