

# Laser chess

## Problem ID: laserschack

Fredrik and Abdullah are playing a game of Laser Chess against each other. The game is played on a grid and the objective is to shoot a laser beam at the opponent's king. Abdullah has an attacking piece that, when a button is pressed, shoots laser in all four directions (up, down, left, and right). The attacking piece is marked with **A** on the grid. Fredrik's king is marked with **K**. There are also mirror pieces on the grid, marked with **O**. When a laser hits a mirror piece, the beam bounces out in all four directions.

The game has reached a position where Abdullah will win if he simply presses the button to shoot the laser. To stop Abdullah from winning, Fredrik has now placed smoke bombs on the board, marked with **R**. The smoke prevents laser beams from traveling through that square. Every second, the smoke spreads to all four adjacent squares. If the attacking piece or the king is in the smoke, Abdullah cannot win.

How many seconds will it take until Abdullah no longer wins by pressing the button? In other words, how many seconds will it take for the smoke to spread so that the laser can no longer reach the king from the attacking piece? It is guaranteed that the game is originally in a position where the laser reaches the king from the attacking piece without passing through any smoke.

### Input

The first line contains two integers  $R$  and  $C$  ( $1 \leq R, C$  and  $R \times C \leq 40,000$ ), the number of rows and columns in the grid that make up the game board.

The following  $R$  lines describe the layout of the game board. The  $i$ -th of these lines contains  $C$  characters describing the appearance of the  $i$ -th row. Each character is one of the following:

- . for an empty square
- o for a mirror piece
- R for a smoke bomb
- A for the attacking piece
- K for the king

It is guaranteed that **A** and **K** each appear exactly once, that **R** appears at least once, and that the laser beam initially reaches the king from the attacking piece.

### Output

Print the number of seconds it takes until the laser no longer reaches the king.

### Points

Your solution will be tested on several test case groups. To get the points for a group, it must pass all the test cases in the group.

Group	Point value	Constraints
1	10	$R = 1$
2	20	There is exactly one <b>R</b> on the board.
3	20	No cell is empty (.)
4	20	$R \times C \leq 400$
5	30	No additional constraints.

### Explanation of Samples

In example case 1, it is optimal for Simon to play the card with value 1 in the first round, and the card with value 2 in the second round. Then Nicole gets  $|1 - 1| + |10 - 2| = 8$  points.

In example case 2, Simon plays the cards with values 2, 5, 1, in that order.

In example case 3, Simon plays the cards with values 4, 6, 3, 1, in that order.

**Sample Input 1**

```

3 3
.Ao
R..
.Ko

```

**Sample Output 1**

```

2

```

**Sample Input 2**

```

5 8
A.....o
..K.o...
o.....o
..o.....
R.....o

```

**Sample Output 2**

```

4

```

**Sample Input 3**

```

10 9
oo.o.oRR.
.K.oo..R.
....oo..R
..R.....
..R.....
A.....o.
...R.....
.....o.o.
.....
o.....o..R

```

**Sample Output 3**

```

3

```