Problem A. Expected Cycle Size

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	512 megabytes

TL;DR Permutation pattern is a permutation with 0 as a wildcard. You are given a permutation pattern. For each index, find its expected cycle size if a random permutation conforming to the pattern is chosen and output it modulo 998 244 353.

And now five times as long, three times as formal

A **permutation** is an array p of length n, such that $\forall_{i \neq j} : p_i \neq p_j, \forall_i : 1 \leq p_i \leq n$

The **product of permutations** p and q which have the same length, denoted as $p \cdot q$ is the permutation r of the same length as both p and q, such that $\forall_i : r_i = p_{q_i}$

The **power** p^k where p is a permutation and k is a positive integer is

1. p if $k = 1$
2. $p^{k-1} \cdot p$ otherwise

Cycle size of index i is the minimal positive integer k, such that $(p^k)_i = i$. It can be shown that such number always exists.

Permutation pattern is an array of length n such that $\forall_{i \neq j} : a_i = 0$ *or* $a_i \neq a_j, \forall_i : 0 \leq a_i \leq n$.

We say permutation p conforms to the pattern t if $\forall_i : p_i = t_i$ *or* $t_i = 0$.

Let ans_i be the expected cycle size of index i in a random permutation conforming to the pattern given in input. You are to find ans_i modulo 998 244 353.

Taking a potentially non-integer number X modulo M is the following procedure:

Jury guarantees that X is equal to some irreducible fraction $\frac{P}{Q}$ where Q has an inverse modulo M. In that case X modulo $M = A$, where A is an integer between 0 and $M - 1$ inclusive and $P - QA$ is divisible by M. It can be shown that A is unique.

Input

The first line contains one integer n ($1 \leq n \leq 10^6$), the length of the permutation pattern.

The second line contains n space separated integers t_i ($0 \leq t_i \leq n$).

It is guaranteed that t is a permutation pattern.

Output

Output n integers. i-th of them must be equal to ans_i modulo 998 244 353.

Examples

standard input	standard output
5 2 3 4 5 0	5 5 5 5 5
2 0 0	499122178 499122178
6 3 0 1 6 5 2	2 3 2 3 1 3

Note

In the second example both ans_i are equal to $\frac{3}{2}$ which equals 499122178 modulo 998244353.