4.3 – Understanding Object Oriented Programming Theory

For this assignment we will be using A Guide to Programming in JAVA by Beth Brown. Please type your answers in this document. When you are done, upload the file to your GitHub account in a repo called "Assignment 4-3" available at:

https://bbarrettchs.weebly.com/uploads/3/7/7/8/37782575/lvp_java_text.pdf

---
Who are you?

---

0. What is your name? Answers may vary

What is an Object?

Read page 179-180 and answer the following questions:

1. The textbook describes an object as a collection of state and behaviour. What is meant by state and behaviour? State is the information (instance variables) that an object stores, while behaviour are the methods that it can perform (ex: accessors and mutators).

2. Define Encapsulation / Information Hiding. Encapsulation is all about protecting an object's data. Correct object-oriented design prevents you from directly accessing variables by making them private and making client code access them through public accessors and mutator methods that include safeguards. For example, our Fraction class had mutators that would prevent the denominator from being set to zero.

3. Define client code. Code that uses class A but is in a different class is said to be a client A.

Designing and Writing a Class

Read page 180-182 and answer the following questions:

4. Define Functional Decomposition. The process of breaking down a big problem into smaller problems. In Object design, this looks like breaking down a class's behaviours into a set of simple methods.

5. What three things does the class declaration contain? Private/Public, the class keyword, and the class name (first letter capitalized by convention)

6. What three things does the class body contain? Instance or member variables, constructors, and methods.

7. Access levels: what does it mean to make a variable or method public? What does it mean to make a variable or method private? Public variables and methods are directly accessible by client code, where as private variables and methods are not. Private information can only be accessed inside the class where it is defined.

8. What is an interface? The list of public methods that client code can use to interact with instances of this class.

9. Define accessor method, modifier method, and helper method. Which one of these types of methods is NOT part of the interface? Accessor method allows client code to access but not modify instance variables. Mutator or modifier methods can access and modify these variables. Helper methods are private methods that assist accessors and mutators, but are NOT part of the interface.

10. Do the problem "Review: Circle - part 1 of 4" on page 182

```
public double circumference () {
    return 2*radius*PI;
}
```

Writing Constructors

Read page 183 and answer the following questions:

11. What does it mean for an object to be instantiated? It is the moment you call the constructor, usually involves the "new" keyword (with the exception of Strings). The object is created in memory, its variables are intialized as per the constructor, and your object variable is assigned a pointer to that memory location.

12. What is a constructor method and what does it do? Involved in instantiation and initializes instance variables.

13. What two things are always true about constructor methods? Do not have a return type and always have the same name as the class.

13. What does it mean to "overload" a constructor method? You can overload a constructor by making multiple versions of it, each one taking a different set of parameters. This provides client code multiple options for how to instantiate an object of this class.

14. Do the problem "Review: Circle - part 2 of 4" on page 184

```
public Circle(double radius) {
        this.radius = radius;
}
```

Instance and Class Members

Read page 184-185 and answer the following questions:

15. What is the difference between an instance variable and a class variable? How do you declare a variable as an instance variable? How do you declare a variable as a class variable? Give an example of each from the Circle class. Class variables are declared with the static keyword, instance variables are not. The difference is that each instance of the class maintains its own independent copy of each instance variable, whereas there is only 1 copy of a class variable for all instances of that class. In the Circle class, radius is an instance variable whereas PI is a class variable.

16. What is the difference between an instance method and a class method? How do you declare a method as an instance method? How do you declare a method as a class method? Give an example of each from the Circle class. Instance methods operate on the state of an object and must be called from an instance of a class. Class methods are called from the class itself, rather than an object of the class, to perform a task. Area(), getRadius(), and setRadius() are all instance methods, whereas displayAreaFormula is a class method.

17. Do the problem "Review: Circle - Part 3 of 4" on page 185.

```
public static void displayAreaFormula() {
   System.out.println("The formula for the area of a circle is a=Pi*r*r");
}
```