AP Computer Science A@Beijing National Day School

Lab 14: Sound

Due date: Thursday, April 4, 2019
Instructor: Mr. Alwin Tareen
Total Points: 15

Task Overview

- Implement a program that alters the amplitude of a sound wave.

Background

- Digital sounds can be represented as an array of integer values. For this question, you will write two unrelated methods of the `Sound` class.
- A partial declaration of the `Sound` class is shown below.

```
1  public class Sound
2  {
3      /** The array of values in this sound; guaranteed not to be null
4       */
5      private int[] samples;
6
7      public Sound(int[] clips)
8      {
9          samples = clips;
10     }
11
12     /** Changes those values in this sound that have an amplitude greater than limit.
13      * @return The number of values in this sound that this method changed.
14      */
15     public int limitAmplitude(int limit)
16     {
17         // to be implemented in part (a)
18     }
19
20     /** Removes all silence from the beginning of this sound.
21      * Silence is represented by a value of 0.
22      */
23     public void trimSilenceFromBeginning()
24     {
25         // to be implemented in part (b)
26     }
27 }
```

The `limitAmplitude()` Method

(a) The volume of a sound depends on the amplitude of each value in the sound. The amplitude of a value is its absolute value. For example, the amplitude of `-2300` is `2300` and the amplitude of `4000` is `4000`.

Write the method `limitAmplitude()` that will change any value that has an amplitude greater than the given `limit`. Values that are greater than `limit` are replaced with `limit`, and values that are less than `-limit` are replaced with `-limit`. The method returns the total number of values that were changed in the array.

For example, assume that the array samples has been initialized with the following values.

40	2532	17	-2300	-17	-4000	2000	1048	-420	33	15	-32	2030	3223

When the following statement is executed:

```
int numChanges = limitAmplitude(2000);
```

The value of `numChanges` will be `5`, and the array `samples` will contain the following values:

40	2000	17	-2000	-17	-2000	2000	1048	-420	33	15	-32	2000	2000

The `trimSilenceFromBeginning()` Method

(b) Recorded sound often begins with silence. Silence in a sound is represented by a value of `0`.

Write the method `trimSilenceFromBeginning` that removes the silence from the beginning of a sound. To remove starting silence, a new array of values is created that contains the same values as the original `samples` array in the same order, but without the leading zeros. The instance variable `samples` is updated to refer to the new array. For example, suppose the instance variable `samples` refers to the following array:

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value	0	0	0	0	-14	0	-35	-39	0	-7	16	32	37	29	0	0

After `trimSilenceFromBeginning()` has been called, the instance variable `samples` will refer to the following array:

Index	0	1	2	3	4	5	6	7	8	9	10	11
Value	-14	0	-35	-39	0	-7	16	32	37	29	0	0

Specification

The Information Box Which Includes Your Name[5 points]

- Type your English and Pinyin name into the `Author` field, where it says: `YOUR NAME HERE`

Alter the Amplitude of a Sound Wave [10 points]

- Write a `Java` program in the file `Sound.java` that alters the amplitude of a sound wave.
- You will write your solution in a class called: `public class Sound` right below the place where it says: `YOUR CODE HERE`.
- Make sure that you run your `Java` program, and ensure that it is free of errors.

Testing

- The file `SoundJUnitTest.java` contains the `JUnit` test cases which verify the correct functionality of the program.

Submission

- Submit your `Java` program by uploading it to the `Web-CAT` automated grading platform: `http://ec2-54-65-207-33.ap-northeast-1.compute.amazonaws.com:8080/Web-CAT/WebObjects/Web-CAT.woa`