Exercise Set 3: Simple Class Hierarchy

Exercise 3.1 Given a class hierarchy to represent information about people at a university, including the classes `Person`, `Instructor`, and `Staff`:

- design `class Student` to be a new subclass of the `Class Person`. It should contain information about the student's GPA and major.
- Develop the method `withHonors`, which determines whether the student's GPA is greater than 3.5
- Complete the test suite for this collection of classes.
- Complete the UML diagram for this collection of classes.

Exercise 3.2 Given a UML class hierarchy to represent items in the grocery store, develop the classes `Grocery`, `Coffee`, `Juice`, and `IceCream` as specified in the UML diagram.

Exercise 3.3 Develop a class hierarchy to represent three different types of vehicles: cars, trucks, and buses. For all vehicles we need to record the size of the fuel tank in gallons, and the estimated fuel consumption given in miles per gallon. Just like the `class Car` in an earlier exercise, we can compute:

- the maximum distance the vehicle can travel on one tank of fuel
- whether it can travel a given distance
- whether it can travel farther than some other vehicle.

Exercise 3.4 *Warning:* This exercise can be completed independently of the previous exercise.
Develop a class hierarchy to represent three different types of vehicles: cars, trucks, and buses. Different kinds of vehicles need to represent additional information as follows:

- A car may or may not pull a trailer.
- A bus can carry some number of passengers (capacity) and has some number of passengers on board.
- A truck has some specified maximum load and some current load.

Develop the method `computeToll`, which will compute the toll for each vehicle according to the following rules:

- A car without a trailer pays $0.25 per mile.
- A car towing a trailer pays $0.35 per mile.
- A bus pays $0.35 per mile and additional $0.20 for each passenger.

- A truck pays $0.40 per mile and in addition $0.05 for each 1000 lb of load it currently carries.

Exercise 3.5

- Create a class to represent the address of some person. Address should include the street, the city, the state and the zip code.
- Extend the class hierarchy from Exercise 3.1, so that it records the address for each kind of person (`Person`, `Instructor`, `Staff`).
- Develop the method `thisZip`, which determines whether this person lives in a given zip code.
- Draw the UML diagram for this collection of classes.

Exercise 3.6

- Modify the `class InventoryItem` from Exercise 2.6 to represent the inventory information about any grocery item in the class hierarchy from Exercise 3.2.
- Draw the UML diagram for this collection of classes.
- Explain briefly how the method `grossIncome` performs the calculations.
- Explain briefly how the method `betterPriceThan` performs the calculation, when we choose to compare a `Coffee` item with an `IceCream` item.