4. Cancer Cells

Program Name: Cancer.java   Input File: cancer.dat

While doing scientific research, scientists noticed a pattern to the growth and decay of a specific cancer. Even though the cells in the body are in three dimensions, for the purpose of this simulation we will consider a set of cells in a flat, square area. Additionally, cells are considered to be adjacent if they are contiguous either vertically, horizontally, or diagonally.

The scientists divided their observations into given intervals or time steps. After watching numerous time steps, they observed the following was true at the end of each time step:

- An infected cell that was adjacent to exactly two or exactly three infected cells at the beginning of the time step continued to be infected.
- An infected cell that was not adjacent to exactly two or exactly three infected cells at the beginning of the time step became uninfected.
- An uninfected cell at the beginning of the time step became infected if it was adjacent to exactly three infected cells.

Even though the cell containing the anti-cancer needle is not infected, for the purpose of the transition rules above, it is considered to be infected. In the example below, the **`@`** is the anti-cancer needle, the **`#`** is an infected cell, and the **`.`** is an uninfected cell. The minimum number of time steps in this example is 3.

Original	Begin Time Step 1	End Time Step 1	Begin Time Step 2	End Time Step 2	Begin Time Step 3	End Time Step 3

`....@`
`##...`
`#....`
`...#.`
`##.##`
	`.....`
	`##.@.`
	`#....`
	`...#.`
	`##.##`
		`.....`
		`##.@.`
		`###..`
		`#####`
		`..###`
			`.....`
			`##@..`
			`###..`
			`#####`
			`..###`
				`.#...`
				`#.@..`
				`.....`
				`#...#`
				`....#`
					`.#...`
					`#..@.`
					`.....`
					`#...#`
					`....#`
						`.....`
						`...@.`
						`.....`
						`.....`
						`.....`

You are to simulate the growth and decay of a specific cancer in time steps as described above, where an anti-cancer needle has already been placed on one cell of a targeted area at the beginning of the simulation. For each time step:

- If possible, move the anti-cancer needle to an adjacent, uninfected cell. If not possible, the area cannot be freed of cancer.
- Mark each cell's future condition as infected or uninfected based on the application of the above rules to the cell's condition at the beginning of the time step.
- Make the noted changes to each cell to create the new state at the end of the time step.
- Repeat the time steps to trace the growth or decay of the cancer.

In the example above, the anti-cancer needle has been moved from its position in the "Original" box to a new position in the "Begin Time Step 1" box, but the state of the other cells remains unchanged from the "Original". Then the rules were applied to create the new state as shown in the "End Time Step 1". These steps are repeated to remove all the cancerous cells. The goal is to remove all the cancerous cells in as few time steps as possible.

Input

The first line of input will contain a single integer `n` that indicates the simulations to follow. For each simulation, the first line will contain a single integer `m`, $0 < m \leq 5$, that indicates the size of the square to be considered. The next `m` lines will each contain `m` characters as described above (no spaces).

Output

For each simulation, you will print a single integer indicating the minimum number of time steps required to free the area of cancer. If the area cannot be freed of cancer, print `-1`. If the area was initially free of cancer, print a 0.

Note: If the state of a given area does not change after five consecutive time steps, you may assume that the area cannot be freed of cancer.

4. Cancer Cells (cont.)

Example Input File

```
3
5
....@
##...
#....
...#.
##.##
3
.##
.#.
@##
3
##.
#..
@..
```

Example Output to Screen

```
3
10
-1
```