Kick Start 2017 - Round B

Christmas Tree

Problem

You are given a rectangular grid with **N** rows and **M** columns. Each cell of this grid is painted with one of two colors: green and white. Your task is to find the number of green cells in the largest Christmas tree in this grid.

To define a Christmas tree, first we define a **good triangle** as follows:

A good triangle with top point at row **R**, column **C** and height **h** is an isoceles triangle consisting entirely of green cells and pointing upward. Formally, this means that: The cell **(R, C)** is green, and for each **i** from 0 to **h-1** inclusive, the cells in row **R+i** from column **C-i** to column **C+i** are all green.

For example:

```
..#..
.###.
#####
```

is a good triangle with height 3. The **#** cells are green and the **.** cells are white. Note that there is a green cell that is not part of the good triangle, even though it touches the good triangle.

```
..#..
.###.
####.
```

is **NOT** a good triangle, because the 5th cell in the 3rd row is white. However, there are good triangles with height 2 present.

```
...#.
.###.
#####.
```

is **NOT** a good triangle. However, there are good triangles with height 2 present.

A **K**-Christmas tree is defined as follows:

- It contains exactly **K** good triangles in vertical arrangement.
- The top cell of the **i+1**-th triangle must share its top edge with the bottom edge of any one of the cells at the base of the **i**-th triangle. This means that, if the base of the **i**-th triangle is at row **r**, from column **c1** to column **c2**, then the top of the **i+1**-th triangle must be on row **r+1**, in a column somewhere between **c1** and **c2**, inclusive.

For example, if **K** = 2:

```
...#...
..###..
.#####.
#######
..#....
.###...
#####..
```

is a valid 2-Christmas tree. Note that the height of the 2 good triangles can be different.

```
..#..
.###.
.#...
```
is also a valid 2-Christmas tree. Note that a good triangle can be of height 1 and have only one green cell.

```
...#...
..###..
.#####.
.......
..#....
.###...
#####..
```
is **NOT** a valid Christmas tree, because the 2nd triangle must starts from the 4-th row.

```
...#.
..###
.#...
###..
```
is **NOT** a valid Christmas tree, because the top of the 2nd triangle must be in a column between 3 and 5, inclusive.

You need to find the K-Christmas tree with the largest number of green cells.

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each test case consists of three lines:

- The first line contains 3 space-separated integers **N**, **M** and **K**, where **N** is the number of rows of the grid, **M** is the number of columns of the grid and **K** is the number of good triangle in the desired Christmas tree.
- The next **N** lines each contain exactly **M** characters. Each character will be either **.** or **#**, representing a white or green cell, respectively.

Output

For each test case, output one line containing `Case #x: y`, where `x` is the test case number (starting from 1) and `y` is the number of green cells in the largest K-Christmas tree. If there is no K-Christmas tree, output 0.

Limits

1 ≤ **T** ≤ 100.
Memory limit: 1GB.
1 ≤ **M** ≤ 100.
1 ≤ **N** ≤ 100.
Each cell in the grid is either `.` or `#`.

Small dataset (Test set 1 - Visible)

Time limit: 30 seconds.
K = 1.

Large dataset (Test set 2 - Hidden)

Time limit: 80 seconds.
1 ≤ **K** ≤ 100.

Sample

Sample Input

```
4
3 5 1
..#..
.###.
#####
3 5 1
.....
.....
.....
4 5 1
#####
#####
#####
#####
4 5 2
#####
#####
#####
#####
```

Sample Output

```
Case #1: 9
Case #2: 0
Case #3: 9
Case #4: 10
```

In sample case #1, the largest 1-Christmas tree has 9 green cells:

```
..#..
.###.
#####
```

In sample case #2, there is no 1-Christmas tree.

In sample case #3, one largest 1-Christmas tree with 9 green cells is:

```
#####
#####
#####
#####
```

In sample case #4, one largest 2-Christmas tree with 10 green cells is:

```
##### 
#####
#####
##### 
```