

IOITC 2021

Similar Arrays

You are given two array a and b with positive integers.

Your aim is to make a and b as close to each other as possible in terms of the sum of element wise squared error. You are allowed one operation. You can multiply each no in b by a possibly different constant once. However, the constants need to form a non-increasing array.

Formally,

Find r_1, r_2, \dots, r_n such that —

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

You will have to just print minimum possible error. No need of printing r_i .

Input

- The first line contains T , the number of testcases. Each testcase contains three lines:
- 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, \dots, a_n ($1 \leq a_i \leq 1000$).
- The third line of each test case contains n integers b_1, b_2, \dots, b_n ($1 \leq b_i \leq 1000$).

Output

For each testcase print the expected minimum sum of element-wise squared error.

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 is accepted if and only if $\frac{|a-b|}{\max(1, |b|)} \leq 10^{-9}$.

Test Data

In all inputs,

- $2 \leq n$
- The sum of n over all test cases does not exceed $5 \cdot 10^5$.

Subtask 1 (5 Points):

- $n = 2$
- $t = 1$

Subtask 2 (11 Points): The sum of n over all testcases doesn't exceed 20.

Subtask 3 (13 Points): The sum of n over all testcases doesn't exceed 300.

Subtask 4 (14 Points): The sum of n over all testcases doesn't exceed 2000.

Subtask 5 (20 Points): The sum of n over all testcases doesn't exceed 7000.

Subtask 6 (37 Points): No additional constraints

Sample Input

```
3
2
2 5
1 8
5
7 9 1 4 3
9 8 6 13 1
10
66 23 51 81 60 7 26 127 66 8
9 88 77 12 2 38 7 63 90 111
```

Sample Output

```
0.0000000000000000
12.247238031469687
17698.696831405897683
```

Explanation

In the first case, we chose $r_1 = 2$ and $r_2 = 0.625$.

Limits

Time: 2.5 seconds

Memory: 256 MB