Attack of the Clones

A boolean function is a function of the form f: B_n -> B, where B = {0, 1} and n is a non-negative integer called the arity of the function. Some Boolean functions are projections: $p_n^k(x_1, ..., x_n) = x_k$. And given an m-ary function f, and n-ary functions $g_1, ..., g_m$, we can construct another n-ary function: $h(x_1, ..., x_n) = f(g1(x_1, ..., x_n), ..., gm(x_1, ..., x_n))$, called their composition. A set of functions closed under composition and containing all projections is called a clone. One trivial clone is a set of all boolean functions. Some of the special clones are:

- Z is a set of 0-preserving functions: f(0, ..., 0) = 0;
- P is a set of 1-preserving functions: f(1, ..., 1) = 1;
- D is a set of self-dual functions: $!f(x_1, ..., x_n) = f(!x_1, ..., !x_n)$;
- A is a set of affine functions: the functions satisfying that if $f(a_1, ..., c, ..., a_n) = f(a_1, ..., d, ..., a_n)$ then $f(b_1, ..., c, ..., b_n) = f(b_1, ..., d, ..., b_n)$, where c and d are at some position i. This should hold for every valid i, $a_1, ..., a_n, b_1, ... b_n$, c and d.

Now we are interested how many n-ary functions are there in some combinations of mentioned above sets. For example, for n = 2, there are exactly 8 functions in Z, 4 functions in the intersection of Z and P, 8 function in the complement of A and so on.

Input

The first line of the input file contains n - the arity of the boolean functions we are looking at. The second line contains the q - number of queries. Each of the next q lines will describe a query. The query is a set expression. The expression will contain the following characters: 'Z', 'P', 'D', 'A' denoting the sets, described above; 'v' - which is set union; '^' - which is set intersection; '!' which is complement; '\' which is set difference; and also '(' and ')' to define operations priority. Operations in brackets have higher priority. Otherwise the '!' operation has the higher priority and 'v', '^' and '\' are of the same priority. It is guaranteed that the expression will be correct. See samples for some examples of set expressions.

Constraints

1 <= n <= 100
1 <= q <= 100
The length of each expression won't exceed 100 characters.

Output

For each query in the input print how many n-ary function are in the set described by the according set expression modulo 1000003.

Example

Input:
2
6
Z

Z^P
!A
!(AvP)^D
AvZvP\A
!A^(Z\(Dv!P))

Output:
8
4
8
0
6
2