



## Task: Drawing

*Paint & Wine* is the first painting studio in Zagreb offering relaxing painting lessons with a glass of wine on the side. During the lesson, students are given a certain theme, and with the aid of master painters usually manage to paint an impressive piece.

Ante is a master painter, Luka is his student, and this task tells the tale of a lesson that included a bit more wine than usual.

**Ante:** “Paint me a tree!”

**Luka:** “Alright. What kind of tree do you want? Palm, oak, pine...?”

**Ante:** “I want a connected acyclic undirected graph!”

**Luka:** “I can do that... Any other wishes?”

**Ante:** “I like it when no node is adjacent to more than three other nodes!”

**Luka:** “Uhm, okay... Well, there are many such trees.”

**Ante:** “Here is a list of edges, I want that one!”

**Luka:** “Ok, wow. Still, there are many ways to draw it.”

**Ante:** “Here is a list of points in the plane where I want the nodes to be drawn. I also don’t want to see a pair of intersecting edges.”

**Luka:** “I’m on it!”

Your task is to help Luka paint the tree according to Ante’s wishes. More precisely, given a description of a tree, such that no node is adjacent to more than three other nodes, and a list of points in the plane, find a one-to-one mapping of nodes to points such that, when edges of the tree are drawn as line segments between corresponding points, they do not intersect (except at end points).

### Input

The first line of input contains an integer  $N$ , the number of nodes in the tree and the number of points in the plane.

The following  $N - 1$  lines describe edges of the tree, one per line. Each edge is described by two integers  $a$  and  $b$ , labels of nodes connected by the edge. Nodes are labelled with integers from 1 to  $N$ .

It is guaranteed that each node is adjacent to at most three other nodes.

The following  $N$  lines contain the points to be used when drawing the tree, one per line. Each point is described by a pair of integer coordinates. No two points share the same pair of coordinates, and **no three points lie on the same line**.

### Output

Output a permutation of integers from 1 to  $N$  in a single line. The  $i$ -th number should be the label of the node which is mapped to the  $i$ -th input point.

If there are multiple valid solutions, output any of them. It’s guaranteed that a solution always exists.

### Scoring

In all subtasks point coordinates are integers between 0 and  $10^9$ .

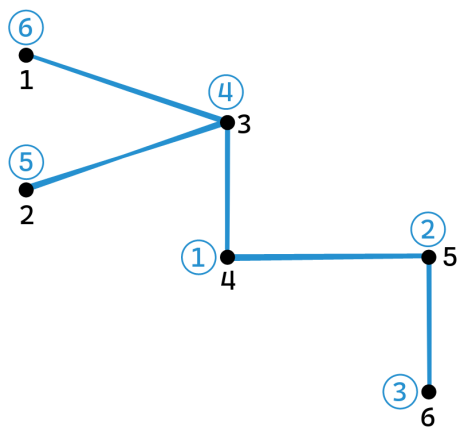


Subtask	Score	Constraints
1	10	$3 \leq N \leq 200\,000$ , there exists a convex polygon with the given points as vertices
2	15	$1 \leq N \leq 4\,000$
3	15	$1 \leq N \leq 10\,000$
4	35	$1 \leq N \leq 80\,000$
5	25	$1 \leq N \leq 200\,000$

Examples

<b>input</b> 3 1 2 2 3 10 10 10 20 20 10 <b>output</b> 1 2 3	<b>input</b> 5 1 2 1 3 1 4 4 5 10 10 10 30 30 10 30 30 20 25 <b>output</b> 5 4 2 3 1	<b>input</b> 6 1 2 2 3 1 4 4 5 4 6 10 60 10 40 40 50 40 30 70 30 70 10 <b>output</b> 6 5 4 1 2 3
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Clarification of the third example:



Blue numbers represent node labels while black numbers represent point indices.