**Activity 1.1.3 Making Objects**

Introduction

In this activity, you will create many Song objects and add a new feature to your MediaLib project to store the cost of media items. Your app will be able to add up total cost, determine the average cost, and even apply discounts to some of your items. To do all of this, you will need some more knowledge about variables and different data types in Java.

Materials

* Computer with BlueJ and Android™ Studio
* Android™ tablet and USB cable, or a device emulator

Activity

Part I: One Class, Many Constructors

You have already created the Song class, but now you need to create many song objects. In this part of the activity, you will learn how to create constructors that makes it easier to instantiate objects in a class

1. Open your MediaLib project in BlueJ, and open the Song class in the editor.
2. When you created the title and rating instance fields, [**you *declared* them**](http://interactivepython.org/runestone/static/JavaReview/VariableBasics/declareVars.html). Using variables from your media library project, show an example of assignment dyslexia as described in the online resource.

Int price;

Correct: price = 10;

Wrong: 10 = price

1. Declare a new instance field called price in your Song class. Initialize it to 0.0 in the Song constructor. Check to be sure you made this a private instance field.
2. Provide an accessor and a mutator method for price.
   1. The accessor must return a data type that is the same as price, that is, a double.
   2. The mutator must also specify a double data type for its parameter.
3. In the main method (in your MediaLib class), use your newly written mutator and accessor methods to:
   1. Show the price of a song in the console.
   2. Assign a price for a song.
4. Back in your Song class, declare a boolean instance field called favorite.

Not all accessors and mutators need to use “get” or “set” in the method name. This is especially true when getting and setting boolean values.

1. Use the following mutator as a mutator of the favorite variable.

|  |  |
| --- | --- |
| 1  2  3 | public void addToFavorites() {  favorite = true;  } |

1. If you wanted to write one mutator method that could set the favorite variable to any boolean value, what might that method look like? Which version of the mutator for favorite do you prefer?

public void Favorites( boolean F ){

favorite = F;

}

The second one gives more flexibility but the first one is faster

Eventually, you will create a lot of songs. With your current code, it may seem tedious to create many songs and set all of the titles, ratings, and prices. An easier way to create them would be to use one constructor and no accessors or mutators. It is possible to do this with your code—you just need a new constructor.

In general, a class can have more than one constructor as long as those constructors are different from one another. For example, the following is how you might create or instantiate a Song object using a constructor that has a title and a price:

Song song1 = new Song("Respect", 1.29);

The constructor would look like:

|  |  |
| --- | --- |
| 1  2  3  4 | public Song(String title, double price) {  this.title = title;  this.price = price;  } |

The declaration for the constructor, public Song(String title, double price), has two variables passed to it. There is a special name for this type of variable—parameter. The first parameter is title and the second parameter is price.

In the body of the constructor, the this.title syntax refers to the instance field title. With the this.title = title syntax, you are setting the title *instance field* to the value that was passed in using the title *parameter*. Using the same name for parameters and instance fields is a common practice in Java constructors. The this. syntax identifies which title variable to reference.

1. Copy and paste the code for the new constructor into your Song class. Compile and fix any bugs.
2. Using the new constructor as a template, create a third Song constructor that has a rating as its third parameter. Be sure to assign this.rating to the new parameter in this third constructor. Compile and check for bugs.
3. Using the constructor that has three parameters, create new songs so that you have at least seven or eight songs in your library. The titles don’t really matter at this point, but use a price of 1.29 or .99 for different songs and vary the ratings.

Part II: Variables and Calculations

Java uses the standard mathematical operators to do calculations:

|  |  |
| --- | --- |
| + | Addition |
| - | Subtraction |
| \* | Multiplication |
| / | Division |

You will use these mathematical operators to do some calculations in this section.

1. First, calculate the total cost of all your songs. To do this, declare an accumulator variable. Name this double variable totalCost. Notice the unique way this variable is named. [**Learn about naming variables in the Java language**](http://interactivepython.org/runestone/static/JavaReview/VariableBasics/nameVars.html).
   1. What is this naming convention called where each word, or each word after the first, starts with an uppercase letter?

CamelCase

* 1. Why should totalCost have a data type of double?

Because it will be a number with a decimal point,

1. In addition to total cost, keep track of the number of songs you have. Create a variable called numSongs.

What data type do you think this variable should be? Compile and check for bugs.

Integer

1. [**Learn how to change variables in Java**](http://interactivepython.org/runestone/static/JavaReview/VariableBasics/changeVars.html). Every time you create a song, add the price to totalCost. Then add 1 to numSongs.
2. In a similar way, create a totalRatings variable and add all ratings of songs to it. Compile and check for bugs.

Part III: Calculation Errors

You have the total cost of all songs and the total number of songs. In this part of the activity, create a new way to find out the average cost of a song in your media library.

1. You can now calculate the average cost:
   1. Create a well-named variable to store the average cost.
   2. Divide the total cost by the number of songs you have and store the result in your new variable.
   3. Using System.out.println(…), display the total cost and the average cost of all songs.
2. The calculated cost may not be what you expected. For example, add this code fragment somewhere in your main method:

|  |  |
| --- | --- |
| 1  2  3  4  5 | // testing a calculation:  double testVal = 109.41;  double testResult = testVal / 10;  System.out.println("Testing Result:");  System.out.println(testResult); |

The result of this calculation is 10.940999999999999. This may seem strange, since 109.41 divided by 10 should be 10.941. Computers store all data in a binary language of 1’s and 0’s (which represents the state of electricity flowing or not flowing). Certain numbers in our decimal system cannot be represented accurately in the binary number system on a computer. Doing calculations with decimals causes round-off errors. For now, you can ignore this round-off error.

1. In the same way you calculated an average cost, calculate an average rating for all of your songs and display it. Check the calculation manually to see whether your average is correct. It may not be!
2. In addition to round-off errors, calculations in Java can be incorrect due to the data type of the variables. Division using integers or doubles can change the results. [**Learn how *casting* variables can solve this problem**](http://interactivepython.org/runestone/static/JavaReview/VariableBasics/casting.html).
3. To correctly calculate the average, the variable that stores the average rating (for example, aveRating) should be a double, totalRating should be an int, and numSongs should be an int.
4. Use a *cast* to get the correct result and check your calculations manually.

Part IV: The Modulus Operator

In addition to the standard math operators +, -, \*, and /, Java has a modulus operator represented by the % symbol. In this part of the activity, you will learn how to use the modulus operator to convert number of minutes into hours and minutes.

1. [**Learn how to use the modulus operator**](http://interactivepython.org/runestone/static/JavaReview/VariableBasics/operators.html). For now, skip the discussion of the Math class and its random method, but be sure to do the practice questions using the modulus operator.
2. Create an integer duration variable for your Movie class and mutator and accessor methods for it.
3. Create a new method for your Movie class that displays the duration of the movie in a user-friendly format in hours and minutes.
4. Test your new method using durations such as 97, 134, or 199.
5. Improve the output: Display all output on one line using another method of the System.out class called print(…) that does not print a new line. Use syntax similar to:

|  |  |
| --- | --- |
| 1 | System.out.print("Hours"); |

Part IV: Android Studio

Transfer the code you have written so far in BlueJ into a new app in Android Studio.

1. If you have not opened Android Studio before, complete the following:
   1. In Activity 1.1.1 Introduction to Android Studio; Part III.
   2. In Activity 1.1.2 Your First Class; Parts V, VI, and VII.
2. Open your MediaLib project for Android Studio and make the changes to your Song class that you made in BlueJ.
3. Use your new constructors to create Song objects (copy/paste from BlueJ) in your MainActivity showMedia method. For now, don’t show the output on your device; just make sure the new constructors and methods work by checking the output in logcat.
4. Make the same type of changes to your Movie and Book classes. Don’t forget about the mutators and accessors for price.
5. To test whether all is well, create at least one Movie and one Book using the new constructors in showMedia.

This process of writing code in a simple IDE and inserting it into code in a more complex IDE is known as *prototyping*. Prototyping can be very useful when you want to test out some code before placing it in a more complex system.

Part V: Android Studio Bugs

You have had some practice fixing bugs in BlueJ. Now, practice fixing bugs in Android Studio.

1. First, display line numbers in your editor window. Select **File** > **Settings…** In the search bar of the dialog that appears, enter line numbers. A Settings structure appears with Editor > General > Appearance. Click Appearance. Check the box to **Show line numbers** and then click **OK**.
2. Remove the semicolon at the end of a line of code anywhere in the showMedia method. What happens to your code?
3. Attempt to run your app. In the **Messages Gradle Build** panel at the bottom of the Android Studio window, you will see a message that states error: ';' expected.
4. Double-click the error message. Android Studio should place your cursor where the error occurs in your code. Fix the error.
5. Remove the last curly brace at the end of the file and compile. What error appears when you hover your mouse over the red squiggle? Fix the error.
6. Remove the closing double-quote in one of your strings. What error appears when you hover your mouse over the red squiggle? Fix the error.
7. Remove the first double-quote in one of your strings. Depending on what your string contains, you may get several different errors. What are the error(s) you see? As in BlueJ, the compiler tries to guess what you are trying to do in your code, and sometimes it guesses wrong. Fix the error.
8. Remove the period between outputText and append. What is the error that appears when you hover your mouse over the red text? Fix the error.
9. Remove the entire string in an append method call, so the line of text appears as outputText.append();.
   1. What is the error? This message states that the compiler cannot find an append() method call that has no parameters.
   2. On a new line of code, enter outputText. A context menu should appear. What are the two append methods you can use with this outputText object? (Notice that CharSequence is an Android-specific version of a String object and that you will only be using the first version of the append method in your apps.)
   3. Use the “undo” feature in Android Studio, <CTRL>z to undo your errors. If you undo too many times, use <CTRL><SHIFT>z to “redo”. These features are also available in the Edit menu.
10. Test your app to be sure you have fixed all errors.
11. Finally, you may notice “gray squiggles” throughout your code, especially in the Song, Movie, and Book classes. These are warnings, usually letting you know that a method or variable is unused. You can ignore them for now.

Conclusion

1. Why would you have more than one constructor for a class?
2. Answer the Free Response Question (FRQ) described in *1.1.3 FRQ1\_Book*.