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# Bacteria

Input file:            **standard input**  
Output file:           **standard output**  
Time limit:            2 seconds  
Memory limit:         64 megabytes

A famous biologist, K. C. Morris, studies on the behavior of bacteria. So he wants to simulate a large swarm of bacteria.

There is a square dish, divided into  $W$  columns and  $H$  rows - it means there are  $W \times H$  cells in the dish. Each cell is in one of two possible states, live or dead. Live means there are bacteria in the cell, and dead means there aren't. Each cell has at most four horizontally or vertically adjacent cells. Because bacteria are affected by their neighbors, the state of each live cell can be changed:

- If a live cell has fewer than two live neighbors, it is changed to the dead state after a second because of under-population.
- If a live cell has more than two live neighbors, it is changed to the dead state after a second because of overcrowding.
- If a live cell has exactly two live neighbors, it remains in the live state.

With the above rule, the swarm of bacteria can be extinct. For example, Figure 1 shows the  $3 \times 4$  dish with 7 live cells, and Figure 2 shows the number of live neighbors for each live cell. Only 3 live cells will remain in the live state after one second, and the swarm will be extinct after two seconds. But the swarm in Figure 4 will not be extinct, because all live cells have exactly two live neighbors.

```
**.  
.**  
.**  
.*.
```

Figure 1.

```
12.  
.32  
.32  
.1.
```

Figure 2.

```
.*.  
..*  
..*  
...
```

Figure 3.

```
***  
*.*  
*.*  
***
```

Figure 4.

Given initial states of cells, write a program that figure out when the swarm will be extinct.

## Input

The first line of the input contains one integer  $T$ , the number of test cases.

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Each test case begins with a line containing two positive integers  $W$  and  $H$ , the width and height of the dish ( $W, H \leq 500$ ). Then  $H$  lines follow, each containing  $W$  characters. The characters describe the initial states of the cells; '.' denotes a dead cell, and '\*' denotes a live cell.

## Output

For each test case, print the time in seconds that the warm will be extinct in one line. If the swarm will not be extinct forever, print -1 instead.

## Example

standard input	standard output
2 3 4 **. .** .** .*. 3 4 *** *.* *.* ***	2 -1