Free Response

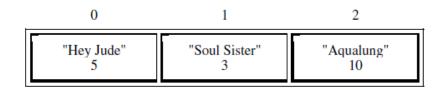
A music Web site keeps track of downloaded music. For each download, the site uses a **DownloadInfo** object to store a song's title and the number of times it has been downloaded. A partial declaration for the **DownloadInfo** class is shown below.

```
public class DownloadInfo
   /** Creates a new instance with the given unique title and sets the
    * number of times downloaded to 1.
    * @param title the unique title of the downloaded song
    */
   public DownloadInfo(String title)
   { /* implementation not shown */ }
   /** @return the title */
   public String getTitle()
   { /* implementation not shown */ }
   /** Increment the number times downloaded by 1 */
   public void incrementTimesDownloaded()
   { /* implementation not shown */ }
   // There may be instance variables, constructors, and methods that are not shown
}
The list of downloaded information is stored in a MusicDownloads object. A partial declaration for the
MusicDownloads class is shown below.
public class MusicDownloads
   /** The list of downloaded information.
    * Guaranteed not to be null and not to contain duplicate titles.
   private List<DownloadInfo> downloadList;
   /** Creates the list of downloaded information. */
   public MusicDownloads()
   { downloadList = new ArrayList<DownloadInfo>(); }
   /** Returns a reference to the DownloadInfo object with the requested
          title if it exists.
    * @param title the requested title
    * @return a reference to the DownloadInfo object with the
    * title that matches the parameter title if it exists in the list;
    * null otherwise.
    * Postcondition:
    * - no changes were made to downloadList.
    */
   public DownloadInfo getDownloadInfo(String title)
   { /* to be implemented in part (a) */ }
```

```
/** Updates downloadList with information from titles.
    * @param titles a list of song titles
    * Postcondition:
    * - there are no duplicate titles in downloadList.
    * - no entries were removed from downloadList.
    * - all songs in titles are represented in downloadList.
    * - for each existing entry in downloadList, the download count is
           increased by the number of times its title appeared in titles.
    * - the order of the existing entries in downloadList is not changed.
    * - the first time an object with a title from titles is added to
           downloadList, it is added to the end of the list.
    * - new entries in downloadList appear in the same order
           in which they first appear in titles.
    * - for each new entry in downloadList, the download count is equal to
           the number of times its title appeared in titles.
    */
   public void updateDownloads(List<String> titles)
   { /* to be implemented in part (b) */ }
   // There may be instance variables, constructors, and methods that are not shown.
}
```

a) Write the MusicDownloads method getDownloadInfo, which returns a reference to a DownloadInfo object if an object with a title that matches the parameter title exists in the downloadList. If no song in downloadList has a title that matches the parameter title, the method returns null.

For example, suppose variable webMusicA refers to an instance of MusicDownloads and that thetable below represents the contents of downloadList. The list contains three DownloadInfo objects. The object at position 0 has a title of "Hey Jude" and a download count of 5. The object at position 1 has a title of "Soul Sister" and a download count of 3. The object at position 2 has a title of "Aqualung" and a download count of 10.



The call webMusicA.getDownloadInfo("Aqualung") returns a reference to the object in position 2 of the list.

The call webMusicA.getDownloadInfo("Happy Birthday") returns null because there are no DownloadInfo objects with that title in the list.

```
Class information repeated from the beginning of the question

public class DownloadInfo

public DownloadInfo(String title)
public String getTitle()
public void incrementTimesDownloaded()

public class MusicDownloads

private List<DownloadInfo> downloadList
public DownloadInfo getDownloadInfo(String title)
public void updateDownloads(List<String> titles)
```

Complete method getDownloadInfo below.

```
/** Returns a reference to the DownloadInfo object with the requested title if it exists.
```

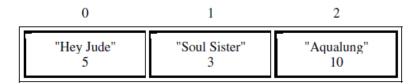
- * @param title the requested title
- * @return a reference to the DownloadInfo object with the
- * title that matches the parameter title if it exists in the list;
- * null otherwise.
- * Postcondition:
- * no changes were made to downloadList.

*/

public DownloadInfo getDownloadInfo(String title)

b) Write the MusicDownloads method updateDownloads, which takes a list of song titles as a parameter. For each title in the list, the method updates downloadList, either by incrementing the download count if a DownloadInfo object with the same title exists, or by adding a new DownloadInfo object with that title and a download count of 1 to the end of the list. When a new DownloadInfo object is added to the end of the list, the order of the already existing entries in downloadList remains unchanged.

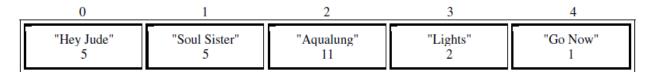
For example, suppose variable webMusicB refers to an instance of MusicDownloads and that the table below represents the contents of the instance variable downloadList.



Assume that the variable List<String> songTitles has been defined and contains the following entries.

```
{"Lights", "Aqualung", "Soul Sister", "Go Now", "Lights", "Soul Sister"}
```

The call webMusicB.updateDownloads (songTitles) results in the following downloadList with incremented download counts for the objects with titles of "Soul Sister" and "Aqualung". It also has a new DownloadInfo object with a title of "Lights" and a download count of 2, and another DownloadInfo object with a title of "Go Now" and a download count of 1. The order of the already existing entries remains unchanged.



```
Class information repeated from the beginning of the question

public class DownloadInfo

public DownloadInfo(String title)
public String getTitle()
public void incrementTimesDownloaded()

public class MusicDownloads

private List<DownloadInfo> downloadList
public DownloadInfo getDownloadInfo(String title)
public void updateDownloads(List<String> titles)
```

In writing your solution, you must use the getDownloadInfo method. Assume that getDownloadInfo works as specified, regardless of what you wrote for part (a).

Complete method updateDownloads below.

```
/** Updates downloadList with information from titles.
 * @param titles a list of song titles
 * Postcondition:
 * - there are no duplicate titles in downloadList.
 * - no entries were removed from downloadList.
 * - all songs in titles are represented in downloadList.
 * - for each existing entry in downloadList, the download count is increased by
          the number of times its title appeared in titles.
 * - the order of the existing entries in downloadList is not changed.
 * - the first time an object with a title from titles is added to downloadList, it
          is added to the end of the list.
 * - new entries in downloadList appear in the same order
          in which they first appear in titles.
 * - for each new entry in downloadList, the download count is equal to
          the number of times its title appeared in titles.
 */
public void updateDownloads(List<String> titles )
```