

Fractal Maze

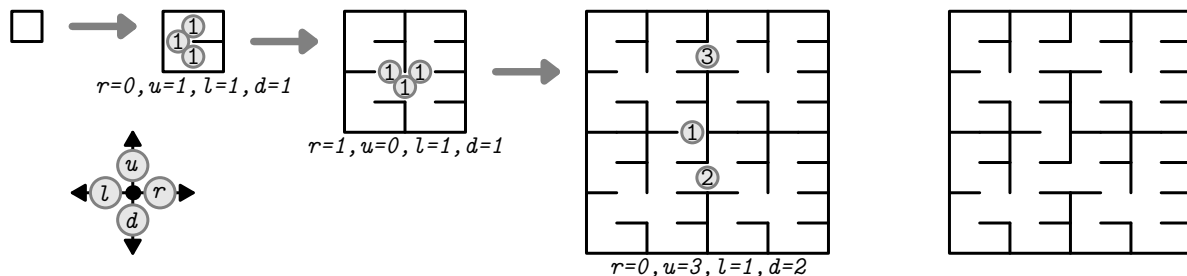
Input file: *standard input*
 Output file: *standard output*
 Time limit: 2 seconds
 Memory limit: 1024 mebibytes

Let us construct a maze consisting of squares and walls between them. Start with a single square surrounded by walls. Then expand the maze several times.

An expansion goes as follows. Glue together four copies of the maze, forming a 2×2 square of copies. Now, imagine standing at the very center of the new maze, in a point between four squares. Consider the four long walls which run from the center, separating the neighboring copies. In three of these walls, we make a passage, one square wide. The fourth wall is left intact.

Let us write down a specific expansion. Assign four numbers to the walls from the center: r to the wall going right, u to the wall going up, l to the wall going left, and d to the wall going down. One of these numbers will be zero. The other three determine where exactly we make a passage: the number of the unit segment of the wall, counting from the center. For example, 1 means a passage next to the center, 2 denotes the second unit segment from the center, and so on.

The figure shows the construction of the maze from the example, along with the result.



The maze we got has exactly one simple path between any two squares; recall that a path is simple if it visits each square at most once. Answer q questions of the following form: given the coordinates of squares A and B , find the length of the simple path between them. The length of a path is the number of steps to the neighboring square.

Input

The first line contains an integer n ($1 \leq n \leq 30$). The next n lines define how the maze is built. Each line describes an expansion and contains four integers: r , u , l , and d . One of them is a zero, and the other three are strictly positive.

The next line contains an integer q ($1 \leq q \leq 1000$). Then follow q lines with questions. Each question consists of four integers: row_A , col_A , row_B , and col_B . These are coordinates of two squares in the maze (from 1 to 2^n). Here, *rows* are numbered from top to bottom, and *columns* from left to right.

Output

For each question, print an integer: the length of the simple path between the given squares.

Example

<i>standard input</i>	<i>standard output</i>
3	0
0 1 1 1	6
1 0 1 1	22
0 3 1 2	15
4	
4 5 4 5	
5 4 8 1	
5 8 1 8	
5 5 4 5	