University of New Brunswick, Faculty of Computer Science

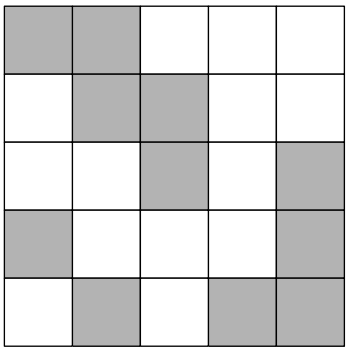
CS 2263 Assignment 4 Winter 2018

Due Date: Friday, March 16, 11:59 pm

Purpose: Practice with recursion and dynamic allocation of 2D array

Counting Pixels

Write a C program to count pixels belonging to an object in a photograph. The data are in a two-dimensional grid of cells, each of which may be empty (value 0) or filled (value 1). The filled cells that are connected form a blob (an object). Two cells are connected if they are adjacent horizontally, vertically or diagonally (i.e. each cell has 8 neighbours). This figure shows a grid with three blobs.



Requirements

1. Your program must include a recursive function that takes the `i,j` coordinate of a cell and returns the number of cells in the blob to which the indicated cell belongs. This function returns 0 if the coordinate is not on the grid (out of bounds) or the cell is empty. To avoid counting a filled cell more than once, mark a cell once you have counted it.
2. Your main function must take the number of rows and columns of your grid as command-line parameters. It then dynamically allocates a two-dimensional array, with all elements stored contiguously (i.e., don't allocate rows individually), and sets each cell as empty or filled using the `rand()` pseudorandom number generator (using `srand(time(NULL))` to set the

seed). The program displays the grid, then asks the user repeatedly for the coordinates of a cell. The size of the blob is indicated, as well as the relative size of the blob compared to the number of filled cells. Here's an example of execution:

```
$./countPixels 6 6

1 1 1 0 0 1
1 0 0 0 1 0
0 0 1 1 0 1
0 0 1 1 0 1
1 1 1 1 1 1
0 1 1 0 0 0
enter coordinate i,j (non-numeric to quit): 0,0
Blob size: 4 (20.0 % of all 1's)
enter coordinate i,j (non-numeric to quit): 0,5
Blob size: 16 (80.0 % of all 1's)
enter coordinate i,j (non-numeric to quit): 0,6
invalid coordinate
enter coordinate i,j (non-numeric to quit): 4,4
Blob size: 16 (80.0 % of all 1's)
enter coordinate i,j (non-numeric to quit): q
$
```

Your program must perform the error checking indicated in this example: check that the coordinate is in bounds and quit the loop if two integers (separated by a coma) aren't input.

Submit a code listing and a record of your testing, showing cases where the selected cell is out of bounds, is empty, and is filled (for several positions in blobs of different sizes).

To pass in the assignment: Create a single pdf document with your code listing and terminal session. Also include the source file separately. Submit these files to the Desire2Learn dropbox. Name your documents `LastName_FirstName_As4.pdf` and `LastName_FirstName_As4.zip` (`LastName` and `FirstName` are of course substituted with your last and first name).