Problem F: Scientist

Filename: *scientist*
Time limit: *4 seconds*

Viruses are back in full force to take over the world, but a team of scientists is ready to stop it! The scientists have identified the locations of each virus, and need to come up with a plan to exterminate as many of them as possible. For the purposes of this problem, we model the world as a two dimensional grid, and in each location of the grid, there is either (a) no problem, (b) a wall, (c) a virus outbreak of one specific virus variant, or (d) a scientist.

Each scientist is specialized in a set of variants, and can be tasked with exterminating one of those variant outbreaks in a single location. In order for a scientist to be able to exterminate an assigned virus, they must also be able to reach the location of that virus outbreak without passing through any walls, and only making moves going up, right, down, or left. Even if a scientist can reach two different locations where there is an outbreak of the same virus that she is able to exterminate, she can only exterminate that virus at one of the locations.

Note that the scientists are equipped with hazmat suits for the mission, so any scientist can walk through any virus, and they can also walk through locations with other scientists.

The Problem

Given the grid of the world containing the locations of the scientists, locations of the viruses, and locations of the walls, as well as the viruses that each scientist is specialized against, determine what is the maximum number of virus outbreaks the team can exterminate.

The Input

The first line of input will contain a single positive integer, c ($c \leq 15$), representing the number of input cases to process. Treat each input case independently. Each of the input cases follow.

The first line of input contains two positive integers n ($1 \leq n \leq 50$), and m ($1 \leq m \leq 50$), indicating the number of rows and columns in the grid, respectively. The second line contains two positive integers s ($1 \leq s \leq 26$), and v ($1 \leq v \leq 26$), $s+v \leq n*m$, representing the number of scientists and the number of viruses in the world.

Then, n lines follow each containing m characters. An uppercase English character in the range [‘A’, ‘A'+s-1] represents a scientist, a lowercase English character in the range [‘a’, ’a’+v-1] represents a virus, ‘.’ represents an empty cell on the grid, and a ‘#’ represents a wall on the grid. It is guaranteed that there will be exactly one occurrence of each character in the range [‘A’, ‘A'+s-1] and at least one occurrence of each character in the range [‘a’, ’a’+v-1].

Lastly, s lines follow, each containing a string of distinct lowercase english characters, representing the virus variants that the i_{th} scientist is specialized in. Each letter in these strings will be in the range [‘a’, ’a’+v-1].

The Output

For each input case, on a line by itself, output the maximum number of viruses that can be exterminated.

Sample Input

```
2
5 4
3 6
A#BC
##ef
ab.d
.c..
..ab
abcd
ad
a
3 3
3 3
ABC
...
bca
ba
ca
ac
```

Sample Output

```
2
3
```

Sample Explanation: In the first sample, even though scientist A can exterminate many types of viruses, she can't reach any of them. But, scientist B can travel to row 2 column 4 to exterminate virus d at that location and scientist C can travel to location row 5 column 3 to exterminate virus a at that location. (Alternatively scientist C can go to location row 3 column 1 to exterminate virus a at that location instead.)

In the second sample, scientist A can exterminate virus b, scientist B can exterminate virus C and scientist C can exterminate virus a.