**CMSC 206: Data Structures**

**Assignment #4: Aggregating Populations**

**due on Gradescope by the beginning of class on Thursday, March 22, 2018**

This assignment builds on Assignment #2 (*not* Assignment #3), adding a feature where we can look up town information (instead of zip code information), adding up the population in perhaps several zip codes used within one town.

Like Assignment #3, the test cases will *not* test erroneous input.

The tasks have an estimated time burden and how much code it should take, as an indication of how hard a task should be. If you're finding it much harder than this, it's time to speak up.

1. Copy your *LookupZip.java*, *ZipParseException.java*, *LookupZipTest.java*, and *Place.java* files from Assignment #2 into a new project folder. (In order to get JUnit to compile, it may work well to create a new JUnit Test Case in the new project folder and then just delete it.) Also copy the *uszipcodes.csv* file into the new folder. Make sure everything is working before making any changes. (5 mins, no code)
2. Modify your Place class to store population information. The constructor should now take *four* parameters (the last one is an int parameter denoting the Place's population), and the toString method should now return the population as well as the other info. (Put the population at the end, with fields separated by colons as before.) You will have to modify your parseLine method to store the population in a Place. If a line in the input file doesn't have a population, assume a population of 0. (This is in sharp contrast to the behavior in Assignment #3.) (15 mins, ~10 lines of new code)
3. Create a new Town class that represents a municipality, possibly comprised of many zip codes. Each Town needs to store the following:
4. town name
5. state
6. total population of the town
7. one zip code in that town
8. the total number of zip codes assigned to that town

Accordingly, it should have a 5-argument constructor that takes all this information. (15 mins, ~25 lines of simple code)

1. Write a public void printInformation method in your Town class that prints the information about a town. Note that this *prints*, not *returns*. (15 mins, ~10 lines) For example, my Town for Philadelphia prints

Town: Philadelphia, PA, 19019 (plus 86 other zip codes)

Population: 1526206

1. Write a new method in your LookupZip class as follows (2-3 hours, ~30 lines):

/\*\* Gathers information about a town. The Town object

\* returned from this method includes the entire

\* population of the given town, even if the town

\* comprises many zip codes. The zip code stored in

\* the returned town is the first listed zip code in

\* the given array.

\* @param places All the known places, as read in

\* from the uszipcodes.csv file

\* @param townState The town name and state; for

\* example, "Bryn Mawr, PA"

\* @return A Town object with all the information

\* about the requested town, or null if

\* the town cannot be found.

\*/

public static Town lookupTown(Place[] places,

String townState)

1. Update your main method to lookup towns instead of zip codes. (15 mins, little to no net change in lines of code) Here is an example session:

What town should I look up (enter "town, state")? Philadelphia, PA

Town: Philadelphia, PA, 19019 (plus 86 other zip codes)

Population: 1526206

Do you want me to search again? yes

What town should I look up (enter "town, state")? Bryn Mawr, PA

Town: Bryn Mawr, PA, 19010

Population: 21103

Do you want me to search again? yes

What town should I look up (enter "town, state")? Apo, AP

Town: Apo, AP, 96201 (plus 66 other zip codes)

Population: 0

Do you want me to search again? yes

What town should I look up (enter "town, state")? Haverford, PA

Town: Haverford, PA, 19041

Population: 6248

Do you want me to search again? yes

What town should I look up (enter "town, state")? Truth or Consequences, NM

I can't find zip code Truth or Consequences, NM

Do you want me to search again? yes

What town should I look up (enter "town, state")? Truth Or Consequences, NM

Town: Truth Or Consequences, NM, 87901

Population: 7139

Do you want me to search again? yes

What town should I look up (enter "town, state")? Clearfield, UT

Town: Clearfield, UT, 84015 (plus 2 other zip codes)

Population: 62494

Do you want me to search again?

1. **Get everything above working before proceeding past this step!**
2. Download the *KWArrayList.java* file from the course syllabus page, putting it in the same Eclipse project. (2 mins)
3. Write a new class KWALIterator that is an iterator for the KWArrayList collection. Your class must have a type parameter E, just like KWArrayList. It must also implement the Iterator<E> interface, overriding the hasNext, next, and remove methods. (Do *not* worry about the forEachRemaining method.) These methods must behave as specified by the online documentation for Iterator, with a full working implementation of remove.

You will need to figure out what data fields are necessary in your KWALIterator class and what constructor to write. The code here is short and straightforward; it's figuring out *what* to do that's hard. Work together and post on Piazza to figure this out! (1 hour to understand task, 1 hour to code; ~50 lines)

1. Modify KWArrayList to implement the Iterable<E> interface. (Look up that interface in the documentation to learn more.) You will have to add a new method to KWArrayList. This method should have about one line in it – and it will likely involve the keyword this. (15 minutes to understand task, 5 minutes to complete; ~5 lines)
2. Modify your LookupZip methods to work with a KWArrayList instead of an array. In your lookupZip and lookupTown methods, use the "foreach" loop (with the for(Place p : places) syntax) to iterate through the KWArrayList. (10 minutes)
3. After getting everything working, run your program on the input in the example session, above. (Your output does *not* have to match mine character-for-character – but the information presented must match.) Save a screenshot (search online for instructions if you don't know how to take a screenshot – tutorials abound) of this test in your project folder. (5 minutes)
4. Write up your reflections, answering the following questions in a *reflections.txt* file (5-10 minutes):
   1. How long did this assignment take you?
   2. What challenged you the most in this assignment?
   3. Whom did you work with on this assignment?
   4. What resources did you consult while doing this assignment?
   5. Do you have any feedback to offer about this assignment?
   6. Any other comments or questions?
5. Submit your work on Gradescope.