

## 4796 Sudoku Checker

A Sudoku puzzle of size  $S$  consists of  $S^2$  non-overlapping  $S \times S$  squares organized into a grid of  $S^2 \times S^2$  numbers. Columns are labeled from left to right starting with number 1, and rows are labeled from top to bottom starting with number 1. Squares are labeled from top to bottom, starting with number 1, such that squares spanning the same rows are assigned consecutive labels. For a puzzle of size 3, the  $S^2$  non-overlapping  $S \times S$  squares are labeled as follows:

1	2	3
4	5	6
7	8	9

A puzzle is given as a partially filled  $S^2 \times S^2$  grid, and a solver attempts to fill each grid location with numbers from 1 to  $S^2$  such that each number appears in:

- Each of the  $S^2$  vertical columns,
- Each of the  $S^2$  horizontal rows, and
- Each of the  $S^2$  non-overlapping “ $S \times S$ ” squares.

An example of a valid solution for a puzzle of size 4 is:

```
14 12 8 10 16 7 4 3 2 9 15 6 11 1 5 13
 7 11 16 9 6 1 12 5 13 10 3 8 15 2 14 4
 5 15 4 3 14 13 10 2 1 12 11 16 6 9 7 8
 6 13 2 1 8 11 15 9 4 5 7 14 16 3 12 10
 2 1 5 13 3 15 9 4 8 16 6 7 14 11 10 12
11 4 10 6 13 12 5 16 3 2 14 9 7 8 15 1
 3 16 12 14 10 8 7 11 5 15 1 4 13 6 2 9
15 9 7 8 2 14 1 6 12 13 10 11 4 5 3 16
 1 5 13 7 12 4 2 10 11 6 16 3 8 15 9 14
10 3 15 16 7 6 8 14 9 4 13 5 1 12 11 2
 8 6 11 2 9 16 13 1 10 14 12 15 3 7 4 5
 4 14 9 12 11 5 3 15 7 8 2 1 10 13 16 6
12 7 6 4 15 2 14 8 16 11 9 13 5 10 1 3
16 10 14 5 1 9 11 13 15 3 8 12 2 4 6 7
 9 8 3 15 5 10 6 7 14 1 4 2 12 16 13 11
13 2 1 11 4 3 16 12 6 7 5 10 9 14 8 15
```

Your task is to write a program to check the validity of solutions for Sudoku puzzles.

### Input

Input starts with an integer  $N$ ,  $1 \leq N \leq 50$ , on a separate line that represents the number of puzzles to be checked.

The specifications of each puzzle starts with an integer on a separate line  $S$  ( $2 \leq S \leq 12$ ) that represents the size of the puzzle. Each of the next  $S^2$  lines lists one line in the Sudoku puzzle's solution, where each line consists of  $S^2$  integers separated by single spaces.

## Output

For each puzzle, print the puzzle number (starting with 1, and using the format in the sample) followed by either:

- a single line with the statement ‘The solution is valid.’, or
- a number of lines that list all the errors followed by a separate line with the statement ‘The solution is invalid.’. First, errors in squares are listed in increasing order of their labels, followed by errors in rows and finally errors in columns.

For each line all the missing numbers are listed first, in increasing order, followed by the numbers that appear multiple times, again in increasing order, using the format shown in the sample below.

## Sample Input

```
3
2
1 2 3 4
3 4 1 2
2 1 4 3
4 3 2 1
2
1 2 3 1
3 4 1 2
2 1 4 3
2 3 2 1
3
3 1 6 7 4 9 8 5 2
7 5 9 2 8 6 1 3 4
4 8 1 5 1 3 6 7 9
1 2 3 3 7 4 5 6 8
8 9 7 6 4 6 2 6 3
6 4 5 4 2 8 9 1 7
5 7 4 1 9 2 3 8 6
2 3 1 8 6 7 6 9 5
9 6 8 4 3 5 7 2 1
```

## Sample Output

```
Puzzle 1
The solution is valid.
Puzzle 2
Square 2 has no 4s and 2 1s
Square 3 has no 4s and 2 2s
Row 1 has no 4s and 2 1s
Row 4 has no 4s and 2 2s
Column 1 has no 4s and 2 2s
Column 4 has no 4s and 2 1s
The solution is invalid.
Puzzle 3
Square 1 has no 2s and 2 1s
Square 5 has no 1s and no 5s and no 9s and 3 4s and 2 6s
```

Square 6 has no 4s and 2 6s  
Square 9 has no 4s and 2 6s  
Row 3 has no 2s and 2 1s  
Row 4 has no 9s and 2 3s  
Row 5 has no 1s and no 5s and 3 6s  
Row 6 has no 3s and 2 4s  
Row 8 has no 4s and 2 6s  
Column 3 has no 2s and 2 1s  
Column 4 has no 9s and 2 4s  
Column 5 has no 5s and 2 4s  
Column 6 has no 1s and 2 6s  
Column 7 has no 4s and 2 6s  
Column 8 has no 4s and 2 6s  
The solution is invalid.