2267 Anthrax Lab Studies

Anthrax, also called Splenic Fever, Malignant Pustule, or Woolsorters' Disease, is caused by *Bacillus anthracis*, an organism that under certain conditions forms highly resistant spores capable of maintaining its virulent effect for many years in contaminated soil and other materials.

Anthrax was the first human disease that was demonstrated to be caused by a specific microrganism. It was also the first infectious disease against which a bacterial vaccine was found to be effective (Louis Pasteur in 1881). These discoveries led to the origin and development of bacteriology and immunology.

Interest has reborn around the study of how infected cells reproduce and die. A hypothesis states that cell reproduction can be modelled as a two-dimensional infinite grid of square cells like chessboard cells but in Practical lab studies its defined as finite grid. In this grid, each cell is considered to be alive or dead. A living cell is represented as a mark on its position in the grid. Each cell has up to 8 neighbouring cells (up, down, left, right, upper-right, upper-left, lower-right and lower-left). Cells located in the border of the grid have smaller number of neighbours.

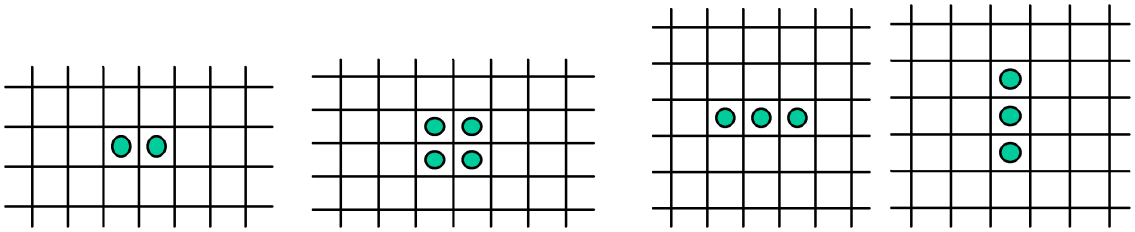
The model starts with an Initial Generation (G_0) consisting of some living and death cells in the Grid. After reproduction rules are applied to every Cell, a new Generation G_1 is obtained. New generations are always created using the information of the previous generation. That is Generation G_i is created based on information of Generation G_{i-1}

The reproduction rules that are used in the model are:

1. A dead cell with exactly three living neighbours becomes a living cell (birth).
2. A living cell with cero or one living neighbours dies (loneliness).
3. A living cell with two or three living neighbours stays alive (survival).
4. A living cell with four or more living neighbours dies (overcrowding).

In all other cases, a cell dies. Existing death cells remain death (overcrowding or loneliness).

EXAMPLES:



(1) (2) (3) (4)

- The initial generation (1) will evolve in a generation where all cells die.
- The initial generation (2) yields generations that will always be the same as the initial.
- If the initial generation is (3) the next generation will be (4) the following generations will be alternating between these two generations.

In more complex cases, it is impossible to look at a starting position (or pattern) and see what will happen in the future. The only way to find out is to follow the rules

Input

The input will contain data for several runs, each run will have the following information:

The first line has two numbers indicating the X and Y dimensions of the grid. (X number of columns, Y number of rows). A '0' in this first line indicates end of run.

The second line is one number representing the number n of generations that must be obtained.

The third line is a number, that specifies the number of cells that have a microrganism.

Starting in the forth line, there will be the coordinates of each microrganism, one per line with format 'x y' (x is column number and y is row number). The row and column numbers start at 1.

Output

In the output you have to show two different generations: first the Initial Generation G_0, followed by the n Generation G_n. A Generation is represented as a matrix showing living microorganisms as an '*' (asterisk) and death cells as a '0' (zero).

In the first line of each test you should output the study number (the number of the run). Before the Initial Generation write the string '`Initial Generation`'. Before the target generation write '`Generation` n', where n is the generation number.

Sample Input

```
15 10
5
3
5 5
5 6
5 7
0
```

Sample Output

```
Study 1
Initial Generation
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 * 0 0 0 0 0 0 0 0 0 0
0 0 0 0 * 0 0 0 0 0 0 0 0 0 0
0 0 0 0 * 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Generation 5
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 * * * 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0