Flood Fill

Yongkoo Kang

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1 Description

Flood Fill is an algorithm for filling a space of connected tiles. For the most basic floodfill algorithm on a matrix, tiles are only said to be connected if they are adjacent horizontally or vertically, with diagonals or wrapping across the board not counting as connections. This is used mainly in applications where grids are given explicitly, but can also be applied to more implicit connections. Flood fill is also a specific case of a DFS.

2 Coding

2.1 General Guidelines

The easiest way to write a floodfill is recursively. At each step, check whether or not you are on one of the tiles you have changed and if you are not, go in all four directions and call the method. However, it can also be written as a BFS using a queue. l

2.2 Pseudocode

```
def floodFill(char TILE, matrix M, int X, int Y)
    if(M[x][y] == TILE)
        return
    //Check boundary conditions, but for sake of brevity it is not checked here
    M[x][y] = TILE;
    floodFill(TILE, M, X-1, Y);
    floodFill(TILE, M, X+1, Y);
    floodFill(TILE, M, X, Y-1);
    floodFill(TILE, M, X, Y+1);
```

3 Runtime

In general, a floodfill runs at an amortized $O(N)$, where N is the number of units in the matrix. The original time is $5N$ for a regular floodfill, which is derived from N, for the number of units, and $4N$, for the number of connections.

4 Problems

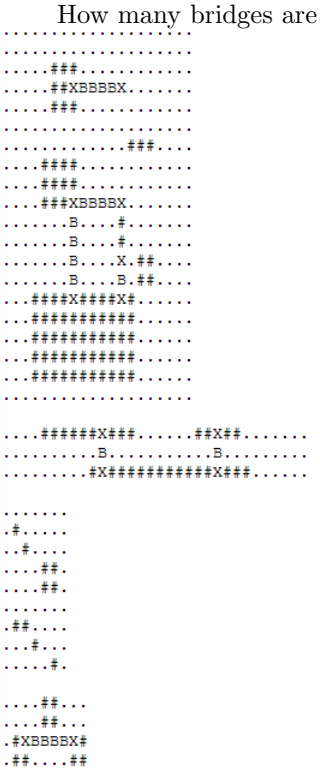
1. Given an matrix of characters which consists of only #s and *s, determine the number of islands of #s and *s, where an island is any one connected group of one of those characters.

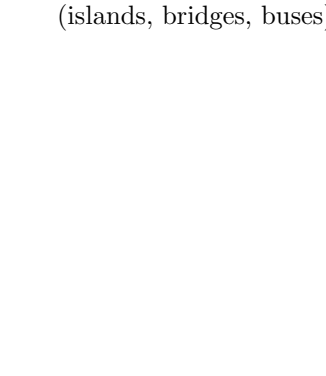
2. Island Buses (ICPC Qual October 5, Problem K) All maps contain only the characters dot (.), X, #, and B. Dots represent ocean water. Xs and #s represent island land. Bs represents bridges, and each X represents the land that is the endpoint of one or more bridges.

   How do you calculate the number of islands (this is without taking into account bridges, so two islands connected by a bridge are still two islands)?

There is one bus for every connected island. How many buses are needed? In other words, how many connected islands are there?

How many bridges are there?





(islands, bridges, buses): (7,4,4), (3,2,1), (6,0,6), (3,1,2).