Problem D
Enumerating Game

Cathy and Willy are playing a two-person game, where Cathy constructs an infinite binary tree and Willy tries to find out the order corresponding to a given pair of integers. Each node of the binary tree consists of a pair of ordered positive integers, i.e., the order of the integers matters. The node associated with a pair of positive integers (i, j) has two children: the ordered pair $(i, i + j)$ is for the left child, and $(i + j, j)$ is for the right child. The root of the binary tree is the first node and has a pair of positive integers (a, b), where a and b are relatively prime. The nodes of the binary tree are enumerated from the root and level-by-level from left to right, just as the ordering in a binary heap. Given a pair of positive integers (c, d), find its order in the binary tree.

Technical Specification

1. (a, b) is the pair of relatively prime positive integers for the root, $1 \leq a, b < 10$.
2. $1 \leq c, d < 64$.

Input Format

The first line of the input contains an integer m ($m \leq 20$), indicating the number of test cases. Each test consists of one line with four space-separated positive integers a, b, c and d.

Output Format

For each test case, the order of (c, d) in the binary tree. Output -1 if (c, d) does not appear in the tree.

Sample Input

```
5
1 1 1 1
1 1 1 5
1 1 3 6
3 2 3 2
5 2 1 2
```

Sample Output for the Sample Input

```
1
16
-1
1
-1
```