Programming Assignment #1
CS 202 Programming Systems

***** Make sure to read the Background Information first!**
It applies to all programming assignments this term***

We do not accept late work beyond the late date. No exceptions.

Background:
When beginning with this project, the first thing to keep in mind is that we are no longer working on CS163 programs! In CS163 we were concerned about creating Abstract Data Types and the class construct facilitated this. Instead, this term we will be focusing on how to create Object Oriented Solutions. An ADT may be part of that solution – but it certainly shouldn't be the primary focus. Instead you want to strive for classes to have specific "jobs" and have classes derived from more general classes, whenever appropriate.

Overview:
In the Portland Metropolitan area, numerous elementary, middle and high schools are being developed. Part of this is an effort to phase out buildings that are past their useful life, part is to handle increasing population density and overcrowding, and part is to provide structural integrity for earthquake shelters. With the new schools, new boundaries are needed. Schools need a reasonable mix of socio-economic breadth, the right number of students for each age group, and a desire to minimize bussing students farther than necessary (~5 miles).

Program #1
For Program #1, you will be creating an object oriented program that will provide three different solutions for school boundaries for a particular city (e.g., CS Metropolis). Load from an external file called **census.txt** information about the population in your selected city. From a second file, load the information about the schools that are being considered (from **schools.txt**). Allow the user to interact with the program by setting the allowed deviation from the expected enrollment and the desired socio-economic mix.

The census information must include:

1. Map Coordinate (eg., GPS coordinates)
2. For each age group, the number of people
3. Race
4. Median house hold income
5. Other?

The school information must include:

1. Map Coordinate (eg., GPS coordinates)
2. For each age group, the number of classes, and the best class size
3. For each age group, the maximum number of students possible

To make this Object Oriented:
You will want to first think about breaking this down into a series of classes and create them independent of the entire problem. Here are some suggestions to start with. With hierarchies always push the common elements up to the base class. You may alter this set of classes but not reduce the number of classes required.

1. Location – since coordinate data is going to be handled by multiple parts of the program, having a class to manage this means that we will be offloading the work to compare coordinates to this class. Think about how coordinates can help with mapping the information to the data structure. Avoid only setters and getters!
2. Household IS a location plus the people that live in the house and their status
3. School IS a location plus information about the number of classrooms and class size allowable.
4. And more! You need a total of at least 5 classes!

Anything that is similar between these or other classes that you write should be pulled up to be part of a base class. For example, classes that manage collections of items may be derived from a common base class that manages the collection. Keep classes small and functions small. A large class or function means that the problem has not yet been broken down into its basic components (objects).

Data structures
There are two data structures. The census data that is read in must be stored in a graph, using an adjacency list. You will be to be traversing this to find the "best" three combinations of boundaries to recommend.

The school data is to be stored in a doubly linked list, with both head and tail pointers.

Implementation of the data structures requires full support of insert, removal, display, retrieval, and remove-all.