In [1]:
```
import numpy as np
import pandas as pd
import folium
```

EXERCISE 1

Create a map of Tenerife.

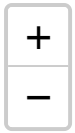
- Use a zoom start of: 5, 10
- Use 3 different styles as tiles including the following 2: Stamen Terrain, Stamen Watercolor

In [18]:
```
tenerife_map = folium.Map(
    location=[28.217, -16.589],
    zoom_start=5,
    tiles='https://tiles.stadiamaps.com/tiles/stamen_terrain/{z}/{x}/{y}{r}.png',
    attr="Map tiles by Stamen Design, CC BY 3.0 — Map data © OpenStreetMap contributors"
)
tenerife_map
```

Out[18]:

In [17]:
```
tenerife_map = folium.Map(
    location=[28.217, -16.589],
    zoom_start=10,
    tiles="https://tiles.stadiamaps.com/tiles/stamen_watercolor/{z}/{x}/{y}{r}.png",
    attr="Map tiles by Stamen Design, CC BY 3.0 — Map data © OpenStreetMap contributors"
)

tenerife_map
```

Out[17]:

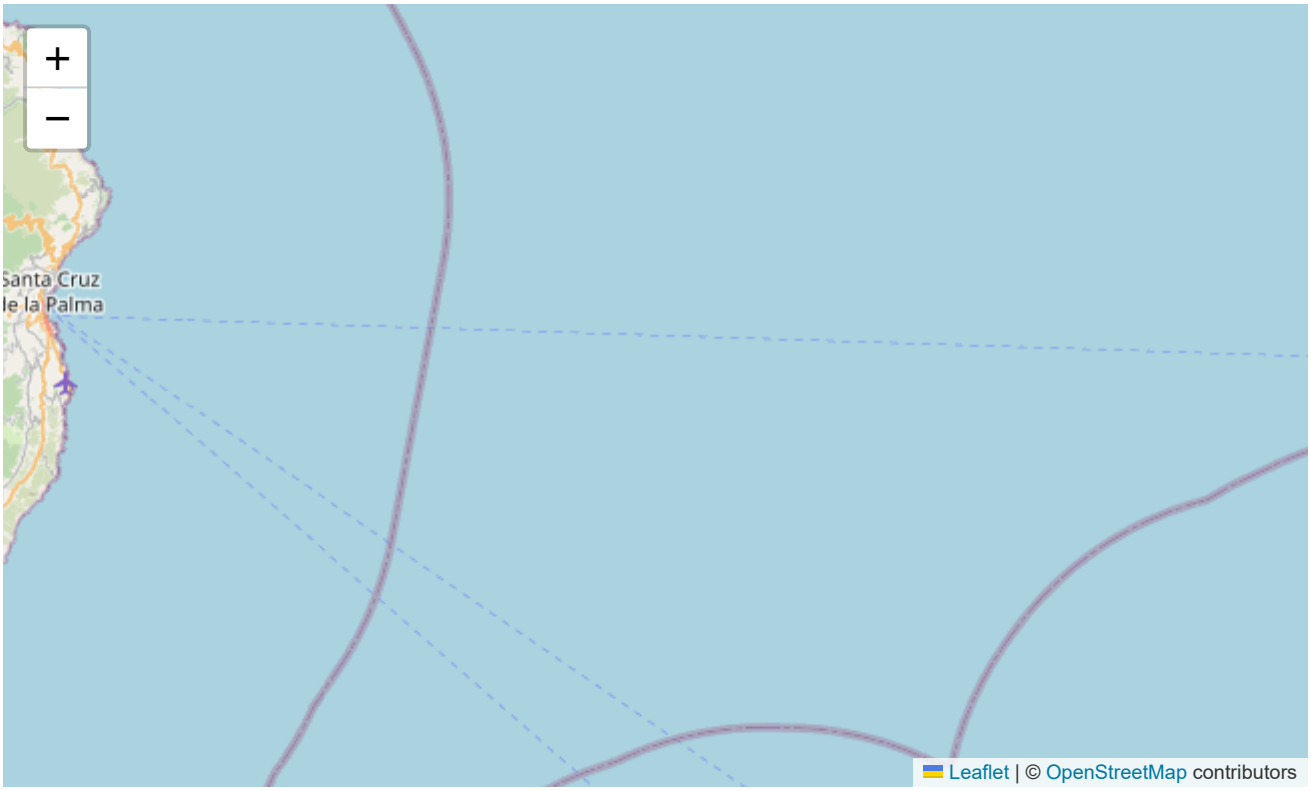


Leaflet | Map tiles by Stamen Design, CC BY 3.0 — Map data © OpenStreetMap contributors

In [20]:

```
tenerife_map = folium.Map(
    location=[28.217, -16.589],
    zoom_start=10,
    tiles="OpenStreetMap",
)

tenerife_map
```

Out[20]:



EXERCISE 2

Create a **map of Romania** with the following properties:

- Use a zoom start of 8.
- Add a feature group and a marker for the following cities: *Cluj-Napoca*, *Sibiu* and *Timisoara*.
- The colours of these markers should be *green*, *pink*, *orange*.

- The icons for the three locations should be: *car*, *flag*, *plug* (selected from here: https://fontawesome.com/icons/categories/humanitarian)
- Add a black line from Cluj-Napoca to Sibiu and from Sibiu to Timisoara (see folium documentation: https://python-visualization.github.io/folium/quickstart.html#Polylines)

In [48]:
```
ro_map = folium.Map(
    location = [45.9432, 24.9668],
    zoom_start = 8
)

car_icon = folium.CustomIcon(
    icon_image='car-solid.svg',
    icon_size=(30,30)
)

flag_icon = folium.CustomIcon(
    icon_image='https://fontawesome.com/icons/flag?f=classic&s=solid',
    icon_size=(30,30)
)

plug_icon = folium.CustomIcon(
    icon_image='https://fontawesome.com/icons/plug?f=classic&s=solid',
    icon_size=(30,30)
)


cluj = folium.map.FeatureGroup()
cluj.add_child(
    folium.features.CircleMarker(
        [46.7784, 23.6172], radius = 5,
        color = 'green', fill_color = 'green'
    )
)

sibiu = folium.map.FeatureGroup()
sibiu.add_child(
    folium.features.CircleMarker(
        [45.7973912, 24.1519202], radius = 5,
        color = 'pink', fill_color = 'pink'
    )
)

timisoara = folium.map.FeatureGroup()
timisoara.add_child(
    folium.features.CircleMarker(
        [45.7538355, 21.2257474], radius = 5,
        color = 'orange', fill_color = 'orange'
    )
)

ro_map.add_child(cluj)
ro_map.add_child(sibiu)
ro_map.add_child(timisoara)

folium.Marker(
    location=[46.7784, 23.6172],
    popup='Cluj-Napoca',
    icon=folium.Icon(color='green', icon='car', prefix='fa')
).add_to(ro_map)

folium.Marker(
    location=[45.7973912, 24.1519202],
    popup='Sibiu',
    icon=folium.Icon(color='pink', icon='flag', prefix='fa')
```

```
).add_to(ro_map)

folium.Marker(
    location=[45.7538355, 21.2257474],
    popup='Timisoara',
    icon=folium.Icon(color='orange', icon='plug', prefix='fa')
).add_to(ro_map)

folium.PolyLine(
    locations=[[46.7784, 23.6172],[45.7973912, 24.1519202]],
    color='#000000'
).add_to(ro_map)

folium.PolyLine(
    locations=[[45.7973912, 24.1519202], [45.7538355, 21.2257474]],
    color='#000000'
).add_to(ro_map)

ro_map
```

Out[48]:

EXERCISE 3

Create a `Choropleth` map of the world showing the immigration to Canada for the last 3 years available in the Canada Immigration Dataset (i.e. years 2011, 2012 and 2013).

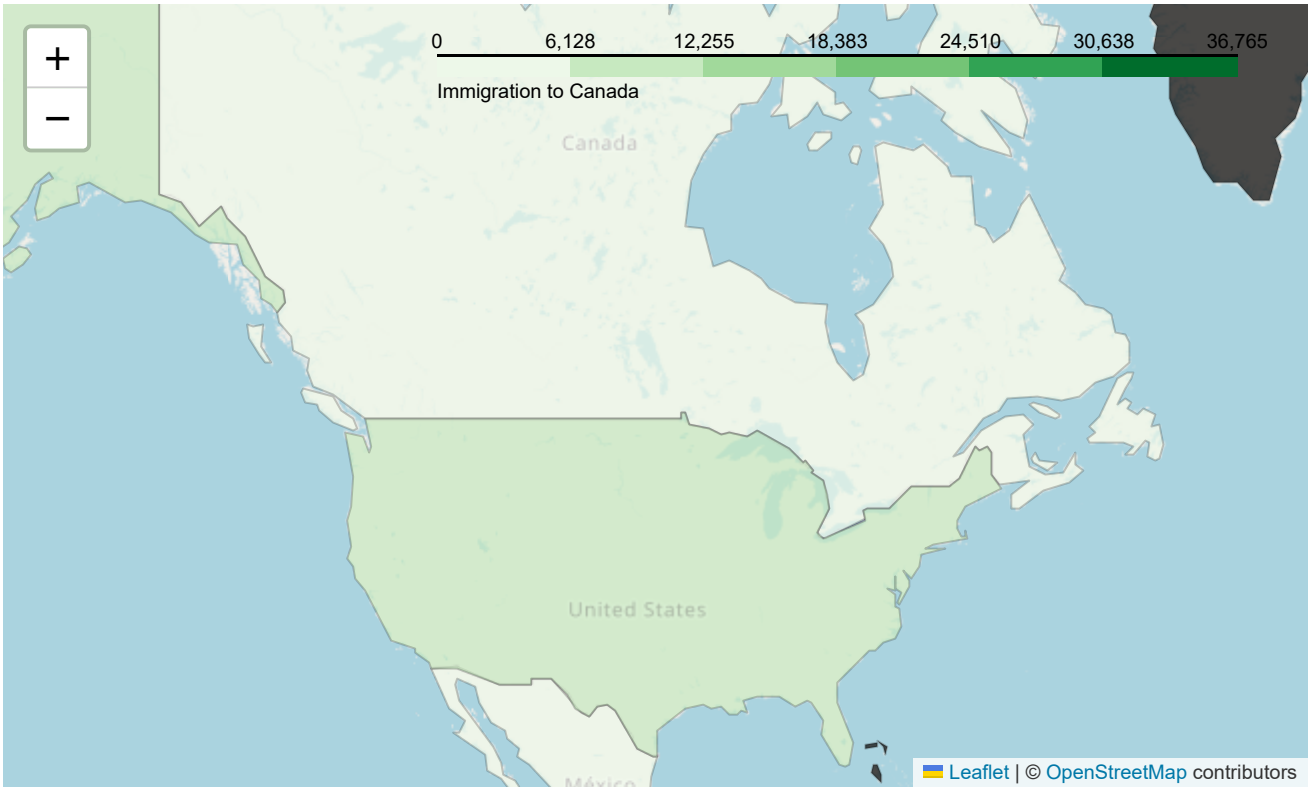
- Set a specific zoom start.
- Choose a new color pallette.
- Set any other parameters you see fit to make the map look nice.

In [50]:

```
df_canada = pd.read_excel("../datasets/Canada.xlsx",
                          sheet_name="Canada by Citizenship",
                          skiprows=range(20),
                          skipfooter=2)

# 1. Remove columns that are not necessary
df_canada.drop(['AREA', 'REG', 'DEV', 'Type', 'Coverage'], axis=1, inplace=True)

# 2. Rename some columns
df_canada.rename(columns={'OdName':'Country', 'AreaName':'Continent','RegName':'Region'}, inp
```

```
# 3. Column labels should be strings
df_canada.columns = list(map(str, df_canada.columns))

# 4. Set the index to the country column
# df_canada.set_index('Country', inplace=True)

# 5. Add an extra column: Total
df_canada['Total'] = df_canada.sum(axis=1, numeric_only = True)

# Create a list of years from 1980 - 2013 as strings
years = list(map(str, range(1980, 2014)))

world_geo = r'world_countries.json' # geojson file

# create a plain world map
world_map = folium.Map(location=[0, 0], zoom_start=3)
folium.Choropleth(
    geo_data=world_geo,
    data=df_canada,
    columns=['Country', '2011', '2012', '2013'], # Must pass column 1 as the key, and column .
    key_on='feature.properties.name',
    fill_color='Greens',
    fill_opacity=0.7,
    line_opacity=0.2,
    legend_name='Immigration to Canada'
).add_to(world_map)
world_map
```

Out[50]:



EXERCISE 4

Create a `Choropleth` map of Romania using any data you find for each county.

For example:

- Voting data: https://prezenta.bec.ro/europarlamentare26052019/romania-pv-final
- Salar mediu: https://insse.ro/cms/sites/default/files/com_presa/com_pdf/cs09r22.pdf

Geo-spatial data for Romania:

- https://geo-spatial.org/vechi/download/romania-seturi-vectoriale

In [67]:
```
romania_geo = r'ro_judete_poligon.json'

romania_map = folium.Map(location=[45.9432, 24.9668], zoom_start=6)
# folium.Choropleth



df = pd.read_csv('prezenta_vot_prezidential.csv')
df_prezenta = df[['Judet', 'Înscriși pe liste permanente', 'LT']]


sums = df.groupby('Judet')[['Înscriși pe liste permanente', 'LT']].sum().reset_index()
sums['Percent_LT'] = (sums['LT'] / sums['Înscriși pe liste permanente']) * 100
# print(sums)

folium.Choropleth(
    geo_data=romania_geo,
    data=sums,
    columns=['Judet', 'Percent_LT'], # Must pass column 1 as the key, and column 2 the values
    key_on='feature.properties.name',
    fill_color='Purples',
    fill_opacity=0.7,
    line_opacity=0.2,
    legend_name='Prezenta vot europarlamentare'
).add_to(romania_map)

romania_map
```

Out[67]: