2011 FRQ Question 1

(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 statement

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

is executed, 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

Complete method `limitAmplitude` below.

```
/** Changes those values in this sound that have an amplitude greater than limit.
 *  Values greater than limit are changed to limit.
 *  Values less than -limit are changed to -limit.
 *  @param limit the amplitude limit
 *         Precondition: limit ≥ 0
 *  @return the number of values in this sound that this method changed
 */
public int limitAmplitude(int limit)
```

(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

Complete method `trimSilenceFromBeginning` below.

```
/** Removes all silence from the beginning of this sound.
 *  Silence is represented by a value of 0.
 *  Precondition: samples contains at least one nonzero value
 *  Postcondition: the length of samples reflects the removal of starting silence
 */
public void trimSilenceFromBeginning()
```

```
public int limitAmplitude(int limit) {
  int changed = 0;
  for(int i = 0; i < samples.length; i++) {
    if(samples[i] < -limit) {
      samples[i] = -limit;
      changed++;
    }
    if(samples[i] > limit) {
      samples[i] = limit;
      changed++
    }
  }
  return changed;
}
```

```
}
```

```
PART B
public void trimSilenceFromBeginning() {
  int i = 0;
  for(i = 0; samples[i] == 0; i++) { }

  int[] newSamples = new int[samples.length - i];

  for(int j = 0; j < newSamples.length; j++) {
    newSamples[j] = samples[j + i];
  }

  samples = newSamples;
}
```

Project: https://github.com/victorkp/ap-java/blob/master/assigments/project-september-8.pdf?raw=true