Chapter 6 Lab
Methods

Lab Objectives

- Be able to declare a new class
- Be able to write a constructor
- Be able to write instance methods that return a value
- Be able to instantiate an object
- Be able to use calls to instance methods to access a change the state of an object

Introduction

Everyone is familiar with a television. It is the object we are going to create in this lab. First we need a blueprint. All manufacturers have the same basic elements in the televisions they produce as well as many options. We are going to work with a few basic elements that are common to all televisions. Think about a television in general. It has a brand name (i.e. it is made by a specific manufacturer). The television screen has a specific size. It has some basic controls. There is a control to turn the power on and off. There is a control to change the channel. There is also a control for the volume. At any point in time, the television's state can be described by how these controls are set.

We will write the `Television` class. Each object that is created from the `Television` class must be able to hold information about that instance of a `Television` in fields. So a `Television` object will have the following attributes:

- **`manufacturer`**. The `manufacturer` attribute will hold the brand name. This cannot change once the television is created, so will be a named constant.
- **`screenSize`**. The `screenSize` attribute will hold the size of the television screen.
  This cannot change once the television has been created so will be a named constant.
- **`powerOn`**. The `powerOn` attribute will hold the value `true` if the power is on and `false` if the power is off.
- **`channel`**. The `channel` attribute will hold the value of the station that the television is showing.
- **`volume`**. The `volume` attribute will hold a number value representing the loudness (0 being no sound).

These attributes become **fields** in our class.

The `Television` object will also be able to control the state of its attributes. These controls become methods in our class.

- **`setChannel`**. The `setChannel` method will store the desired station in the `channel` field.

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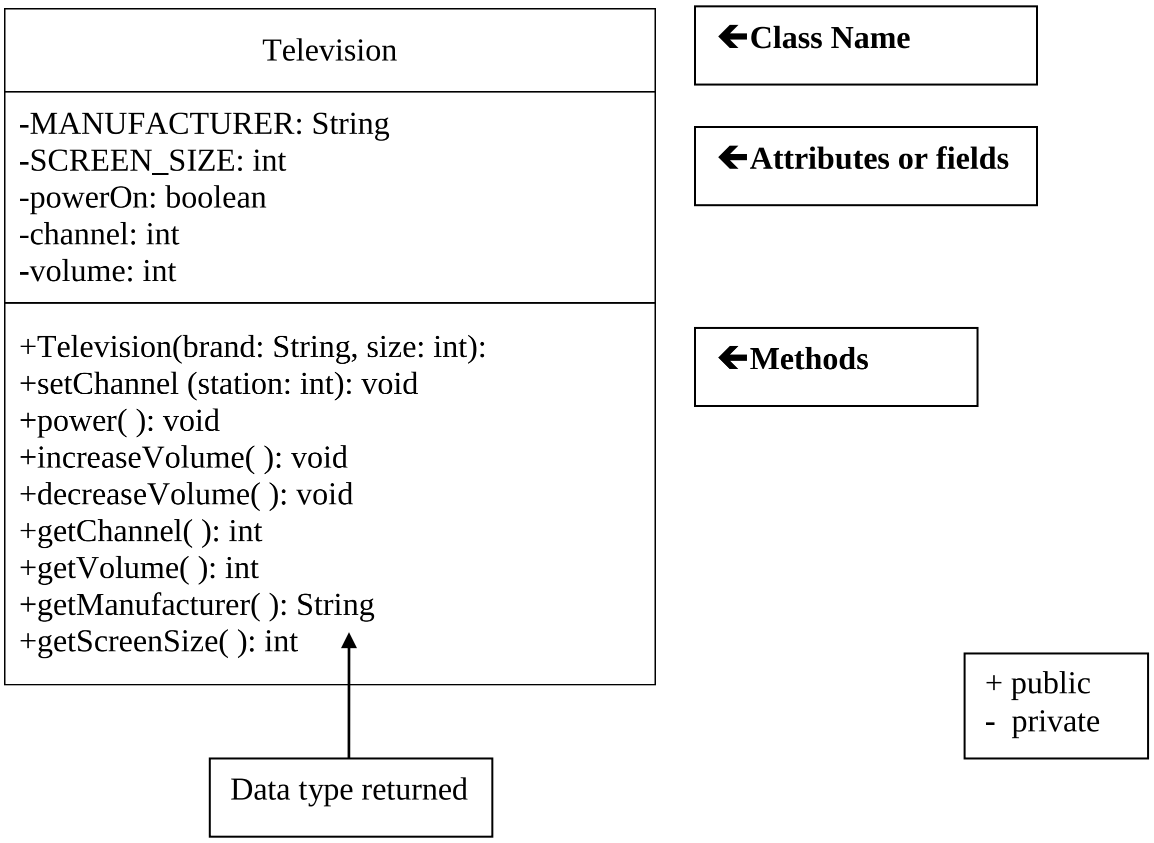
- **`power`**. The `power` method will toggle the power between on and off, changing the value stored in the `powerOn` field from `true` to `false` or from `false` to `true`.
- **`increaseVolume`**. The `increaseVolume` method will increase the value stored in the `volume` field by 1.
- **`decreaseVolume`**. The `decreaseVolume` method will decrease the value stored in the `volume` field by 1.
- **`getChannel`**. The `getChannel` method will return the value stored in the `channel` field.
- **`getVolume`**. The `getVolume` method will return the value stored in the `volume` field.
- **`getManufacturer`**. The `getManufacturer` method will return the constant value stored in the `MANUFACTURER` field.
- **`getScreenSize`**. The `getScreenSize` method will return the constant value stored in the `SCREEN_SIZE` field.

We will also need a constructor method that will be used to create an instance of a `Television`.

These ideas can be brought together to form a UML (Unified Modeling Language) diagram for this class, as shown below.



Television
-MANUFACTURER: String -SCREEN_SIZE: int -powerOn: boolean -channel: int -volume: int
+Television(brand: String, size: int): +setChannel (station: int): void +power( ): void +increaseVolume( ): void +decreaseVolume( ): void +getChannel( ): int +getVolume( ): int +getManufacturer( ): String +getScreenSize( ): int

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Task #1 Creating a New Class

1. In a new file, create a class definition called `Television`.
2. Put a program header (comments or documentation) at the top of the file
   ```
   // The purpose of this class is to model a television
   // Your name and today's date
   ```
3. Declare the 2 constant fields listed in the UML diagram.
4. Declare the 3 remaining fields listed in the UML diagram.
5. Write a comment for each field indicating what it represents.
6. Save this file as *Television.java*.
7. Compile and debug. Do not run.

Task #2 Writing a Constructor

1. Create a constructor definition that has two parameters, a manufacturer's brand and a screen size. These parameters will bring in information.
2. Inside the constructor, assign the values taken in from the parameters to the corresponding fields.
3. Initialize the `powerOn` field to `false` (power is off), the `volume` to 20, and the `channel` to 2.
4. Write comments describing the purpose of the constructor above the method header.
5. Compile and debug. Do not run.

Task #3 Methods

1. Define accessor methods called `getVolume`, `getChannel`, `getManufacturer`, and `getScreenSize` that return the value of the corresponding field.
2. Define a mutator method called `setChannel` that accepts a value to be stored in the `channel` field.
3. Define a mutator method called `power` that changes the state from `true` to `false` or from `false` to `true`. This can be accomplished by using the NOT operator (`!`). If the `boolean` variable `powerOn` is `true`, then `!powerOn` is `false` and vice versa.
   Use the assignment statement
   ```
         powerOn = !powerOn;
   ```
   to change the state of `powerOn` and then store it back into `powerOn` (remember assignment statements evaluate the right hand side first, then assign the result to the left hand side variable.
4. Define two mutator methods to change the `volume`. One method should be called `increaseVolume` and will increase the `volume` by 1. The other method should be called `decreaseVolume` and will decrease the `volume` by 1.
5. Write `javadoc` comments above each method header.

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6. Compile and debug. Do not run.

Task #4 Running the Application

1. You can only execute (run) a program that has a `main` method, so there is a driver program that is already written to test out your `Television` class. Copy the file *TelevisionDemo.java* (see Code Listing 3.1) from the Student CD or as directed by your instructor. Make sure it is in the same directory as *Television.java*.
2. Compile and run `TelevisionDemo` and follow the prompts.
3. If your output matches the output below, `Television.java` is complete and correct. You will not need to modify it further for this lab.

OUTPUT (boldface is user input)

```
A 55 inch Toshiba has been turned on.
What channel do you want? 56
Channel: 56 Volume: 21
Too loud! Lowering the volume.
Channel: 56 Volume: 15
```

Task #5 Creating another instance of a `Television`

1. Edit the `TelevisionDemo.java` file.
2. Declare another `Television` object called `portable`.
3. Instantiate `portable` to be a Sharp 19 inch television.
4. Use a call to the `power` method to turn the power on.
5. Use calls to the accessor methods to print what television was turned on.
6. Use calls to the mutator methods to change the `channel` to the user's preference and decrease the `volume` by two.
7. Use calls to the accessor methods to print the changed state of the portable.
8. Compile and debug this class.
9. Run `TelevisionDemo` again.
10. The output for Task #5 will appear after the output from above, since we added onto the bottom of the program. The output for Task #5 is shown below.

    OUTPUT (boldface is user input)

    ```
    A 19 inch Sharp has been turned on.
    What channel do you want? 7
    Channel: 7 Volume: 18
    ```

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Code Listing 6.1 (`TelevisionDemo.java`)

```
import java.util.Scanner;  // Needed for the Scanner class

/**
   This class demonstrates the Television class.
*/

public class TelevisionDemo
{
   public static void main(String[] args)
   {
      // Create a Scanner object to read from the keyboard
      Scanner keyboard = new Scanner (System.in);

      // Declare variables
      int station;         // The user's channel choice

      // Declare and instantiate a television object
      Television bigScreen = new Television("Toshiba", 55);

      // Turn the power on
      bigScreen.power();

      // Display the state of the television
      System.out.println("A " +
                         bigScreen.getScreenSize() +
                         " inch " +
                         bigScreen.getManufacturer() +
                         " has been turned on.");

      // Prompt the user for input and store into station
      System.out.print("What channel do you want? ");
      station = keyboard.nextInt();

      // Change the channel on the television
      bigScreen.setChannel(station);

      // Increase the volume of the television
      bigScreen.increaseVolume();

      // Display the the current channel and
      // volume of the television
      System.out.println("Channel: " +
                         bigScreen.getChannel() +
                         " Volume: " +
                         bigScreen.getVolume());
```

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```
        System.out.println("Too loud! Lowering the volume.");

        // Decrease the volume of the television
        bigScreen.decreaseVolume();
        bigScreen.decreaseVolume();
        bigScreen.decreaseVolume();
        bigScreen.decreaseVolume();
        bigScreen.decreaseVolume();
        bigScreen.decreaseVolume();

        // Display the the current channel and
        // volume of the television
        System.out.println("Channel: " +
                           bigScreen.getChannel() +
                           " Volume: " +
                           bigScreen.getVolume());

        System.out.println();   // For a blank line

        // HERE IS WHERE YOU DO TASK #5
    }
}
```

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