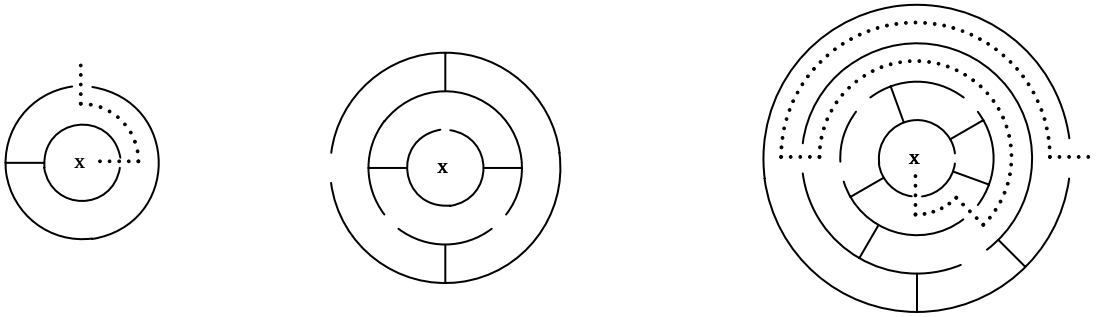
Problem 2: Circular Mazes

A circular maze consists of a number of concentric circles. Each circle may have *gates* that permit passage between the regions enclosed by the circles, and there may be *walls* joining adjacent pairs of concentric circles that block passage. Given the description of a circular maze, your job is to find a path from outside the maze to the innermost circle.

Here are three examples. In each case, "x" marks the spot you are to reach, and the dotted line shows the path to be taken, except for the middle maze, which has no solution. For comparison with the sample input/output, angles are measured counterclockwise from the east, which is 0 degrees.



Input

There will be multiple input cases to consider. The first line of input for each case contains an integer N ($1 \le N \le 10$) that specifies the number of concentric circles in the maze. This line is followed by N lines, each giving integer values specifying (a) the number of gates in a circle, (b) the angular position of those gates (in any order), (c) the number of walls connecting the circle to the next inner circle, and (d) the angular position of those walls (in any order). These N lines are ordered from the innermost circle to the outermost. The innermost circle will never have any walls, and no circle will ever have more than 10 gates or 10 walls. The line following the input for the last case will contain an integer 0.

Output

For each input case, display the case number (1, 2, …) and the path from outside the maze to the interior of the innermost circle as an alternating sequence of integer angles and the direction of movement between circles (IN to the next inner circle, or OUT to the next outer circle). Each angle and direction should be separated by a single space. Any correct solution for a case will be accepted, except those that retrace all or part of a path. Display "No solution" if there is no path.

Example

For example, consider the leftmost maze shown above. The first three lines of the sample input (shown on the next page) correspond to this maze. The first line (**2**) indicates there are two concentric circles in the maze. The second line (**1 0 0**), corresponding to the innermost circle, indicates 1 gate located at 0 degrees, and no (0) walls. The third line (**1 90 1 180**), corresponding to the next (and outermost) circle, indicates 1 gate located at 90 degrees, and 1 wall located at 180 degrees.

The solution, as illustrated by the dotted line, indicates entry to the maze through the outermost circle at 90 degrees ("north") and entry to the innermost circle at 0 degrees ("east"). This is shown

in the solution as **90 IN 0 IN**. Although **90 IN 90 OUT 90 IN 0 IN** would logically still be a valid solution, repetition of all or part of a path is not permitted.

Sample Input	Output for the Sample Input
2 1 0 0 1 90 1 180 3 1 90 0 2 225 315 2 0 180 1 180 2 90 270 4 2 0 270 0 4 45 135 190 315 4 30 210 340 110 2 180 300 1 240 1 0 2 270 315 0	Case 1: 90 IN 0 IN Case 2: No solution Case 3: 0 IN 180 IN 315 IN 270 IN