

## Problem A. Hide-And-Seek Game

Input file:            `standard input`  
Output file:          `standard output`  
Time limit:           5 seconds  
Memory limit:        128 megabytes

During the summer vacation, Serenade and Rhapsody are playing hide-and-seek in a park structured as a tree. Each edge of the tree has a weight of 1. Serenade keeps running back and forth between  $S_a$  and  $T_a$  ( $S_a \neq T_a$ ), while Rhapsody runs back and forth between  $S_b$  and  $T_b$  ( $S_b \neq T_b$ ). However, Aria doesn't want to run around with them and only wants to know the **earliest** location where Serenade and Rhapsody will meet. Please output the identification number of this location. If they will never meet, output -1.

To be more specific, Serenade starts from  $S_a$  and moves one edge towards  $T_a$  each time. Once reaching  $T_a$ , Serenade then moves one edge towards  $S_a$  each time. After reaching  $S_a$ , Serenade moves one edge towards  $T_a$  each time, and so on. Rhapsody follows a similar pattern of movement.

Note that this park is quite **mysterious**, so Serenade and Rhapsody will **not meet on an edge** (you can assume that they will choose different paths to traverse the same edge).

### Input

The input consists of multiple test cases. The first line contains a single integer  $t$  ( $1 \leq t \leq 500$ ) — the number of test cases. Description of the test cases follows.

The first line of each test case contains two integers  $n$  and  $m$  ( $2 \leq n, m \leq 3 \cdot 10^3$ ) — the number of the vertices in the given tree and the number of questions.

Each of the next  $n - 1$  lines contains two integers  $u$  and  $v$  ( $1 \leq u, v \leq n, u \neq v$ ) meaning that there is an edge between vertices  $u$  and  $v$  in the tree.

Each of the next  $m$  lines contains four integers  $S_a$ ,  $T_a$ ,  $S_b$  and  $T_b$  ( $1 \leq S_a, T_a, S_b, T_b \leq n, S_a \neq T_a$  and  $S_b \neq T_b$ ).

It is guaranteed that the given graph is a tree.

The data guarantees that there will be no more than 20 groups with a value of  $n$  exceeding 400.

The data guarantees that there will be no more than 20 groups with a value of  $m$  exceeding 400.

### Output

For each test case print a single integer — the identification number of this location which *Serenade* and *Rhapsody* will meet or -1.

## Example

standard input	standard output
1	3
9 4	6
1 2	-1
1 9	3
2 3	
2 6	
3 4	
3 5	
6 7	
6 8	
4 7 5 8	
4 7 2 8	
4 5 3 6	
4 5 5 7	