

## Data Structures

### Lab1: Recursive Algorithms

You are asked to implement a program that takes a text file containing the snapshot of a set of objects (called blobs), and compute the number of pixels, center of mass for each blob on the screen. A blob pixel on the given file is indicated by a 'X' char, and a non-blob pixel is indicated by a space char. A blob is defined to be a set of connected pixels, where a pixel (r, c) is connected only to its 4 neighbors. That is, the pixel (r, c) can be connected to its LEFT neighbor (r, c-1), its RIGHT neighbor (r, c+1), its UP neighbor (r-1, c) and its DOWN neighbor (r+1, c). Your job is to find all pixels that make up each blob and also compute the blob's center of mass, which is defined to be the average of the coordinates making up the blob in the x and y coordinates.

Consider the following example file: blob1.txt (This file is given to you).

```
10 20
XXXX   XXXXX
XXXX   XXXXX
XXXX   XXXXX
      XXXXX
    X   XXXXX
  XXX
XXXXX
XXXXXXX
XXXXXXXXX
XXXXXXXXXXX
```

The first row of the file contains the number of rows (10) and the number of columns (20) in this file. As you can see there are 3 blobs in the file: Two rectangles and a triangle. Your program will first prompt the user for the name of this file. It will then read this file and create a two-dimensional array to store the pixels (either an 'X' indicating a pixel belonging to a blob, or a space character indicating that the pixel is empty). You are then asked to implement a recursive algorithm that takes this 2D array and compute the number of pixels and the center of mass for each blob.

Your program must first print the input matrix on the screen and then print the result. An example output for the above input file is given below. Your output must match our output:

```
D:\Home\ClassNotes\2003-2016-ESTU-ClassNotes\2013-Fall\BIM213\Projects\Solutions\BlobCounter\Debug\BlobCounter.exe
Enter the filename: blobs1.txt
01234567890123456789
+-----+
0|xxxx      xxxxx|0
1|xxxx      xxxxx|1
2|xxxx      xxxxx|2
3|          xxxxx|3
4|          x   xxxxx|4
5|          xxx      |5
6|          xxxxx     |6
7|          xxxxxxxx  |7
8|          xxxxxxxxxx|8
9|          xxxxxxxxxx|9
+-----+
01234567890123456789

+-----+
| BLOB | NoOfPixels | CoM Row | CoM Column |
+-----+
| 1 | 12 | 1.00 | 1.50 |
| 2 | 25 | 2.00 | 17.00 |
| 3 | 36 | 7.47 | 9.00 |
+-----+
```

As you can see from our output given above, you must first print the input file in a nicely formatted table. Then you must process the input and print statistics for each blob: The blob number, the number of pixels making up the blob, and its center of mass (CoM) in the y and x coordinates, that is, CoM Row and CoM Column.

Submission

You must implement your project in C++. Put all of your code inside main.cpp and submit this file. Make sure that you test your code with other test files. When grading your projects, we will use other test files.

You may do the project in groups of 2 or 3. Make sure that only one group member submits the project. Write the name and ID of both group members inside comments at the top of main.cpp

P.S. Do not cheat. Cheaters will fail the class.