

Programming Assignment #5

Due 10/9 @ 8pm, No Late Period

Description

For this exam, you will be modifying 1 class and creating 5 others. You will be submitting P5.jar to the auto grader for grading. You are going to create a project called P5. In that project, you will create the following classes (or use the classes created for the midterm):

1. Recursion
2. Vehicle
3. Motorcycle
4. Bicycle
5. Car
6. Semi

You will use the .java files from each of these classes to create the M1.jar files you will submit.

Recursion.java

To solve the below problem, you must use recursion. UNDER NO CIRCUMSTANCES SHOULD YOU USE A LOOP or a global variable. We will search for both as part of the grading, any loops or global variables that are found will result in a zero for the entire program.

Implement the following methods within the class:

public String dupEachChar (ArrayList<Character> str)

This method takes an ArrayList of characters and returns a string that consists of two of each of the characters – in the ArrayList. In addition, these duplicates are added to the ArrayList. If the ArrayList is empty, an empty string is returned and no characters are added to the ArrayList.

Example (note – the ‘ and “ below are used to denote contents and are not part of the data):

If an ArrayList containing ‘a’, ‘b’, and ‘c’ is passed to the method, the method would return “aabbcc” back as a String. In addition, the ArrayList would now have 6 elements instead of 3 matching the characters in the return string and in the same order.

public String addStars (ArrayList<Character> str)

This method takes an ArrayList of characters and returns a string that consists of each of the characters in the ArrayList with stars in between them. In addition, these stars are added to the ArrayList. If the ArrayList is empty, an empty string is returned and no characters are added to the ArrayList.

Example (note – the ' and " below are used to denote contents and are not part of the data):

If an ArrayList containing 'a', 'b', and 'c' is passed to the method, the method would return "a*b*c" back as a String. In addition, the ArrayList would now have 5 elements instead of 3 matching the characters in the return string and in the same order.

public int sumOfSquares (ArrayList<Integer> num)

This method takes an ArrayList of integers and returns the sum of the squares of each element of the ArrayList. In addition, these squares of each element are added to the ArrayList after the element. If the ArrayList is empty, a zero is returned and no numbers are added to the ArrayList.

If an ArrayList containing 1, 2, and 3 is passed to the method, the method would return 14 back as an integer. In addition, the ArrayList would now have 6 elements instead of 3 and would contain in order: 1, 1, 2, 4, 3, 9.

public int sumOfCubes (ArrayList<Integer> num)

This method takes an ArrayList of integers and returns the sum of the cubes of each element of the ArrayList. In addition, these cubes of each element are added to the ArrayList before each element. If the ArrayList is empty, a zero is returned and no numbers are added to the ArrayList.

If an ArrayList containing 1, 2, and 3 is passed to the method, the method would have a return of 36. In addition, the ArrayList would now have 6 elements instead of 3 and would contain in order: 1, 1, 8, 2, 27, 3.

Vehicle.java

Copy the code this abstract class into your Vehicle.java class:

http://www.cs.colostate.edu/~cs161/Fall16/more_assignments/P5/src/Vehicle.java

Complete the constructor, and the accessors / mutators (getters and setters) in the class. DO NOT change any signatures in the class.

Motorcycle.java

Implement this concrete class of Vehicle using inheritance. The class should have one private instance variable called **cost** (no other instance variables allowed) and the constructor of the class should be:

```
public Motorcycle (int cost)
```

You should implement the abstract methods and the accessors and mutators for the instance variable. The formula for the costOfMaint method is $(\text{cost} * \text{miles} + 10)$. The method updateNumWheels should update the number of wheels for the motorcycle only if the input is either 2 or 3). A license is required and the default number of wheels is 2.

Bicycle.java

Implement this concrete class of Vehicle using inheritance. The class should have one private instance variable called **cost** (no other instance variables allowed) and the constructor of the class should be:

```
public Bicycle (int cost)
```

You should implement the abstract methods and the accessors and mutators for the instance variable. The formula for the costOfMaint method is $(\text{cost} * \text{miles})$. The method updateNumWheels should update the number of wheels for the bicycle only if the input is either 1 or 2). A license is not required and the default number of wheels is 2.

Car.java

Implement this concrete class of Vehicle using inheritance. The class should have one private instance variable called **cost** (no other instance variables allowed) and the constructor of the class should be:

```
public Car (int cost)
```

You should implement the abstract methods and the accessors and mutators for the instance variable. The formula for the costOfMaint method is $(\text{cost} * \text{miles} + 25)$. The method updateNumWheels should update the number of wheels for the car only if the input is either 4 or 6). A license is required and the default number of wheels is 4.

Semi.java

Implement this concrete class of Vehicle using inheritance. The class should have one private instance variable called **cost** (no other instance variables allowed) and the constructor of the class should be:

```
public Semi (int cost)
```

You should implement the abstract methods and the accessors and mutators for the instance variable. The formula for the costOfMaint method is $(\text{cost} * \text{miles} + 100)$. The method updateNumWheels should update the number of wheels for the semi only if the input is either 10 or 18). A license is required and the default number of wheels is 18.

Submitting your assignment

When you have completed your code and unit tested it to your satisfaction, you should create a P5.jar file that contains the 6 .java files. This .jar file should be submitted to the autograder for grading.