

# **4D Sudoku**

A brief introduction

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## The puzzle

What are the rules?

Based upon the original Sudoku, there are four elements in the 4D Sudoku:

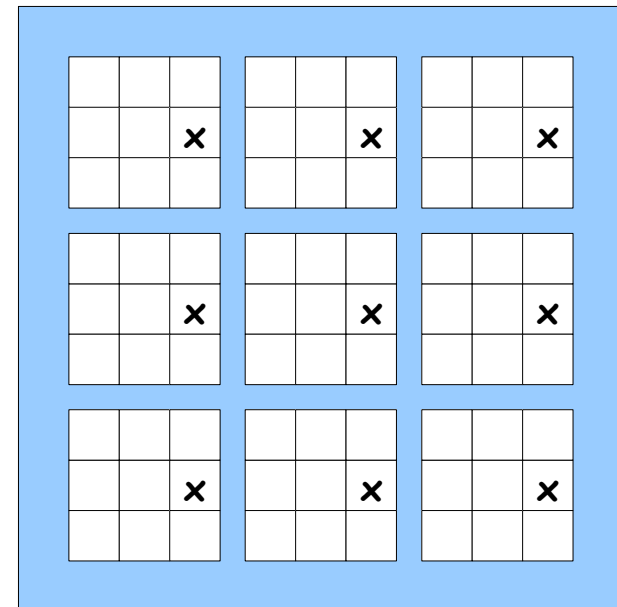
Rows  
Columns  
Boxes  
Hyperboxes

Each element must, in the completed puzzle, contain all of the digits, from one to nine.

What is a hyperbox?

A hyperbox is a set of nine cells with similar relative positions within their box.

This diagram marks one such hyperbox:



## Overview

Having four constraints, instead of three, allows the puzzle setter to create puzzles with less initial information, hence allowing more complicated puzzles to be created.

To solve the 4D Sudoku, it is necessary to master all four elements; the hyperbox adds a new dimension to the puzzle, allowing for cleverer logical deduction than is possible in the traditional Sudoku puzzle.

To make it easier to visualise this new element in this tutorial, the boxes have been separated slightly; further, there are some solving techniques, outlined in pages 7-13, that make working with the hyperbox easier, even if the solver is having difficulty visualising it.

One major advantage of this puzzle is its similarity to the traditional Sudoku; almost any logical strategy that a solver has developed in traditional Sudoku can be used in the 4D variant. I say “almost” because there are some subtle techniques, relying on the knowledge that a puzzle must have a unique solution, that need slight alteration to work with the new puzzle.

The 4D Sudoku provides an interesting and fun challenge for any Sudoku solver!



## A worked example

Here is our first complete puzzle:

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

Careful study of the bottom row reveals that there is only one place that the 6 can go; with this 6 in place, there is only one place for the 2 to go in the bottom left box... let's fill these two digits in.

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

The next step is slightly harder to see; we must ask the question "where does the 8 go in the bottom right hyperbox"? To assist you, the bottom right hyperbox is highlighted in yellow; there is, in fact, only one possibility (the top left box). Filling in this 8, we now ask "where does the 7 go in the bottom right hyperbox"? Again, there is only one possibility.

## A worked example

This is what we had from page 4:

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

There are now two more numbers that we can fill out using normal Sudoku logic... the 8 in the top row and the 7 in the bottom left box. These have been “penciled in”. The puzzle is about to get much harder...

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

I guarantee that there is no “simple” next step to be found in this puzzle; we must now resort to cunning!

As this is such a good example of the finesse involved in solving a 4D Sudoku, I ask that you have a go at finding a next step before proceeding to page 6 to see one possible move...

## A worked example

This is what we had from page 5:

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

Looking at the places in which the 6 might go in the top left and left boxes (highlighted in yellow above), we see that, whichever way around they go, they must occupy the centre and right-hand hyperbox positions.

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

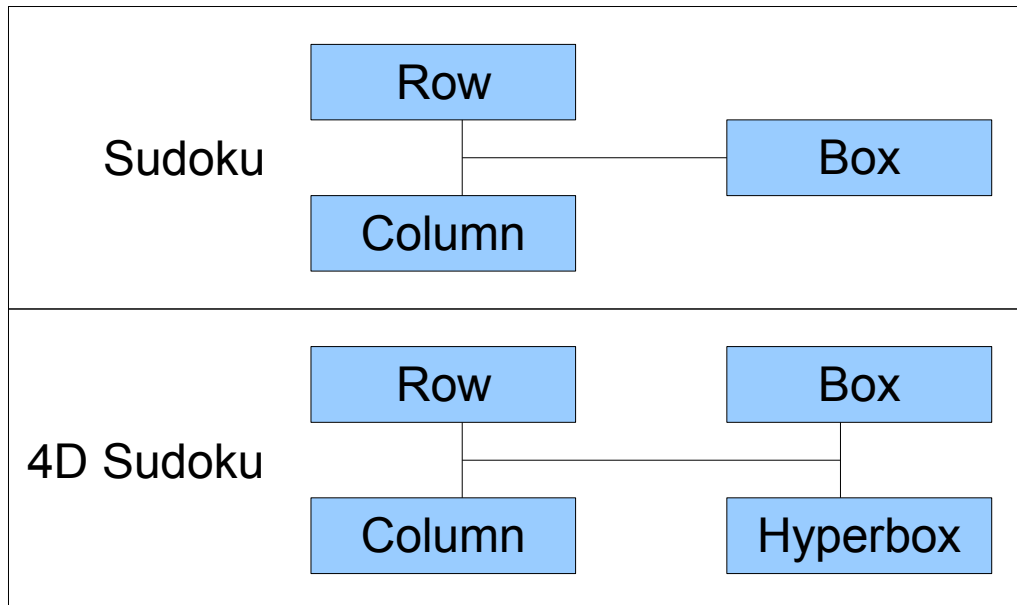
Now, knowing that the central and right hyperboxes contain 6's in the second and fifth rows, the eighth row must have a 6 in the left hyperbox (highlighted above)... and there is only one such position free.

We have come a long way but the puzzle is far from over.. I leave the reader with this challenge!



## Some solving strategies

The four elements of the 4D Sudoku are better balanced than the three in traditional Sudoku. The row and the column are obviously twins; they are related to the box as if they were cousins. In the 4D Sudoku, the box and the hyperbox are twins. Thus, the following diagram highlights the greater symmetry in a 4D Sudoku:



One of the results of this symmetry is that the solver must pay equal attention to all four elements to master a 4D Sudoku; another result is an intriguing solving strategy:

In a traditional Sudoku, you could rewrite the puzzle (at any stage of completeness), switching the rows and the columns. You would have, essentially, the same puzzle – but it would be presented in a different way. In the 4D Sudoku, there are more interesting options...

It is possible to switch the box and the hyperbox; alternatively, it is possible to switch the {rows and columns} with the {boxes and hyperboxes}. Both of these strategies make the hyperbox more easily accessible.

## Some solving strategies

Example of re-writing a puzzle, switching the box and the hyperbox elements:  
(Using the puzzle left at page 5)

N.B. The colours aren't needed but they make it easier to see what is happening

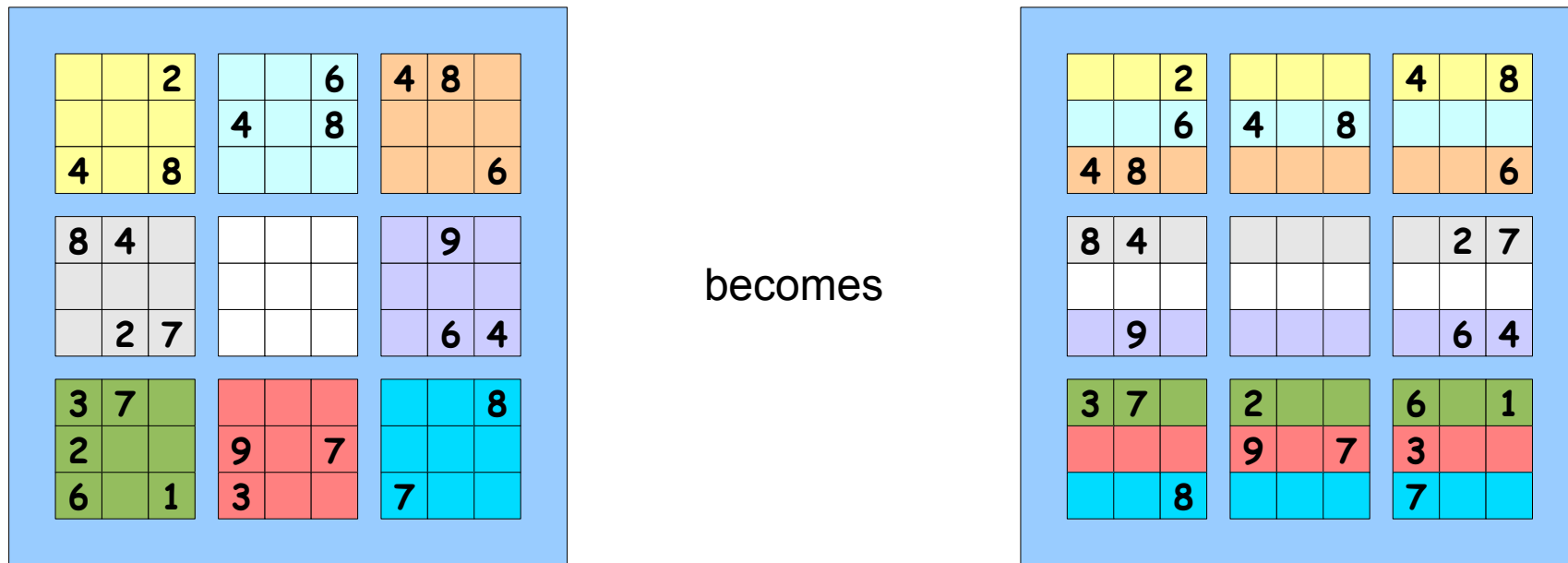
2			6			4	8	
			4		8			
4		8						6
8	4					9		
	2	7				6	4	
3	7							8
2			9		7			
6		1	3			7		

becomes

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

## Some solving strategies

Example of re-writing a puzzle, switching the {row and column} and {box and hyperbox} elements... N.B. This means that the rows and boxes are switching at the same time as the columns and hyperboxes are switching:



It is worth noting that this “shuffle” has made the logical step laid out on page 6 easier to spot... looking carefully at the grey and yellow lines, we see that the 6 must go in a central box in both lines... further, it cannot go in the left-hand column of either box (because of the green 6)... thus, there must be a 6 in the left hand column of the central bottom box!

We have come to the end of our small introduction to the 4D Sudoku; I hope that the reader is now keen to take up the challenge of some puzzles; these can be found at [www.4dsudoku.com](http://www.4dsudoku.com)

Two technical notes before you get started:

1. Internet Explorer users may find that my Applet is blocked by the security bar. Click on it and choose “allow content” to continue.
2. Once the Applet has loaded, you must first click on it to give it the focus; then you move the mouse over a cell and press a number key on the keyboard to enter your moves. Oh, and use zero to correct errors!

Best of luck and please don't forget to email me at: [feedback@4dsudoku.com](mailto:feedback@4dsudoku.com)