Chapter 4 – Writing Classes – AP

Chapter Objectives

- Define classes that act like blue-prints for new objects, made of variables and methods.
- Explain encapsulation and Java modifiers.
- Explore the details of method declarations.
- Review method invocation and parameter passing.
- Explain and use method overloading.
- Learn to divide complicated methods into simpler, supporting methods.
- Describe relationships between objects.

Chapter Overview: The writing classes chapter is a gentle introduction to object oriented design. This chapter explores some of the concepts of how to break code into usable pieces as well as some of the important features of designing abstract data types and data storage classes. A solid understanding of this material is crucial if you are to move into more advanced concepts.

Multiple Choice: 4.1 – 4.10

True False: 4.1 – 4.10

Short Answer: 4.1 – 4.23

AP Multiple Choice: 4.1 – 4.6

AP Style Free Response: 4.1

Programming Projects – MPG, Library

Library

Create a class called Library. The project must meet the following criteria:

- A person can have no more than two books checked out at any given time.
- Create a constructor that initiates a new library account.
- Create any instance variables that may apply.
- Create 2 methods (overloading) called "checkout." One for checking out one book and one for checking out two books.
- Create 2 methods called "returnBook." One for returning one book, and one for returning two books.
- Create a method called "isCheckedOut" that will check to see if that person has checked out a particular book (by comparing its title name).
- Create a method called "toString" that shows all checked out books.
- Create a LibraryRunner class that tests all of the methods more than once, for at least two objects (people).

Project - MPG

The specifications of a class that models the fuel efficiency of a car would be:

Instance Variables

```
int myStartMiles;        // Starting odometer reading
int myEndMiles;          // Ending odometer reading
double myGallonsUsed;    // Gallons of gas used between the readings
```

Constructors

// Creates a new instance of a Car object with the starting
// odometer readings.

```
Car(int odometerReading)   //simulates buying a used car
```

Methods

// Simulates filling up the tank. Record the current odometer reading
//   and the number of gallons to fill the tank

```
public void fillUp(int odometerReading, double gallons)
```

// Calculates and returns the miles per gallon for the car.

```
public double calculateMPG()
```

Assignment:

1. Implement a Car class with the following properties.
    a. A Car keeps track of the start odometer reading, ending odometer reading, and the number of gallons used between readings.
    b. The initial odometer reading is specified in the constructor
    c. A method calculateMPG calculates and returns the mile per gallon for the car.
    d. A method fillup simulates filling up the tank at a gas station: odometerReading is the current odometer reading and gallons is the number of gallons that filled the tank. Save these values in instance variables.
    e. With this information, miles per gallon can be calculated. Write the method so that it updates the instance variables each time it is called (simulating another visit to the pumps). After each call, calculateMPG will calculate the latest miles per gallon.
2. Write a testing class with a main that constructs a car and calls fillUp and calculateMPG a few times.

    Sample usage would be `Car auto = new Car(15);  // initial odometer reading of 15 miles`

    ```
    auto.fillUp(250, 10);   // odometer is at 250 miles
                            // fillup with 10 gallons of gas
                            // repeat auto.fillup line for additional fillups

    System.out.println(auto.calculateMPG()) // print miles per gallon
    ```

3. Write a testing class with a main() that constructs a car and calls fillUp() and calculateMPG() a few times.

    A sample run of the program would give (values in ***bold italics*** represent input from the user):

    ```
    New car odometer reading: 15

    Filling Station Visit                         Filling Station Visit
             odometer reading: 250                         odometer reading: 455
             gallons to fill tank: 10                      gallons to fill tank: 12.5
             Miles per gallon: 23.50                       Miles per gallon: 16.40z
    ```