Problem F
Smart Care Center III

Time limit: **3 seconds**
Memory limit: **1024 megabytes**

Problem Description

Jim has upgraded the Smart Wristband to Version 3.0! He realized that wall collisions are harmless, but wet floors (puddles) are the real enemy. He introduces a Global Warning System.

The environment contains Safe Zones (0) and Puddles (1). You are given the map size, the layout of the grid, and a list of N elderly people attempting to walk through the center sequentially.

Jim updates the simulation rules for Version 3.0:

- Wall Logic (Safety Barrier): If an instruction causes the person to move Outside the Grid boundaries, the wristband detects the barrier and IGNORES that instruction. The person stays in the current position. They do not fall.
- Puddle Logic (Danger): If an elderly person steps into a Puddle (`1`), they slip and fall immediately. The simulation for this person ends. The coordinate of this Puddle is permanently recorded in the cloud database as a "Known Danger Zone".
- Global Warning (Prevention): If a future person attempts to step into a coordinate that is already marked as a "Known Danger Zone", the wristband vibrates and IGNORES the instruction. The person stays in the previous safe spot and continues to the next instruction.

The Movement Rules are shown as follows:

- Directions are represented by integers: `0` (North), `1` (East), `2` (South), `3` (West).
- Instructions string consists of:
  - `F`: Move forward one step in the current direction.
  - `R`: Turn right (90 degrees clockwise).
  - `L`: Turn left (90 degrees counter-clockwise)

Your task is to simulate N elderly people walking sequentially. The discoveries made by previous people (finding puddles) will protect the subsequent ones.

Input Format

The input consists of multiple test cases until EOF. The first line contains two integers R and C (Rows and Columns of the map). Each of the following R lines contains C integers consists of `0` or `1`, representing the $R \times C$ grid. The $R + 2$ line contains an interger N, representing the number of elderly persons. The following $2 \times N$ lines represent the N elderly persons. Each person contains 2

lines. The first line contains three integers sr, sc and dir, which represent the starting row and column (0-indexed) (sr, sc) and the initial direction dir (0:N, 1:E, 2:S, 3:W). And the second line contains a string of instructions.

Output Format

For each person, output '`Fall at (r, c)`' if the person falls into a puddle, where `(r, c)` is the puddle's coordinate. Otherwise, output '`Safe at (r, c)`', where `(r, c)` is the final coordinate.

Technical Specification

- $1 \leq R, C, N \leq 50$
- $0 \leq sr < R$
- $0 \leq sc < C$
- $0 \leq dir \leq 3$
- The instruction length is at most 100.

Sample Input 1

```
3 3
0 0 1
0 0 0
0 0 0
3
0 0 0
F
0 0 1
FF
0 0 1
FFF
```

Sample Output 1

```
Safe at (0, 0)
Fall at (0, 2)
Safe at (0, 1)
```