

Problem A

A-maze-ing grace

Input file: `maze.in`
Output file: `maze.out`

This problem concerns finding your way through a *maze* (also known as a *labyrinth*). Not only that: you are supposed to find the *shortest* way. (If there is more than one optimal route, you can print any one of them.)

Input

The first input line contains an integer giving the number of test cases.

Every test case start with a line containing two integers: the width (**W**) and the height (**H**) of the maze; we assume that $3 \leq W \leq 100$ and $3 \leq H \leq 100$. Then comes **H** lines defining the maze using the following characters:

X is a wall in the maze. You may not pass through the walls. Every maze is completely surrounded by a wall.

␣ (space) is an open space on which you can move. You can only move horizontally or vertically, never diagonally.

***** is the starting point. There is exactly one starting point in every maze.

\$ is the target. There is exactly one target in every maze.

Only the first **W** characters of every line are used.

Output

For every test case, the output should be a copy of the input maze with the optimal path marked with dots ('.'). Below each maze should be printed

`The optimal path is n steps.`

where *n* is the number of steps, or—if there is no solution—the message should be

`This maze has no solutions.`

Sample input

```

3
12 5
XXXXXXXXXXXXX
X      *   X
X XXXXXXXX X
X$      X
XXXXXXXXXXXXX
20 13
XXXXXXXXXXXXXXXXXXXXX
X                      X
X XXXXXXXXXXXXXXXXXX X
X X      X *   X
X X XXXXXX XXXXXXXXX
X X X      X      X
X X XXXXXX X      X
X X      X      X
X X XXXXXX X      X
X X X $   X      X
X X XXXXXX X      X
X      X      X
XXXXXXXXXXXXXXXXXXXXX
9 7
XXXXXXXXXX
X      X
X XXXXX X
X X $ X X
X XXXXX X
X*      X
XXXXXXXXXX

```

Output for sample input

```

XXXXXXXXXXXXX
X.....* X
X.XXXXXXX X
X$      X
XXXXXXXXXXXXX
The optimal path is 9 steps.
XXXXXXXXXXXXXXXXXXXXX
X.....X
X.XXXXXXXXXXXXXXX.X
X.X      X *...X
X.X XXXXXX XXXXXXXXX
X.X X      X      X
X.X XXXXXX X      X
X.X      X      X
X.X XXXXXX X      X
X.X X $...X      X
X.X XXXXXX.X      X
X.....X      X
XXXXXXXXXXXXXXXXXXXXX
The optimal path is 49 steps.
XXXXXXXXXX
X      X
X XXXXX X
X X $ X X
X XXXXX X
X*      X
XXXXXXXXXX
This maze has no solutions.

```