#### 2013 AP<sup>®</sup> COMPUTER SCIENCE A FREE-RESPONSE QUESTIONS

# COMPUTER SCIENCE A SECTION II

Time—1 hour and 45 minutes Number of questions—4 Percent of total score—50

# Directions: SHOW ALL YOUR WORK. REMEMBER THAT PROGRAM SEGMENTS ARE TO BE WRITTEN IN JAVA.

#### Notes:

- Assume that the classes listed in the appendices have been imported where appropriate.
- Unless otherwise noted in the question, assume that parameters in method calls are not null and that methods are called only when their preconditions are satisfied.
- In writing solutions for each question, you may use any of the accessible methods that are listed in classes defined in that question. Writing significant amounts of code that can be replaced by a call to one of these methods may not receive full credit.
- 1. 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.

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.
       Oparam 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.
```

Part (a) begins on page 4.

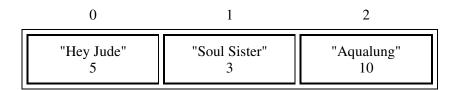
}

{

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(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 the table 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)
```

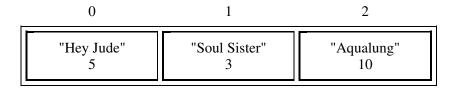
#### WRITE YOUR SOLUTION ON THE NEXT PAGE.

Complete method getDownloadInfo below.

Part (b) begins on page 6.

(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.

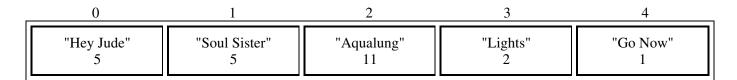
For example, suppose variable webMusicB refers to an instance of MusicDownloads and that the table below represents the contents of the instance variable downloadList.



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).

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Complete method updateDownloads below.

```
/** Updates downloadList with information from titles.
     Oparam 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 )
```