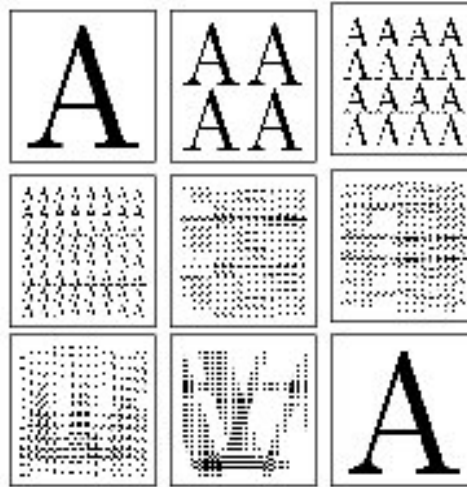




## 3510 - Pixel Shuffle

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Shuffling the pixels in a bitmap image sometimes yields random looking images. However, by repeating the shuffling enough times, one finally recovers the original images. This should be no surprise, since "shuffling" means applying a one-to-one mapping (or permutation) over the cells of the image, which come in finite number.

### Problem

Your program should read a number  $n$ , and a series of elementary transformations that define a "shuffling"  $\phi$  of  $n \times n$  images. Then, your program should compute the minimal number  $m$  ( $m > 0$ ), such that  $m$  applications of  $\phi$  always yield the original  $n \times n$  image.

For instance if  $\phi$  is counter-clockwise  $90^\circ$  rotation then  $m = 4$ .



### Input

The input begins with a single positive integer on a line by itself indicating the number of the cases following, each of them as described below. This line is followed by a blank line, and there is also a blank line between two consecutive inputs.

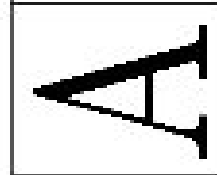
Input is made of two lines, the first line is number  $n$  ( $2 \leq n \leq 2^{10}$ ,  $n$  even). The number  $n$  is the size of images, one image is represented internally by a  $n \times n$  pixel matrix  $(a_i^j)$ , where  $i$  is the row number and  $j$  is the column number. The pixel at the upper left corner is at row 0 and column 0.

The second line is a non-empty list of at most 32 words, separated by spaces. Valid words are the keywords id, rot, sym, bhsym, bvsym, div and mix, or a keyword followed by ``-". Each keyword key designates an elementary transform (as defined by Figure 1), and key- designates the inverse of transform key. For instance, rot- is the inverse of counter-clockwise  $90^\circ$  rotation, that is clockwise  $90^\circ$  rotation. Finally, the list  $k_1, k_2, \dots, k_p$  designates the compound transform  $\phi = k_1 \circ k_2 \circ \dots \circ k_p$ . For instance, ``bvsym rot-" is the transform that first performs clockwise  $90^\circ$  rotation and then vertical symmetry on the lower half of the image.

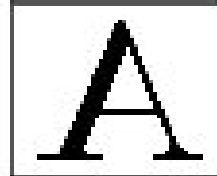


Figure 1: Transformations of image  $(a_i^j)$  into image  $(b_i^j)$

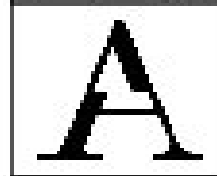
**rot** , counter-clockwise  $90^\circ$  rotation



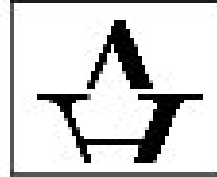
**sym** , horizontal symmetry :  $b_i^j = a_i^{n-1-j}$



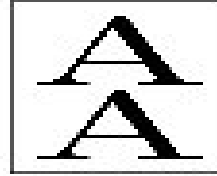
**bhsym** , horizontal symmetry applied to the lower half of image : when  $i \geq n/2$ , then  $b_i^j = a_i^{n-1-j}$ . Otherwise  $b_i^j = a_i^j$ .



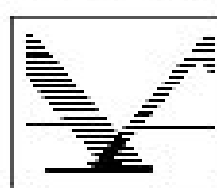
**bvsym** , vertical symmetry applied to the lower half of image ( $i \geq n/2$ )



**div** , division. Rows  $0, 2, \dots, n-2$  become rows  $0, 1, \dots, n/2-1$ , while rows  $1, 3, \dots, n-1$  become rows  $n/2, n/2+1, \dots, n-1$ .



**mix** , row mix. Rows  $2k$  and  $2k+1$  are interleaved. The pixels of row  $2k$  in the new image are  $a_{2k}^0, a_{2k+1}^0, a_{2k}^1, a_{2k+1}^1, \dots, a_{2k}^{n/2-1}, a_{2k+1}^{n/2-1}$ , while the pixels of row  $2k+1$  in the new image are  $a_{2k}^{n/2}, a_{2k+1}^{n/2}, a_{2k}^{n/2+1}, a_{2k+1}^{n/2+1}, \dots, a_{2k}^{n-1}, a_{2k+1}^{n-1}$ .



## Output

For each test case, the output must follow the description below. The outputs of two consecutive cases will be separated by a blank line.

Your program should output a single line whose contents is the minimal number  $m$  ( $m > 0$ ) such that  $\phi^m$  is the identity. You may assume that, for all test input, you have  $m < 2^{31}$ .

## Sample Input

2

256  
rot- div rot div

256  
bvsym div mix

## Sample Output

8

63457

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