G. Turtle Magic: Royal Turtle Shell Pattern

time limit per test: 3 seconds
memory limit per test: 256 megabytes
input: standard input
output: standard output

Turtle Alice is currently designing a fortune cookie box, and she would like to incorporate the theory of LuoShu into it.

The box can be seen as an $n \times m$ grid ($n, m \geq 5$), where the rows are numbered $1, 2, \ldots, n$ and columns are numbered $1, 2, \ldots, m$. Each cell can either be **empty** or have a single fortune cookie of one of the following shapes: **circle** or **square**. The cell at the intersection of the a-th row and the b-th column is denoted as (a, b).

Initially, the entire grid is empty. Then, Alice performs q operations on the fortune cookie box. The i-th operation ($1 \leq i \leq q$) is as follows: specify a currently empty cell (r_i, c_i) and a shape (circle or square), then put a fortune cookie of the specified shape on cell (r_i, c_i). Note that after the i-th operation, the cell (r_i, c_i) is no longer empty.

Before all operations **and** after each of the q operations, Alice wonders what the number of ways to place fortune cookies in **all remaining empty cells** is, such that the following condition is satisfied:

No three consecutive cells (in horizontal, vertical, and both diagonal directions) contain cookies of the same shape. Formally:

- There does not exist any (i, j) satisfying $1 \leq i \leq n, 1 \leq j \leq m-2$, such that there are cookies of the same shape in cells $(i, j), (i, j+1), (i, j+2)$.
- There does not exist any (i, j) satisfying $1 \leq i \leq n-2, 1 \leq j \leq m$, such that there are cookies of the same shape in cells $(i, j), (i+1, j), (i+2, j)$.
- There does not exist any (i, j) satisfying $1 \leq i \leq n-2, 1 \leq j \leq m-2$, such that there are cookies of the same shape in cells $(i, j), (i+1, j+1), (i+2, j+2)$.
- There does not exist any (i, j) satisfying $1 \leq i \leq n-2, 1 \leq j \leq m-2$, such that there are cookies of the same shape in cells $(i, j+2), (i+1, j+1), (i+2, j)$.

You should output all answers modulo $998\,244\,353$. Also note that it is possible that after some operations, the condition is already not satisfied with the already placed candies, in this case you should output 0.

Input

The first line of the input contains a single integer t ($1 \leq t \leq 10^3$) — the number of test cases.

The first line of each test case contains three integers n, m, q ($5 \leq n, m \leq 10^9, 0 \leq q \leq \min(n \times m, 10^5)$).

The i-th of the next q lines contains two integers r_i, c_i and a single string shape_i ($1 \leq r_i \leq n, 1 \leq c_i \leq m$, shape_i = "`circle`" or "`square`"), representing the operations. It is guaranteed that the cell on the r_i-th row and the c_i-th column is initially empty. That means, each (r_i, c_i) will appear at most once in the updates.

The sum of q over all test cases does not exceed 10^5.

Output

For each test case, output $q+1$ lines. The first line of each test case should contain the answer before any operations. The i-th line ($2 \leq i \leq q+1$) should contain the answer after the first $i-1$ operations. All answers should be taken modulo $998\,244\,353$.

Example

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input Copy

```
2
6 7 4
3 3 circle
3 6 square
5 3 circle
5 4 square
5 5 3
1 1 circle
1 2 circle
1 3 circle
```

output Copy

```
8
4
3
1
0
8
4
1
0
```

Note

In the second sample, after placing a circle-shaped fortune cookie to cells $(1, 1)$, $(1, 2)$ and $(1, 3)$, the condition is already not satisfied. Therefore, you should output 0.

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