

CSCI 145 -- PA 11

More on Inheritance & Polymorphism

Feel free to discuss and help each other out but does not imply that you can give away your code or your answers! You can work with a lab partner for this assignment. **You must always use the required template (JavaClassTemplate.java from Canvas) and output "Author: Your Name(s)" or "Modified by: Your Name(s)" for each program as applicable.**

You can work with a lab partner and each one must submit the same PDF file (include both names in the submission file). Each person must include a brief statement about your contribution to this assignment.

Perform as many exercises from chapter 10 of lab book as possible, but the following lab exercises must be completed. You are not required to turn in written answers to various questions, but it is very helpful in understanding important concepts. You might see those questions on quizzes and exams.

- **Exercise 1 --** Another Type of Employee (use files from chapter 10 of the textbook; include only files modified Staff.java and new file Commission.java in your submission)
- **Exercise 2 --** Painting Shapes – the formula for the cylinder is not correct and it should be $\text{area} = 2\pi rh + 2\pi r^2$; sample output should be 2.0, 8.1, and 7.2
- **Exercise 3 --** Searching and Sorting in an Integer List; **only need to do steps 1 and 2**; try the following test cases:
 1. Create a list (option 1), print it (option 4), and search for an element in the list (option 3, pick one value in the middle of the list). Now look for an element that is not in the list (option 3). Now sort the list (option 2) and print it to verify that it is in sorted (option 4).
 2. Test replaceFirst (new option 5, try both cases – in the list and not in the list)
 3. Test replaceAll (new option 6, try both cases – in the list more than once and not in the list)

Exercise 4 – Plant Information

Given a base Plant class and a derived Flower class, setup an application to create an ArrayList called **myGarden**. The ArrayList should be able to store objects that belong to the Plant class or the Flower class. Create a static method called printArrayList(), that uses the toString() methods defined in the respective classes and prints each element in **myGarden**. The program use a sentinel loop to read plants or flowers from keyboard (ending with string “neither”), adding each Plant or Flower to the **myGarden** ArrayList, and output each element in **myGarden** using the printArrayList() method. In addition, it also outputs the number of plants and total cost for those plants. *Hint: input first item and use it to determine what to do next; assume user will enter valid data.*

Sample Input/Output:

```
Enter plant or flower: plant Spirea 10<E>
Enter plant or flower: flower Petunia 2 true pink<E>
Enter plant or flower: flower Rose 6 false white <E>
Enter plant or flower: plant Mint 4<E>
Enter plant or flower: neither<E>
```

```
Plant Information:
  Plant name: Spirea
  Cost: 10
```

```
Plant Information:
  Plant name: Petunia
  Cost: 2
  Annual: true
  Color of flowers: pink
```

```
Plant Information:
  Plant name: Rose
  Cost: 6
  Annual: false
  Color of flowers: white
```

```
Plant Information:
  Plant name: Mint
  Cost: 4
```

You have 4 plants with a total cost of 22.

Question 1: Provide two good reasons for utilizing inheritance in a program.

Question 2: Is it possible to use an interface to achieve polymorphism in Java? Explain why or why not.

Extra Credit: Perform one part of exercise “**Timing Searching and Sorting Algorithms**” from chapter 10 of lab book. Collect the run times for either selection sort or insertion sort (use random int values and store then in an array; sorted the same list twice and collect time for each one: unsorted list first time and sorted list second time,) for the following array sizes: 10000, 20000, and 100000. You should be able to confirm that the runtime is n^2 for unsorted list (i.e., going from 10000 to 20000 should be about 4 times slower and going from 20000 to 100000 should be about 25 times slower). Does it run faster for a sorted list for your selected sorting algorithm? Explain.

Fill out and turn in the PA submission file for this assignment (save as PDF format).