S1-B. Counting Trees

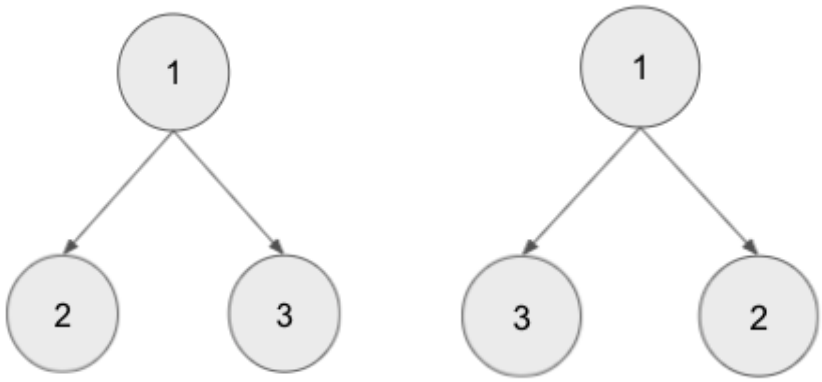
Time limit	1 s
Memory limit	256 MB

Description

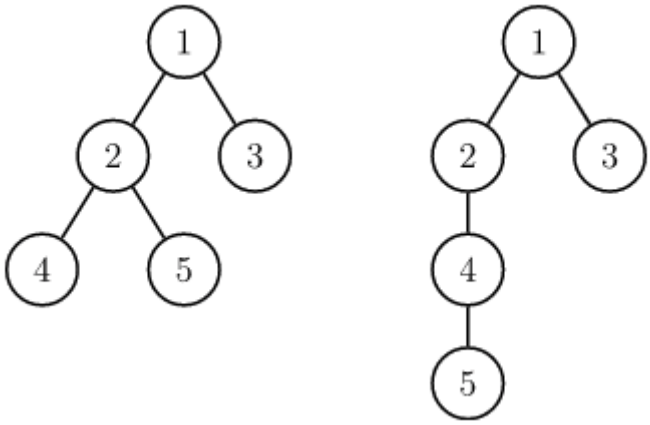
Cats and dogs are known to have always lived together in harmony. Their friendship was established long ago when Mr. Dengklek, the founder of The Cat Association, exchanged a “sacred” rooted tree with Mr. Ganesh, the founder of The Dog Association. This is not an ordinary tree, as it is a key to some secret treasure.

They thought that the tree is too precious, so they decided to lock it in a storage. The storage could be unlocked only by drawing the shape of the original tree. Nobody should be able to open it without the other’s permission. Hence, Mr. Dengklek wrote down the Depth First Search (DFS) ordering of the tree. Similarly, Mr. Ganesh wrote down the BFS (Breadth First Search) ordering of the tree. They then went to some place to erase their memory about the original tree and lived on their own.

The DFS order and BFS order are defined as the order in which DFS and BFS algorithm visits the vertices respectively. If the vertex has more than one child, then the algorithm will visit its children by following their relative order. For example, the tree on the left has the DFS and BFS ordering of `1 2 3` while the tree on the right has the DFS and BFS ordering of `1 3 2.`



Many decades later, both organizations suddenly encounter a lot of problems, and they decide that they need to open the treasure. But, they suddenly realize that there’s a flaw with the way they established the pact. It turns out that the orderings could lead to multiple different trees. As an example, if the DFS ordering of the tree is `1 2 4 5 3` and the BFS ordering of the tree is `1 2 3 4 5`, here are two trees that satisfy both orderings.



As you are a well-known detective, they asked for your help to restore the original tree. You claimed that you could restore the tree if you know the average height of all possible trees. Hence, your task is to determine the average height of all trees satisfying the condition. That is, if there are K different rooted trees satisfying the given DFS and BFS orderings, and their heights are respectively $h_1, h_2, ..., h_K$, find the value of $\frac{h_1+h_2+...+h_K}{K}$. For this problem, the height of the tree is equal to the depth of the deepest node of the tree.

Task

You have to implement the `count_average_height` function :

- `double count_average_height(N, vector<int> DFS, vector<int> BFS)` - this function will be called by the grader exactly once.
  - N : an integer representing the number of nodes of the rooted tree.
  - DFS : a vector of N distinct integers, each between 1 to N inclusive, representing the DFS ordering of the tree.
  - BFS : a vector of N distinct integers, each between 1 to N inclusive, representing the BFS ordering of the tree.
  - It is guaranteed that there exists at least one tree satisfying the given orderings.
  - This function returns a single real number, representing the average height of the tree. If your function's return value differs from the correct answer by no more than 0.001, then you will receive full marks on the test case. Otherwise you will receive no marks.

Example

In the following example, $N = 5$, $DFS = [1, 2, 4, 5, 3]$ and $BFS = [1, 2, 3, 4, 5]$, the possible trees are the ones shown in the description. Then, the function should return 3.5.

Subtasks

For all subtasks :

- $2 \leq N \leq 2 \times 10^5$

Subtask 1 (20 points)

- $N \leq 10$

Subtask 2 (20 points)

- $N \leq 100$

Subtask 3 (45 points)

- $N \leq 2000$

Subtask 4 (15 points)

- No additional constraints

Sample Grader

The sample grader reads the input in the following format:

- The first line contains a positive integer N, the number of nodes in the tree.
- The second line contains N positive integers, representing the DFS ordering of the tree.
- The third line contains N positive integers, representing the BFS ordering of the tree.

The sample grader outputs in the following format:

- A single line that contains a real number A, the value returned by the function `count_average_height`.