



# Level 3: Detect connected areas

Given a set of luminosity values, we need to determine the connected areas.

**Input:** nrOfRows nrOfColumns 2D-image-data

nrOfRows = number of rows of the 2D image

nrOfColumns = number of cols of the 2D image

2D-image-data = list of luminosity-values (with nrOfRows x nrOfColumns elements)

luminosity-value = number from 0 .. 7 (0 .. dark ; 7 .. bright)

**Output:** Input of level 2 (i.e. image with connected areas of same brightness)



# Example (see also next page)

Input: 12 19 0 0 0 0 ...

```
00440000000000000000
00444000000000000000
00004000000000055000
00000000000005555500
0006602200005555500
0666022220005555000
0066002220000550000
0066602220011110000
0066602220111110000
00000000000111110000
00000000000000000000
00000000000000000000
```

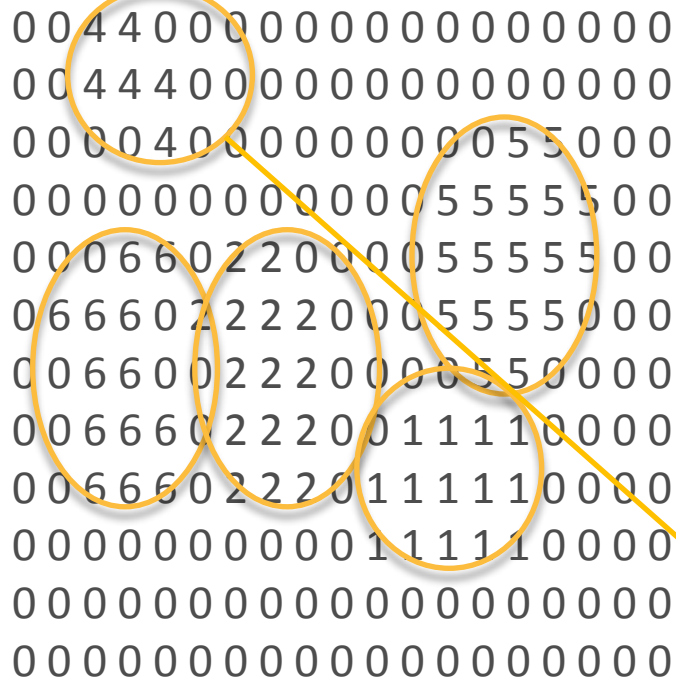
Output: 12 19 0 0 0 0 ...

```
00110000000000000000
00111000000000000000
00001000000000022000
00000000000002222200
0003304400002222200
0333044440002222000
0033004440000220000
0033304440055550000
0033304440555550000
00000000000555550000
00000000000000000000
00000000000000000000
```

5 1 4 2 5 3 6 4 2 5 1

# C Example (continued)

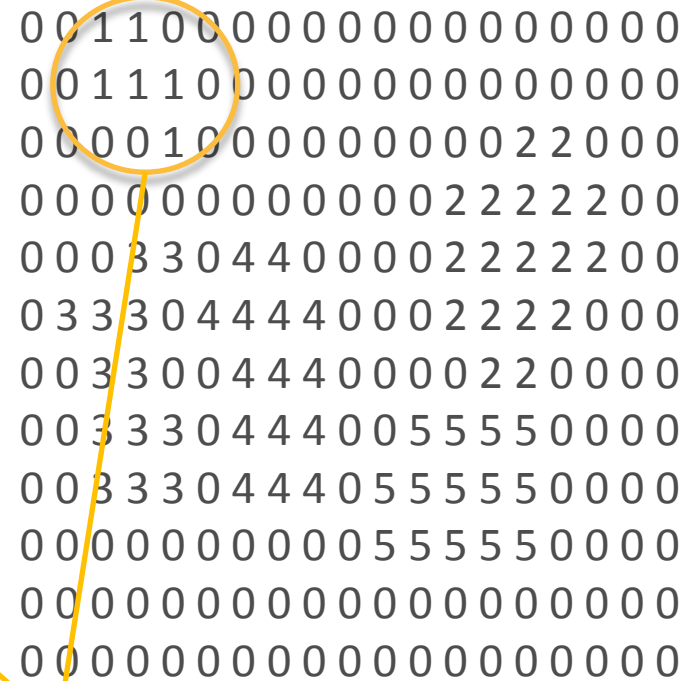
Input: 12 19 0 0 0 0 ...



A 12x12 grid of numbers. The first row is 00440000000000000000. The second row is 00444000000000000000. The third row is 0000400000000000055000. The fourth row is 00000000000000005555500. The fifth row is 000660222000055555500. The sixth row is 066602222000055555000. The seventh row is 006600222000005500000. The eighth row is 006660222001111100000. The ninth row is 006660222011111100000. The tenth row is 000000000001111100000. The eleventh row is 000000000000000000000. The twelfth row is 000000000000000000000. Five orange ellipses mark connected areas: one around the '4's in row 1, one around the '5's in row 3, one around the '6's in row 5, one around the '2's in row 5, and one around the '1's in row 8. A yellow arrow points from the '1's in row 8 to the '1' in the output sequence.

```
00440000000000000000
00444000000000000000
0000400000000000055000
00000000000000005555500
000660222000055555500
066602222000055555000
006600222000005500000
006660222001111100000
006660222011111100000
000000000001111100000
000000000000000000000
000000000000000000000
```

Output: 12 19 0 0 0 0 ...



A 12x12 grid of numbers. The first row is 00110000000000000000. The second row is 00111000000000000000. The third row is 000010000000000022000. The fourth row is 000000000000002222200. The fifth row is 0003304400002222200. The sixth row is 0333044440002222000. The seventh row is 0033004440000220000. The eighth row is 0033304440055550000. The ninth row is 0033304440555550000. The tenth row is 0000000000555550000. The eleventh row is 0000000000000000000. The twelfth row is 0000000000000000000. Two orange ellipses mark connected areas: one around the '1's in row 1 and one around the '5's in row 8. A yellow arrow points from the '5's in row 8 to the '5' in the output sequence.

```
00110000000000000000
00111000000000000000
000010000000000022000
000000000000002222200
0003304400002222200
0333044440002222000
0033004440000220000
0033304440055550000
0033304440555550000
0000000000555550000
0000000000000000000
0000000000000000000
```

5 1 4 2 5 3 6 4 2 5 1

The ellipses mark connected areas.  
Give each connected area an ID