

Competition 02

Due: September 7

GOOD LUCK, EVERYBODY!

Problem A. As is commonly known, cows are very socially polite creatures: any time two cows meet after being apart, they greet each-other with a friendly “moo”.

Bessie the cow and her friend, Elsie, are walking around on a long path on Farmer John’s farm. For all practical purposes, we can think of this path as a one-dimensional number line. Bessie and Elsie both start at the origin, and they both then begin walking around at identical speeds for some amount of time. Given a description of the movements taken by each cow, please determine the number of “moos” exchanged.

Bessie and Elsie can stop moving at different points in time, and neither cow will travel for more than 1,000,000 units of time.

input format: The input consists of $\rho \geq 1$ *challenges*, each in the format:

- Line 1: Two space-separated integers, B ($1 \leq B \leq 50,000$) and E ($1 \leq E \leq 50,000$).
- Lines $2 \dots 1+B$: These B lines describe Bessie’s movements. Each line contains a positive integer followed by either “L” or “R”, indicating the distance Bessie moves in a direction that is either left or right.
- Lines $2+B \dots 1+B+E$: These E lines describe Elsie’s movements. Each line contains a positive integer followed by either “L” or “R”, indicating the distance Elsie moves in a direction that is either left or right.

No extra lines intervene between two successive challenges. The last challenge is followed by a line containing a single copy of the character #.

sample challenge:

```
4 5
3 L
5 R
1 L
2 R
4 R
1 L
3 L
4 R
2 L
```

sample details: Bessie moves left for 3 units of time, then right for 5 units of time, then left for 1 unit of time, and finally right for 2 units of time; she then stands still. Elsie moves right for 4 units of time, then left for 4 units of time, then right for 4 units of time, then left for 2 units of time; she then stands still.

output format: The output should consist of ρ *responses*, each in the format:

- Line 1: An integer specifying the number of “moos” exchanged by the two cows. Their initial shared starting position at the origin does not cause a “moo”.

No extra lines should intervene between two successive responses.

sample response:

```
3
```

sample details: Bessie and Elsie meet after being temporarily apart at time 7, time 9, and time 13.

Problem B. Hearing that the latest fashion trend was cows with two spots on their hides, Farmer John has purchased an entire herd of two-spot cows. Unfortunately, fashion trends tend to change quickly, and the most popular current fashion is cows with only one spot!

FJ wants to make his herd more fashionable by painting each of his cows in such a way that merges their two spots into one. The hide of a cow is represented by an N by M ($1 \leq N, M \leq 50$) grid of characters like this:

```
.....
..XXXX...XXX...
...XXXX...XX...
.XXXX.....XXX..
.....XXXXX...
.....XXX....
```

Here, each 'X' denotes part of a spot. Two 'X's belong to the same spot if they are vertically or horizontally adjacent (diagonally adjacent does not count), so the figure above has exactly two spots. All of the cows in FJ's herd have exactly two spots.

FJ wants to use as little paint as possible to merge the two spots into one. In the example above, he can do this by painting only three additional characters with 'X's (the new characters are marked with '*'s below to make them easier to see).

```
.....
..XXXX...XXX...
...XXXX*...XX...
.XXXX..**..XXX..
.....XXXXX...
.....XXX....
```

Please help FJ determine the minimum number of new 'X's he must paint in order to merge two spots into one large spot.

input format: The input consists of $\rho \geq 1$ challenges, each in the format:

- Line 1: Two space-separated integers, N and M .
- Lines 2...1+N: Each line contains a length- M string of 'X's and '.'s specifying one row of the cow hide pattern.

No extra lines intervene between two successive challenges. The last challenge is followed by a line containing a single copy of the character #.

sample challenge:

```
6 16
.....
..XXXX...XXX...
...XXXX...XX...
.XXXX.....XXX..
.....XXXXX...
.....XXX....
```

sample details: The pattern in the input shows a cow hide with two distinct spots, labeled 1 and 2 below:

```

.....
..1111....222...
...1111....22...
.1111.....222..
.....22222...
.....222....

```

output format: The output should consist of ρ *responses*, each in the format:

- Line 1: The minimum number of new ‘X’s that must be added to the input pattern in order to obtain one single spot.

No extra lines should intervene between two successive responses.

sample response:

3

sample details: Three ‘X’s suffice to join the two spots into one:

```

.....
..1111....222...
...1111X...22...
.1111..XX..222..
.....22222...
.....222....

```

Problem C. Bessie the cow is just learning how to convert numbers between different bases, but she keeps making errors since she cannot easily hold a pen between her two front hooves.

Whenever Bessie converts a number to a new base and writes down the result, she always writes one of the digits wrong. For example, if she converts the number 14 into binary (i.e., base 2), the correct result should be “1110”, but she might instead write down “0110” or “1111”. Bessie never accidentally adds or deletes digits, so she might write down a number with a leading digit of “0” if this is the digit she gets wrong.

Given Bessie’s output when converting a number N into base 2 and base 3, please determine the correct original value of N (in base 10). You can assume N is at most 1 billion, and that there is a unique solution for N .

Please feel welcome to consult any on-line reference you wish regarding base-2 and base-3 numbers, if these concepts are new to you.

input format: The input consists of $\rho \geq 1$ challenges, each in the format:

- Line 1: The base-2 representation of N , with one digit written incorrectly.
- Line 2: The base-3 representation of N , with one digit written incorrectly.

No extra lines intervene between two successive challenges. The last challenge is followed by a line containing a single copy of the character #.

sample challenge:

```
1010
212
```

sample details: When Bessie incorrectly converts N into base 2, she writes down “1010”. When she incorrectly converts N into base 3, she writes down “212”.

output format: The output should consist of ρ responses, each in the format:

- Line 1: The correct value of N .

No extra lines should intervene between two successive responses.

sample response:

```
14
```

sample details: The correct value of N is 14 (“1110” in base 2, “112” in base 3).