

Kick Start 2020 - Round D

Beauty of tree

Problem

Amadea and Bilva are decorating a rooted tree containing **N** nodes, labelled from 1 to **N**. Node 1 is the root of the tree, and all other nodes have a node with a numerically smaller label as their parent.

Amadea and Bilva's decorate the tree as follows:

- Amadea picks a node of the tree uniformly at random and paints it. Then, she travels up the tree painting every **A**-th node until she reaches the root.
- Bilva picks a node of the tree uniformly at random and paints it. Then, she travels up the tree painting every **B**-th node until she reaches the root.

The *beauty* of the tree is equal to the number of nodes painted *at least once* by either Amadea or Bilva. Note that even if they both paint a node, it only counts once.

What is the [expected](#) beauty of the tree?

Input

The first line of the input gives the number of test cases, **T**. **T** test cases follow. Each test case begins with a line containing the three integers **N**, **A** and **B**. The second line contains **N**-1 integers. The *i*-th integer is the parent of node *i*+1.

Output

For each test case, output one line containing `Case #x: y`, where *x* is the test case number (starting from 1) and *y* is the expected beauty of the tree.

y will be considered correct if it is within an absolute or relative error of 10^{-6} of the correct answer. See the [FAQ](#) for an explanation of what that means, and what formats of real numbers we accept.

Limits

Memory limit: 1 GB.

$1 \leq T \leq 100$.

$1 \leq A \leq N$.

$1 \leq B \leq N$.

Test Set 1

Time limit: 20 seconds.

$1 \leq N \leq 100$.

Test Set 2

Time limit: 40 seconds.

For up to 5 cases, $1 \leq N \leq 5 \times 10^5$.

For all other cases, $1 \leq N \leq 100$.


Sample

Sample Input

```
3
8 2 3
1 1 3 4 4 3 4
10 3 4
1 1 1 1 1 1 1 1 1
4 3 1
1 2 3
```

Sample Output

```
Case #1: 2.65625
Case #2: 1.9
Case #3: 2.875
```

The trees for each sample case are shown in the diagram below.  A few example colourings for sample case #1 are shown below.

- If Amadea picks node 5 and Bilva picks node 8, then together they paint 4 unique nodes: Amadea paints nodes 5 and 3, while Bilva paints nodes 8 and 1.
- If Amadea picks node 7 and Bilva picks node 6, then together they paint 3 unique nodes: Amadea paints nodes 7 and 1, while Bilva paints nodes 6 and 1 (note that Amadea painted node 1 as well).

