

Kick Start 2015 - Round D

Dynamic Grid

Problem

We have a grid with **R** rows and **C** columns in which every entry is either 0 or 1. We are going to perform **N** operations on the grid, each of which is one of the following:

- Operation M: Change a number in one cell of the grid to 0 or 1
- Operation Q: Determine the number of different *connected regions* of 1s. A connected region of 1s is a subset of cells that are all 1, in which any cell in the region can be reached from any other cell in the region by traveling between cells along edges (**not** corners).

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each test case starts with one line with two integers, **R** and **C**, which represent the number of rows and columns in the grid. Then, there are **R** lines of **C** characters each, in which every character is either 0 or 1. These lines represent the initial state of the grid.

The next line has one integer, **N**, the number of operations to perform on the grid. **N** more lines follow; each has one operation. All operation Ms will be of the form $M \ x \ y \ z$, meaning that the cell at row x and column y should be changed to the value z . All operation Qs will be of the form Q .

Output

For each test case, output one line containing "Case #x:", where x is the test case number (starting from 1). Then, for every operation Q in the test case, in order, output one line containing the number of connected regions of 1s.

Limits

Time limit: 30 seconds per test set.

Memory limit: 1 GB.

$1 \leq T \leq 10$.

$1 \leq R, C \leq 100$.

$0 \leq x < R$.

$0 \leq y < C$.

$0 \leq z \leq 1$.

Small dataset (Test Set 1 - Visible)

$1 \leq N \leq 10$.

Large dataset (Test Set 2 - Hidden)

$1 \leq N \leq 1000$.

Sample

Sample Input

```
1
4 4
0101
0010
0100
1111
7
Q
M 0 2 1
Q
M 2 2 0
Q
M 2 1 0
Q
```

Sample Output

```
Case #1:
4
2
2
2
```