Problem K – Kayaking

Your friend Luis is an expert kayaker planning to navigate a treacherous river. The river is modeled as a $2 \times N$ grid, completely enclosed by border cells to form a grid with 4 rows and $N + 2$ columns.

Border cells describe the surroundings of the river. Each of them is either a safe zone, like a calm eddy or the shore, represented by "`.`" (dot), or an obstacle, like a rock or a waterfall, represented by "`#`" (hash).

In each river cell, the current flows left, right, up or down, represented respectively by "`<`" (less-than sign), "`>`" (greater-than sign), "`^`" (caret) or "`v`" (lowercase letter v). Some river cells may have an unknown flow direction, represented by "`?`" (question mark).

A river cell is *safe* if following the current from that cell eventually leads to a safe zone "`.`". Otherwise, the river cell is *unsafe*: the current hits an obstacle "`#`" or enters a loop within the river.

For example, consider the first sample input, where $N = 2$. The top-left river cell is safe since the current flows into the safe zone on its left. The other three river cells are unsafe: the current from the bottom-left river cell leads to the obstacle directly below it, while the two river cells on the right form a loop.

A *configuration* of the river is obtained by assigning any of the four directions "`<`", "`>`", "`^`" or "`v`" to each unknown flow direction "`?`"; each unknown flow direction can be assigned independently of the others.

Luis needs your help to assess the river's safety. For each integer k from 0 to $2N$ inclusive, you must determine the number of configurations having exactly k safe river cells.

Input

The first line contains an integer N ($1 \leq N \leq 1000$).

Each of the next 4 lines contains a string of $N + 2$ characters representing a row of the grid, as described in the statement.

Output

Output a single line with $2N + 1$ integers $C_0, C_1, \ldots, C_{2N}$, where C_k indicates the number of configurations having exactly k safe river cells. Since these numbers can be large, output the remainder of dividing each of them by 998 244 353.

Sample input 1	**Sample output 1**
2 ##.# .<v. .v^. ##.#	0 1 0 0 0

Sample input 2	**Sample output 2**
1 #.# .?. .?. #.#	1 0 15

Sample input 3	Sample output 3
2 ##.# .??. .^<# ...#	6 4 0 0 6

Sample input 4	Sample output 4
4 ..#..# #>v^?. #?<??. #.#.#.	0 18 48 39 87 3 12 9 40

Sample input 5	Sample output 5
8 .########. #????????# #???^????# .########.	75497471 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0