Problem J. Suffix Structure

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2 seconds
Memory limit:	1024 megabytes

For a string $u = u_1 \dots u_n$, let $\text{pre}(u, i)$ be the prefix $u_1 \dots u_i$. In particular, $\text{pre}(u, 0)$ is empty string.

For two strings $u = u_1 \dots u_n$ and $v = v_1 \dots v_m$, let $u + v$ be the concatenation $u_1 \dots u_n v_1 \dots v_m$.

You are given a string $t = t_1 \dots t_m$ of length m and a tree T with $(n + 1)$ vertices labeled with $0, 1, \dots, n$ rooted at vertex 0. Each edge is associated with a character. Please note that in this problem, the alphabet may contain more than 26 characters.

Consider the following function

$$f(i, j) = \max\{d(x) \mid s_x \text{ is a suffix of } s_i + \text{pre}(t, j)\}$$

where s_i be the concatenation of characters on the shortest path from root to vertex i and $d(i)$ be the number of edges on the shortest path from the root to vertex i.

Your task is to compute the values of $g_1, g_2, \dots, g_m$ where $g_j = \sum_{i=1}^{n} f(i, j)$.

Note that s_0 is the empty string and empty string is a suffix of any string.

Input

There are multiple test cases. The first line of the input contains an integer T indicating the number of test cases. For each test case:

The first line contains two integers n and m ($1 \le n, m \le 2 \times 10^5$).

The second line contains n integers $p_1, p_2, \dots, p_n$ ($0 \le p_i < i$) where p_i indicates the parent of vertex i.

The third line contains n integers $c_1, c_2, \dots, c_n$ ($1 \le c_i \le n$) where c_i indicates that the edge from vertex p_i to vertex i is associated with the c_i-th character from the alphabet. It is guaranteed that $p_i \neq p_j$ or $c_i \neq c_j$ for all $i \neq j$.

The fourth line contains m integers $t_1, t_2, \dots, t_m$ ($1 \le t_i \le n$) where t_i is the i-th character of string t.

It is guaranteed that neither the sum of n nor the sum of m will exceed 2×10^5.

Output

For each test case output one line containing m integers $g_1, g_2, \dots, g_m$ separated by a space.

Please, DO NOT output extra spaces at the end of each line, or your solution may be considered incorrect!

Example

standard input	standard output
2 11 3 0 1 2 0 4 5 4 6 0 9 10 1 3 2 2 1 3 4 1 3 2 1 3 2 4 5 16 0 0 0 1 4 1 2 3 2 2 2 1 3 3 2 1 3 2 1 3 2 2 1 1 2 1	17 26 22 8 5 5 5 5 5 5 5 5 5 5 5 5 5 10 5

Note

Let's calculate $f(11,1)$ and $f(11,2)$ in the first sample test case to help you further understand. We have $s_{11} = \{3,2,1\}$ so $s_{11} + \text{pre}(t,1) = \{3,2,1,3\}$. As $s_6 = \{2,1,3\}$ is its longest suffix existing in the tree, $f(11,1) = d(6) = 3$. Also $s_{11} + \text{pre}(t,2) = \{3,2,1,3,2\}$ and $s_3 = \{1,3,2\}$ is its longest suffix existing in the tree, so $f(11,2) = d(3) = 3$.