Problem 9: The Last Invention (15 points) [Codeforces]

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What do you do at the end of the world? Are you busy? Will you save us?

Neural Tangent Kernels (NTKs) enable exact computation of the infinite-width limit of neural networks. You think the idea is interesting, but come up with something better: instead of using NTKs for neural network architectures that already exist, why not invent an "ideal" neural network, without considerations of practicality, and use a NTK to make the computation fast?

As such, you invent, and implement, the Adaptive Convolutional Neural Tangent Kernel (AC). Unfortunately, it is not fast enough. You have identified the culprit: the convolution used many times across the kernel training runs in linear time each, and is thus too slow. Can you improve it?

Problem Statement

The convolution used is as such: you have an array A and a **fixed** array W, each of length N. Through training, you have to varyingly query for the convolution and update the kernel weights. Thus, you have a sequence of Q queries/updates, as follows:

Query: Given L, R, calculate the standard convolution $\sum_{i=L}^{R} A_i \cdot W_{R-i+L}$.
Update: Given L, R, X, set $A_L = A_{L+1} = \cdots = A_R = X$.

Through a few statistical tests, you determine the queries and updates in the kernel are "essentially random": that is, you can assume queries and updates occur with equal probability, L and R are selected randomly from $[1, N]$, and X is selected randomly from $[-10^3, 10^3]$. But due to your laser focus on machine learning, your algorithmic pedigree is not high enough to go any further. Or is it?

Input

The first line contains two space-separated positive integers N and Q (in that order). The second line contains N space-separated positive integers $A_1, \ldots, A_N$, and the third line contains N space-separated positive integers $W_1, \ldots, W_N$. The last Q lines contain either `1 L R` (for a query) or `2 L R X` (for an update).

Output
For each query, output a line with one integer containing the answer.

Constraints
You can assume that $1 \leq N, Q \leq 10^6$, $1 \leq L \leq R \leq N$, and $-10^3 \leq A_i, W_i, X \leq 10^3$. The program has a time limit of 8 seconds.

Partial Credit
You will get 3 points if you can solve cases where $1 \leq N, Q \leq 500$.

Example

Input:

```
10 5
1 4 3 2 1 5 -3 1 4 5
4 3 2 2 4 5 1 -1 5 6
1 3 5
2 4 6 3
1 4 7
2 2 8 -4
1 1 10
```

Output:

```
18
24
-34
```