Problem E. Balanced Array

- 2023.10.06 15:00 Update: Strengthened testcases and rejudged solutions.

Problem Description

Given an array $a = [a[0], a[1], \ldots, a[n-1]]$ with $\sum_{i=0}^{n-1} a[i] = 0$, you want to balance the array such that every element becomes 0.

To achieve this, you can perform the following operations any number of times:

- Choose an index i $(0 \leq i \leq n-1)$, pay $w[i]$ dollars, and update $(a[i], a[(i+1) \bmod n])$ to $(a[i]-1, a[(i+1) \bmod n]+1)$.
- Choose an index i $(0 \leq i \leq n-1)$, pay $w[i]$ dollars, and update $(a[i], a[(i+1) \bmod n])$ to $(a[i]+1, a[(i+1) \bmod n]-1)$.

It is guaranteed that $w[n-1] = 0$. Can you determine the minimum amount of dollars you have to pay to balance the array?

Input Format

- line 1: n
- line 2: $a[0]$ $a[1]$ $\ldots$ $a[n-1]$
- line 3: $w[0]$ $w[1]$ $\ldots$ $w[n-1]$

Output Format

- line 1: the minimum cost to make the array balanced.

Constraints

- $2 \leq n \leq 1\,000\,000$.
- $|a[i]| \leq 1000$ for $i = 0, 1, \ldots, n-1$.
- $\sum_{i=0}^{n-1} a[i] = 0$.
- $0 \leq w[i] \leq 1000$ for $i = 0, 1, \ldots, n-1$.
- $w[n-1] = 0$.
- All the inputs are integers.

Subtasks

1. (25 points) $n \leq 100$; $|a[i]| \leq 100$ for $i = 0, 1, \ldots, n-1$.
2. (75 points) No additional constraints.

No.	Testdata Range	Time Limit (ms)	Memory Limit (KiB)
Samples	1-4	1000	262144
1	5-21	1000	262144
2	1-33	1000	262144

Samples

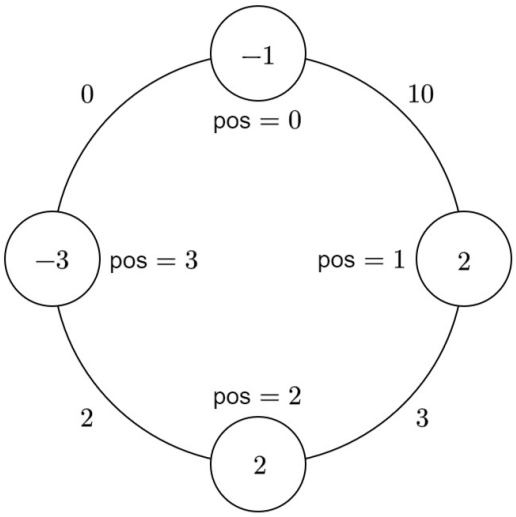
Sample Input 1

```
4
-1 2 2 -3
10 3 2 0
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 1

```
14
```



The picture of sample 1.

The number inside the circle is $a[i]$ and the number on the line connecting position i and $(i+1) \bmod 4$ is $w[i]$.

In the optimal solution, we first pay $w[1] = 3$ dollars twice to update the array to $[-1, 0, 4, -3]$. Then, we pay $w[2] = 2$ dollars four times to further update the array to $[-1, 0, 0, 1]$. Finally, we pay $w[3] = 0$ dollars to achieve a balanced array.

Sample Input 2

```
5
4 1 -9 3 1
7 3 5 3 0
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 2

```
58
```

Sample Input 3

```
8
10 20 30 40 -40 -30 -20 -10
88 46 90 17 22 63 99 0
```

This sample input satisfies the constraints of all the subtasks.

Sample Output 3

```
8290
```

Sample Input 4

```
4
1000 -1000 1000 -1000
0 0 0 0
```

This sample input satisfies the constraints of Subtasks 2.

Sample Output 4

```
0
```