IOI '24 P1 - Nile

Time limit: 2.0s **Memory limit:** 1G

You want to transport N artifacts through the Nile. The artifacts are numbered from 0 to $N-1$. The weight of artifact i ($0 \leq i < N$) is $W[i]$.

To transport the artifacts, you use specialized boats. Each boat can carry **at most two** artifacts.

- If you decide to put a single artifact in a boat, the artifact weight can be arbitrary.
- If you want to put two artifacts in the same boat, you have to make sure the boat is balanced evenly. Specifically, you can send artifacts p and q ($0 \leq p < q < N$) in the same boat only if the absolute difference between their weights is at most D, that is $|W[p] - W[q]| \leq D$.

To transport an artifact, you have to pay a cost that depends on the number of artifacts carried in the same boat. The cost of transporting artifact i ($0 \leq i < N$) is:

- $A[i]$, if you put the artifact in its own boat, or
- $B[i]$, if you put it in a boat together with some other artifact.

Note that in the latter case, you have to pay for both artifacts in the boat. Specifically, if you decide to send artifacts p and q ($0 \leq p < q < N$) in the same boat, you need to pay $B[p] + B[q]$.

Sending an artifact in a boat by itself is always more expensive than sending it with some other artifact sharing the boat with it, so $B[i] < A[i]$ for all i such that $0 \leq i < N$.

Unfortunately, the river is very unpredictable and the value of D changes often. Your task is to answer Q questions numbered from 0 to $Q-1$. The questions are described by an array E of length Q. The answer to question j ($0 \leq j < Q$) is the minimum total cost of transporting all N artifacts, when the value of D is equal to $E[j]$.

Implementation Details

You should implement the following procedure.

```
std::vector<long long> calculate_costs(
    std::vector<int> W, std::vector<int> A,
    std::vector<int> B, std::vector<int> E)
```

- W, A, B: arrays of integers of length N, describing the weights of the artifacts and the costs of transporting them.
- E: an array of integers of length Q describing the value of D for each question.
- This procedure should return an array R of Q integers containing the minimum total cost of transporting the artifacts, where $R[j]$ gives the cost when the value of D is $E[j]$ (for each j such that $0 \leq j < Q$).
- This procedure is called exactly once for each test case.

Constraints

- $1 \leq N \leq 100\,000$
- $1 \leq Q \leq 100\,000$
- $1 \leq W[i] \leq 10^9$ for each i such that $0 \leq i < N$
- $1 \leq B[i] < A[i] \leq 10^9$ for each i such that $0 \leq i < N$
- $1 \leq E[j] \leq 10^9$ for each j such that $0 \leq j < Q$

Subtasks

Subtask	Score	Additional Constraints
1	6	$Q \leq 5$; $N \leq 2000$; $W[i] = 1$ for each i such that $0 \leq i < N$
2	13	$Q \leq 5$; $W[i] = i + 1$ for each i such that $0 \leq i < N$
3	17	$Q \leq 5$; $A[i] = 2$ and $B[i] = 1$ for each i such that $0 \leq i < N$
4	11	$Q \leq 5$; $N \leq 2000$
5	20	$Q \leq 5$
6	15	$A[i] = 2$ and $B[i] = 1$ for each i such that $0 \leq i < N$
7	18	No additional constraints.

Example

Consider the following call.

```
calculate_costs([15, 12, 2, 10, 21],
                [5, 4, 5, 6, 3],
                [1, 2, 2, 3, 2],
                [5, 9, 1])
```

In this example we have $N = 5$ artifacts and $Q = 3$ questions.

In the first question, $D = 5$. You can send artifacts 0 and 3 in one boat (since $|15 - 10| \leq 5$) and the remaining artifacts in separate boats. This yields the minimum cost of transporting all the artifacts, which is $1 + 4 + 5 + 3 + 3 = 16$.

In the second question, $D = 9$. You can send artifacts 0 and 1 in one boat (since $|15 - 12| \leq 9$) and send artifacts 2 and 3 in one boat (since $|2 - 10| \leq 9$). The remaining artifact can be sent in a separate boat. This yields the minimum cost of transporting all the artifacts, which is $1 + 2 + 2 + 3 + 3 = 11$.

In the final question, $D = 1$. You need to send each artifact in its own boat. This yields the minimum cost of transporting all the artifacts, which is $5 + 4 + 5 + 6 + 3 = 23$.

Hence, this procedure should return $[16, 11, 23]$.

Sample Grader

Input format:

```
N
W[0] A[0] B[0]
W[1] A[1] B[1]
...
W[N-1] A[N-1] B[N-1]
Q
E[0]
E[1]
...
E[Q-1]
```

Output format:

```
R[0]
R[1]
...
R[S-1]
```

Here, S is the length of the array R returned by `calculate_costs`.

Attachment Package

The sample grader along with sample test cases are available here.