AP Computer Science In-Class Assignment 2

Due date: Tuesday, November 8, 2016 at 4:15PM
Instructor: Mr. Alwin Tareen

Part A: Smoothing an Image by Averaging a 2-D Array of Integers

- A gray-level **image** is sometimes stored as an array of `int` values. The values represent the intensity of light at discrete positions in the image.
- An image may be smoothed by replacing each element with the average of the element's neighbouring elements.
- Consider the situation where the original values are in the two-dimensional array `pic`. Compute the smoothed array by performing the following calculations: Each value `smooth[row][col]` is the average of the following nine values:

```
pic[row-1][col-1] | pic[row-1][col] | pic[row-1][col+1]
------------------------------------------------------------
pic[row  ][col-1] | pic[row  ][col] | pic[row  ][col+1]
------------------------------------------------------------
pic[row+1][col-1] | pic[row+1][col] | pic[row+1][col+1]
```

- Assume that the image is rectangular, that is, all rows have the same number of columns. Use integer arithmetic for this, so that all the values in the array `smooth` are integers.
- The edges of the image are a problem, because only some of the nine values exist, that go into the calculation of the average. There are various ways to deal with this problem, but you should use an easy solution:
  - Leave all the edge locations in the smoothed image at zero. Only inside locations get an averaged value from the image.
  - This means that when you loop across a row, the start value should be `1`, and the terminating condition should be `pic.length-1`
  - When looping across columns, the start value should be `1`, and the terminating condition should be `pic[0].length-1`
- The array `image` containing the original gray-level image has been provided for you. Also, there are two for-each loops which perform the task of displaying the `image` array and `smooth` array. The output should look like the following:

```
image:
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 5 5 5 5 5 5 5 5 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
```

```
smooth:
0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 1 1 1 1 1 1 1 0 0
0 1 2 3 3 3 3 3 3 2 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 3 5 5 5 5 5 5 3 1 0
0 1 2 3 3 3 3 3 3 2 1 0
0 0 1 1 1 1 1 1 1 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0
```

- You are provided with the files `SmoothImage.java` and `SmoothImageJUnitTest.java` to develop this program.
- Write your code in the area indicated by `// YOUR CODE HERE`.
- On your `BlueJ` project window, you should see a button labelled `Run Tests`. Press this button to run the `JUnit` tests.
- You should see a `BlueJ: Test Results` window pop up. If everything is correct, you should see a green bar that indicates that your code has passed the `JUnit` tests. If your program is incorrect, you will see a red bar. You can click on the method name to get more information about the problem. Otherwise, just click on the `Close` button, and you can go ahead and upload this program to `Web-CAT`.

Part B: Submission

- Submit your Java program `SmoothImage.java` by uploading it to the Web-CAT automated grading platform.