CPSC 231 Tutorial #17

michael-hung.ca/teaching

Reminders

TODAY

Quiz 9

THURSDAY

Quiz 9 Review

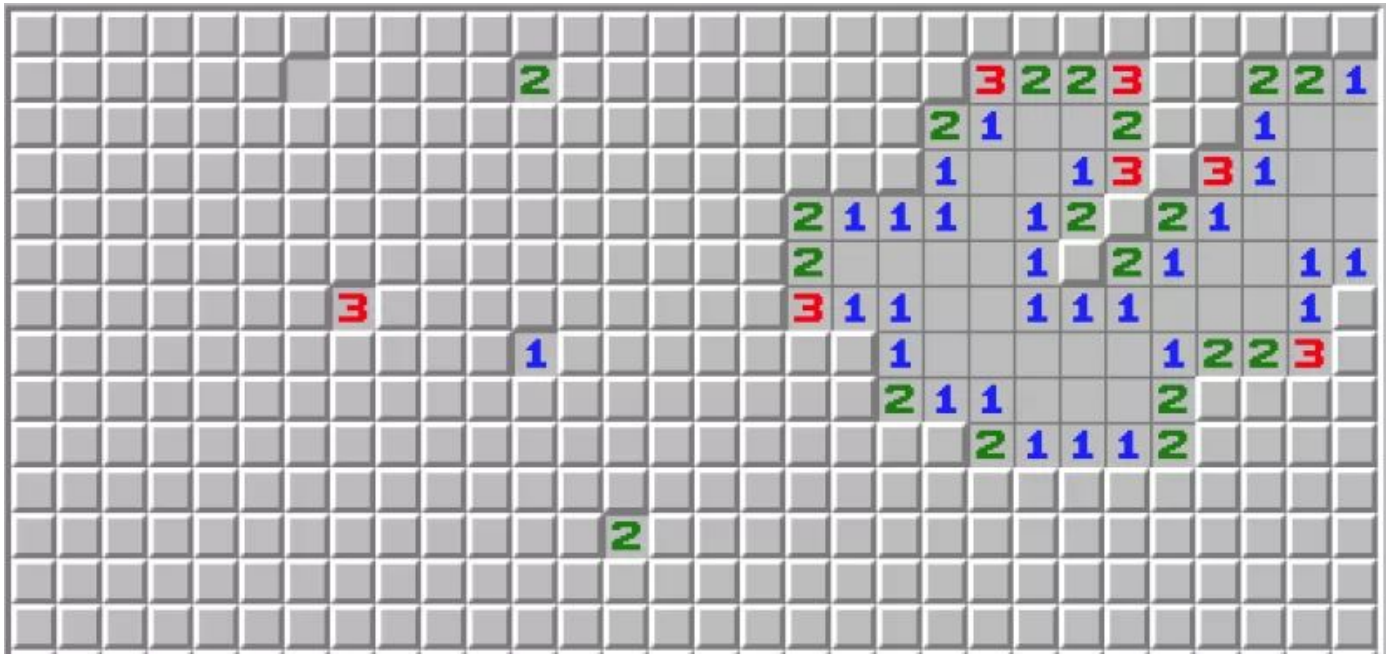
FRIDAY

Assignment 5 Individual Component

NEXT WEEK

Reading Week! No classes!

Minesweeper



Decomposing the Problem

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1. Graphics
2. Game State
3. Game Logic

Minesweeper Graphics

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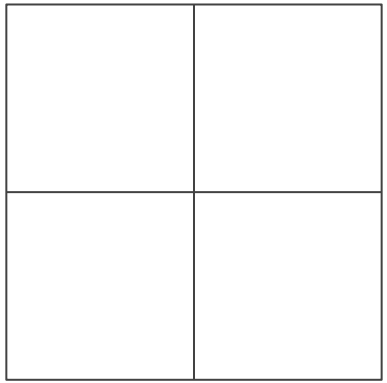
1. Draw a **Board**
2. Reveal a **Tile**
3. Draw a **Mine**
4. Draw a **Number**

Drawing the Board

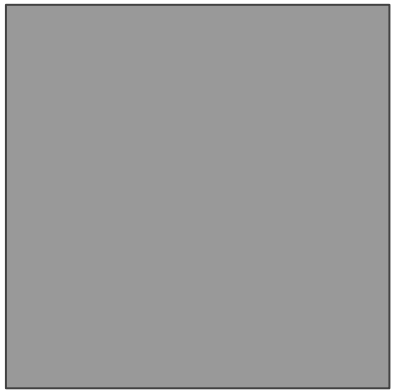
Based on width x and height y, draw a grid separating the board into x*y squares.



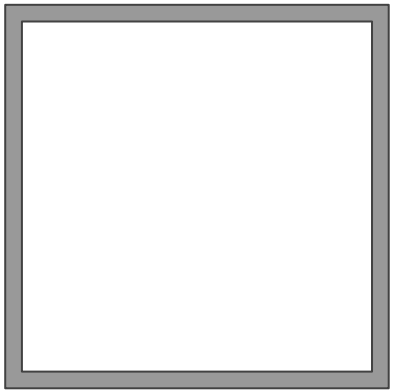
```
Width:   2        Vertical lines:      3
Height:  2        Horizontal lines:    3
```

Revealing a Tile

Start with a dark colour as the default state, then draw a lighter colour on top of it.



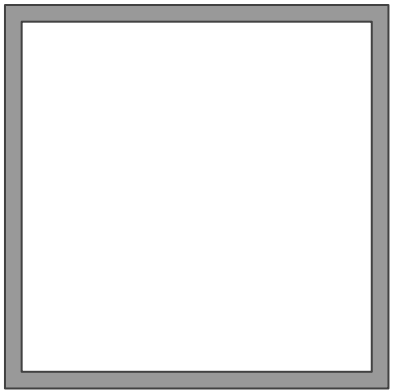
unrevealed



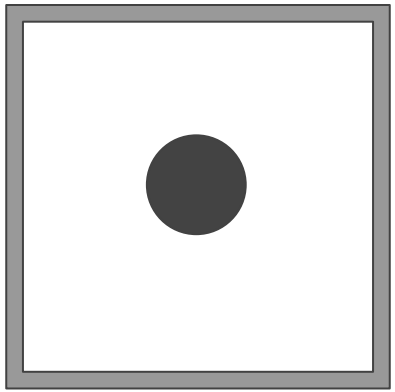
revealed

Drawing a Mine or Number

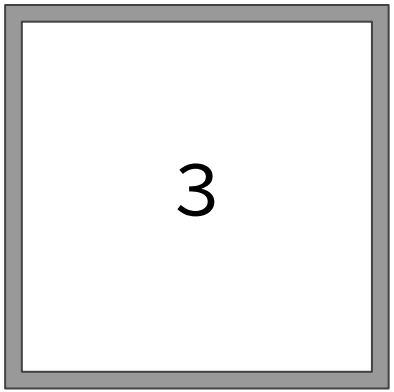
A tile can hide a mine, be blank, or display the number of adjacent mines (blank if 0). Draw on top of a revealed tile.



blank



mine



number

Minesweeper Game State

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1. Setup the board
2. Identify a tile
3. Mines adjacent to a tile
4. Is the game won?

Setting up the Board

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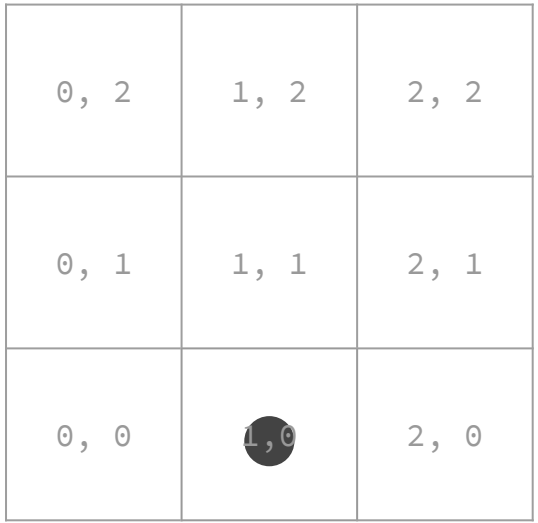
1. Generate a 2D array to hold the value of each tile.

e.g.



Fill the array with 0's and 1's; 0 for an empty tile and 1 for a mine.

```
[[0, 0, 0],
 [1, 0, 0],
 [0, 0, 0]]
```

Identifying a Tile

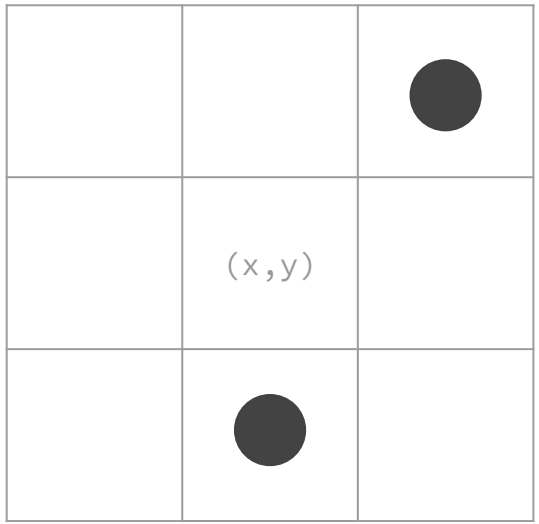
To make it easier to check a tile, make three functions that check if a given index [x][y] is **0** (empty), **1** (a mine), or **2** (a value used for how we'll reveal adjacent tiles later).

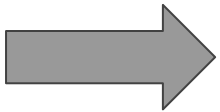
```
isClear(x, y)    isMine(x, y)    isRevealed(x, y)
```

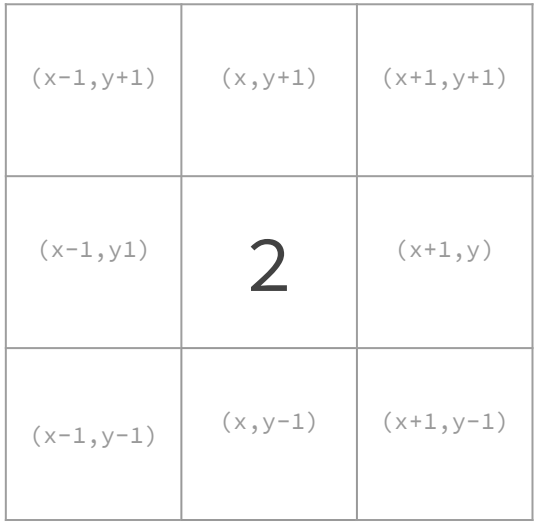
In all three, make sure to handle if x or y are out of bounds. Treat out-of-bound tiles as if they are **already revealed** and are **not mines**.

Number of Mines Near a Tile

For each tile revealed, if there is a mine within 1 tile away (diagonals included), display the number of mines.







Winning Condition

Constantly check the board to see if the game is won.

The game is won when **all non-mine tiles are revealed**.

i.e. there are no 0's in the 2D array.

Minesweeper Game Logic

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1. Click on a tile
2. If tile is mine, game is lost
3. Reveal all tiles touching the clicked tile unless touching a mine

Clicking a Tile

When we click on a tile, we need to get that tile's position.

1. Set X and Y scales according to board dimensions. So a 3x5 board has X scale from 0 to 3 and Y scale from 0 to 5
2. Clicking on a tile, then, will give us two floats: mouseX and mouseY. Taking the floor will give us the index of the tile.

Clicking a Tile

0, 2	1, 2	2, 2
0, 1	1, 1	2, 1
0, 0	1,0	2, 0

Take this 3x3 board. Clicking somewhere on the middle tile might give something like:

(1.632…, 1.497…)

Simply taking the floor of each gives us the index [1][1]

Losing Condition

---

1. Use a boolean variable, **gameover**, initialized to False, to keep a While loop running the game.
   a. When **gameover** is **True**, the loop breaks.

2. When you reveal a tile, check if it is a mine by calling **isMine**(*x*, *y*).
   a. If it is a mine, set **gameover** to **True**.

3. Similarly, a variable can be made for the winning condition.

Revealing all Touching Tiles

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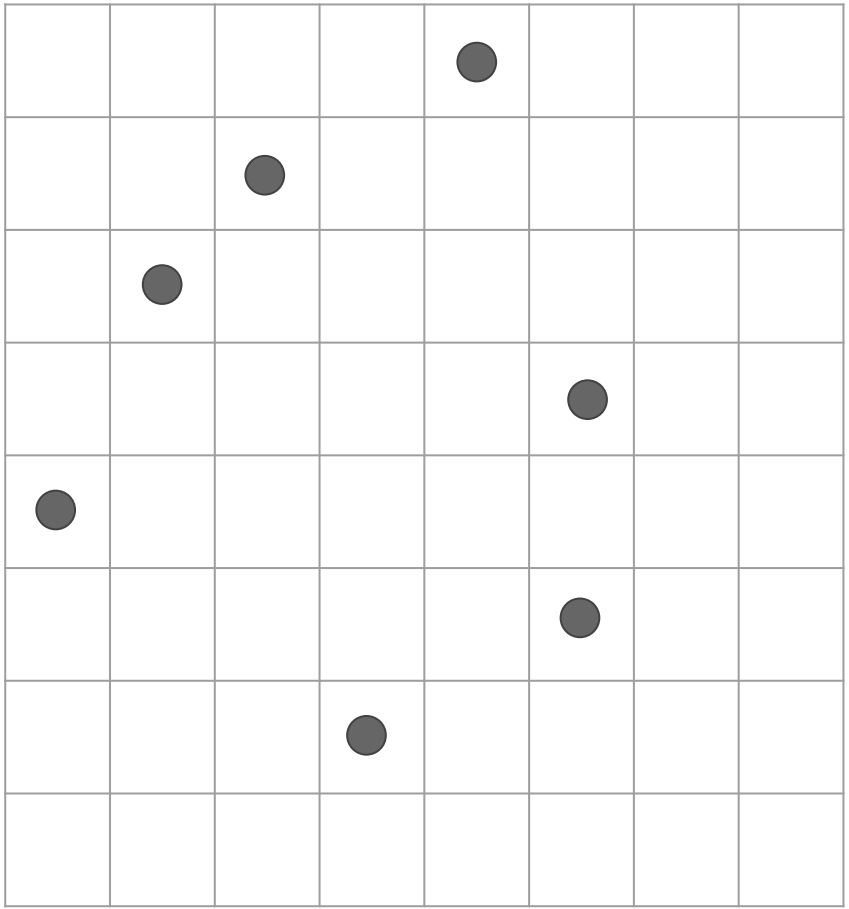
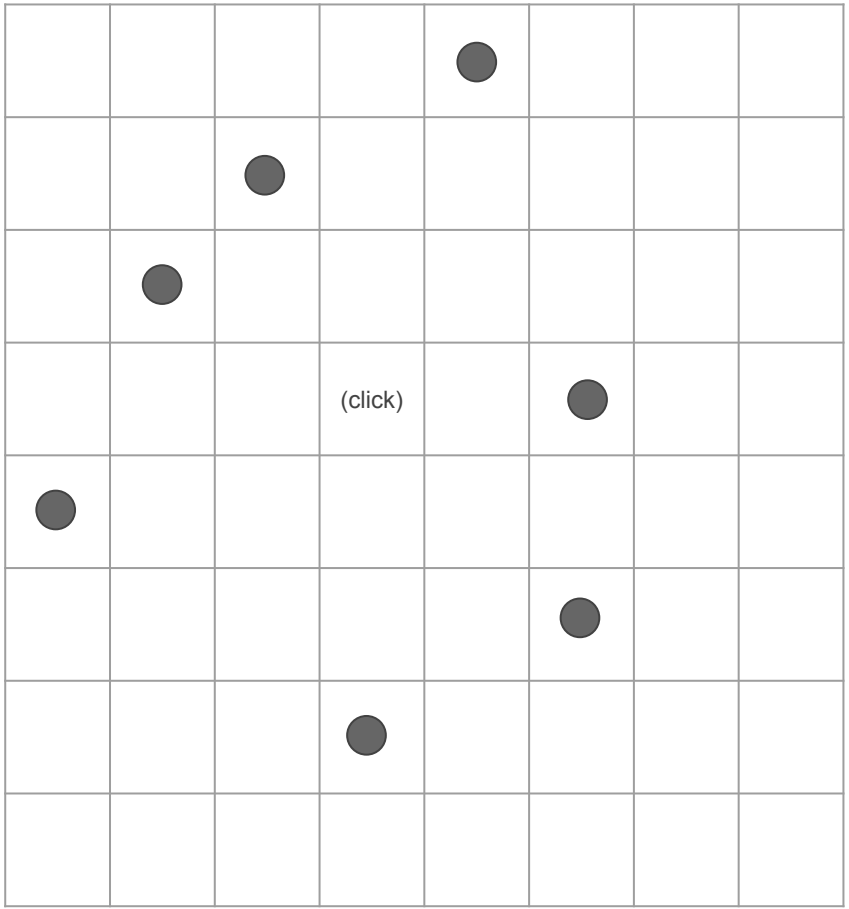
1. If you click on a tile that is not touching a mine, all tiles touching it that **are not a mine** are revealed.
2. If that tile is **also** not a mine *and* is also **not touching** a mine, then reveal all of *its* touching tiles.



Revealed
To Be Checked
Mine



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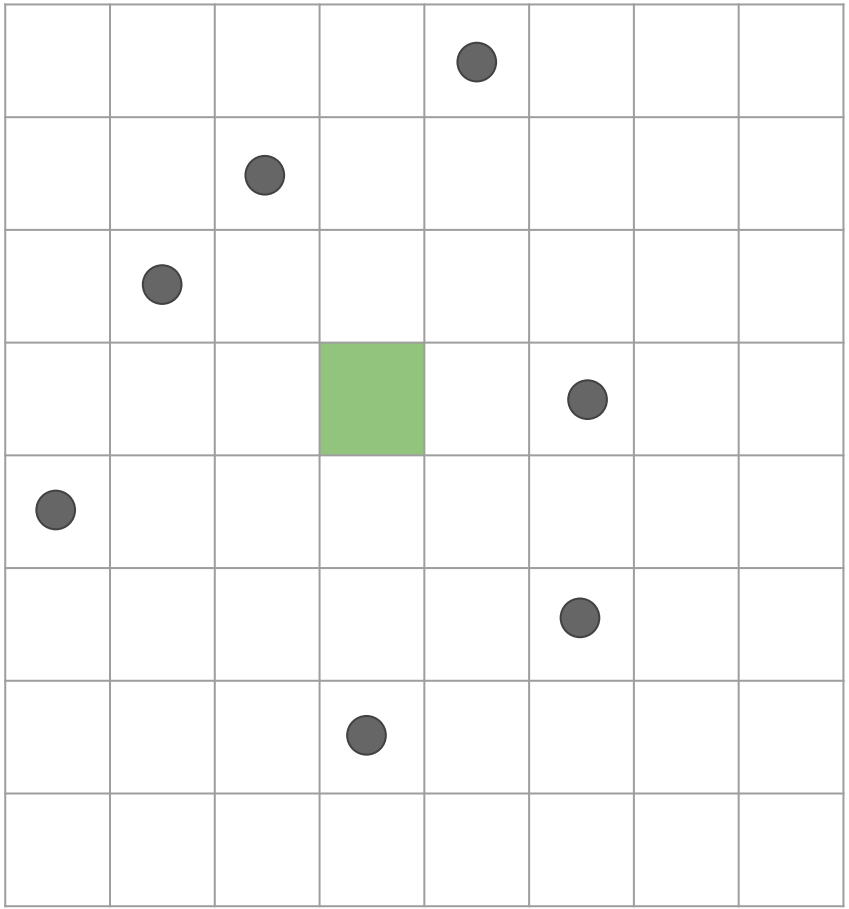

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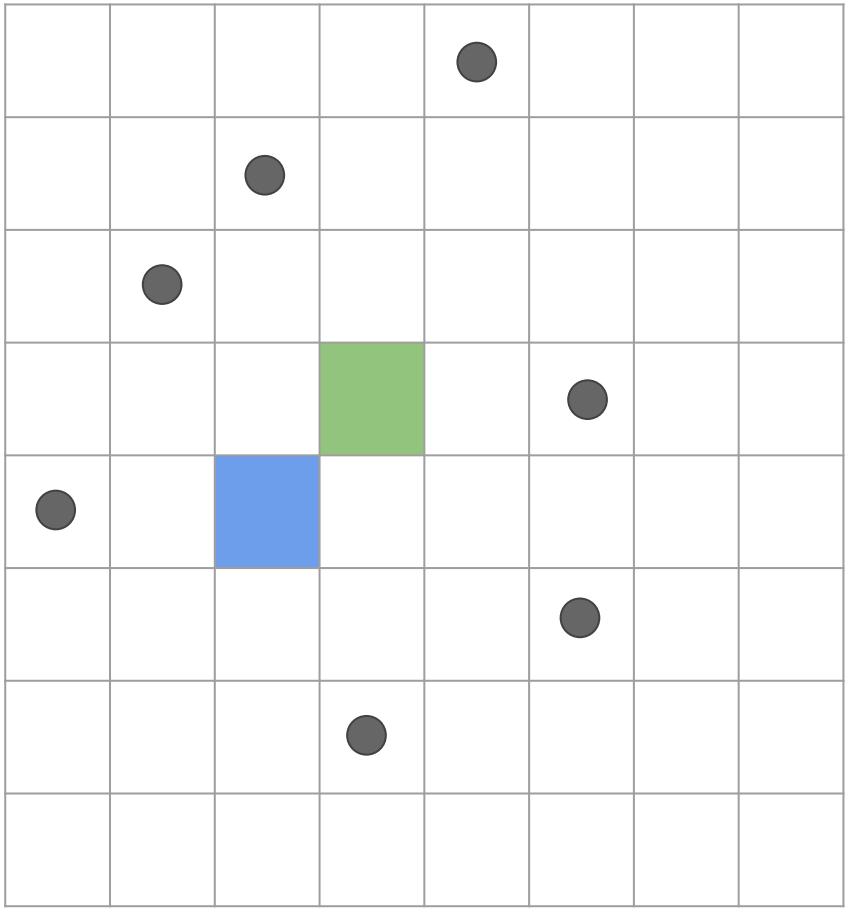
Mine



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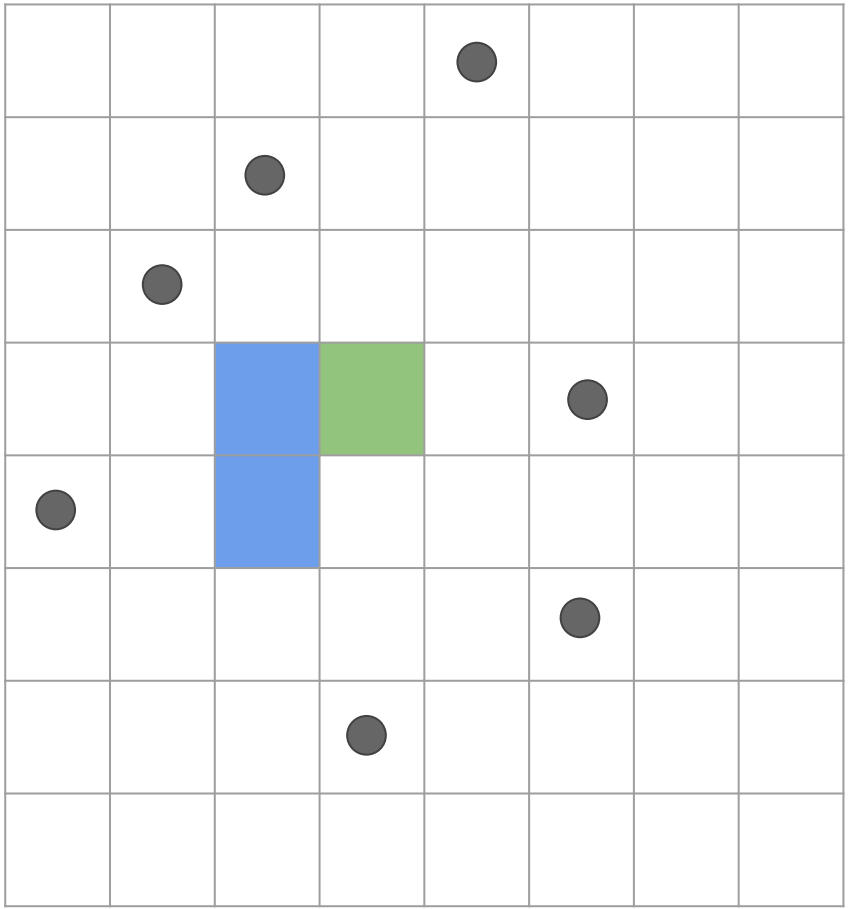

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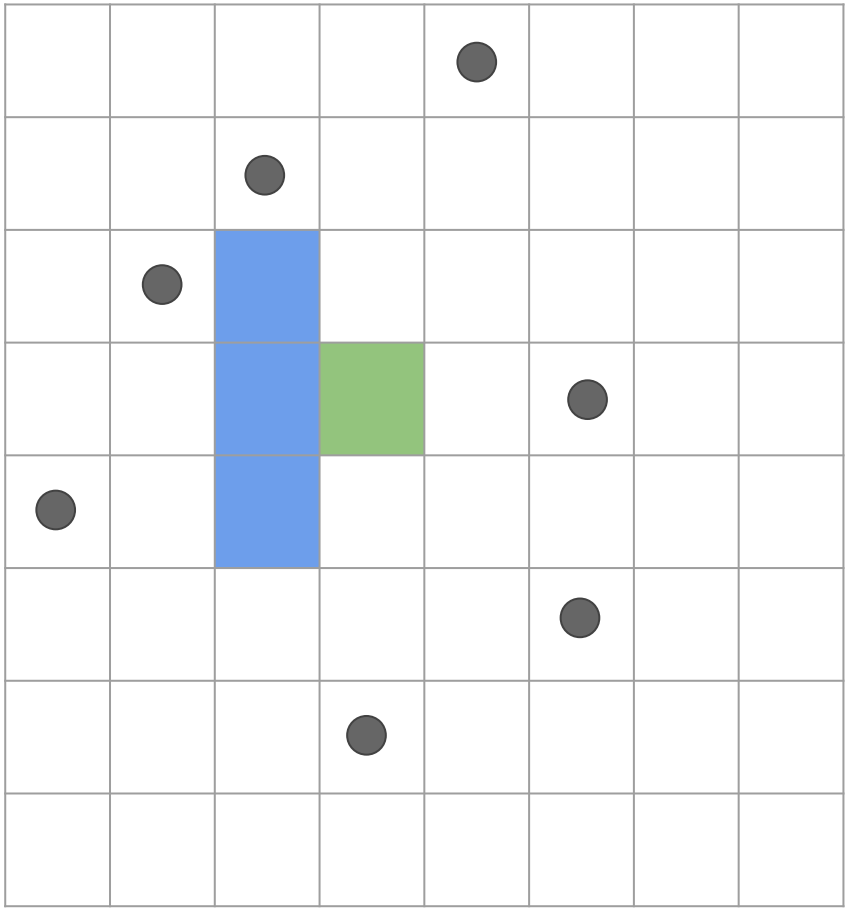

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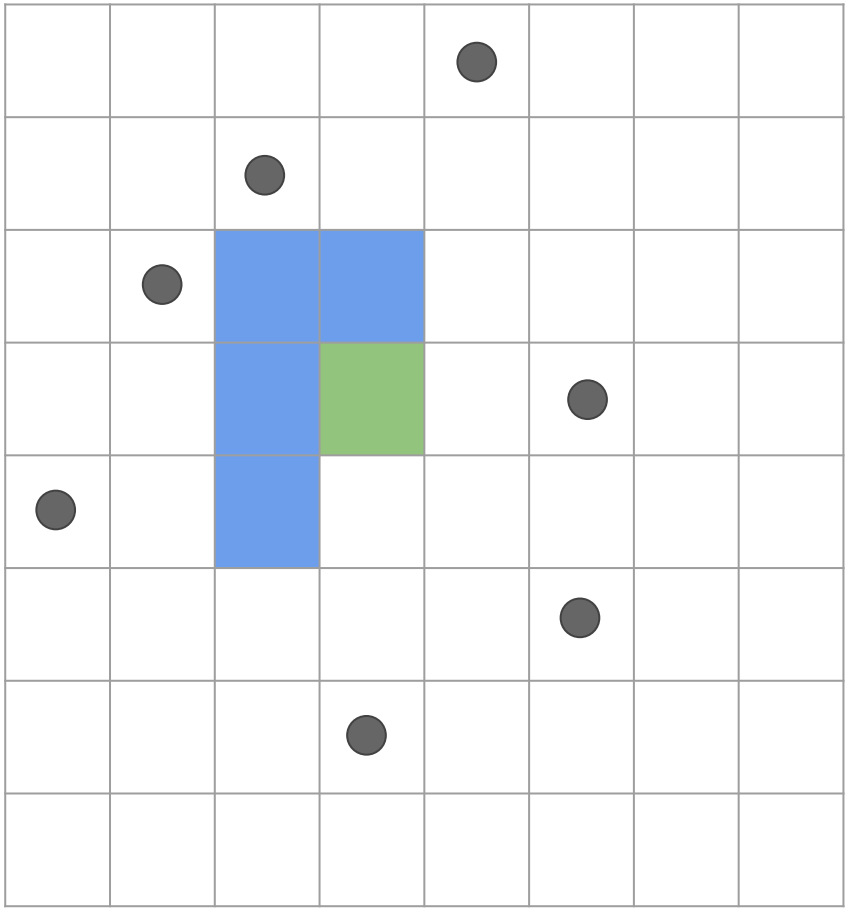

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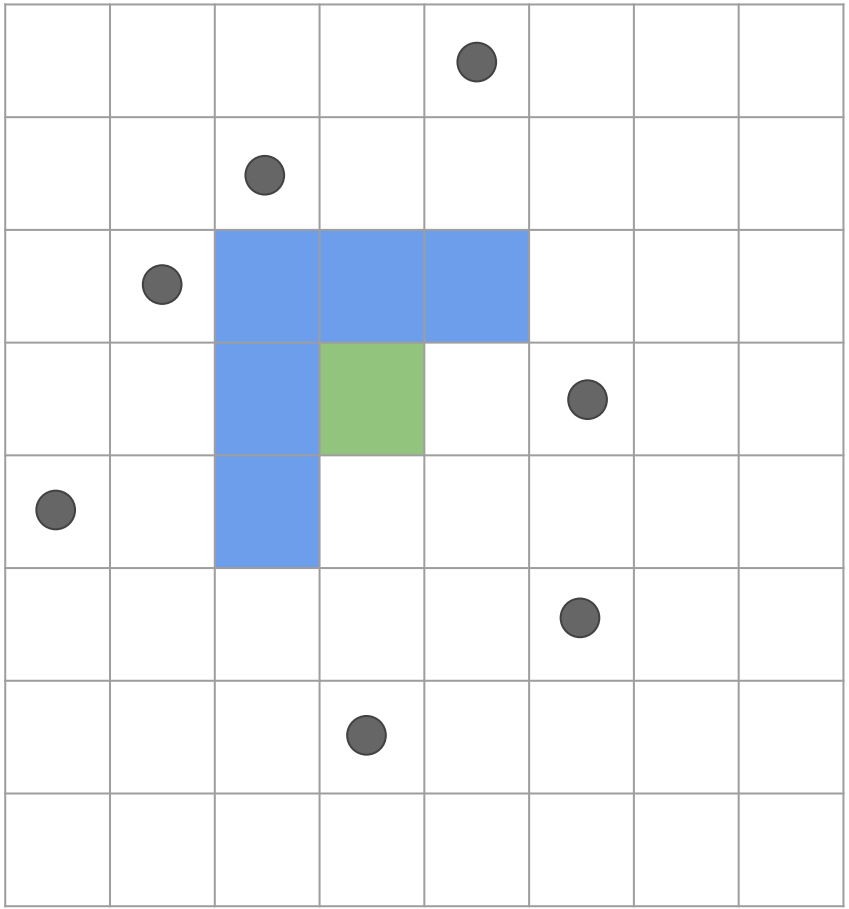

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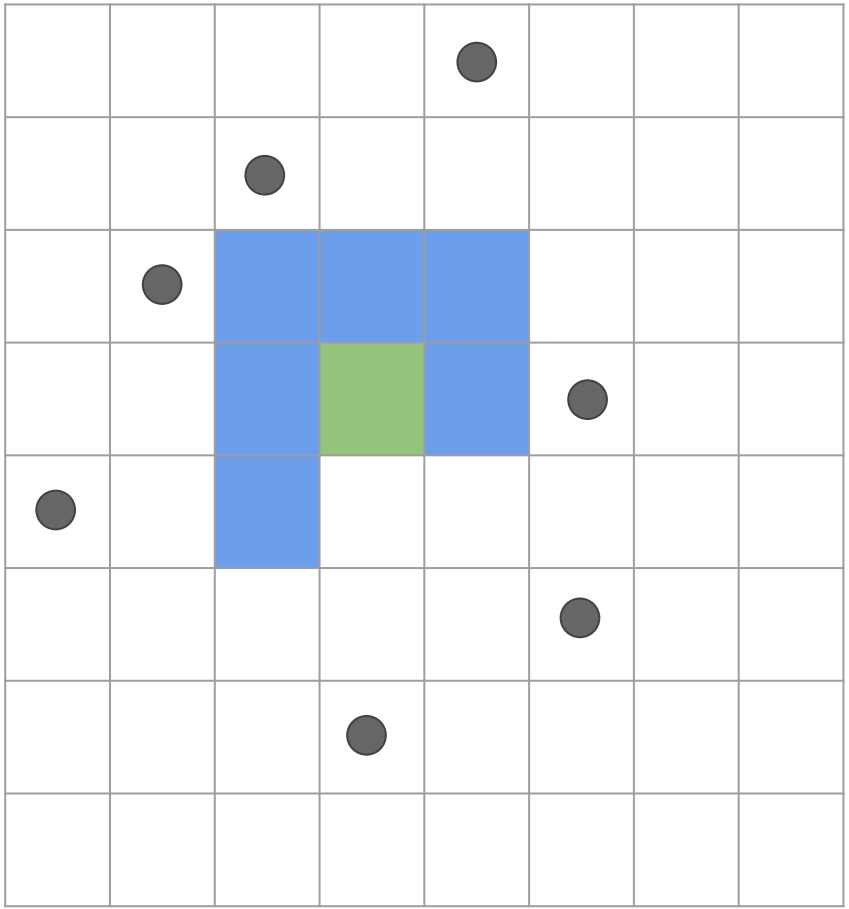

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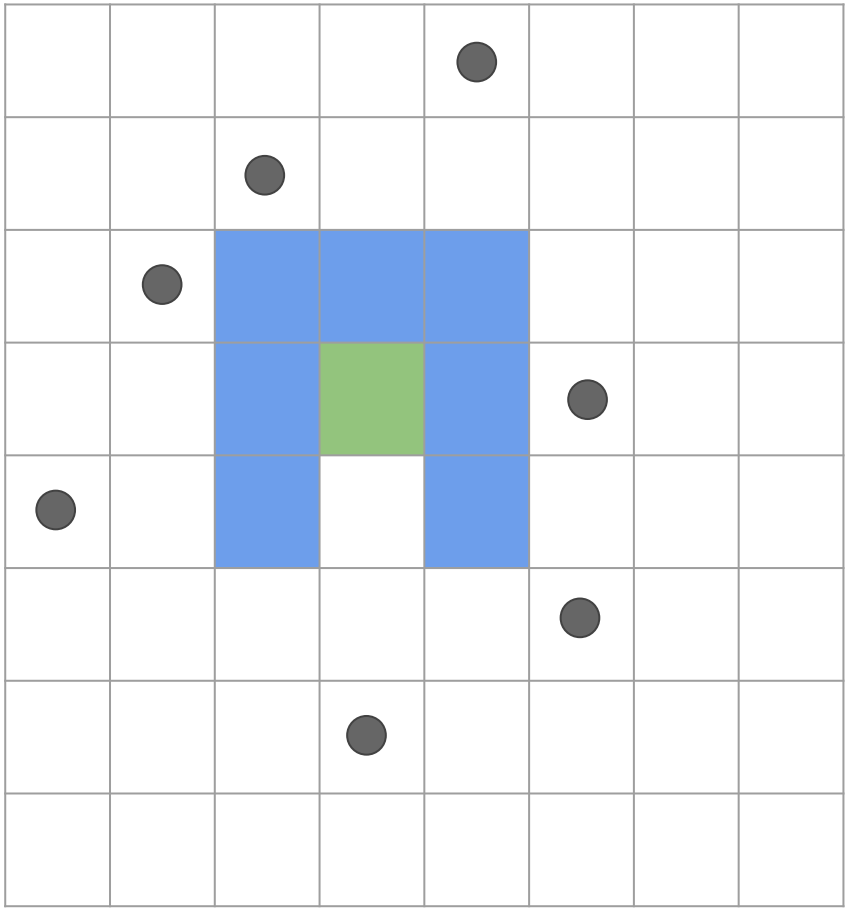

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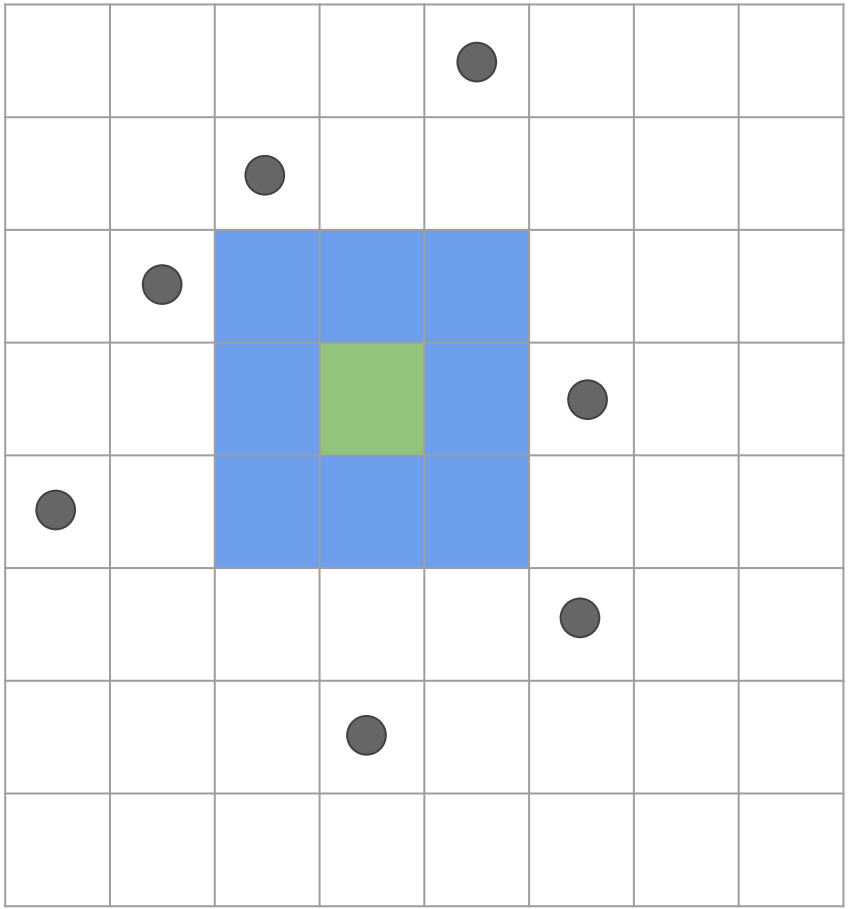

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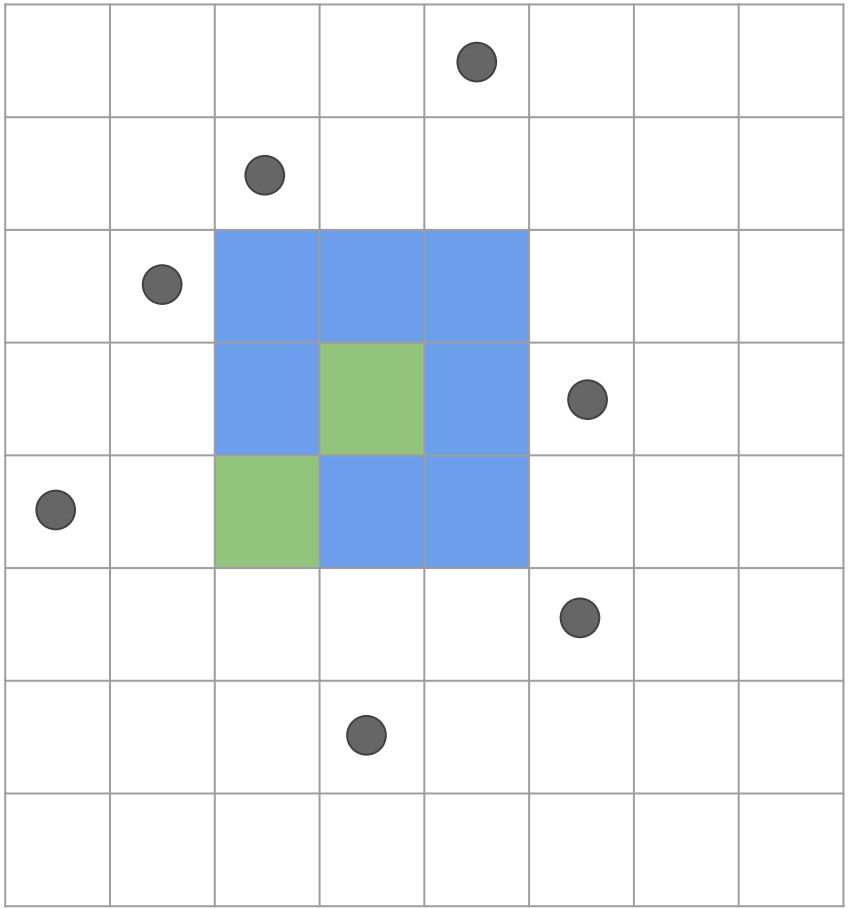

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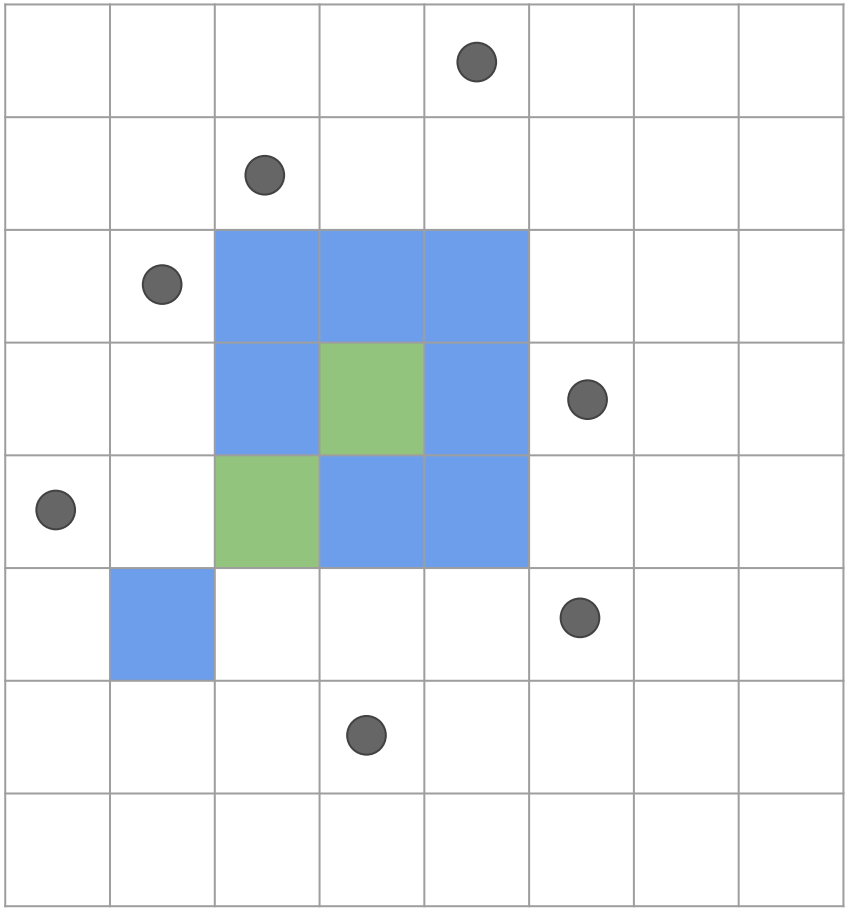

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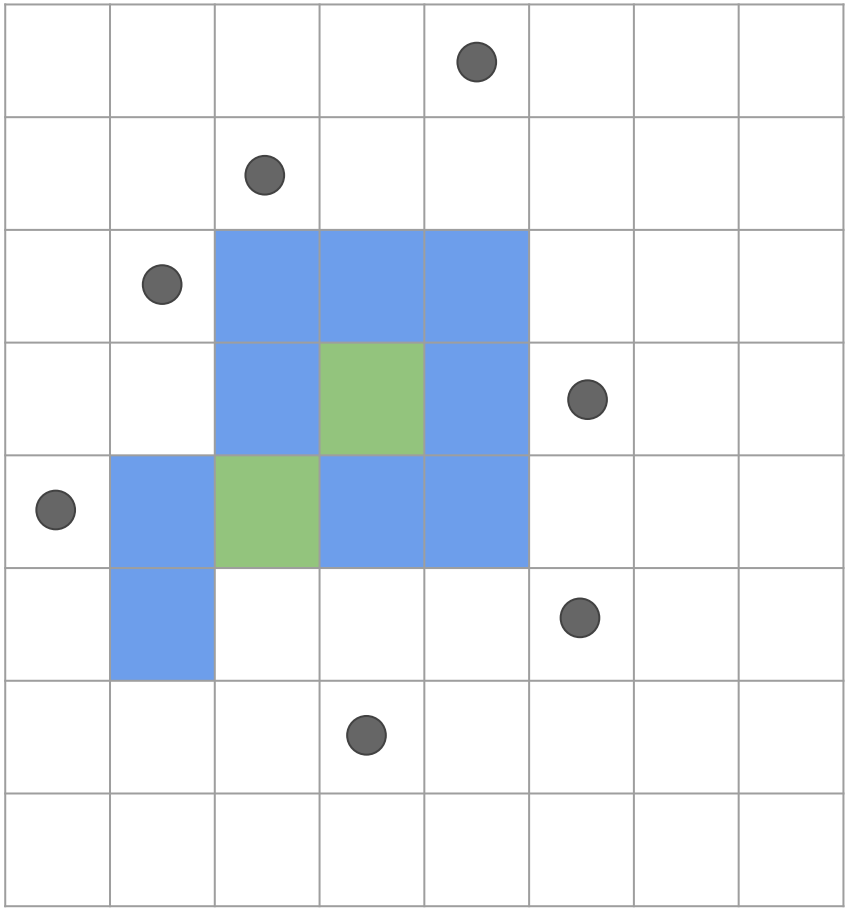

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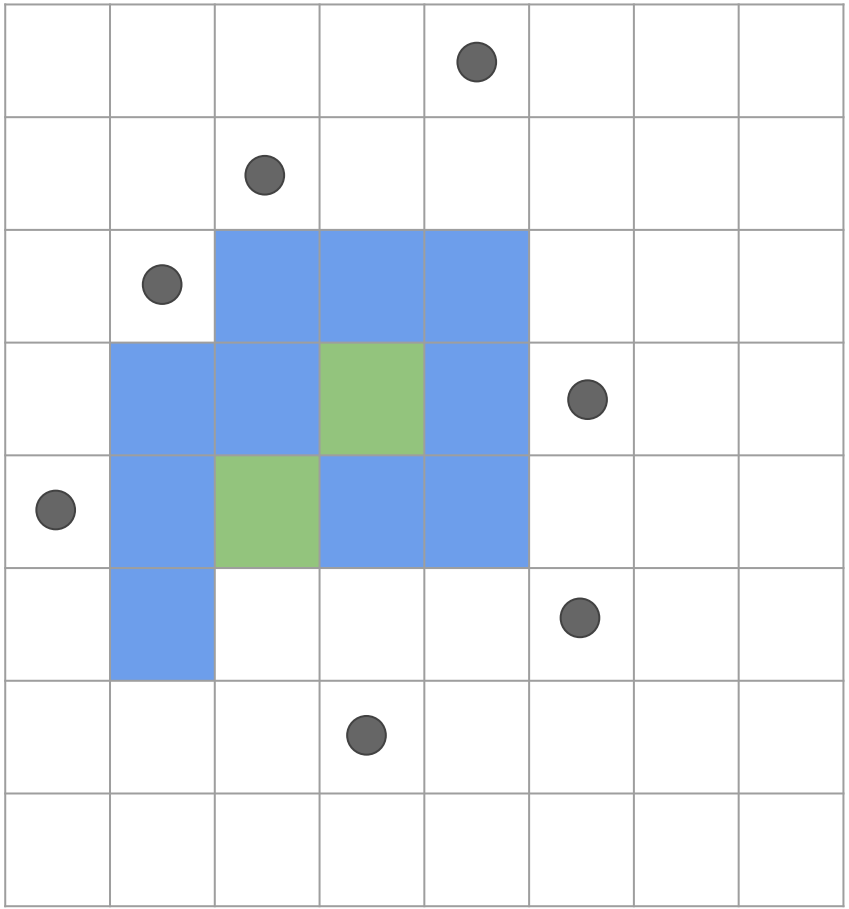

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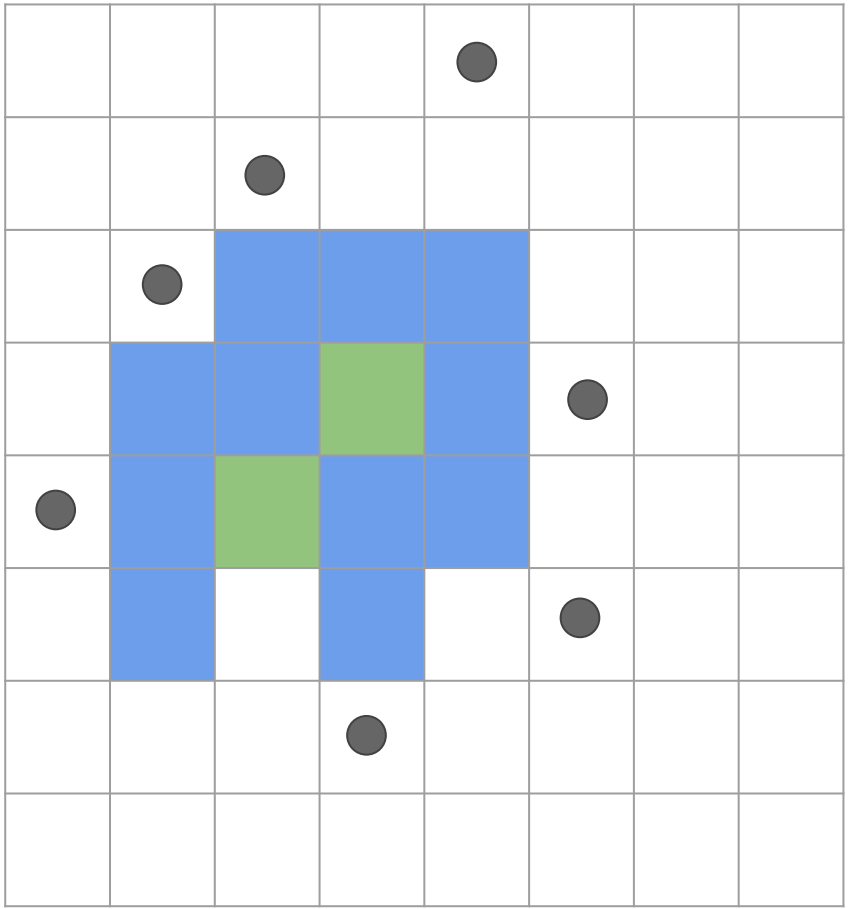

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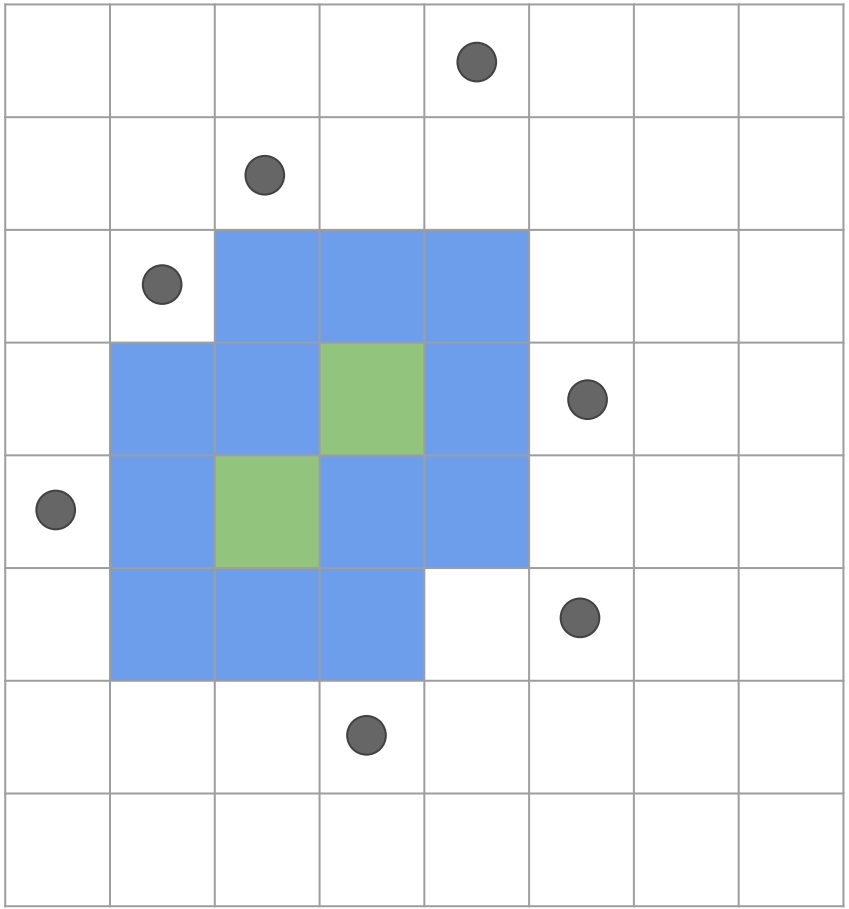

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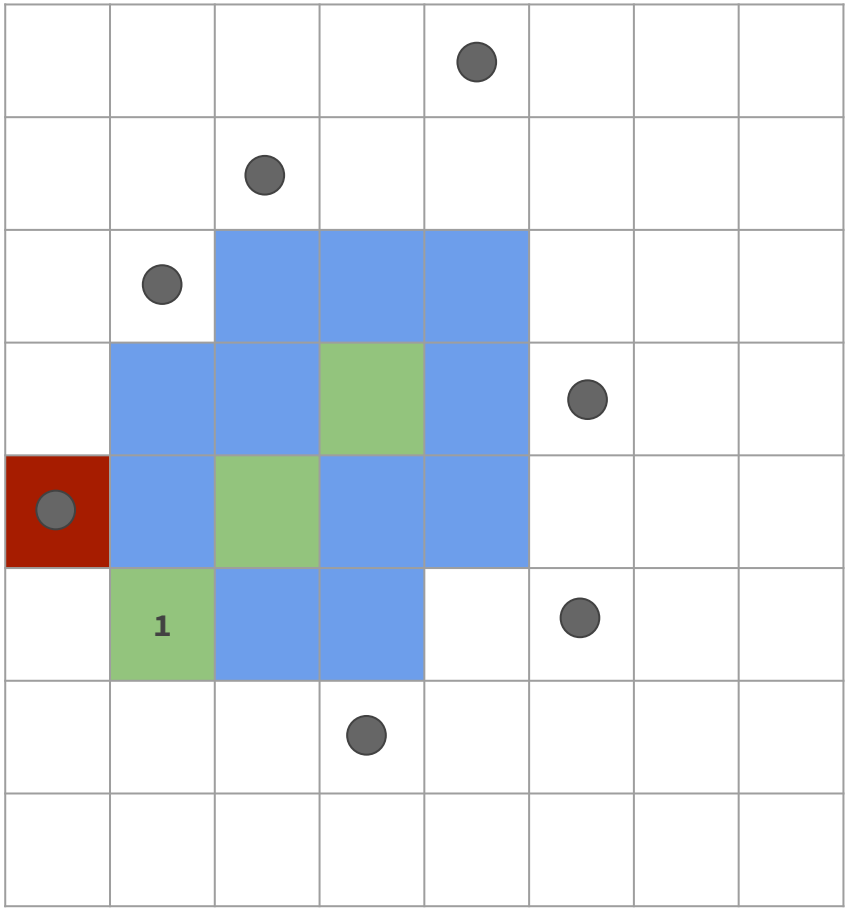

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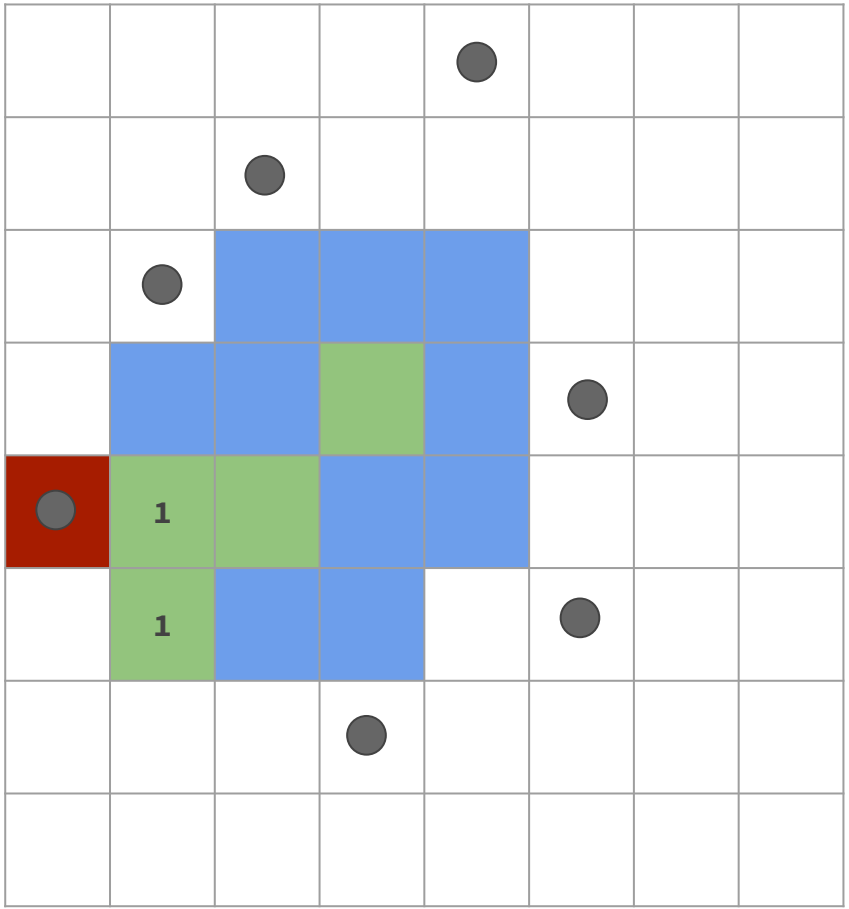

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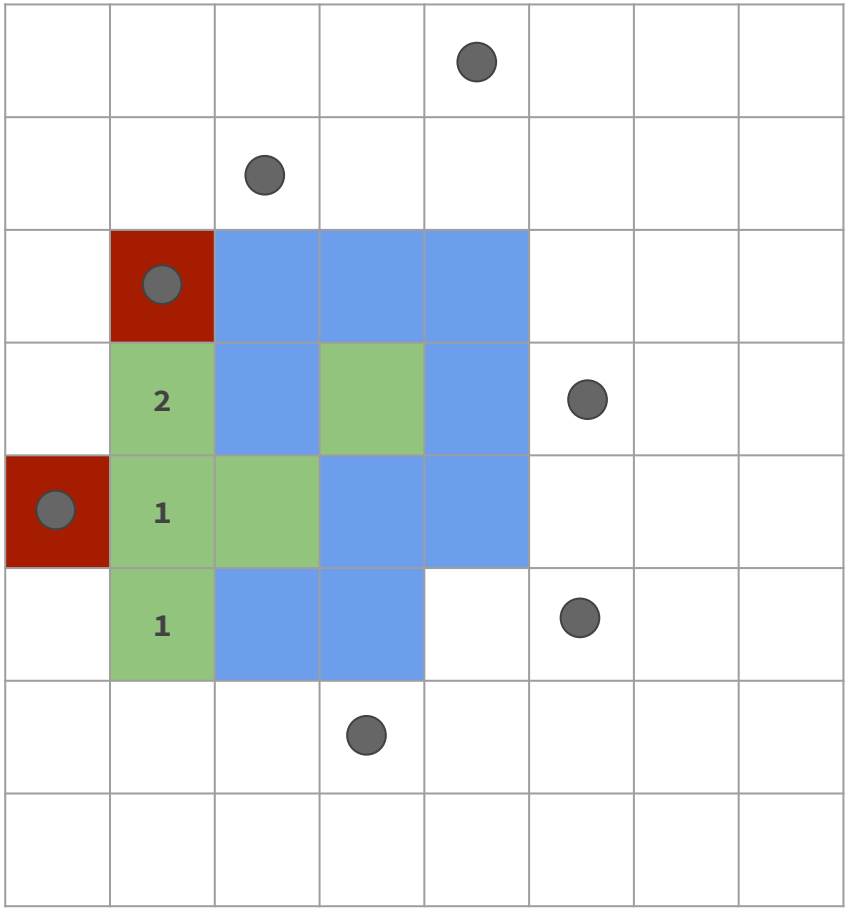

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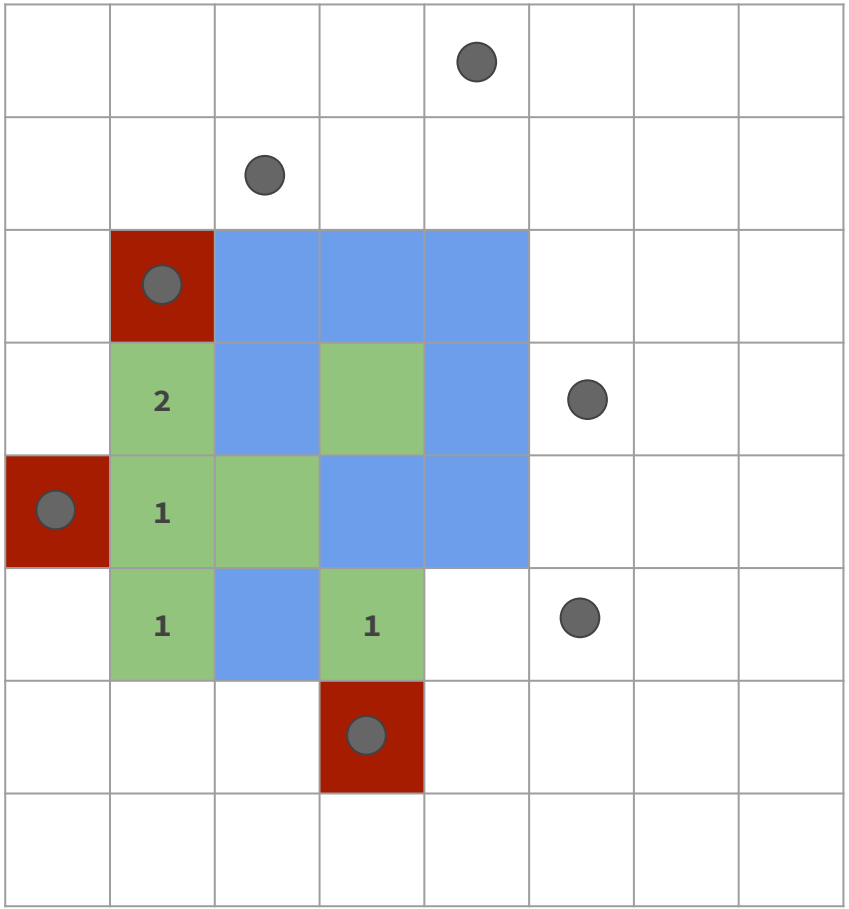

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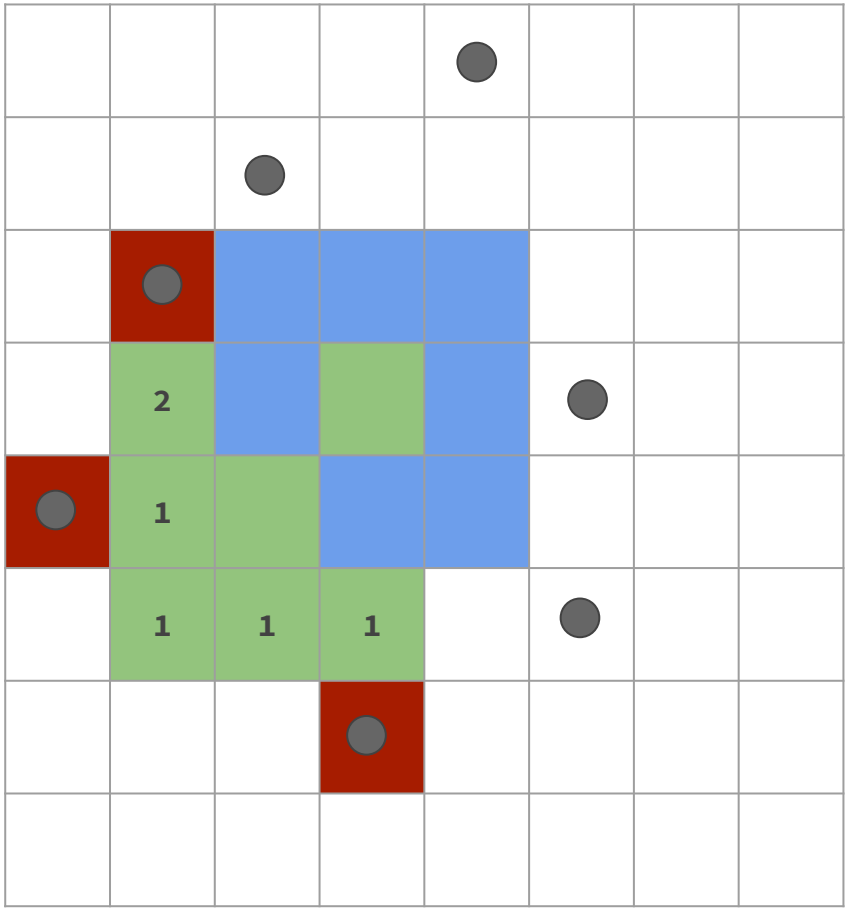

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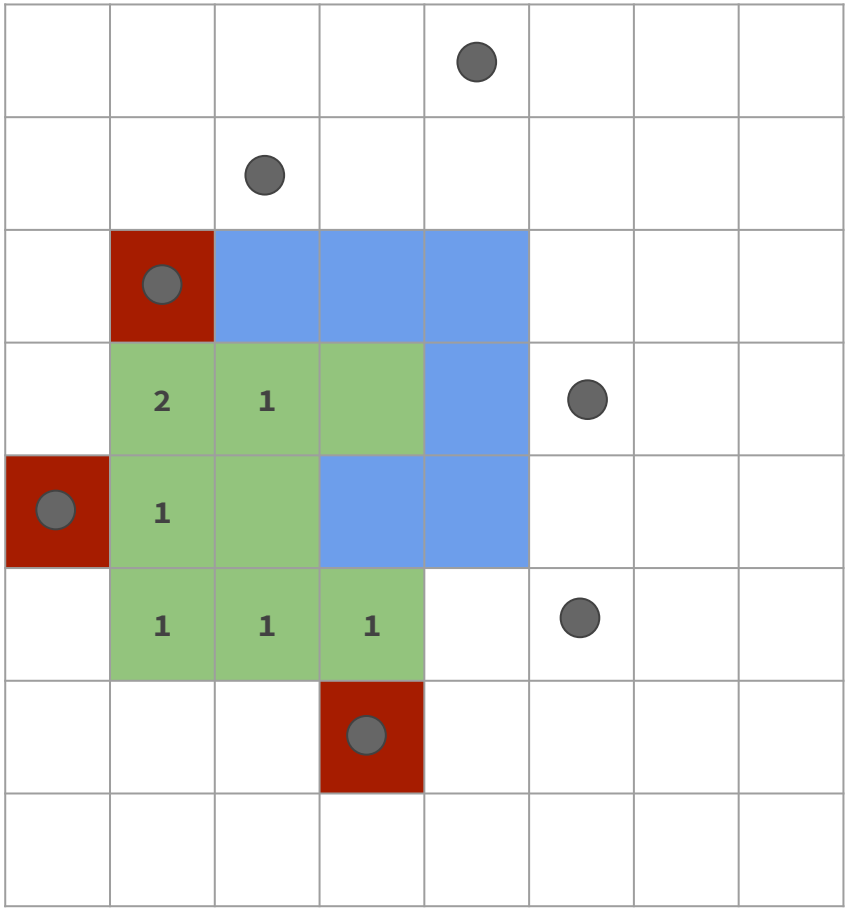

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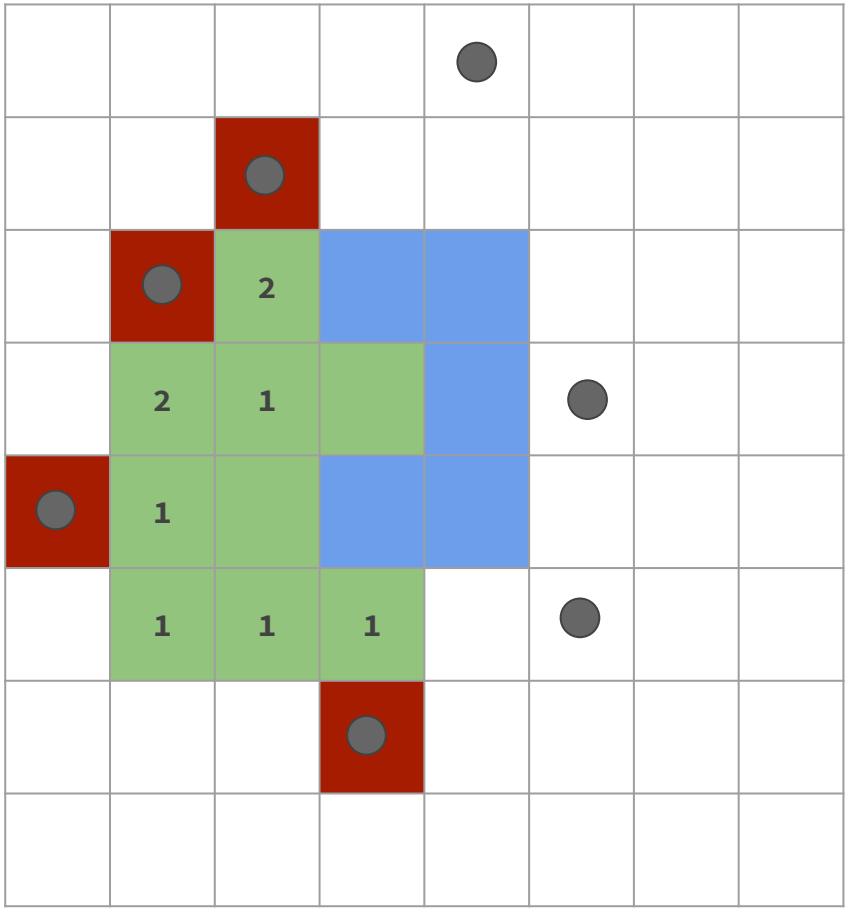

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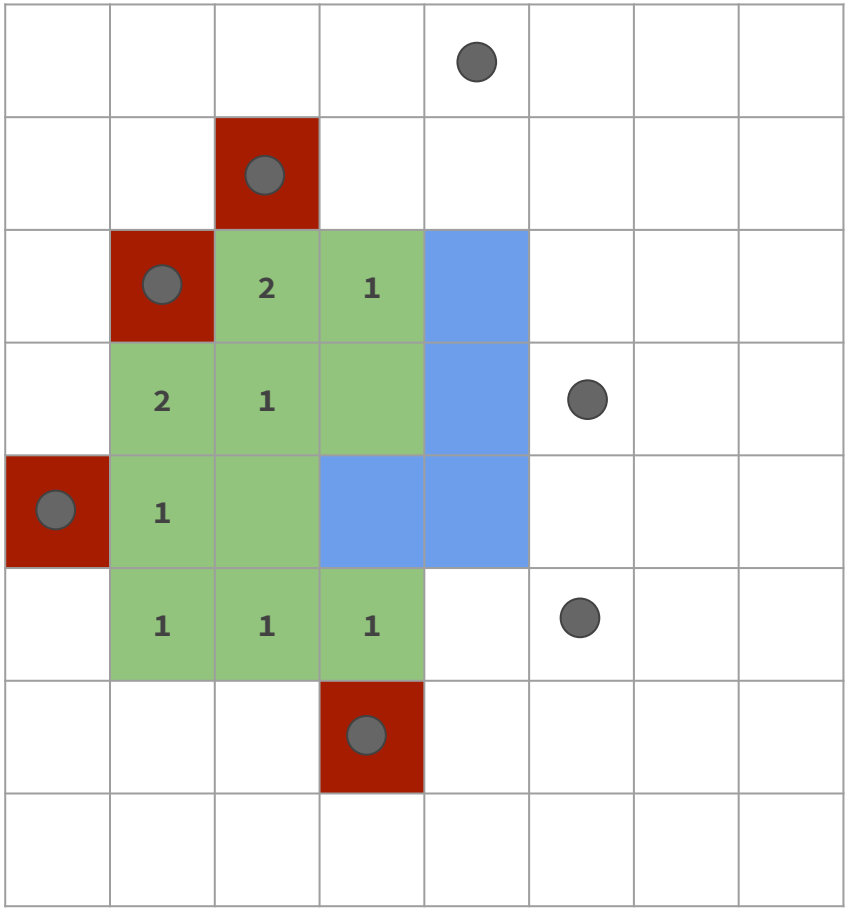

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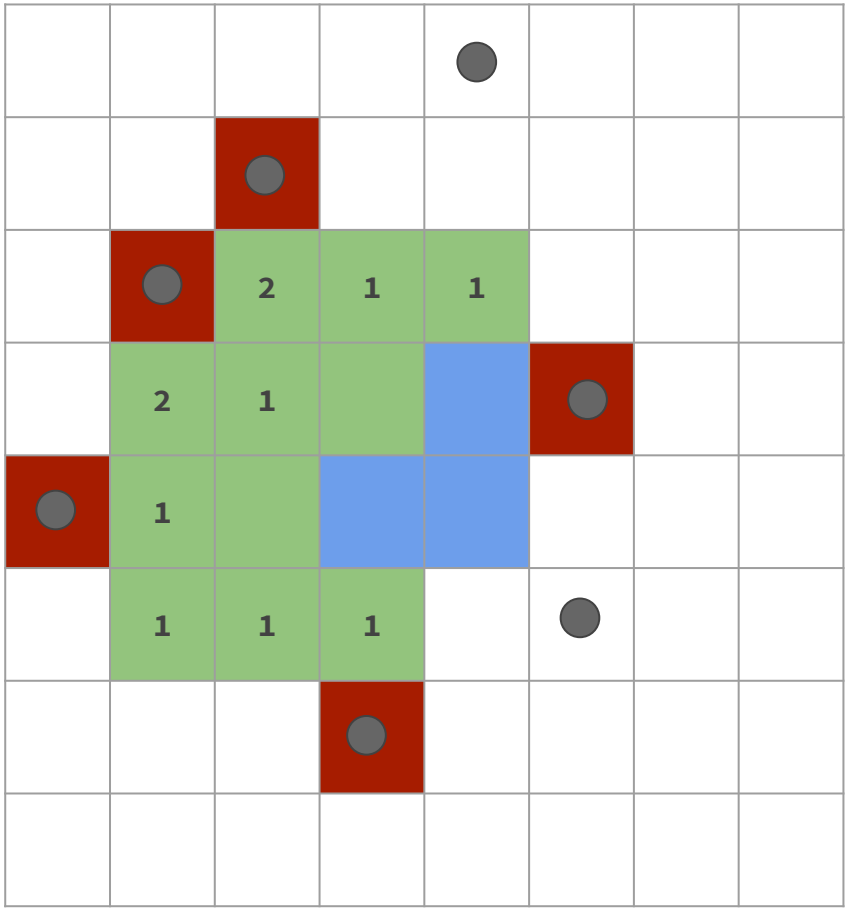

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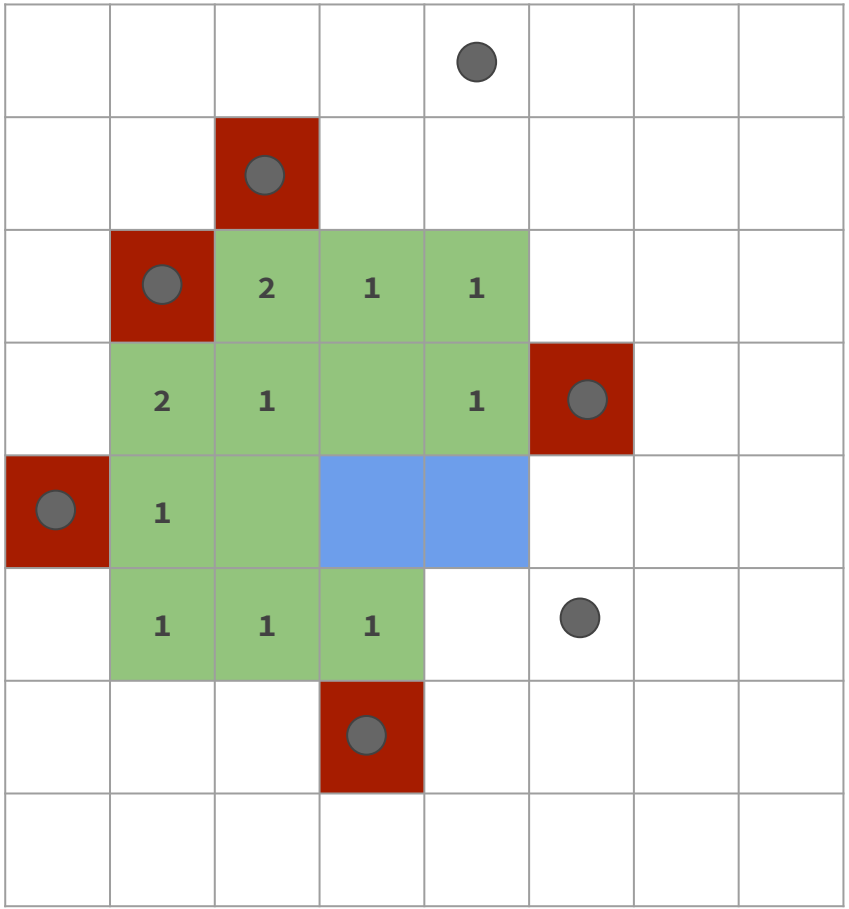

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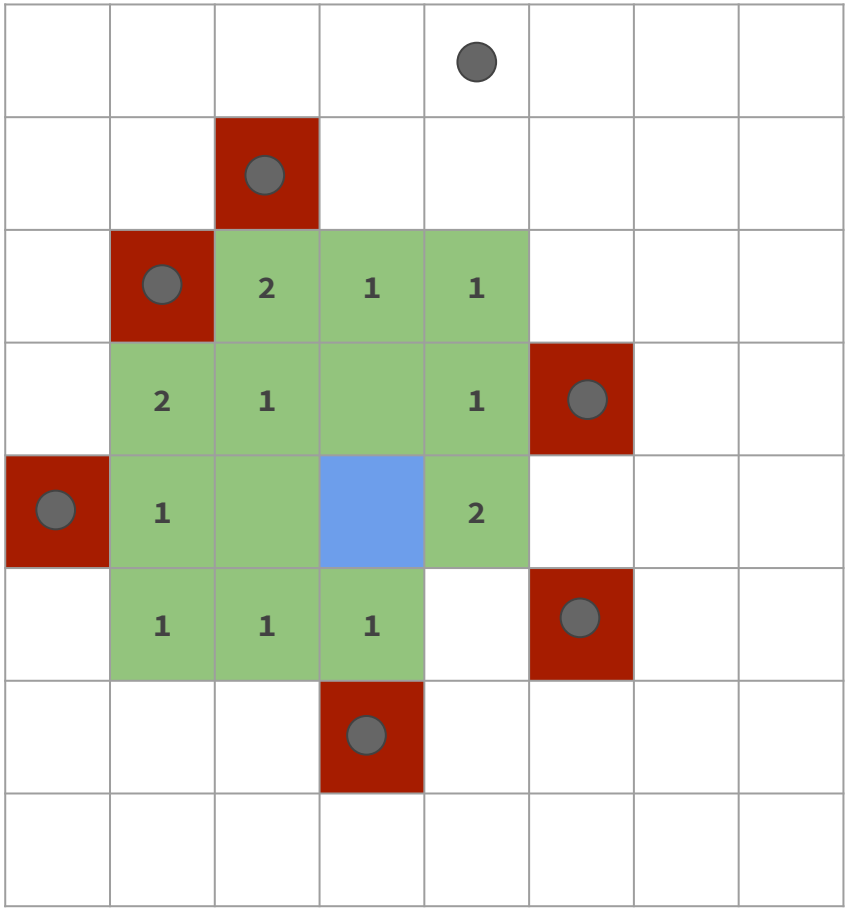

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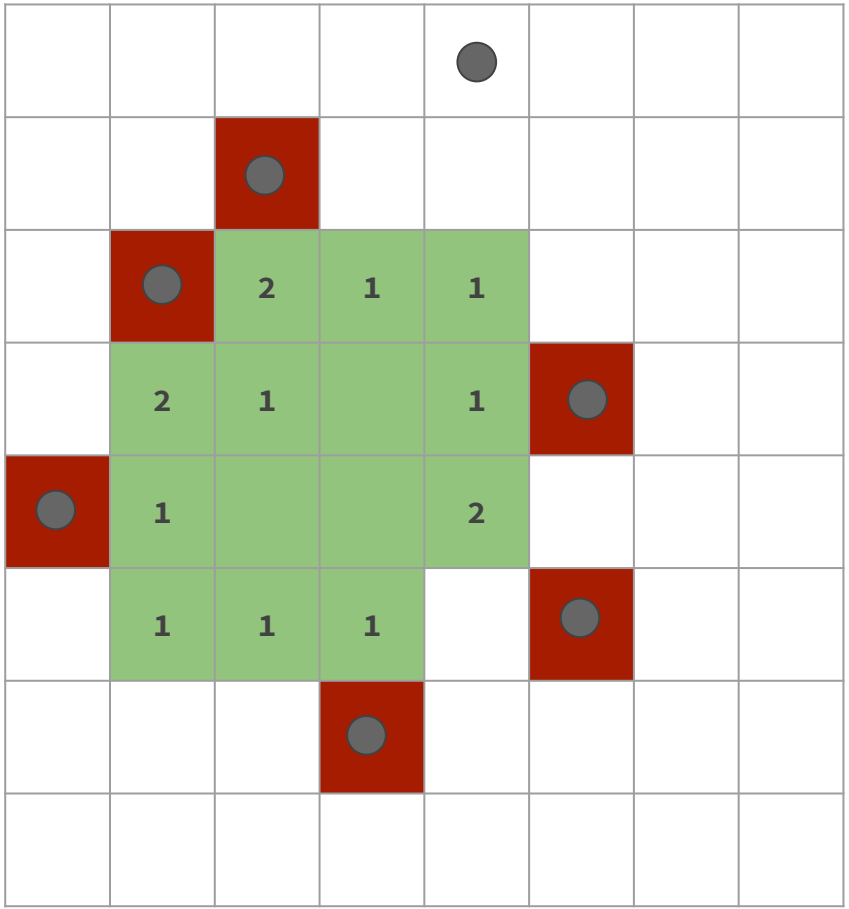

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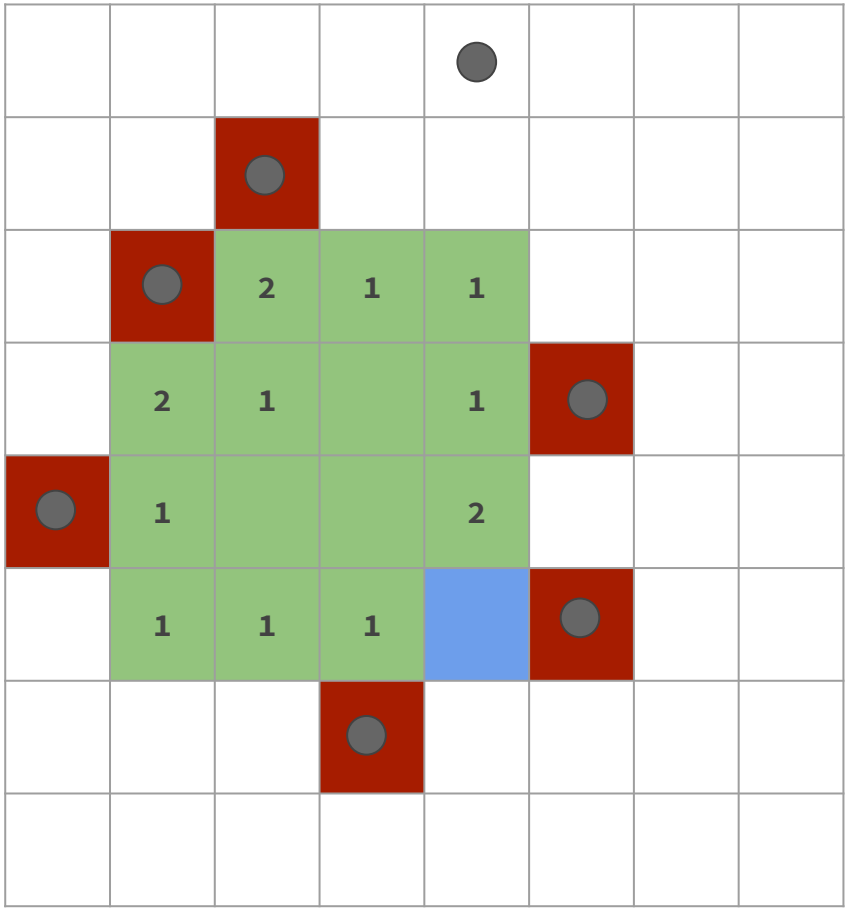

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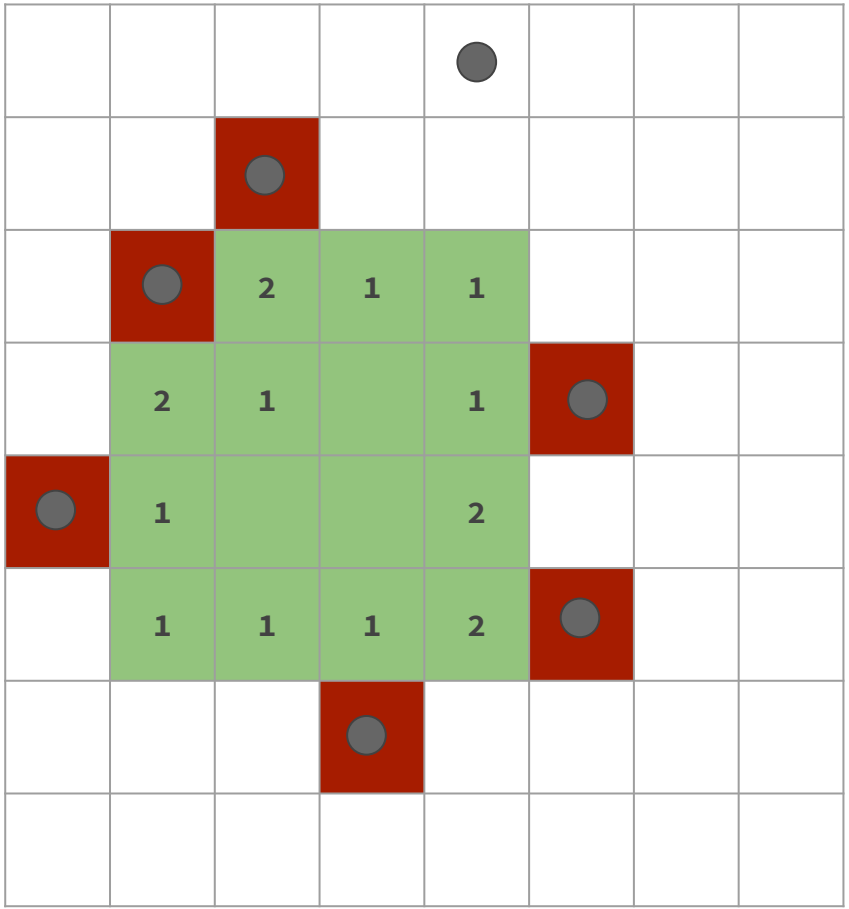

Revealed
To Be Checked
Mine