Programming Project 06

This assignment is worth 45 points (4.5% of the course grade) and must be **completed and turned in before 11:59 on Monday, October, 23rd.**

Assignment Overview

- List and Tuples
- File manipulation

Assignment Background

Water is an important resource that is used everywhere by everyone. We use it for personal hygiene, food preparation, and recreational activities. However, this resource is limited and we need to keep track of how much water is being used and how it is distributed. The U.S. Geological Survey (https://water.usgs.gov/watuse/data) has publicly available data of water usage from 1950 to 2010. These datasets keep track of water usage in the United States across different areas, but for this project we'll focus on five: Public, Domestic, Industrial, Irrigation of crops, and Livestock. For this project we use the data file from 2010.

Project Specifications

1. You must implement the following functions:

   a) **`open_file()`** prompts the user to enter a filename. The program will try to open a comma-separated value (csv) file. An error message should be shown if the file cannot be opened. This function will loop until it receives proper input and successfully opens the file. It returns a file pointer.

   b) **`read_file(fp)`** receives a file pointer of the data file. For this project, we are only interested in the following columns. Convert number strings to float. Convert population which is in thousand to its actual value. No other values need conversion for this project. If a value is missing, use 0 as the value.

```
state = line[0]
county = line[2]
population = line[6]
fresh water usage = line[114]
salt water usage = line[115]
water usage (public) = line[18]
water usage (domestic) = line[26]
water usage (industrial) = line[35]
water usage (irrigation) = line[45]
```

```
water usage (livestock) = line[59]
```

This function returns a list of tuples:

```
tup = (state, county, population, fresh_water, salt_water,
public, domestic, industrial, irrigation, livestock)
data_list.append(tup)
```

c) **`extract_data(data_list, state)`** Receives, `data_list`, a list of tuples containing all the U.S water data usage and `state` , a string containing the name of a state. This function returns a list of tuples containing all the water data from `state`. If the `state` is not found in `data_list` , return an empty list.

d) **`compute_usage(state_list)`** This function receives `state_list`, the list of water usage for a specific state. For each county in `state_list` compute the total water used (salt and fresh) and compute the fresh water usage *per person* in the county. Put those values in a tuple:
`tup = (county, population, total_water, per_person_water)`
The function returns a list of tuples, one tuple for each county in `state_list`.

e) **`display_data(state_list, state)`** This function displays the following information for each county in the `state_list`: county name, population, total water usage per person, total water used by the county. Call the `compute_usage` function to get those values. Remember to use string formatting to properly display the table.
To match Mimir tests use the following formatting:

i. Title should be centered using ^: `{:^88s}`
ii. County Name = 22 spaces, left justified
iii. Population = 22 spaces, right justified, 0 decimal digits, include commas
Hint: `{:>22,.0f}`
iv. Total Water used by County = 22 spaces, right justified, 2 decimal digits
v. Total Water used per Person = 22 spaces, right justified, 2 decimal digits

2. Requirements

a) When asking the `state` input, you need to validate that the `extract_data` function does not return an empty list. In the skeleton file provided, we provide a list of state codes that includes 'DC', 'PR', and 'VI'. When checking state input the user must be allowed to use a mixture of cases, e.g. "Mi" or "mi" for "MI". Hint: use `upper()`

b) Provided function: **`plot_water_usage(some_list, plt_title)`** This function receives two parameters: The list of tuples **`some_list`** with the water data of the input state and the title for the plot **`plt_title`**.

c) Your program must prompt to plot (this feature lets us test all code without plots on Mimir).

Deliverables

The deliverable for this assignment is the following file:

proj06.py – the source code for your Python program

Be sure to use the specified file name and to submit it for grading via the **Mimir system** before the project deadline.

Mimir Tests

Function Test `read_file` uses `tiny_data.csv`:

```
Instructor value for read_file: [('OH', 'Adams County', 28550.0, 588.76,
0.0, 2.22, 1.76, 0.0, 0.0, 0.3), ('OH', 'Allen County', 106331.0, 34.57,
0.0, 27.09, 9.09, 2.63, 0.34, 0.23)]
```

Function Test `extract_data` uses `Water_Data_small_2010.csv` and "CO":

```
Instructor value for extract_data: [('CO', 'Adams County', 441603.0,
230.9, 0.02, 77.15, 36.5, 0.0, 143.74, 0.26), ('CO', 'Alamosa County',
15445.0, 152.41, 0.0, 1.72, 2.09, 0.0, 149.31, 0.15), ('CO', 'Arapahoe
County', 572003.0, 186.99, 0.01, 168.55, 120.84, 0.01, 14.07, 0.11)]
```

Function Test `compute_usage` uses `Water_Data_small_2010.csv` and "CO":

```
Instructor value for compute_usage: [('Adams County', 441603.0,
230.92000000000002, 0.0005228678247203936), ('Alamosa County', 15445.0,
152.41, 0.009867918420200713), ('Arapahoe County', 572003.0, 187.0,
0.0003269038798747559)]
```

Test Case 1:

```
Water Usage Data from the US and its States and Territories.

Input a file name: Water_Data_small_2010.csv

Enter state code or 'all' or 'quit': MI

                                Water Usage in MI for 2010
County                              Population       Total (Mgal/day) Per Person (Mgal/person)
Alcona County                           10,942                  6.29                  0.0006
Alger County                             9,601                  5.59                  0.0006
Allegan County                         111,408                 23.59                  0.0002
Alpena County                           29,598                120.32                  0.0041

Do you want to plot? no

Enter state code or 'all' or 'quit': quit
```

Test Case 2:

```
Water Usage Data from the US and its States and Territories.

Input a file name: xxxx
Unable to open file. Please try again.
Input a file name: water_2010.csv
Unable to open file. Please try again.
Input a file name: Water_Data_small_2010.csv

Enter state code or 'all' or 'quit': Texas
Error in state code.  Please try again.

Enter state code or 'all' or 'quit': Tx

                              Water Usage in TX for 2010
County                            Population       Total (Mgal/day) Per Person (Mgal/person)
Anderson County                       58,458                28.73                 0.0004
Andrews County                        14,786                64.01                 0.0017
Angelina County                       86,771                15.18                 0.0002

Do you want to plot? no

Enter state code or 'all' or 'quit': PR

                              Water Usage in PR for 2010
County                            Population       Total (Mgal/day) Per Person (Mgal/person)
Adjuntas County                       19,483                 1.20                 0.0001
Aguada County                         41,959                 1.12                 0.0000
Aguadilla County                      60,949                28.66                 0.0005
Aguas Buenas County                   28,659                21.81                 0.0008

Do you want to plot? no

Enter state code or 'all' or 'quit': quit
```

Test Case 3:

```
Water Usage Data from the US and its States and Territories.

Input a file name: Water_Data_small_2010.csv

Enter state code or 'all' or 'quit': all

                             Water Usage in ALL for 2010
County                            Population       Total (Mgal/day) Per Person (Mgal/person)
Adams County                          28,550               588.76                 0.0206
Allen County                         106,331                34.57                 0.0003
Ashland County                        53,139                 5.57                 0.0001
Ashtabula County                     101,497               189.63                 0.0019
Athens County                         64,757                 9.52                 0.0001
Alamance County                      151,131                23.85                 0.0002
Alexander County                      37,198                 4.23                 0.0001
Alleghany County                      11,155                 5.54                 0.0005
Anson County                          26,948                 9.53                 0.0004
Kent County                          162,310                43.30                 0.0003
New Castle County                    538,479               404.68                 0.0003
Sussex County                        197,145               269.48                 0.0005
Abbeville County                      25,417                 4.36                 0.0002
```

Aiken County	160,099	207.87	0.0013
Accomack County	33,164	15.19	0.0005
Albemarle County	98,970	19.22	0.0002
Atlantic County	274,549	60.06	0.0002
Bergen County	905,116	116.30	0.0001
Burlington County	448,734	109.48	0.0002
Camden County	513,657	57.45	0.0001
Cape May County	97,265	79.60	0.0002
Adams County	31,364	128.06	0.0041
Antelope County	6,685	83.11	0.0124
Churchill County	24,877	191.76	0.0073
Clark County	1,951,269	486.64	0.0002
Douglas County	46,997	111.57	0.0024
Elko County	48,818	357.05	0.0073
Esmeralda County	783	25.80	0.0329
Adams County	441,603	230.92	0.0005
Alamosa County	15,445	152.41	0.0099
Arapahoe County	572,003	187.00	0.0003
Adair County	7,682	2.31	0.0003
Anderson County	75,129	307.71	0.0041
Bedford County	45,058	15.95	0.0004
Benton County	16,489	2.46	0.0001
Bledsoe County	12,876	3.07	0.0002
Apache County	71,518	48.96	0.0007
Cochise County	131,346	238.40	0.0018
Coconino County	134,421	52.18	0.0004
Adair County	25,607	3.17	0.0001
Andrew County	17,291	19.71	0.0011
Atchison County	5,685	6.30	0.0011
District of Columbia	601,723	0.10	0.0000
Anderson County	58,458	28.73	0.0004
Andrews County	14,786	64.01	0.0017
Angelina County	86,771	15.18	0.0002
Baker County	16,134	496.02	0.0307
Benton County	85,579	38.83	0.0005
Barbour County	16,589	2.12	0.0001
Berkeley County	104,169	28.80	0.0003
Albany County	36,299	189.30	0.0052
Adams County	32,297	7.51	0.0002
Adams County	67,103	19.41	0.0003
Adams County	2,343	0.52	0.0002
Barnes County	11,066	2.15	0.0002
Benson County	6,660	2.14	0.0003
Billings County	783	2.09	0.0009
Bristol County	49,875	1.58	0.0000
Kent County	166,158	3.99	0.0000
Newport County	82,888	11.73	0.0001
Providence County	626,667	330.77	0.0002
Adams County	101,407	20.16	0.0002
Allegheny County	1,223,348	641.48	0.0005
Armstrong County	68,941	180.42	0.0026
Autauga County	54,571	55.55	0.0010
Alachua County	247,336	53.80	0.0002
Baker County	27,115	5.18	0.0002
Bay County	168,852	301.36	0.0003
Adams County	20,875	50.86	0.0024
Ashland County	16,157	35.05	0.0022
Barron County	45,870	11.61	0.0003
Bayfield County	15,014	10.71	0.0007
Belknap County	60,088	9.32	0.0002
Carroll County	47,818	4.98	0.0001
Cheshire County	77,117	7.93	0.0001
Albany County	304,204	50.04	0.0002

```
Allegany County                48,946              5.70              0.0001
Bronx County                1,385,108              0.19              0.0000
Broome County                 200,600             47.31              0.0002
Cattaraugus County             80,317             13.74              0.0002
Bernalillo County             662,564            149.00              0.0002
Catron County                   3,725             19.99              0.0054
Adair County                   22,680             10.26              0.0005
Alfalfa County                  5,640              8.21              0.0010
Atoka County                   14,180             24.40              0.0017
Barnstable County             215,888             60.81              0.0002
Berkshire County              131,219             24.27              0.0002
Appling County                 18,236             60.93              0.0033
Atkinson County                 8,375              2.62              0.0003
Bacon County                   11,096              2.25              0.0002
Baker County                    3,451             36.47              0.0106
Baldwin County                 45,720              6.91              0.0002
Aurora County                   2,710              0.77              0.0003
Beadle County                  17,398              5.72              0.0003
Bennett County                  3,431             26.24              0.0076
Ada County                    392,365            832.18              0.0021
Adams County                    3,976             78.18              0.0197
Adjuntas County                19,483              1.20              0.0001
Aguada County                  41,959              1.12              0.0000
Aguadilla County               60,949             28.66              0.0005
Aguas Buenas County            28,659             21.81              0.0008
Allen County                   13,371              3.80              0.0003
Anderson County                 8,102              1.94              0.0002
Atchison County                16,924              5.44              0.0003
Barber County                   4,861              5.93              0.0012
Beaver County                   6,629            101.25              0.0142
Box Elder County               49,975            405.27              0.0081
Cache County                  112,656            289.49              0.0026
Carbon County                  21,403             41.28              0.0019
Alcona County                  10,942              6.29              0.0006
Alger County                    9,601              5.59              0.0006
Allegan County                111,408             23.59              0.0002
Alpena County                  29,598            120.32              0.0041
St Croix County                50,601             53.85              0.0000
St John County                  4,170              0.34              0.0001
Adams County                   34,387              7.77              0.0002
Allen County                  355,329             48.61              0.0001
Bartholomew County             76,794             18.23              0.0002
Benton County                   8,854              0.89              0.0001
Aitkin County                  16,202              3.44              0.0002
Anoka County                  330,844            126.06              0.0004
Becker County                  32,504              8.57              0.0003
Beltrami County                44,442              6.39              0.0001
Benton County                  38,451             21.85              0.0006
Beaverhead County               9,246            482.96              0.0522
Big Horn County                12,865            268.08              0.0207
Blaine County                   6,491            236.44              0.0364
Broadwater County               5,612            192.40              0.0343
Carbon County                  10,078            400.19              0.0396

Do you want to plot? no

Enter state code or 'all' or 'quit': quit
```

Test Case 4 (plotting not tested on Mimir):

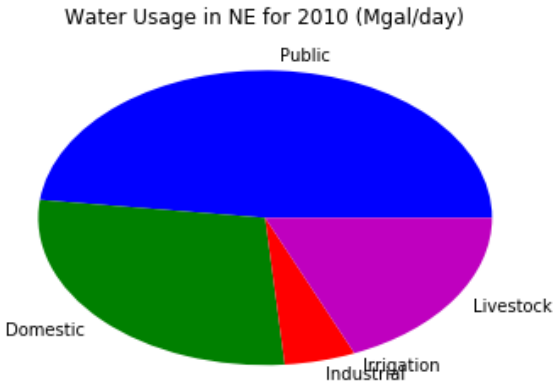
```
Water Usage Data from the US and its States and Territories.
```

```
Input a file name: Water_Data_2010.csv

Enter state code or 'all' or 'quit': NE
```

Water Usage in NE for 2010

County	Population	Total (Mgal/day)	Per Person (Mgal/person)
Adams County	31,364	128.06	0.0041
Antelope County	6,685	83.11	0.0124
Arthur County	460	5.49	0.0119
Banner County	690	17.48	0.0253
Blaine County	478	3.08	0.0064
Boone County	5,505	60.86	0.0111
Box Butte County	11,308	101.79	0.0090
Boyd County	2,099	9.13	0.0043
Brown County	3,145	51.05	0.0162
Buffalo County	46,102	230.81	0.0050
Burt County	6,858	10.63	0.0016
Butler County	8,395	51.21	0.0061
Cass County	25,241	18.38	0.0007
Cedar County	8,852	28.41	0.0032
Chase County	3,966	144.22	0.0364
Cherry County	5,713	44.71	0.0078
Cheyenne County	9,998	43.26	0.0043
Clay County	6,542	121.33	0.0185
Colfax County	10,515	24.12	0.0023
Cuming County	9,139	12.75	0.0014
Custer County	10,939	169.12	0.0155
Dakota County	21,006	7.36	0.0004
Dawes County	9,182	7.91	0.0009
Dawson County	24,326	182.71	0.0075
Deuel County	1,941	27.96	0.0144
Dixon County	6,000	9.58	0.0016
Dodge County	36,691	35.95	0.0010
Douglas County	517,110	386.02	0.0007
Dundy County	2,008	108.03	0.0538
Fillmore County	5,890	120.55	0.0205
Franklin County	3,225	37.48	0.0116
Frontier County	2,756	35.99	0.0131
Furnas County	4,959	32.84	0.0066
Gage County	22,311	24.88	0.0011
Garden County	2,057	27.93	0.0136
Garfield County	2,049	12.69	0.0062
Gosper County	2,044	57.33	0.0280
Grant County	614	2.12	0.0035
Greeley County	2,538	51.47	0.0203
Hall County	58,607	132.64	0.0023
Hamilton County	9,124	142.72	0.0156
Harlan County	3,423	37.23	0.0109
Hayes County	967	41.60	0.0430
Hitchcock County	2,908	24.64	0.0085
Holt County	10,435	358.20	0.0343
Hooker County	736	2.59	0.0035
Howard County	6,274	167.96	0.0268
Jefferson County	7,547	40.57	0.0054
Johnson County	5,217	6.92	0.0013
Kearney County	6,489	103.55	0.0160
Keith County	8,368	119.79	0.0143
Keya Paha County	824	22.08	0.0268
Kimball County	3,821	29.11	0.0076
Knox County	8,701	33.06	0.0038
Lancaster County	285,407	22.01	0.0001
Lincoln County	36,288	263.35	0.0073
Logan County	763	12.29	0.0161

```
Loup County                    632          9.05          0.0143
McPherson County               539          6.90          0.0128
Madison County              34,876         40.52          0.0012
Merrick County               7,845        111.90          0.0143
Morrill County               5,042        213.89          0.0424
Nance County                 3,735         36.42          0.0098
Nemaha County                7,248        727.00          0.1003
Nuckolls County              4,500         62.37          0.0139
Otoe County                 15,740        314.77          0.0200
Pawnee County                2,773          4.91          0.0018
Perkins County               2,970         96.51          0.0325
Phelps County                9,188        153.88          0.0167
Pierce County                7,266         54.35          0.0075
Platte County               32,237        124.46          0.0039
Polk County                  5,406         65.45          0.0121
Red Willow County           11,055         39.89          0.0036
Richardson County            8,363          2.87          0.0003
Rock County                  1,526         21.63          0.0142
Saline County               14,200         46.08          0.0032
Sarpy County               158,840         35.05          0.0002
Saunders County             20,780        104.31          0.0050
Scotts Bluff County         36,970        518.73          0.0140
Seward County               16,750         51.21          0.0031
Sheridan County              5,469         54.40          0.0099
Sherman County               3,152         45.05          0.0143
Sioux County                 1,311         98.96          0.0755
Stanton County               6,129         19.03          0.0031
Thayer County                5,228         79.11          0.0151
Thomas County                  647          1.39          0.0021
Thurston County              6,940          5.92          0.0009
Valley County                4,260        120.02          0.0282
Washington County           20,234        445.80          0.0220
Wayne County                 9,595         15.75          0.0016
Webster County               3,812         42.01          0.0110
Wheeler County                 818         40.45          0.0494
York County                 13,665        138.18          0.0101

Do you want to plot? Yes
```




```
Enter state code or 'all' or 'quit': quit
```

Grading Rubric

Computer Project #06 Scoring Summary

General Requirements:

__0__ (5 pts) Coding Standard 1-9

(descriptive comments, function headers, etc...)

Implementation:

__0__ (5 pts) open_file function (no Mimir test)

-2 Did not use try/except

__0__ (5 pts) read_file function

__0__ (5 pts) extract_data function

__0__ (5 pts) compute_usage function

__0__ (5 pts) Pass Test1

__0__ (5 pts) Pass Test2

__0__ (5 pts) Pass Test3

__0__ (5 pts) Pass Test4 Draws Pie Chart (no Mimir test)