

## Coding Problem

### Expectations

Do your best to solve the following problem in a language of your choosing. While having a correct answer is ideal, even partially correct answers will be considered. We will schedule a review session together to go over your solution and talk through the problem and any challenges you may have faced. There are intentional ambiguities in the problem provided. Please do not contact us trying to clarify these ambiguities, simply make a decision on your own and move forward. We can discuss your choices in the review meeting.

### Background

Given as input a two-dimensional array of values, we wish to automatically generate a list of the subregions of interest, defined as all contiguous groups of adjacent cells for which the signal is greater than a threshold value  $T$ . Cells that are touching at corners are considered to be (diagonally) adjacent cells.

For example, consider the 6 x 6 array shown in the following diagram. If we have threshold value  $T = 200$ , then the three gray-shaded subregions identified are the subregions of interest. The subregions of interest can be identified by listing the X,Y coordinates of the cells they contain. In the example, these would be:

- Lower-left sub-region:  $\{(1,1)\}$
- Middle "W-shaped" sub-region:  $\{(3,3), (3,2), (4,2), (4,1), (5,1)\}$
- Upper-right sub-region:  $\{(5,4), (5,5)\}$

5	5	0	25	5	145	250
4	0	5	95	115	165	250
3	15	5	175	250	185	160
2	5	0	145	250	245	140
1	115	210	60	5	230	220
0	0	80	45	95	170	145
	0	1	2	3	4	5

$X$

## Problem

1) Write a function that takes two inputs:

- a two-dimensional array of values
- a threshold  $T$

and determines this output:

- A list of the subregions of interest
- For each subregion of interest, an (X,Y) value pair that identifies the center of mass of the subregion. (There will be one X,Y coordinate pair for each subregion.) Define "center of mass" for a given sub-region to be the average position, expressed in X,Y coordinates, of the cells in that subregion, each cell's location being weighted by that cell's signal value.

**Please include any make or project files necessary to compile your solution.**

2) Be prepared to discuss your preferred strategy for testing the function you defined in part 1, including how you might automate the testing, how you would select test input cases (feel free to enumerate example cases).

Good Luck!