Similar Arrays

Input file:	`standard input`
Output file:	`standard output`
Time limit:	2.5 seconds
Memory limit:	256 megabytes

You are given two arrays of positive integers a and b, each of length n.

You must choose a sequence of n non-increasing real constants $r_1, r_2, \ldots, r_n$ to multiply with corresponding terms $b_1, b_2, \ldots, b_n$ such that the sum of the squares of their differences with corresponding terms $a_1, a_2, \ldots, a_n$ is minimized.

Formally, choose n real numbers $r_1, r_2, \ldots, r_n$ such that

- $r_1 \geq r_2 \geq \ldots \geq r_n$
- $\sum_{i=1}^{i=n}(a_i - r_i \cdot b_i)^2$ is minimized.

Print the minimum value after choosing appropriate constants.

Input

The first line contains t, the number of testcases. Below is the description of each testcase.

The first line of each test case contains a single integer n ($2 \leq n \leq 5 \cdot 10^5$).

The second line of each test case contains n integers $a_1, a_2, \ldots, a_n$ ($1 \leq a_i \leq 1000$).

The third line of each test case contains n integers $b_1, b_2, \ldots, b_n$ ($1 \leq b_i \leq 1000$).

The sum of n across all testcases $\leq 5 \cdot 10^5$.

Output

For each testcase print the minimum value of $\sum_{i=1}^{i=n}(a_i - r_i \cdot b_i)^2$.

Your answer is considered correct if its absolute or relative error does not exceed 10^{-9}. Formally, let your answer be a, and the jury's answer be b. Your answer will be accepted if and only if $\frac{|a-b|}{\max(1,|b|)} \leq 10^{-9}$.

Scoring

There are 6 subtasks.

Note that N here is the sum of n across all testcases.

Subtask 1 (5 points): $t = 1, n = 2$

Subtask 2 (11 points): $N \leq 20$

Subtask 3 (13 points): $N \leq 300$

Subtask 4 (14 points): $N \leq 2000$

Subtask 5 (20 points): $N \leq 7000$

Subtask 6 (37 points): No additional constraints.

Example

standard input	standard output
1 2 450 188 900 940	0.0

Note

In the sample case, choosing $r_1 = 0.5$ and $r_2 = 0.2$ yields the value 0.