

CS206 Lab#2: ArrayList, Inheritance

In this lab, we will practice ArrayList and design inheritance classes.

Exercise 1: Write a program that reads the text file `nums.txt` into an ArrayList called `lst`. Then perform the following operations on `lst`:

1. Print all the numbers out in the following format: (1, 2, 3, ..., 100)
 - a. You should not use `toString`
2. Print all the numbers out in reverse order
 - a. This should be done via an explicit traversal of `lst`.
3. Compute the average of all numbers in `lst` and print it out
4. Remove all even numbers and print `lst`.
5. Insert 200 to the beginning of `lst`, 300 to the end of `lst` then 400 to the middle of `lst` and print `lst`
 - a. Should look like this: (200, 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 400, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99, 300)

Exercise 2: Design all the necessary classes in order to make the following driver program work properly (steps have been broken down for you in the sub-parts).

```
public static void main(String[] args){
    Mammal[] mammals = new Mammal[4];
    mammals[0] = new Dolphin();
    mammals[1] = new Platypus();
    mammals[2] = new Human();
    mammals[3] = new CSStudent();

    for (int i=0; i< mammals.length; i++){
        print("Generally, a " + mammals[i].getName());
        print(" can be found ");
        if(mammals[i].livesInWater() == false){
            print("on land, ");
        }
        else {
            print("in water, ");
        }

        print("it can ");
        if(mammals[i].laysEggs() == false) {
            print("not ");
        }
        print("lay eggs, and is often overheard saying '");
        mammals[i].speak();
        println("'");
    }
}
```

For example, this is a sample output that is acceptable:

Generally, a Dolphin can be found in water, it can not lay eggs, and is often overheard saying 'ak, ak, ak, ak'

Generally, a Platypus can be found on land, it can lay eggs, and is often overheard saying 'errrr'

Generally, a Human can be found on land, it can not lay eggs, and is often overheard saying 'I'll take a grande latte with a double-shot of espresso'

Generally, a CSStudent can be found on land, it can not lay eggs, and is often overheard saying 'I love programming!'

Specifically, perform the following tasks. In a new directory (say lab02/03/):

1. Design a class `Mammal` with:
 - a. two `private String` variables called `name` and `sound`
 - b. a constructor that initializes the two variables
 - c. getters for the two instance variables
 - d. a `void` method `speak()` that prints the object's sound
 - e. a `boolean` method `laysEggs()`
 - f. a `boolean` method `livesInWater()`
2. Design a class called `Dolphin` that extends `Mammal`. Override methods as appropriate.
3. Design a class called `Platypus` that extends `Mammal`. Override methods as appropriate.
4. Design a class called `Human` that extends `Mammal`. Override methods as appropriate.
5. Design a class called `CSStudent` that extends `Human`. Override methods as appropriate.
6. Each class should now be declared `public`, and thus be stored in a separate file that matches the class name, i.e. `Mammal.java`, `Dolphin.java`, etc. The given `main` should be in a class called `Main` and a file called `Main.java`
7. Once you had the above working, change the main data structure in the driver program from array to `ArrayList` and make sure the program works the same.