- Select your language (C/C++/Java/Python2/Python3)
- Paste your code into the submission window.
- There are some public test cases and some (hidden) private test cases.
- "Compile and run" will evaluate your submission against the public test cases.
- "Submit" will evaluate your submission against the hidden private test cases and report a score on 100. There are 7 private testcases in all, each with equal weightage.
- Ignore warnings about "Presentation errors".

Wealth Disparity

Indian National Olympiad in Informatics, 2016

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 A[i] - A[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 5, (2,3) with 4, (2,4) with -2 and (4,3) with 6. So the answer is 6.

Solution hint

The company hierarchy is a tree. Explore using DFS and incrementally keep track of the maximum difference. Your algorithm should work in time O(n+m).

Input Format

There are three lines of input. The first line contains a single integer N, giving the number of employees in the company. The next line has N integers A[1], .., A[N] that give the wealth of the N employees. The third line has N integers 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:

$1 \le n \le 10^5$.

$-10^8 \le A[i] \le 10^8$, for all i.

Sample Input

```
4
5 10 6 12
2 -1 4 2
```

Sample Output

```
6
```

Evaluation

- For each function, there are some public test cases and some (hidden) private test cases.
- "Compile and run" will evaluate your submission against the public test cases.
- "Submit" will evaluate your submission against the hidden private test cases and report a score on 100.
- The private test cases include some large inputs that validate the efficiency of your algorithm.

Sample Test Cases

	Input
Test Case 1	4 5 10 6 12 2 -1 4 2
Test Case 2	10 -84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 9 3 7 7 7 4 -1 9 5 9
Test Case 3	500 -84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 -26691609 32134125 1 243 435 266 360 162 480 84 37 201 143 400 343 73 114 284 23 430 344 275 65 361 439 314 416 402 164 175 382 283 319

```
Test 4
Case5 10 6 12
4   2 -1 4 2
Test 10
Case-84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767
5   9 3 7 7 7 4 -1 9 5 9
Test 500
Case-84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 -26691609 32134125 1
6   243 435 266 360 162 480 84 37 201 143 400 343 73 114 284 23 430 344 275 65 361 439 314 416 402 164 175 382 283 319
Test 500
Case-84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 -26691609 32134125 1
7   119 60 485 214 277 300 369 152 409 386 210 411 160 364 428 402 167 284 282 321 83 493 232 344 267 240 349 471 225 4
Test 500
Case-84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 -26691609 32134125 1
8   495 262 246 338 454 140 408 465 19 332 301 460 376 362 235 395 366 391 319 175 264 104 217 311 117 133 380 102 445
Test 500
Case-84597717 6135976 -55501214 -97723328 -89733556 -91129590 -74195203 74072104 71058203 11945767 -26691609 32134125 1
9   243 435 266 360 162 480 84 37 201 143 400 343 73 114 284 23 430 344 275 65 361 439 314 416 402 164 175 382 283 319
Test 100000
Case-53583121 23921951 -43903673 -26709364 -77886492 68088003 1968382 43891402 56062976 -4841379 49146820 -6262560 3050
10  95418 70404 81144 42417 62092 70334 52742 8808 16101 27666 62052 49276 82043 69245 48890 43799 4430 99474 40379 481
```

Due Date Exceeded.
7 out of 7 tests passed.
You scored 100.0/100.

Your last recorded submission was :

```cpp
#include <bits/stdc++.h>
using namespace std;
#define int long long
int n, dummy, root, ans=INT_MIN;
vector < vector < int > > adj; vector < int > value;

void solve(int node, int maxval)
{
    maxval=max(maxval, value[node]);
    ans=max(ans, maxval-value[node]);
    for (int i=0; i<adj[node].size(); i++) solve(adj[node][i], maxval);
}

signed main()
{
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cin >> n;
    adj.resize(n+1);
    value.resize(n+1);
    for (int i=1; i<=n; i++) cin >> value[i];
    for (int i=1; i<=n; i++)
    {
        cin >> dummy;
        if (dummy==-1) root=i;
        else adj[dummy].push_back(i);
    }
    solve(root, value[root]);
    cout << ans;
}
```

End