Problem M. Vulpecula

Input file:	`standard input`
Output file:	`standard output`
Time limit:	5 seconds
Memory limit:	512 megabytes

In the center of the Summer Triangle nestles a little fox, a constellation named Vulpecula, to be precise. It is situated in a zone with numerous brilliant stars, but it itself is relatively faint. Even the brightest star in the constellation has an apparent magnitude of merely 4.44. However, despite its dimness, Vulpecula captures the attention of many stargazers for various reasons. Say, Mu, the protagonist of our problem, regards Vulpecula as his favorite constellation because there, he can always see his own reflection.

Mu lives a stressful life and only by viewing stars can he find some relief. Every night, he would climb onto the roof, watching skyward with his telescope and identifying constellations of all shapes. While admiring the cosmic wonder, he would occasionally write down some thoughts that crossed his mind. And this night started with a strange question: "*What in the world are dreams for?*"

Thoughtfully, Mu looked up at the starry fox as the past experience came reeling through his head. Although recent years have been even rougher, his striving for dreams has never diminished all the way. He gave up money because he should not overvalue it. He gave up prestige because he could not maintain it. He gave up the place he longed to settle because he did not deserve it. He gave up everything but...

"*Dreams are like the stars, distant and sometimes insignificant, yet enough to spark up the darkest night.*" Mu jotted it down on a note and squeezed a smile, before immersing himself in the joy of stargazing again.



The Constellation Vulpecula

Now, let's get back to the problem. People have associated constellations with animals and mythological characters since ancient times. Giving free rein to their imagination, they drew straight lines between the stars on a chart and conceived the story behind every constellation. Suppose there are n stars numbered from 1 to n in Vulpecula with $n-1$ imaginary lines connecting them. Namely, for each pair of stars (s, t), there always exists a sequence of stars $u_0, u_1, \ldots, u_k$ where $u_0 = s$ and $u_k = t$, satisfying that star u_{i-1} and star u_i are linked by a line for each $i = 1, 2, \ldots, k$, and the *distance* between star s and star t is defined as the minimum k among all such sequences.

Mu is prepared to view those stars in Vulpecula, and he will focus his telescope on one of the n stars. Detailed observation, however, requires advanced technology as there will be several obstacles.

One is that some stars may be too tiny to observe. To tackle it, Mu can screw a knob to zoom in or out. Specifically, after selecting the focused star, he will adjust the focal distance to an integer d between 0 and $n-1$ and see all stars whose *distance* from the focused star is not more than d.

The other is that some stars may be too faint to observe. Luckily, Mu can use filters to regulate the rays of a star. Let a_i represent the *visibility* of star i which is initially 0. A filter denoted as (i, x) only applies to star i, and when Mu installs it, a_i will become $a_i \oplus x$, where $\oplus$ denotes the bitwise exclusive-OR operation. Mu can pick a set of filters he has got and install them in arbitrary order. He may also pick no filters or two or more identical filters.

For a pleasant stargazing experience, Mu will make the *visibilities* of the stars in sight equal and maximized. Playing with a telescope is quite easy, whereas your task is not so simple. Suppose $f(d)$ is the maximum visibility under a certain focal distance d. Can you calculate the sum of $f(d)$ over $d = 0, 1, \ldots, n-1$ modulo 2^{64} for each star if it is the focused star?

Input

The first line contains an integer n ($2 \le n \le 5 \times 10^4$), denoting the number of stars in Vulpecula.

The second line contains $n-1$ integers $p_1, p_2, \ldots, p_{n-1}$ ($1 \le p_i \le i$), indicating that there is an imaginary line between star p_i and star $i+1$ for each $i = 1, 2, \ldots, n-1$. It is guaranteed that the given $n-1$ imaginary lines connect all the stars.

In the i-th of the following n lines, an integer m_i ($m_i \ge 0$) comes first, denoting the number of filters that apply to star i. Then m_i integers $x_{i,1}, x_{i,2}, \ldots, x_{i,m_i}$ ($0 \le x_{i,j} < 2^{64}$) follow, the j-th of which denotes a filter $(i, x_{i,j})$. It is guaranteed that the sum of m_i over $i = 1, 2, \ldots, n$ does not exceed 2×10^6.

Output

Output n lines, the i-th of which contains a single integer, indicating the sum of $f(d)$ over $d = 0, 1, \ldots, n-1$ modulo 2^{64} if star i is the focused star.

Examples

standard input	standard output
2 1 2 2 3 2 1 1	4 2
5 1 2 2 3 3 83 75 58 4 125 124 58 16 4 39 125 71 112 3 69 66 5 4 48 73 69 6	171 125 183 142 243

Note

In the first sample case, if star 1 is the focused star, Mu can install filter $(1, 3)$ to reach $f(0) = 3$ because star 1 is the only star in sight when $d = 0$. He can successively install filter $(1, 2)$, filter $(1, 3)$ and either filter $(2, 1)$ to reach $f(1) = 1$. Thus, the sum for star 1 is $(3 + 1) \bmod 2^{64} = 4$.