Week 9 In-Class Exercise

Using the given data file, cities.csv, to work in this In-Class Exercise.

1. Use the following code to read and partially print the data file.

1.1 Reader	1.2 DictReader

`import csv`
`cities_data = []`
`with open('cities.csv','r') as f:`
`    rows = csv.reader(f)`
`    for r in rows:`
`        cities_data.append(r)`
`print(cities_data[0:10])`
`print(cities_data[8:10])`
	`import csv`
	`cities_data = []`
	`with open('cities.csv','r') as f:`
	`    rows = csv.DictReader(f)`
	`    for r in rows:`
	`        cities_data.append(r)`
	`print(cities_data[0:10])`
	`print(cities_data[8:10])`

   - Compare the given result and specify the difference.
   - Determine which one do you prefer to use?

2. Use `cities_data` from Reader and DictReader to create the tuple of all cities and their temperatures. Print the tuple at the end.

Partial Program

`# … Continue from 1.1 or 1.2`
 	
`city_temp_tuple = []`
 	
`# fill in the code yourself`
 	
`print(city_temp_tuple)`

Expected output:
[('Aalborg', 57.03), ('Aberdeen', 57.17), ('Abisko', 63.35), ('Adana', 36.99), ('Albacete', 39.0), ('Algeciras', 36.13), ('Amiens', 49.9), ('Amsterdam', 52.35), ('Ancona', 43.6), ('Andorra', 42.5), …, ('Yevpatoriya', 45.2), ('Zaragoza', 41.65), ('Zhytomyr', 50.25), ('Zonguldak', 41.43), ('Zurich', 47.38)]

See OrderedDict reference at: *https://www.geeksforgeeks.org/ordereddict-in-python/*

3. Write a function called *list_countries* to construct a list of unique countries in the data file.
   Hint: Use *in* operator to help out with membership test. (If you do not know what *in* operator is about, read more in Google Classroom, Pre-midterm VDOs, Topic 4: List, Slides, page 14, Slide 27.)

Partial Program for Main

`# … Continue from 1.2 + Remove last two print lines in 1.2`
 	
`countries = list_countries(cities_data)`
`print(len(countries))`
`print(countries)`

Expected output:
37 ['Denmark', 'United Kingdom', 'Sweden', 'Turkey', 'Spain', 'France', 'Netherlands', 'Italy', 'Andorra', 'Romania', 'Greece', 'Germany', 'Moldova', 'Switzerland', 'Serbia', 'Norway', 'Poland', 'Ukraine', 'Portugal', 'Slovakia', 'Belarus', 'Czech Republic', 'Belgium', 'Hungary', 'Bulgaria', 'Ireland', 'Latvia', 'Albania', 'Austria', 'Finland', 'Lithuania', 'Slovenia', 'Montenegro', 'Croatia', 'Bosnia and Herzegovina', 'Macedonia', 'Estonia']

4. Write a function called *compute_ave_country_temp* to compute average temperature, based on cities from each country.
   The function will return a dictionary whose key:value pair = country name:its average temp. The size of the returned dictionary must be equal to number of countries represented in Exercise 3.
   Hint: Make use of function *list_countries* from Exercise 3.

Partial Program for Main

`# … Continue from 1.2 + Remove last two print lines in 1.2`
 	
`country_temps = compute_ave_country_temp(cities_data)`
`print(len(country_temps))`
`print(country_temps)`

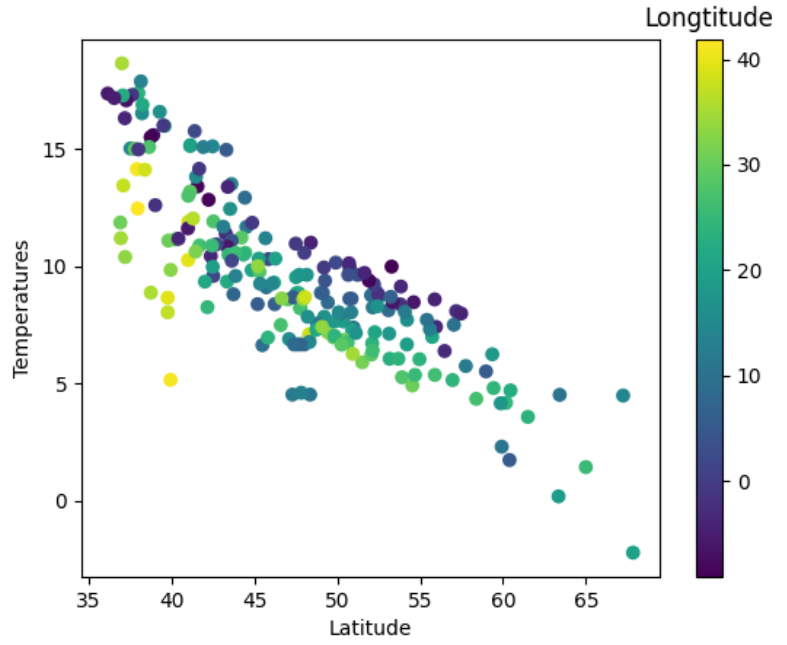
Expected output:
37 {'Denmark': 7.625, 'United Kingdom': 8.649999999999999, 'Sweden': 3.5866666666666673, 'Turkey': 11.726666666666665, 'Spain': 14.238333333333332, 'France': 10.151111111111112, 'Netherlands': 8.756666666666668, 'Italy': 13.474666666666668, 'Andorra': 9.6, 'Romania': 9.224444444444444, 'Greece': 16.9025, 'Germany': 7.869285714285714, 'Moldova': 8.415, 'Switzerland': 7.253333333333333, 'Serbia': 9.85, 'Norway': 3.7260000000000004, 'Poland': 7.250000000000002, 'Ukraine': 7.420000000000002, 'Portugal': 14.469999999999999, 'Slovakia': 8.48, 'Belarus': 5.946666666666666, 'Czech Republic': 7.8566666666666665, 'Belgium': 9.65, 'Hungary': 9.6025, 'Bulgaria': 10.44, 'Ireland': 9.299999999999999, 'Latvia': 5.27, 'Albania': 15.18, 'Austria': 6.144, 'Finland': 3.4875, 'Lithuania': 6.1433333333333335, 'Slovenia': 9.27, 'Montenegro': 9.99, 'Croatia': 10.865, 'Bosnia and Herzegovina': 9.6, 'Macedonia': 9.36, 'Estonia': 4.59}

5. Create a function *read_file* by using code from DictReader (Exercise 1.2) and pass in filename as function input parameter.
   In addition, create *extract_to_list* function to extract data from all rows of specific value. For example, *lat* in the code below is a list of latitude from all cities in the file. Try to write *extract_to_list* using list comprehension.

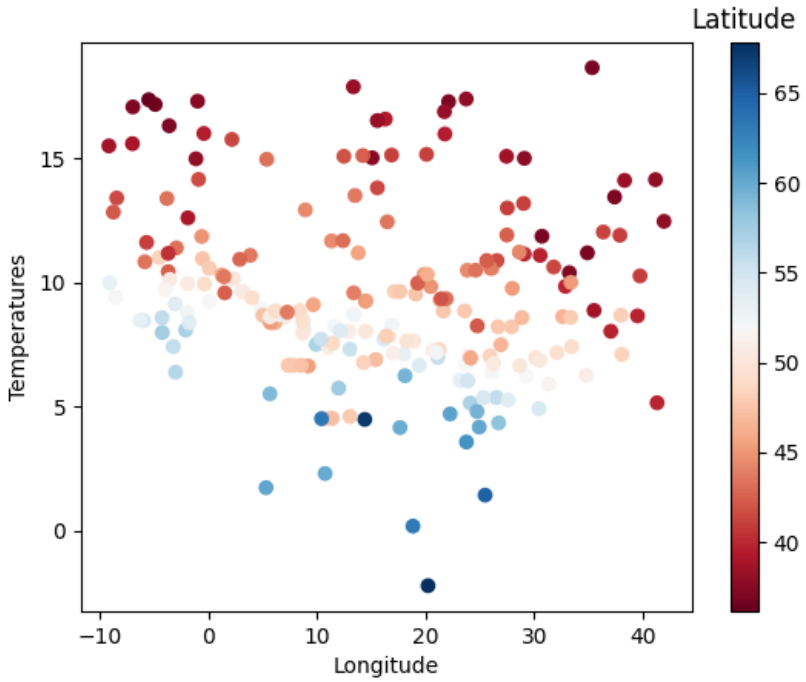
Code for Main

```
import csv
import matplotlib.pyplot as plt

cities_data = read_file('cities.csv')
lat = extract_to_list(cities_data,'latitude')
long = extract_to_list(cities_data,'longitude')
temps = extract_to_list(cities_data,'temperature')
high = extract_to_list(cities_data,'highest')

# Plot scatter plot using x = latitude,
#                         y = temperature,
#                         color=longitude
plt.scatter(lat,temps,c=long)
# Add x-axis label
plt.xlabel('Latitude')
# Add y-axis label
plt.ylabel('Temperatures')
# Add label for color bar
plt.colorbar().ax.set_title('Longtitude')
# Save plot as image file
plt.savefig('lat_temps_long.png')
# Show plot
plt.show()

plt.scatter(long,temps,c=lat)
plt.xlabel('Longitude')
plt.ylabel('Temperatures')
plt.colorbar().ax.set_title('Latitude')
# Set colormap to the selected one
# See more colormap selection in the reference at the end of
Exercise 5
plt.set_cmap('RdBu')
plt.savefig('long_temps_lat.png')
plt.show()
```

Expected output: `lat_temps_long.png`
(See next page)



Expected output: `long_temps_lat.png`



See Scatterplot reference at:
https://matplotlib.org/3.3.2/api/_as_gen/matplotlib.pyplot.scatter.html

See colormap reference at:

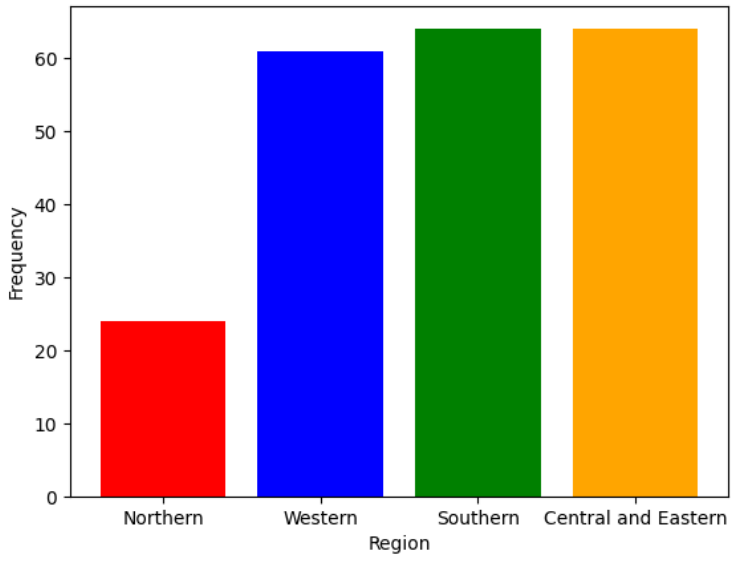
https://matplotlib.org/3.2.1/tutorials/colors/colormaps.html

6. Create a function *count_region_freq* to find unique region and the region frequency. Region frequency = Number of countries in such region. This function returns 2 output values: 1) list of unique regions, and 2) list of region frequencies.

Code for Main

```
import csv
import matplotlib.pyplot as plt

cities_data = read_file('cities.csv')

region_list, region_freq_list = count_region_freq(cities_data)
# Set up bar colors in bar graph
# See more color names in the reference at the end of Exercise 6
my_colors = ['red','blue','green','orange']
# Plot bar graph using x = unique region list
#                      y = region frequency
# Bar graph color is set to my_colors list
plt.bar(region_list, region_freq_list, color=my_colors)
plt.xlabel('Region')
plt.ylabel('Frequency')
plt.savefig('region_freq.png')
plt.show()
```

Expected output: region_freq.png



See Bar plot reference at:
https://matplotlib.org/3.3.2/api/_as_gen/matplotlib.pyplot.bar.html

See color name reference at:
https://matplotlib.org/3.1.0/gallery/color/named_colors.html

7. Create a function *find_lowest_highest_avg_city_temp* to find countries with lowest and highest average city temperature. This function returns 2 output values: 1) country with lowest city temperature and 2) country with highest city temperature.

Sample outputs:

```
>>> find_lowest_highest_avg_city_temp(cities_data[:11])
['Sweden', 'Turkey']
>>> find_lowest_highest_avg_city_temp(cities_data[-10:])
['Lithuania', 'Spain']
>>> find_lowest_highest_avg_city_temp(cities_data)
['Finland', 'Greece']
```

8. Create a function *compute_ave_region_highest* to compute average highest inside each region. This function returns 2 output lists: 1) list of unique regions, and 2) list of average highest for corresponding region.
   Additionally, use two output lists from this function to create a bar graph where x-axis is region, and y-axis is average highest from each region. You must change the colors of bars in the graph. Do not use the same color set as the given bar graph in Exercise 6.

9. From Exercise 5, answer the following questions:
   a. Based on the first scatter plot: *lat_temps_long.png*, when latitude increases, does temperature tend to increase or decrease or have no pattern?
      To answer this question, look at the plot (no need to compute the values) and find out the followings:
      - Find out A = value of temperature when latitude is small (for example, latitude 35-40).
      - Find out B = value of temperature when latitude is large (for example, latitude 55-65).
      - Compare values of A and B to find out that when latitude increases, temperature increases or decreases. If A and B are about the same value, that means when latitude increases, there is no pattern whether temperature increases or decreases.
   b. Based on the second scatter plot: *long_temps_lat.png*, when longitude increases, does temperature tend to increase or decrease or have not pattern?
   c. Create another scatter plot (feel free to use either latitude or longitude for color), and find out when highest increases, does temperature tend to increase or decrease or have not pattern?
   d. From your answers from Exercises 9.a, 9.b, 9.c , are they reasonable in the real world?

Submission: **Create StudentID_Firstname_inclass9 folder**, where **StudentID** is your KU student ID and **Firstname** is your given name. **Put the following two files into the folder**.

1) Python file (filename_format: *studentID*_week9.py)
2) PDF file (filename_format: *studentID*_week9.pdf). Your PDF will contain the followings:
   - Two scatter plots from Exercise 5. (Feel free to choose colors on your own.)
   - One bar graph from Exercise 6. (Feel free to choose on your own.)
   - One bar graph from Exercise 8.
   - Your answers for Exercises 9.a – 9.d

Label Exercise numbers clearly, so we know graph or answer belongs to which Exercise.

Zip the folder and submit the zip file.