Crossword

Introduction

The military personnel of the 1st Company 2nd Battalion 3rd Regiment 5th Brigade 8th Division 13th Corps 21st Army of the 34th Front of the Great Stark Rim lodging in the barracks have fallen into sluggishness and lethargy. Despite being an elite military unit they have been stuck as a reserve for months, not only deprived of any possibility to show their skills, but also of any activity apart from the endurance exercises and firearms practice, repeated ad nauseam, obstacles rearranged unexpectedly being the only variation.

After another routine inspection Master Major Gnat for beetle security, the 2nd Battalion morale officer, fell into a pensive mood. *„This state of affairs is unacceptable"* – he thought – *„they will surely become completely demoralized"* and started wringing his limbs. As a veteran of many a battle for soldiers' morale, he knew that he had to act quickly, before the damage became irreversible. When he was considering his options, a crossword in the „Beetlejournal" magazine captured his attention. *„That's it. Orderly – report!"*

A few moments later the company's schedule was rewritten. Soldiers, divided into temporary groups, received a task – prepare the best, the most complicated and highest scored crossword! To further complicate matters – in a few local, rather idiosyncratic dialects. Dictionaries have been prepared and made available, rules have been established – ready, steady, go!

What's going on, or a private's perspective

Each group receives an identical data set consisting of:

- dictionaries, one of each dialect,
- a board on which they will be working; premium squares are marked on the board,
- information concerning the value of each letter within the overall score,
- a sequence of letters – made available gradually – in the order they can be used,
- the size of the letter pool that can be used at a given moment.

A note is attached to all of the above explaining the board and additional rules: *„Note! Premium letter squares multiply the score of a letter that is placed on them, premium word squares multiply the score for the entire word including the letters previously placed on the board. Keep in mind that each premium square is like a landmine – works only once, when you're placing a letter on it! Furthermore, bear in mind that letter premiums are counted before word premiums!"*.

There is an additional note in smaller print below: *„By personal recommendation of Major Bone: First word may be placed wherever on the board. All the following words must intersect the ones already on the board. Forming more than one word at a time complicates the work of an officer in an unacceptable way! Each turn may result in just one word, a turn when more than one word is formed will be regarded as the grounds for rejecting such a solution and executing the soldier presenting such a thing!"*.

The Major is focused on achieving goals he sets for himself (and not only himself). Therefore he expects each team to deliver a crossword. The best ones can count on being given the most interesting firing courses and maybe even – attention – to be relocated to front-line units!

Problem

As a soldier involved in the Major's plan you create a crossword in an unknown language written in a not necessarily logical alphabet, on a board you've only just been shown, using a limited letter pool, to which you don't always have full access. Good luck.

Input data

Test sets are given in `crossword*.in` files.
Dictionaries are given in `dict*.in` files.

The first line of the test set includes one integer T denoting the number of tests. The following lines include descriptions of tests.

The first line of the description includes one natural number D denoting the number of a dictionary you should use. Second line of the test set contains two natural numbers M and N denoting the board dimensions.

The following N lines include M $P_{i,j}$ characters each. Each of the characters denotes one board square with coordinates (i, j) and can take one of the following values:

- '`.`' – denotes an ordinary field,
- '`2`' – denotes a field multiplying the score of the letter placed on it by 2,
- '`3`' – denotes a field multiplying the score of the letter placed on it by 3,
- '`x`' – denotes a field multiplying the score of the word containing the letter placed on it by 2,
- '`X`' – denotes a field multiplying the score of the word containing the letter placed on it by 3.

The next line contains one integer L denoting the number of letters in the alphabet of the dialect used at the time.

The following line includes L pairs (C, V), where C denotes the letter of the alphabet and V is the score of the letter expressed as an integer. Each letter C can be one of the letters of the Latin alphabet. There is a distinction between small and capital letters ($C \in \{\texttt{a}, \texttt{b}, \texttt{c}, \ldots, \texttt{z}, \texttt{A}, \texttt{B}, \texttt{C}, \ldots, \texttt{Z}\}$).

The line following after that includes two integers B and Q separated with a single space. B denotes the length of a letter buffer the crossword maker can use, Q is the overall number of letters available for the maker.

The subsequent line contains exactly Q letters of the alphabet described earlier. It is a sequence of elements that will find their way into the buffer gradually and in batches, as the letters available in it are used.

$$1 \leqslant T \leqslant 10$$
$$1 \leqslant D \leqslant 5$$
$$5 \leqslant M, N \leqslant 50$$
$$1 \leqslant i \leqslant M$$
$$1 \leqslant j \leqslant N$$
$$P_{i,j} \in \{\texttt{.}, \texttt{2}, \texttt{3}, \texttt{x}, \texttt{X}\}$$
$$5 \leqslant L \leqslant 52$$
$$0 \leqslant V \leqslant 10$$
$$3 \leqslant B \leqslant Q$$
$$10 \leqslant Q \leqslant M \cdot N$$

Output data

Write a description of the crossword making for each test. Descriptions should be given in order corresponding to the input data.

The first line of each description should contain two natural numbers separated with a single space: W denoting the number of words formed and S denoting the score obtained during crossword making.

Each of the next W lines of the description should include four consecutive items: coordinates (horizontal and vertical) of the first letter of a formed word, a formed word, and orientation: '`H`' for the horizontal coordinate or '`V`' for the vertical one.

Example

For the input data:

```
1
5
12 9
............
..2......3..
............
.......x....
............
....X..2....
............
..3......2..
............
22
a 1 b 1 c 2 e 2 f 1 g 1 h 1 i 3 l 2 m 1 n 2 o 3 p 3 r 3 t 1 u 4 v 3 E 3 M 2 O 3 S 4 U 5
9 42
moStUhtfrliMapvucebunirgEepuolvbOMtinSutir
```

A possible correct answer is:

```
9 201
3 2 trUth V
1 2 optiMal H
7 1 clue V
3 4 UniverSum H
1 1 go V
9 4 SolvE V
3 6 hOpeful H
5 4 input V
9 4 SolvEr V
```

Example clarification

In the first step the letters we have in the buffer are: `moStUhtfr`. From them we form the word `trUth` (each word must be a part of the dictionary number 5 – the dictionary is extensive and is not shown in the example). After this operation, 4 letters (`moSf`) would remain and another five letters would be added to the buffer that would then look like this: `moSfliMap`.

This allows for the word `optiMal` to be formed, as one of the letters ('`t`' – underlined in Table 1) will be shared with the letters already on the board. The buffer will again be filled up with 9 letters and will contain the following 9 characters: `mSfvucebu`.

```
g.....c.....
optiMal.....
..r...u.....
..UniverSum.
..t.n...o...
..hOpeful...
....u...v...
....t...E...
........r...
```

Using the letter '`l`' on the board we form the word `clue`. The contents of the buffer will be altered to: `mSfvbunir`. Another word – `UniverSum` – will contain seven letters from the buffer and two letters already on the board (letters: '`U`' and '`e`'), and so on.

The remaining words are formed analogically. The contents of the buffer at individual stages, words formed and scores given for them are shown in Table 1.

The score S for the entire crossword equals therefore: $12+15+10+54+4+15+60+13+18=201$.

Table 1: Example – consecutive steps of crossword making and the scores.

Buffer	Word	Score
moStUhtfr	trUth	$12 = 2 \cdot 1 + 3 + 5 + 1 + 1$
moSfliMap	optiMal	$15 = 3 + 3 + 1 + 3 + 2 + 1 + 2$
mSfvucebu	clue	$10 = 2 + 2 + 4 + 2$
mSfvbunir	UniverSum	$54 = 2 \cdot (5 + 2 + 3 + 3 + 2 + 3 + 4 + 4 + 1)$
fbgEepuol	go	$4 = 1 + 3$
fbEepuolv	SolvE	$15 = 4 + 3 + 2 + 3 + 3$
fbepubOMt	hOpeful	$60 = 3 \cdot (1 + 3 + 3 + 2 + 1 + 2 \cdot 4 + 2)$
bbMtinSut	input	$13 = 3 + 2 + 3 + 4 + 1$
bbMtiSir	SolvEr	$18 = 4 + 3 + 2 + 3 + 3 + 3$

Score

If the following conditions are satisfied for each test:

- output data is in the correct format,
- each consecutive word added to the crossword (apart from the first one) has at least one letter shared with the words already on the board,
- adding a new word each time creates a correct crossword (compliant with the Major's guidelines),
- the score for the crossword is correctly calculated,

the score for a given set equals the sum of S values from all the tests. Otherwise the score is 0.