

# Sudoku Solver

Filename: sudoku

## The Problem

Sudoku Puzzles have recently caught on as a hot new item amongst games in newspapers. The game is as follows:

- 1) You are given a 9x9 grid, with some squares filled in with positive integers in between 1 and 9, inclusive.
- 2) Your goal is to complete the grid with positive integers in between 1 and 9, inclusive, so that each row, column and mini 3x3 square that is designated contain each integer in the range 1 through 9 exactly once.

Below is an example of a Sudoku puzzle:

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

(taken from [www.sudoku.com](http://www.sudoku.com) on 11:45am on 2/1/06)

Here is the puzzle solved:

<b>9</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>7</b>	<b>4</b>	<b>2</b>	<b>5</b>	<b>8</b>
<b>1</b>	<b>7</b>	<b>8</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>6</b>	<b>4</b>	<b>9</b>
<b>2</b>	<b>5</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>9</b>	<b>7</b>	<b>3</b>	<b>1</b>
<b>8</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>	<b>7</b>	<b>5</b>	<b>9</b>	<b>6</b>
<b>4</b>	<b>9</b>	<b>6</b>	<b>8</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>7</b>
<b>7</b>	<b>3</b>	<b>5</b>	<b>9</b>	<b>6</b>	<b>1</b>	<b>8</b>	<b>2</b>	<b>4</b>
<b>5</b>	<b>8</b>	<b>9</b>	<b>7</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>2</b>
<b>3</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>4</b>	<b>6</b>	<b>9</b>	<b>8</b>	<b>5</b>
<b>6</b>	<b>4</b>	<b>2</b>	<b>5</b>	<b>9</b>	<b>8</b>	<b>1</b>	<b>7</b>	<b>3</b>

Your program will read in a file of sudoku puzzles, all of which either have no solution or a unique solution. You will output to the screen for each test case, either the filled in game board, or the statement, "No solution possible."

### **Input Format**

The first line of the input file will be a positive integer  $n$ , representing the number of puzzles to solve in the input file. This will be followed by a blank line. The following  $10n$  lines will contain the  $n$  cases, with each case taking exactly 10 lines. Within each test case, the  $i^{\text{th}}$  line will contain the 9 values on the  $i^{\text{th}}$  row of the unsolved puzzle, in order, from left to right, each separated by spaces. This will be followed by the 10<sup>th</sup> line that is blank. In particular, all blank entries of the puzzle will be indicated with a 0, and the 9 integer values (all in between 0 and 9, inclusive) on the line each will be separated by a space.

### **Output Format**

The first line for each test case will be of the format:

Test case k:

where  $k$  ranges in between 1 and  $n$ , inclusive and represents the test case number. Follow this with a blank line.

If the puzzle has no solution, then the line of output after the blank line will be:

No solution possible.

If the puzzle has a solution, output it on the following nine lines, with each value separated by a single space. For the puzzle above the output would be:

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

Separate the output for each test case with two blank lines.

**Sample Input**

2

```
0 6 0 1 0 4 0 5 0
0 0 8 3 0 5 6 0 0
2 0 0 0 0 0 0 0 1
8 0 0 4 0 7 0 0 6
0 0 6 0 0 0 3 0 0
7 0 0 9 0 1 0 0 4
5 0 0 0 0 0 0 0 2
0 0 7 2 0 6 9 0 0
0 4 0 5 0 8 0 7 0
```

```
0 6 0 1 0 4 0 5 0
0 0 8 3 0 5 6 0 0
2 0 0 0 0 0 0 0 1
8 0 0 4 0 7 0 0 6
0 0 6 0 0 0 3 0 0
7 0 0 9 0 1 0 0 4
5 0 0 0 0 0 0 0 2
0 0 7 2 0 6 9 0 0
0 4 0 5 0 8 0 7 9
```

**Sample Output**

Test case 1:

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

Test case 2:

No solution possible.