

# Klotski

Input file:            **standard input**  
Output file:           **standard output**  
Time limit:            4 seconds  
Memory limit:         1024 megabytes

There is a grid with  $n$  rows and  $m$  columns. In each cell, there is an arrow pointing either up (U), down (D), left (L), or right (R).

In each operation, you may remove exactly one arrow. However, to remove an arrow, there must be no other arrows in the direction it points. More specifically, let  $s_{i,j}$  be the arrow located in row  $i$  and column  $j$ . To remove  $s_{i,j}$ :

- If  $s_{i,j} = \text{U}$ , all  $s_{k,j}$  satisfying  $1 \leq k < i$  must be removed beforehand.
- If  $s_{i,j} = \text{D}$ , all  $s_{k,j}$  satisfying  $i < k \leq n$  must be removed beforehand.
- If  $s_{i,j} = \text{L}$ , all  $s_{i,k}$  satisfying  $1 \leq k < j$  must be removed beforehand.
- If  $s_{i,j} = \text{R}$ , all  $s_{i,k}$  satisfying  $j < k \leq m$  must be removed beforehand.

For each arrow, answer the following question separately: What is the minimum number of operations needed to remove it?

## Input

There are multiple test cases. The first line of the input contains an integer  $T$  ( $1 \leq T \leq 10^3$ ), indicating the number of test cases. For each test case:

The first line contains two integers  $n$  and  $m$  ( $1 \leq n, m \leq 5 \times 10^4$ ,  $n \times m \leq 5 \times 10^4$ ), indicating the number of rows and columns in the grid.

In the following  $n$  lines, the  $i$ -th line contains a string  $s_{i,1}s_{i,2} \dots s_{i,m}$  of length  $m$  ( $s_{i,j} \in \{\text{U, D, L, R}\}$ ), where  $s_{i,j}$  indicates the arrow in the  $i$ -th row and  $j$ -th column.

It is guaranteed that the sum of  $n \times m$  over all test cases does not exceed  $5 \times 10^4$ .

## Output

For each test case, output  $n$  lines. The  $i$ -th line contains  $m$  integers  $a_{i,1}, a_{i,2}, \dots, a_{i,m}$ , separated by spaces, where  $a_{i,j}$  is the minimum number of operations needed to remove the arrow  $s_{i,j}$ . If it is impossible to remove the arrow  $s_{i,j}$ , then  $a_{i,j}$  should be  $-1$ .

## Example

standard input	standard output
2	-1 -1 -1
4 3	7 -1 -1
RRD	5 3 2
DUL	3 2 1
RDD	1 1
RRR	
1 2	
LR	