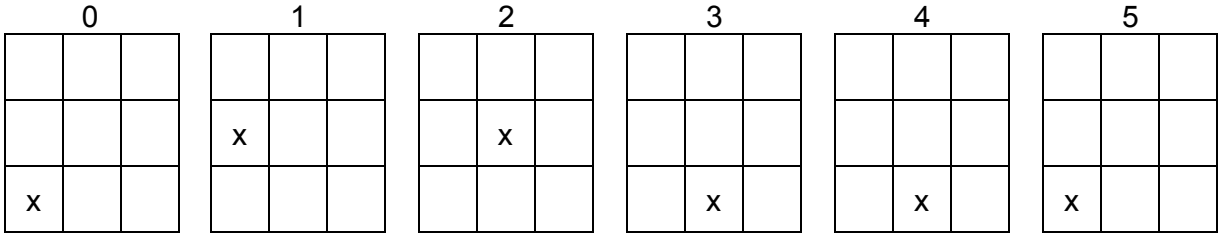
Cruel World! (prob14)

The Problem

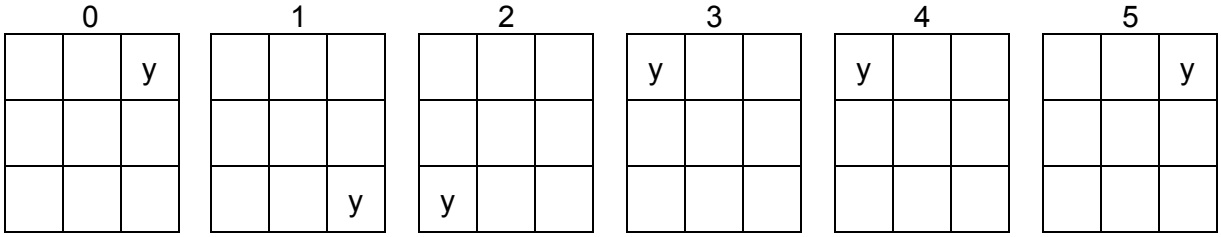
Determine the outcome of a scenario in a world containing simple organisms.

Organisms inhabit a world laid out in a grid of N×N cells—that is, N rows and N columns. The organisms move from cell to cell in unison at discrete time steps in one of four directions: north, south, east or west. Sometimes an organism might remain in a cell during a time step. More than one organism can occupy a cell.

Each organism is one of M different species. Species are labeled by a letter of the English alphabet (A-Z). The DNA of a species encodes a pattern of movement followed by an organism of that species. A DNA sequence is made up of the letters n, e, w, s, and r indicating movement *north, east, west, south,* and *remain*. Thus the DNA sequence *nesrw* codes an organism to move north at the first time step, move east at the second time step, move south at the third time step, rest at the fourth time step, and move west at the fifth time step. At the sixth time step, the pattern repeats so the organism moves north again. The sequence of grids below show the movement of an organism x having the DNA *nesrw* over five time steps. (The first grid shows the world at time 0.)



The world is a torus, so the cells in the top row are south of the cells in the bottom row, the cells in the bottom row are north of the cells in the top row, the cells in the rightmost column are west of the cells in the leftmost column, and the cells in the leftmost column are east of the cells in the rightmost column. Consequently, an organism y of the same species as x above will follow the movements shown.

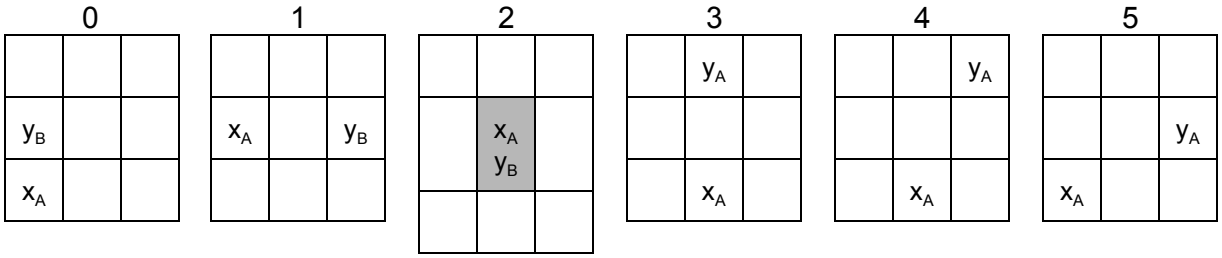


Species have a strict domination hierarchy. Species A dominates species B, B dominates C, and so on. The relationship is transitive, so A dominates C, and so on.

When organisms occupy the same cell at the end of a time step, they interact as follows:

- Two organisms of the same species have no effect on one another.
- The organism(s) of the most dominant species in a cell infect(s) all of the other organisms with DNA. Consequently, those organisms take on the behavior of the dominant species in that cell and on the next time step start to move based on the most dominant species' DNA sequence, starting with the direction given by the first letter in the DNA sequence.

Let x_A denote an organism of species A (DNA *nesrw*) and y_B denote an organism of species B (DNA *wwreer*).



a *infects* b

The interaction in the center square after time step 2 results in y becoming an instance of the species A (indicated by y_A) in time step 3. The change in species causes y to start moving according to the DNA for species A at step 0. Hence it moves north in time step 3.

Write a program to determine how many organisms of each species occupy a world after a sequence of C time steps.

Input

The input consists of a sequence of test cases, each representing a scenario. The first line of the input provides the number of test cases that follow.

Each scenario occupies a number of lines determined by the grid size and by the number of species in that test case.

- The first line contains M, the number of species in the test case. Note: $0 < m \leq 26$.
- The next M lines contain a species letter (A-Z), a space, and then a DNA sequence made up of the letters n, s, e, w, and r. A DNA sequence must contain at least one of these letters. The species letters A-Z on these M lines are in no particular order.
- The next line contains the number of cells N across (and hence down) the grid. Note: $0 < N \leq 256$.

- The next N lines of input contain the contents of the cells in the grid. Each of these N lines contains a sequence of N characters. Each character is either a species letter or a period. A letter indicates an organism of that species occupies a cell. A period indicates that no organism occupies a cell. Note that at most one organism can occupy a cell at the start.

- The next line contains an integer value C that specifies the number of time steps to run a simulation of the world.Note: 0 < C < 1,000,000.

Output

The output for each test case is the scenario number followed by the number of organisms of each species left after C time steps. The species and counts must be listed with species in alphabetical order.

Sample Input	Sample Output
2 2 A nesrw B wwreer 3 ... B.. A.. 5 3 C nneesswww A nsewsnwer B en 5 C.B.A ..... BB... .A.C. A.B.C 10	Scenario 1 A:2 B:0 Scenario 2 A:4 B:3 C:3