INOI 2016 Problem 1: Wealth Disparity

Boing Inc, has N employees, numbered 1 ... N. Every employee other than Mr. Hojo (the head of the company) has a manager (P[i] denotes the manager of employee i). Thus an employee may manage any number of other employees but he reports only to one manager, so that the organization forms a tree with Mr. Hojo at the root. We say that employee B is a subordinate of employee A if B appears in the subtree rooted at A.

Mr. Hojo, has hired Nikhil to analyze data about the employees to suggest how to identify faults in Boing Inc. Nikhil, who is just a clueless consultant, has decided to examine wealth disparity in the company. He has with him the net wealth of every employee (denoted A[i] for employee i). Note that this can be negative if the employee is in debt. He has already decided that he will present evidence that wealth falls rapidly as one goes down the organizational tree. He plans to identify a pair of employees i and j, j a subordinate of i, such that the wealth difference between i and j is maximum. Your task is to help him do this.

Suppose, Boing Inc has 4 employees and the parent (P[i]) and wealth information (A[i]) for each employee are as follows:

i	1	2	3	4
A[i]	5	10	6	12
P[i]	2	-1	4	2

P[2] = -1 indicates that employee 2 has no manager, so employee 2 is Mr. Hojo.

In this case, the possible choices to consider are (2,1) with a difference in wealth of of 5, (2,3) with 4, (2,4) with -2 and (4,3) with 6. So the answer is 6.

Input Format:
There will be one line which contains (2*N + 1) space-separate integers. The first integer is N, giving the number of employees in the company. The next N integers A[1], .., A[N] give the wealth of the N employees. The last N integers are P[1], P[2], .., P[N], where P[i] identifies the manager of employee i. If Mr. Hojo is employee i then, P[i] = -1, indicating that he has no manager.

Output Format:
One integer, which is the needed answer.

Constraints:
-10^8 <= A[i] <= 10^8, for all i.

Subtasks:
For 30% of the marks, 1 <= N <= 500.
For 100% of the marks, 2 <= N <= 10^5.

```
Sample Input:
4 5 10 6 12 2 -1 4 2

Sample Output:
6
```

INOI 2016, Problem 2: Brackets

There are k types of brackets each with its own opening bracket and closing bracket. We assume that the first pair is denoted by the numbers 1 and k+1, the second by 2 and k+2 and so on. Thus the opening brackets are denoted by 1,2,.., k, and the corresponding closing brackets are denoted by k+1,k+2,..., 2*k respectively.

Some sequences with elements from 1,2, ... 2*k form well-bracketed sequences while others don't. A sequence is well-bracketed, if we can match or pair up opening brackets and closing brackets of the same type in such a way that the following holds:
 1) every bracket is paired up
 2) in each matched pair, the opening bracket occurs before the closing bracket
 3) for a matched pair, any other matched pair lies either completely between them or outside them.

For the examples discussed below, let us assume that k = 2. The sequence 1,1,3 is not well-bracketed as one of the two 1's cannot be paired. The sequence 3,1,3,1 is not well-bracketed as there is no way to match the second 1 to a closing bracket occurring after it. The sequence 1,2,3,4 is not well-bracketed as the matched pair 2,4 is neither completely between the matched pair 1,3 nor completely outside it. That is, the matched pairs cannot overlap. The sequence 1,2,4,3,1,3 is well-bracketed. We match the first 1 with the first 3, the 2 with the 4 and the second 1 with the second 3, satisfying all the 3 conditions. If you rewrite these sequences using [,{,],} instead of 1,2,3,4 respectively, this will be quite clear.

In this problem you are given a sequence of brackets, of length N: B[1], .., B[N], where each B[i] is one of the brackets. You are also given an array of Values: V[1],.., V[N].

Among all the subsequences in the Values array, such that the corresponding bracket subsequence in the B Array is a well-bracketed sequence, you need to find the maximum sum.

Suppose N = 6, k = 3 and the values of V and B are as follows:

i	1	2	3	4	5	6
V[i]	4	5	-2	1	1	6
B[i]	1	3	4	2	5	6

Then, the brackets in positions 1,3 form a well-bracketed sequence (1,4) and the sum of the values in these positions is 2 (4 + -2 = 2). The brackets in positions 1,3,4,5 form a well-bracketed sequence (1,4,2,5) and the sum of the values in these positions is 4. Finally, the brackets in positions 2,4,5,6 forms a well-bracketed sequence (3,2,5,6) and the sum of the values in these positions is 13. The sum of the values in positions 1,2,5,6 is 16 but the brackets in these positions (1,3,5,6) do not form a well-bracketed sequence. You can check the best sum from positions whose brackets form a well-bracketed sequence is 13.

Input Format:
One line, which contains (2*N + 2) space separate integers. The first integer denotes N. The next integer is k. The next N integers are V[1],..., V[N]. The last N integers are B[1],.., B[N].

Output Format:
One integer, which is the maximum sum possible satisfying the requirement
mentioned above.

Constraints:
1 <= k <= 7
-10^6 <= V[i] <= 10^6, for all i
1 <= B[i] <= 2*k, for all i.

Subtasks:
For 40% of the marks, 1 <= n <= 10
For 100% of the marks, 1 <= n <= 700

Sample Input:
6 3 4 5 -2 1 1 6 1 3 4 2 5 6

Sample Output:
13