J. DOTS

Mika loves doodling in her notebook. Today, she's drawn N dots and connected them with N - 1 lines. These lines are drawn in a such a way that she can follow a path from one dot to another without having to lift her pencil.

The dots are numbered from 0 to N - 1. Mika wants to follow a path from dot 0 to some other dot without lifting her pencil. The path can contain a line more than once.

To make things challenging, she assigns N integers E_0, E_1, E_2, … $E_{(N - 1)}$ to each dot. For any dot i, she must ensure that her path does not leave that dot more than E_i times.

For each integer i from 0 to N - 1, determine the length of the longest path Mika can follow to get from dot 0 to dot i that satisfies the conditions above.

INPUT

The first line contains an integer N - the number of dots ($1 \leq N \leq 50000$).

The second line contains N integers E_0, E_1, E_2, …, $E_{(n - 1)}$ ($1 \leq E_i \leq 40000$), where E_i is the maximum number of times the path can leave dot i. It is guaranteed that E_i is greater than or equal to the number of lines that come out of dot i.

The next N - 1 lines contain two integers U_i and V_i ($0 \leq U_i, V_i \leq N - 1$), indicating that there is a line between dots Ui and Vi.

OUTPUT

For each integer i from 0 to N - 1, print one line containing the length of the longest path that ends at dot i.

Sample Input	Sample Output
3 2 6 2 0 1 1 2	8 7 8