IOITC 2016 TST Day 3

Correcting Heaps

You are given a complete rooted binary tree of height H, that is, on $2^H - 1$ nodes. The root is numbered 1 and the children of node x are numbered $2x$ and $2x + 1$ in that order. In other words, the parent of the node numbered x is the node numbered $\lfloor \frac{x}{2} \rfloor$ when $x \geq 2$. Each node has a value attached to it and a cost attached to it. They are given by the arrays $v_1, v_2, \ldots, v_{2^H-1}$ and $c_1, c_2, \ldots, c_{2^H-1}$. All the given values are integers.

You are also given a bit b, which is 0 or 1.

- If b is 0, you are supposed to convert the binary tree into a *maximum heap* by choosing some of the nodes and changing the value to any other integral value. The current value of node x is v_x and the cost to change its value to any other integral value is c_x.
- If b is 1, you are supposed to convert the binary tree into a *strict maximum heap* by choosing some of the nodes and changing the value to any other integral value. The current value of node x is v_x and the cost to change its value to any other integral value is c_x.

A *maximum heap* is a binary tree such that the value at any node is greater than or equal to the values at the children, if it has any. And a *strict maximum heap* is a binary tree such that the value at any node is strictly greater than the values at the children, if it has any.

The total cost is the sum of the costs incurred for each node. For the given bit b, print the minimum cost to do the required operation. Note that the updated values have to be integers and that they need not be necessarily positive.

Input

The first line contains the height of the binary tree H.
The second line contains $2^H - 1$ integers, the array $v_1, \ldots, v_{2^H-1}$.
The third line contains $2^H - 1$ integers, the array $c_1, \ldots, c_{2^H-1}$.
The fourth and final line contains the bit b.

Output

Print a single line containing the minimum cost to convert the binary tree into a *maximum heap* or a *strict maximum heap* corresponding to the bit b.

Test Data

In all subtasks:

- $0 \leq b \leq 1$
- $1 \leq c_x \leq 10^3$, for all nodes x
- $1 \leq v_x \leq 10^9$, for all nodes x

Subtask 1 (19 Points):

- $1 \leq h \leq 10$
- $b = 0$

Subtask 2 (28 Points):

- $1 \leq h \leq 20$
- $b = 0$

Subtask 3 (53 Points):

- $1 \leq h \leq 20$
- $0 \leq b \leq 1$

Sample Input 1

```
2
2 3 3
3 1 1
0
```

Sample Output 1

```
2
```

Sample Input 2

```
2
2 3 3
3 2 2
1
```

Sample Output 1

```
3
```

Limits

Time: 2 seconds

Memory: 256 MB