

E. Analysis of Pathes in Functional Graph

time limit per test: 2 seconds
memory limit per test: 512 megabytes
input: standard input
output: standard output

You are given a *functional graph*. It is a directed graph, in which from each vertex goes exactly one arc. The vertices are numerated from 0 to $n - 1$.

Graph is given as the array f_0, f_1, \dots, f_{n-1} , where f_i — the number of vertex to which goes the only arc from the vertex i . Besides you are given array with weights of the arcs w_0, w_1, \dots, w_{n-1} , where w_i — the arc weight from i to f_i .

The graph from the first sample test.

Also you are given the integer k (the length of the path) and you need to find for each vertex two numbers s_i and m_i , where:

- s_i — the sum of the weights of all arcs of the path with length equals to k which starts from the vertex i ;
- m_i — the minimal weight from all arcs on the path with length k which starts from the vertex i .

The length of the path is the number of arcs on this path.

Input

The first line contains two integers n, k ($1 \leq n \leq 10^5$, $1 \leq k \leq 10^{10}$). The second line contains the sequence f_0, f_1, \dots, f_{n-1} ($0 \leq f_i < n$) and the third — the sequence w_0, w_1, \dots, w_{n-1} ($0 \leq w_i \leq 10^8$).

Output

Print n lines, the pair of integers s_i, m_i in each line.

Examples

input
7 3 1 2 3 4 3 2 6 6 3 1 4 2 2 3
output
10 1 8 1 7 1 10 2 8 2 7 1 9 3

input
4 4 0 1 2 3 0 1 2 3
output
0 0 4 1 8 2 12 3

input

5 3
1 2 3 4 0
4 1 2 14 3

output

7 1
17 1
19 2
21 3
8 1