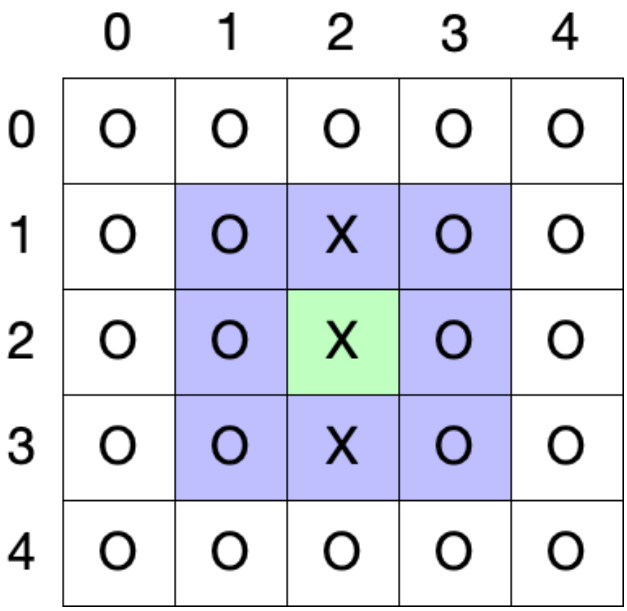
Problem L

The Game of Life

Problem ID: thegameoflife

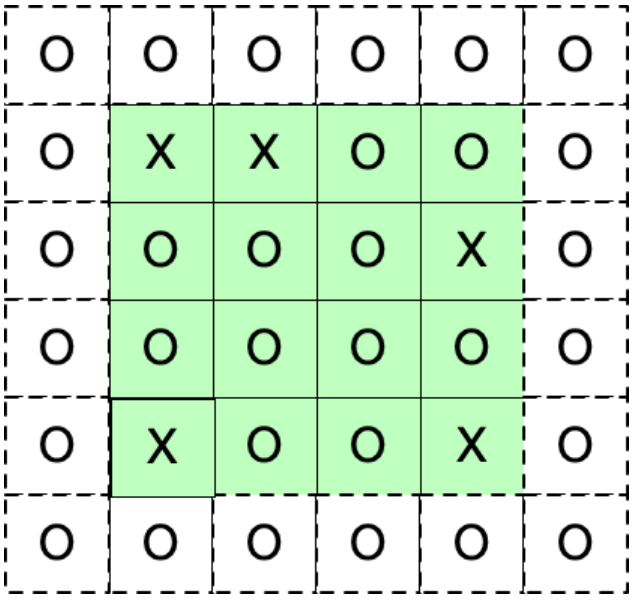
The Game of Life is a cellular automaton used to model the genetic laws of birth, survival, and death. It was devised by British mathematician John Horton Conway in 1970 as a zero-player game, which means that its evolution is determined by its initial state with no further input by any players. The game is setup as a grid that consists of A rows and B columns (i.e., $A \times B$ dimension). Each cell can be open (`O`), or contain a living organism (`X`). Each cell (except for the borders) has eight neighbors. The following diagram illustrates a 5×5 grid and the eight neighbors of the cell at $(2, 2)$:



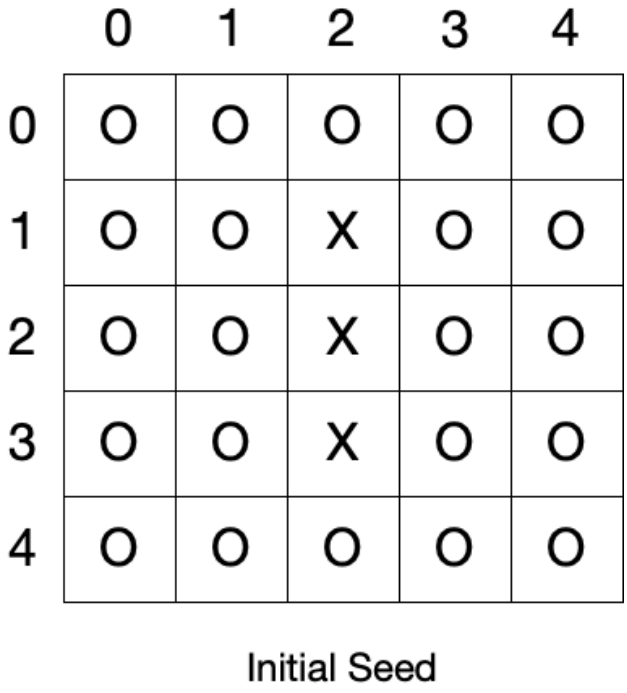
Based on the initial grid configuration, a player observes how the organisms evolve from generation to generation based on a these rules:

1. Birth – an organism will be born in each empty location that has exactly three living organisms as neighbors.
2. Death – an organism with four or more neighboring organism will die from overcrowding. An organism with fewer than two neighboring organisms will die from loneliness.
3. Survival – an organism with two or three neighboring organisms will survive to the next generation.

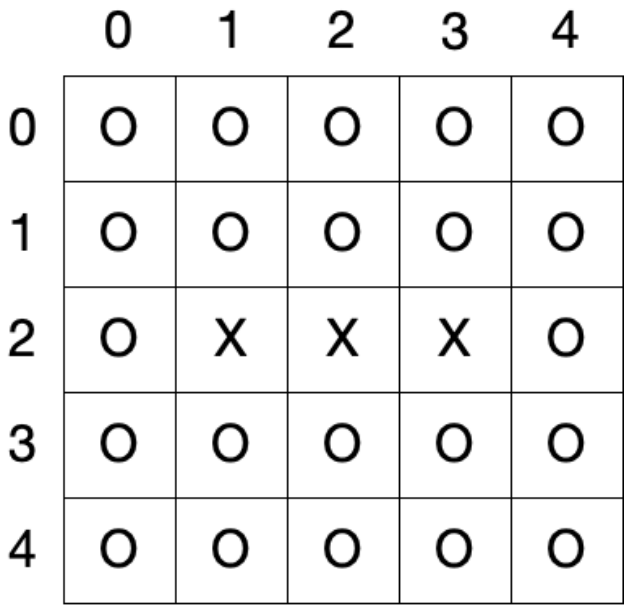
As mentioned earlier, the border cells do not have eight neighbors; however, each cell is required to have eight neighbors in the game. To fix this problem, assume that every cell outside the grid is dead. For example, here's a 4×4 grid (highlighted) with the outside cells (dotted boxes) set to `O`:



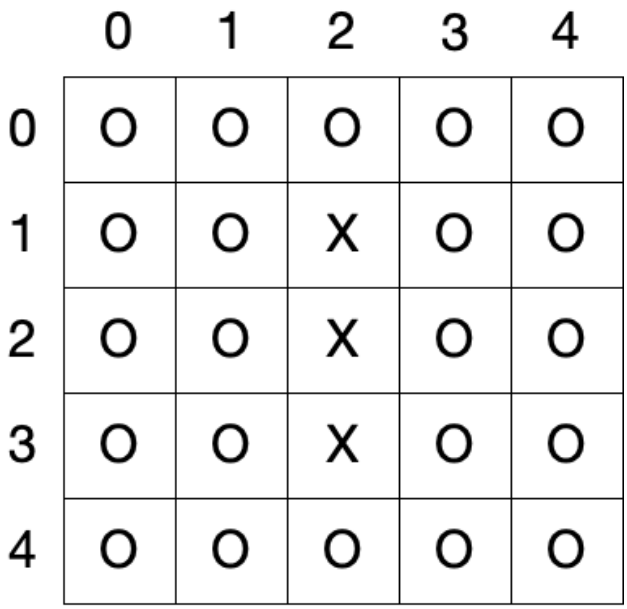
The initial configuration is known as the *initial seed* for the game and the first generation is the generation after applying the above rules to the initial seed. For example, here are three generations of the 5×5 grid shown previously:



Initial Seed



1st Generation



2nd Generation

Note: This initial configuration represents a specific pattern that occurs in the Game of Life. The pattern is known as an *oscillator* because it returns to its initial state after a finite number of generations, which is two in this case.

For this problem, you will be given the initial seed for the game that states the location of all the organisms and empty cells. Based on this information, you will need to determine the N-th generation. In the above example, $N = 2$.

Input

The input contains the specification of an initial seed for the game. The specification starts with a line with three non-zero positive integers, A, B, and N, each separated by a single space, that specify the dimensions of the board and the nth-generation to compute (A, B, and N are described in the problem description above). This is followed by A lines, each corresponding to a line of the grid. Each of these lines has B characters, each separated from the next by a single space, corresponding to each column of that row. An `X` denotes that there is an organism in that position, an `O` denotes an empty cell at that position.

You can assume the following:

- Possible values for the dimensions of the board range from 2 to 100 (i.e., $2 \leqslant A \leqslant 100$ and $2 \leqslant B \leqslant 100$).
- N has the range ($0 < N \leqslant 100$).

Output

The output is the print out of the N-th generation of the game. The output contains A lines, each corresponding to a line of the grid. Each of these lines has B characters, each separated from the next by a single space, corresponding to each column of that row. An `X` denotes that there is an organism in that position, an `O` denotes an empty cell at that position.

Sample Input 1

```
5 5 1
O O O O O
O O X O O
O O X O O
O O X O O
O O O O O
```

Sample Output 1

```
O O O O O
O O O O O
O X X X O
O O O O O
O O O O O
```

Sample Input 2

```
6 6 3
O O O O O O
O X X O O O
O X X O O O
O O O X X O
O O O X X O
O O O O O O
```

Sample Output 2

```
O O O O O O
O X X O O O
O X O O O O
O O O O X O
O O O X X O
O O O O O O
```

Sample Input 3

```
4 4 4
O O O O
O X X O
O X X O
O O O O
```

Sample Output 3

```
O O O O
O X X O
O X X O
O O O O
```