Su Doku

the

Number-Placing Puzzle

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

This entertaining puzzle requires digits to be arranged on a grid to match some given conditions. No arithmetic needed; only simple logical reasoning is required.

Easy to understand - Fiendish to do!

Version 2

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Numbers given on the left are to be found at bottom left on each page.

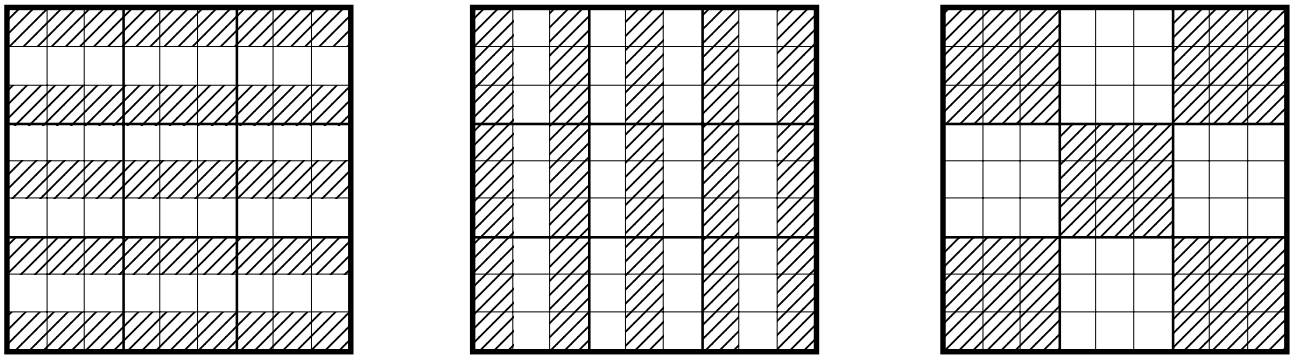
INTRODUCTION

Primarily this is concerned with the *'classic'* version of the Su Doku (or SuDoku) puzzle, which uses a 9 by 9 grid. Other sizes of grid are possible, but the principles are the same, and some of those are also included in this unit. They are especially useful for younger puzzlers, and beginners.

First we need to be familiar with how the grid is divided up in three different ways.

These are

rows **columns** **blocks** (or boxes)



Then the grid has to filled up so that each **row**, each **column**, and each **block**, contains the digits 1 to 9, with the obvious restriction that each cell must contain one, and only one, digit.

It is a good beginning exercise and enforces the idea if, after explaining that, blank grids are given out and pupils are asked to fill them in so as to meet those requirements. It can be surprisingly hard, especially if you are not organised. If some sort of checking is thought to be necessary they can do it by swopping amongst themselves.

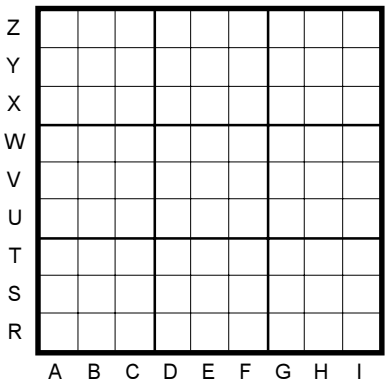
And that is just about all it is necessary to know in order to solve a Su Doku puzzle.

One further thing we need, which has nothing at all to do with the puzzle itself, but is a considerable help when talking with others about solving it, is a means of identifying individual components.

For that reason letters have been put in. A to I along the bottom and R to Z up the side. Now the use of a single letter will identify any row or any column.

The use of two letters (like EX) will identify any single cell.

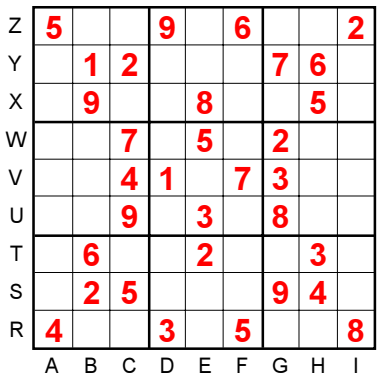
It is tempting to extend this to using three letters to identify separate blocks (like UWB), but it is clumsy and doesn't work. The more 'natural' way of combining *top*, *middle*, or *bottom*, with *left*, *centre*, or *right*, 'just happens'.



All of that is merely a preliminary, explaining how the (classic) Su Doku grid is to be completed. How that is to be done, starting from a given set of conditions, is when the 'fun' starts.

On the right is shown a Su Doku Puzzle.

(This is the same puzzle given as an OHP transparency later on.)



32 digits have already been placed, and the remainding digits needed to complete the grid have to be put in.

(In passing, notice the symmetry formed by the original placings. This is a feature of all these puzzles; but is more obvious in some than in others.)

These puzzles are intended to be solved by a series of logical steps, each new digit being placed in its cell, knowing that no other digit can possibly belong there.

We shall not look at alternatives, but only argue for the steps taken here, which were the ones used by *this* solver.

Look at the top three rows (X, Y, Z)

There are 9's in rows X and Z but none in row Y
These 9's are in the first two blocks so the 9 needed in row Y must be in the third block.
Since cells GY and HY are already full, it must be that cell **IY = 9**

Pass over the middle three rows (U, V, W)

Look at the bottom three rows (R, S, T)

There are 2's in rows S, T but none in row R
These 2's are in the first two blocks so the 2 needed in row R must be in the third block.
Is that GR or HR ?
Study the columns G and H. Column G already has a 2, so it must be that **HR = 2**

Now look at the first three columns (A, B, C)

There are 4's in columns A and C but none in column B
That 'missing' 4 must go in the top block, so it must be that **BZ = 4**

There are two 9's (in columns B and C) but none in column A
It must go in the bottom block but is that AS or AT ?
Row S already has a 9 so it must be that **AT = 9**

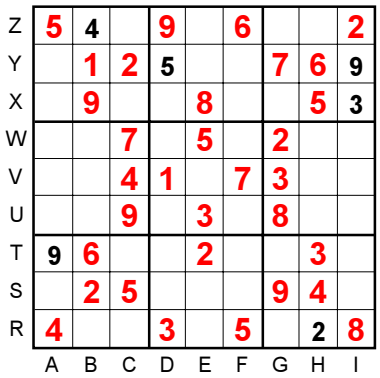
Now the middle three columns (D, E, F)

There is no 5 in column D
Must be in the top block, but in row X or Y ?
5 already in row X so it must be that **DY = 5**

Then the last three columns (G, H, I)

We can see two 3's but none in column I
Must be in the top block, so it must be that **IX = 3**

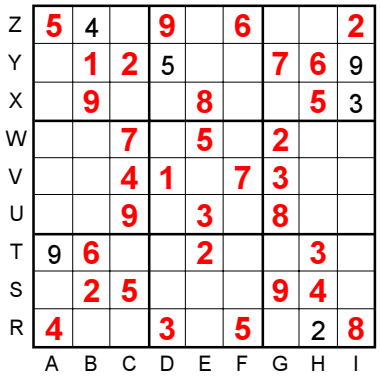
With those six in place, the grid now looks like that on the right.



Solution continued on next page.

Solution continued from previous page.

The grid we have filled in so far is shown on the right.



	A	B	C	D	E	F	G	H	I
Z	5	4		9		6			2
Y		1	2	5			7	6	9
X		9			8			5	3
W			7		5		2		
V			4	1		7	3		
U			9		3		8		
T	9	6			2			3	
S		2	5				9	4	
R	4			3		5		2	8

We will now do a re-scan of the rows and columns to take advantage of the additional information we now have.

The bottom three rows (R, S, T) lack a 9
This must be in row R, middle block, which means **ER = 9**

Follow up *that* addition to the middle three columns (D, E, F)
A 9 is needed in column F, and must be in the middle block.
Row U already has one so it must be that **FW = 9**

Follow up *that* addition to the middle three rows (U, V, W)
Row V needs a 9 in the right-hand block.
It cannot be in column I so it must be that **HV = 9**

Now try completing the digits in a block.

Start with the top left-hand block. It lacks 3, 6, 7, 8
Little can be done about 3 and 6, but 7 can be placed because it cannot be in row Y or column C so it must be that **AX = 7**

Using that addition to the top three rows (X, Y, Z) reveals that row Z lacks a 7 which must be in the middle block so it must be that **EZ = 7**

Re-looking at the first three columns (A, B, C) shows a 7 is missing in column B, bottom block, so it must be that **BR = 7**

Top middle block lacks a 1
Cannot be in row Y or column D so it must be that cell **FX = 1**
Looking in that same block then leads to **FY = 3**
And then, that cell **EY = 4**

Look at row Y it lacks only an 8 so it must be that **AY = 8**

Top left block lacks only a 3 and a 6 (in CX and CZ)
Row Z already has a 6 so it must be that **CZ = 3**
Then, of course, **CX = 6**

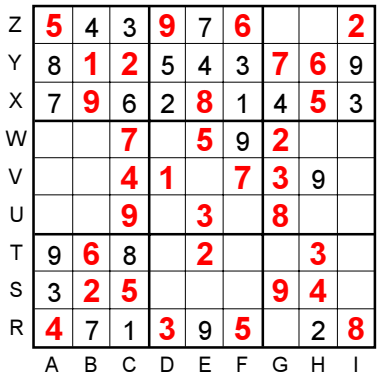
Row X now lacks only a 4 so it must be that **GX = 4**

Column C needs a 1 and an 8 (in CR and CT) to complete it.
Row R already has an 8 so it must be that **CT = 8**
Then, of course, **CR = 1**

Bottom left block lacks only a 3 and so **AS = 3**

and so on . . .

The result after all the above has been done is shown on the right, and the task of completing it is left to the reader.



	A	B	C	D	E	F	G	H	I
Z	5	4	3	9	7	6			2
Y	8	1	2	5	4	3	7	6	9
X	7	9	6	2	8	1	4	5	3
W			7		5	9	2		
V			4	1		7	3	9	
U			9		3		8		
T	9	6	8		2			3	
S	3	2	5				9	4	
R	4	7	1	3	9	5		2	8

The explanatory working has been given in considerable detail to make clear the different sorts of attack possible, always balancing the requirements of the rows, columns, and blocks against each other; and remembering to keep going back and re-examining situations as new data becomes available. And never forget that every cell filled-in should be a reasoned certainty, not a guess!

The first and most obvious variation is to change the size.
A 4 x 4 using 2 x 2 blocks and the digits 1 to 4 is posssible.
A 6 x 6 using 2 x 3 (or 3 x 2) blocks and the digits 1 to 6 is posssible.
Examples of both of these sizes are included in this work.
But the 9 x 9 using 3 x 3 blocks and the digits 1 to 9 (the *Classic*) is undoubtedly the favourite.
Bigger grids are also possible but they feel more like a chore and are best left to to the addicts!

Another variation is to require letters instead of digits to be placed in the grid.
Unfortunately, this makes the puzzle harder for the wrong reason.
For most people it is much easier to scan an unordered set of digits and detect what is missing than it is to scan an unordered set of letters, unless it is a small group of, say, six or less.

Perhaps the most important variation is that of changing the degree of difficulty.
This is not merely a matter of giving the solver more or less numbers to start with (it usually varies between 24 and 36 in the *Classic*), but much more a matter of adjusting the depth and complexity of the underlying logic that is required to solve it. This is extremely difficult, and time consuming, if done by hand, and explains why a computer program is really necessary to produce these puzzles.
Read the page on Historical Background for more about that.

Caution

The program used to generate these puzzles has settings for five levels of difficulty:

Very Easy, Easy, Medium, Hard, and Very Hard.

However, these are constraints which the program imposes on its own logic when making the puzzle and it can, and does, happen that solvers can find one classed as 'Hard' easier to solve than one graded 'Medium'.

Be aware then that the gradings cannot be treated as absolutes.

Equalising the Difficulties

If a set of 'different' puzzles is required, all to be of equal difficulty (perhaps for competition purposes) there is only one way of doing it.
First of all generate one puzzle at whatever grade is thought to be correct.
Then set up a mapping from the nine digits (in order) to another set of the nine digits (in a different order), and generate a second puzzle by simply using that mapping on the first puzzle.
It is a lot of work, but it is the only way of ensuring that even those in close proximity are each working on a puzzle of the same grade with no recourse to cheating without it being very obvious indeed. An example of this being done, changing the one on the left into the one on the right is shown below. Since the digits are only symbols they must be of equal difficulty.

	A	B	C	D	E	F	G	H	I
Z	5			9		6			2
Y		1	2				7	6	
X		9			8			5	
W			7		5		2		
V			4	1		7	3		
U			9		3		8		
T		6			2			3	
S		2	5				9	4	
R	4			3		5			8

Mapping

Change		To
1	→	3
2	→	5
3	→	8
4	→	2
5	→	9
6	→	7
7	→	1
8	→	4
9	→	6

	A	B	C	D	E	F	G	H	I
Z	9			6		7			5
Y		3	5				1	7	
X		6			4			9	
W			1		9		5		
V			2	3		1	8		
U			6		8		4		
T		7			5			8	
S		5	9				6	2	
R	2			8		9			4

Classroom Considerations

Just a few jottings (reminders really) on things to be thought about if this material is to be used in the classroom. As always, many decisions will have to be made in presenting and matching this work to the environment, that's why we have teachers isn't it?

The opening presentation and necessary explanations will clearly depend upon the abilities of the pupils. It could vary from a very brief statement of the rules delivered verbally, or a full-scale development using the ohp slide-masters (or whiteboard of course) to show every step of how such puzzles may be solved.

Which puzzles are to be used? 4 x 4, 6 x 6, or 9 x 9? And what level of difficulty?

How is the work to be done? Will everyone work on the same puzzle or will they all have a different puzzle?

What about working in pairs so they can prompt each other?

What about working in groups where a lot of fruitful discussion can be generated. Each group member has his or her own copy of the puzzle, but each group has a different puzzle so that there is not too much 'cross-pollination'. In this situation the identification system is a necessity.

All of it requires a lot of planning (and copying and tearing-up) in preparation. But once organised and started, it runs itself.

How much help are you prepared to give? And what form shall it take?

Would there be some merit in having a starting guide for some? This, at its simplest, could be a list of cells in the order in which they can be solved. For instance, the guide for the puzzle solved on pages 4 and 5 would start – IY, HR, BZ, AT, DY, IX … It might help some to know where to concentrate their efforts, in the beginning at least.

What about them making their own? To keep one's sanity on this one, do not get involved in solving them yourself, encourage only their production and dissemination for others to attempt, leaving the arguments to carried on between the dissenters and the compilers. Blank grids are provided!

Very useful activity for a Maths Club.

Probably no use as a Homework since solutions can easily be found (or the programs to find the solutions) are readily available on the Web. Which is a total negation of the whole point and value of doing such puzzles. Of course, writing a program to solve the puzzles is of value – but that is an entirely different matter.

Do not forget that the identification system is a coordinate system when it comes to identifying individual cells, and the uniqueness of the letters allows them to be stated in any order. In the interest of compatibility it is a good idea to try and keep it lined-up with our usual convention and give column, row (i.e. BW rather than WB)

In short, and as usual, this is a great activity of which teachers can make much, little or nothing.

Su Doku puzzles were introduced to the UK public (I know nothing of other countries) and, in particular, to readers of *The Times* on Friday, 12th November 2004.

This took the form of an introductory article and four sample puzzles graded as: Easy, Medium, Hard, and Very Hard; with a brief description on how to start solving them. Answers were given.

There was an account of the 'originator' of these puzzles and how it all started. He is Wayne Gould, a New Zealander who had served as a High Court Judge in Hong Kong but was now retired. He found these puzzles in Japan. (Just think how difficult – impossible – it must be to have CrossWord puzzles in an ideographic-based written language!) There were several books of these puzzles and, once he worked out what he had to do he was hooked. It seems that the puzzles were fairly well-known, but only to the more 'serious' puzzlists, like those who attend meetings on the subject and enter world competitions. Anyway he decided that here was a puzzle that the world in general would appreciate. He then set to building a computer program that would produce them to order. This took six years! Forming a company (Pappocom) and marketing the program has given this excellent program to the rest of the world. His Web-site is to be found at: www.sudoku.com

The first daily puzzle for *Times* readers to solve was given on Monday 15th November 2004, on the back of T2. At that stage the puzzles were unnumbered.

A puzzle was given every day, from Monday to Friday; starting the week with an Easy one and finishing with one rated as Fiendish.

On the 27th November they put one in their Saturday edition for the first time.

The numbering of the puzzles was started on Monday 31st January 2005 with number 55. Unfortunately it was actually number 64. It could be that, since they publish regional editions with variations the editor counted only those for a region which had started later. (A request for an explanation was ignored.) When they are celebrating their 1000th Su Doku puzzle no one will know that they will have already passed it!

The Su Doku puzzle proved to be very popular and they published another big article about it on Monday 28th February, with hints on solving and copies of various readers' letters. They also gave a 'big' puzzle to solve (it was the classic 9 x 9 but 21 centimetres square!) with a rating of 'fiendish' – but it wasn't. Then the next day another columnist wrote about his way of solving that particular puzzle. The whole thing was headlined

I've found the key (but I might lose the wife)

which gives a good idea of some of the inter-family conflicts readers had mentioned.

On the next day, Wednesday, 2nd March, they published a second Su Doku puzzle especially for Beginners (graded Easy) and said they would continue to do so (but only Monday to Friday at the present time of writing). These are not numbered.

In early March, 2005 they published their first collection of puzzles in book form. This contains 100 puzzles: 4 Easy, 26 Mild, 45 Difficult, and 25 Fiendish, (Those are the grade-names used by *The Times*.) together with their solutions. It was compiled by Wayne Gould.

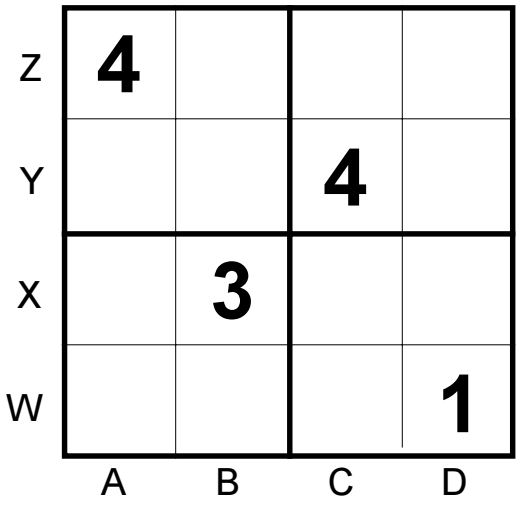
The book has the ISBN 0-00-720732-8

For those who want to go further, Wayne Gould's own program can be found at the Web-site given above. It is available for a 28-day free trial and costs less than 10 pounds (in the UK) to buy. It is highly recommended. It is the program on which all the puzzles given here were generated.

To see the daily puzzle in *The Times* go to www.timesonline.co.uk/ and click on GAMES.

Su Doku Puzzles 1 ~ 6

1



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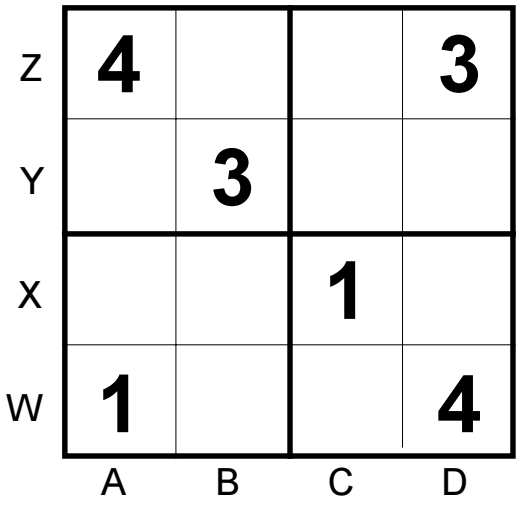

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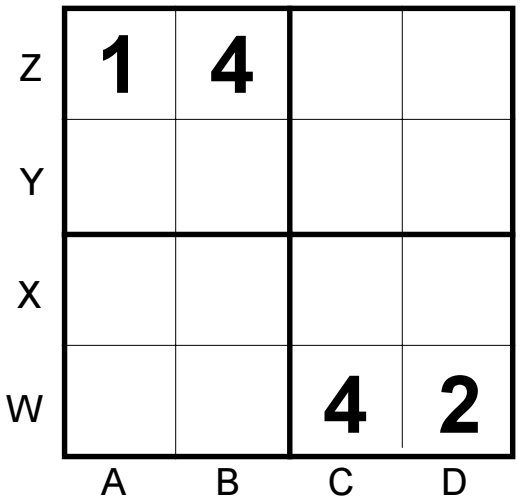

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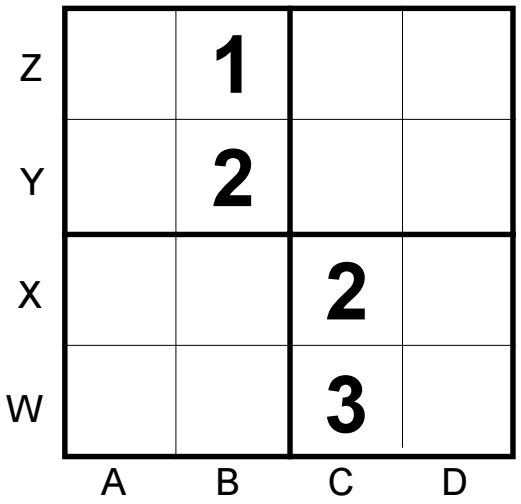

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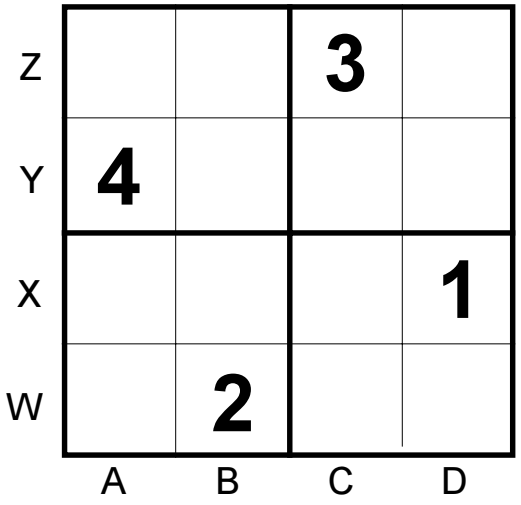

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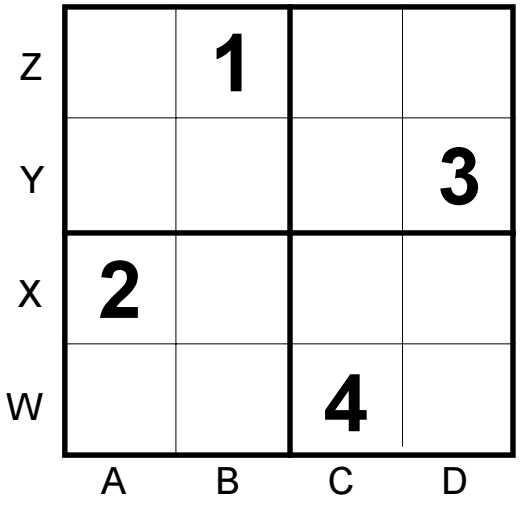
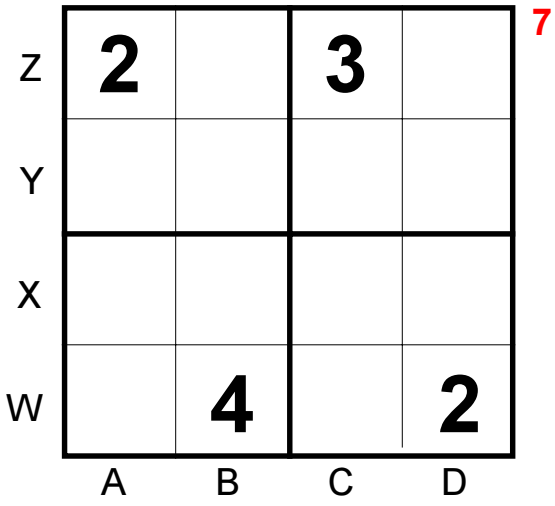


Su Doku Puzzles 7 ~ 12

7



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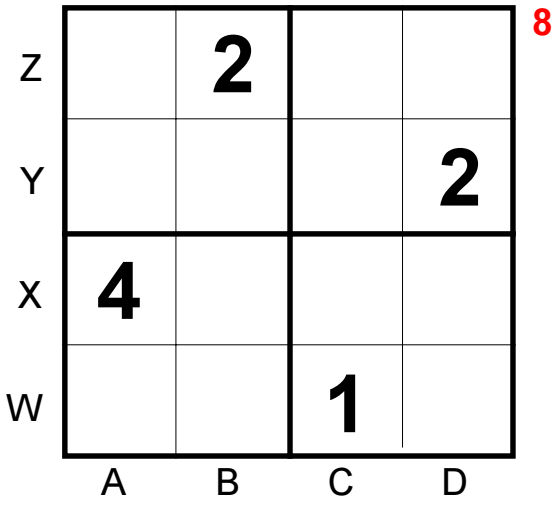

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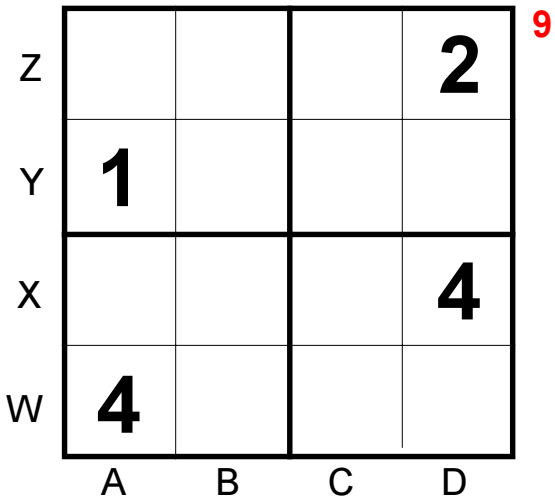

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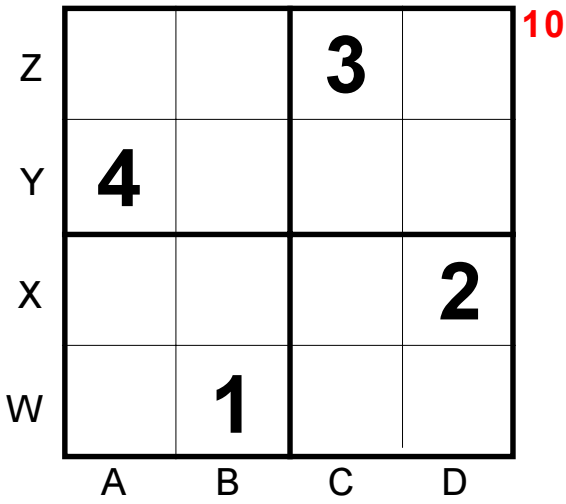

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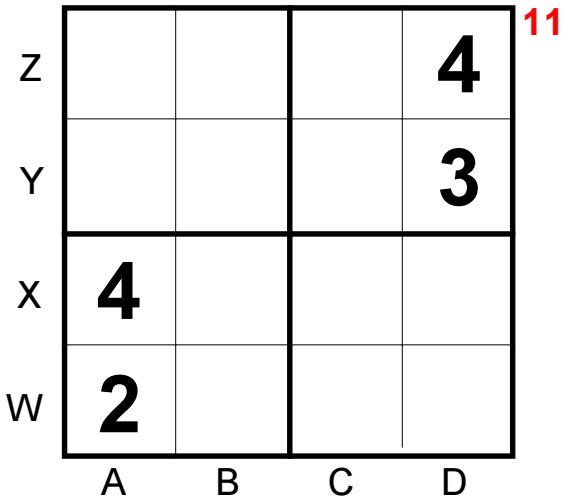

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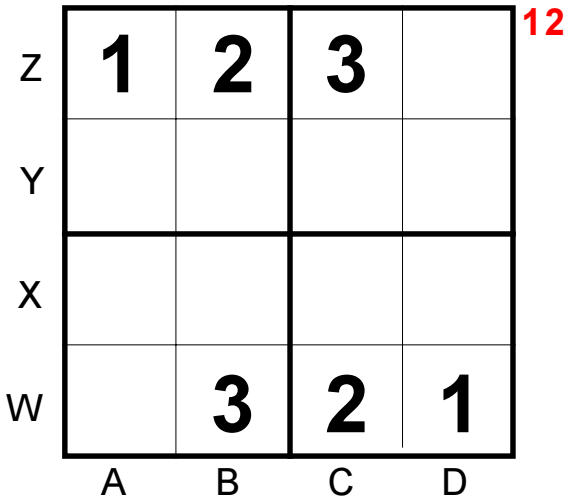
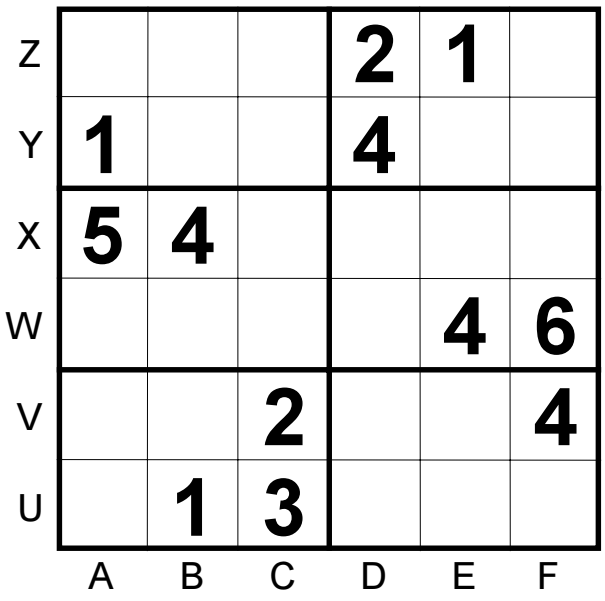


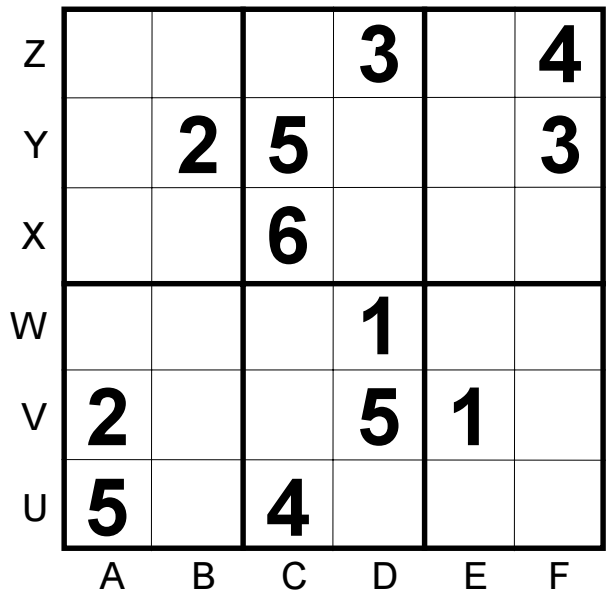
Su Doku Puzzles 13 ~ 18

13



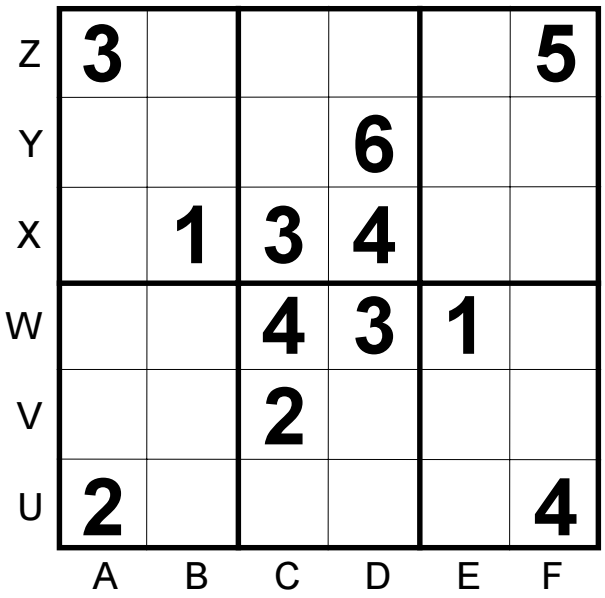
	A	B	C	D	E	F
Z				2	1	
Y	1			4		
X	5	4				
W					4	6
V			2			4
U		1	3			

14



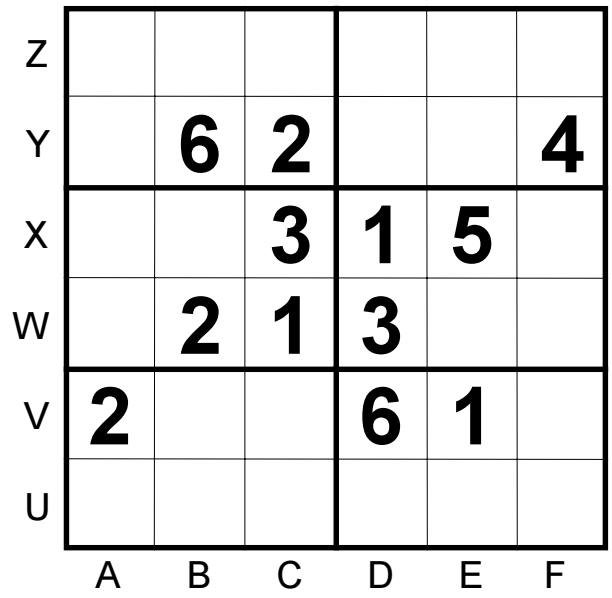
	A	B	C	D	E	F
Z				3		4
Y		2	5			3
X			6			
W				1		
V	2			5	1	
U	5		4			

15



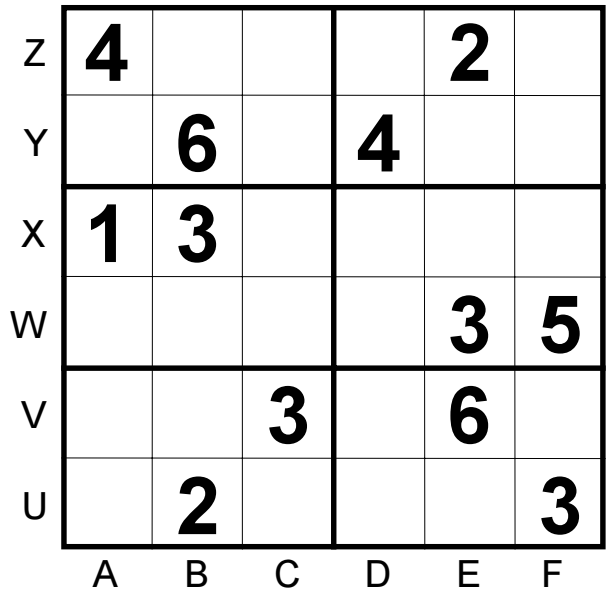
	A	B	C	D	E	F
Z	3					5
Y				6		
X		1	3	4		
W			4	3	1	
V			2			
U	2					4

16



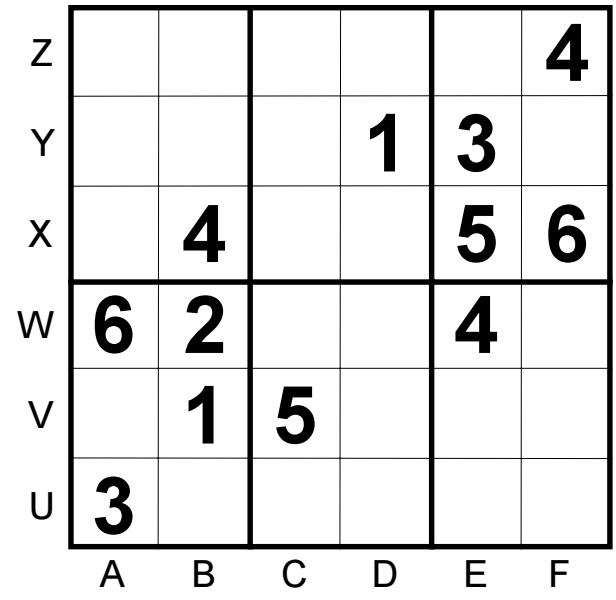
	A	B	C	D	E	F
Z						
Y		6	2			4
X			3	1	5	
W		2	1	3		
V	2			6	1	
U						

17



	A	B	C	D	E	F
Z	4				2	
Y		6		4		
X	1	3				
W					3	5
V			3		6	
U		2				3

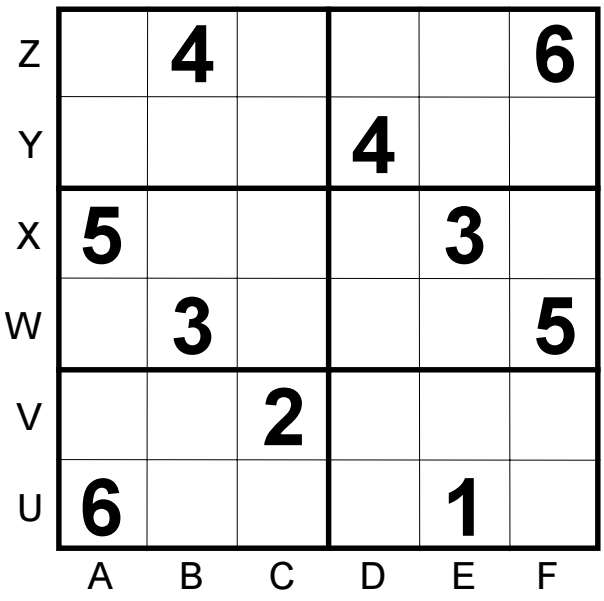
18



	A	B	C	D	E	F
Z						4
Y				1	3	
X		4			5	6
W	6	2			4	
V		1	5			
U	3					

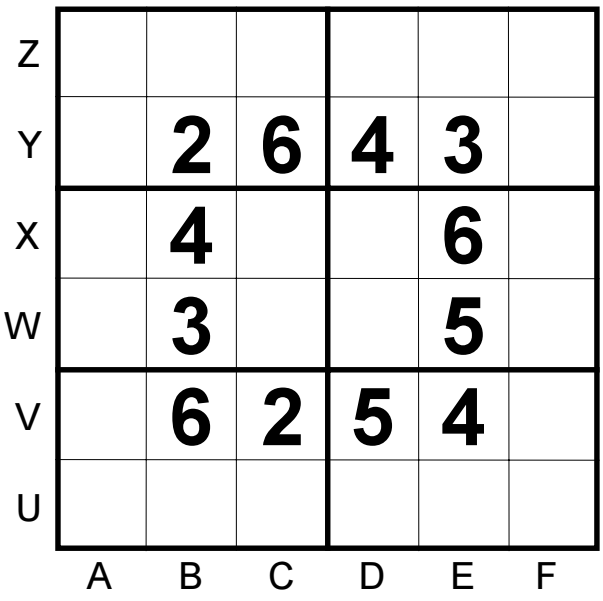
Su Doku Puzzles 19 ~ 24

19



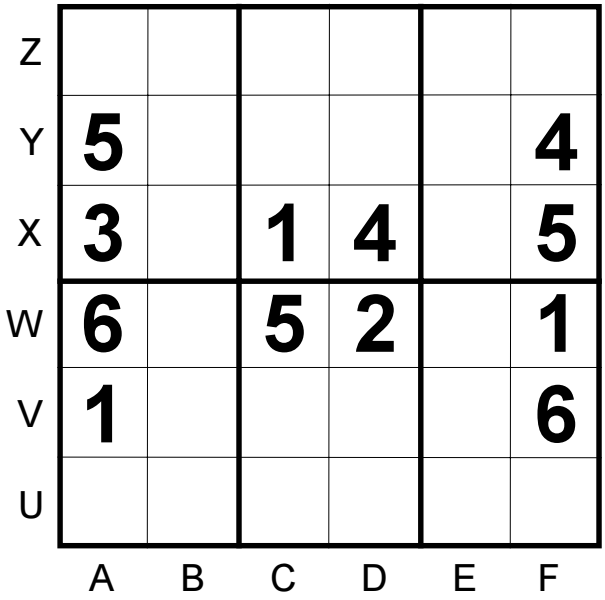
	A	B	C	D	E	F
Z		4				6
Y				4		
X	5				3	
W		3				5
V			2			
U	6				1	

20



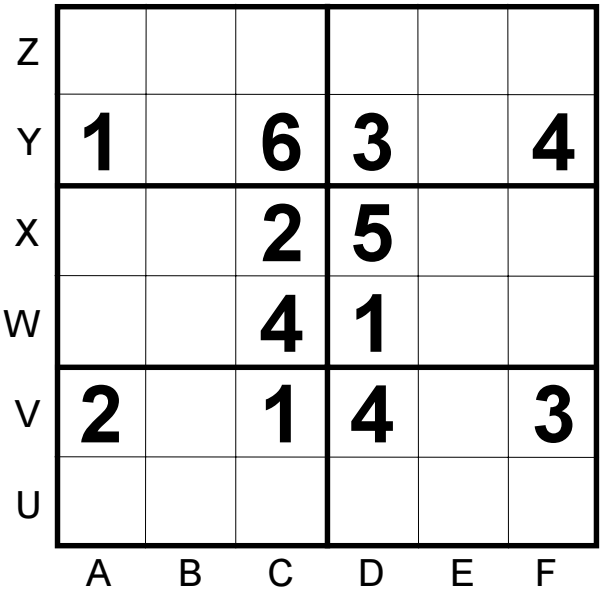
	A	B	C	D	E	F
Z						
Y		2	6	4	3	
X		4			6	
W		3			5	
V		6	2	5	4	
U						

21



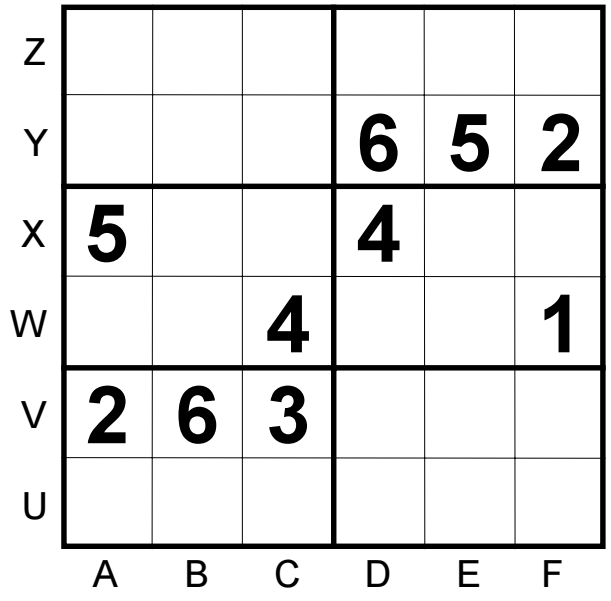
	A	B	C	D	E	F
Z						
Y	5					4
X	3		1	4		5
W	6		5	2		1
V	1					6
U						

22



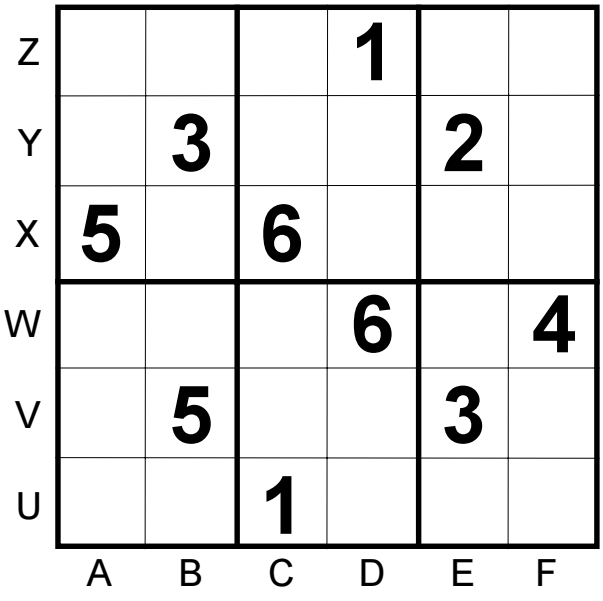
	A	B	C	D	E	F
Z						
Y	1		6	3		4
X			2	5		
W			4	1		
V	2		1	4		3
U						

23



	A	B	C	D	E	F
Z						
Y				6	5	2
X	5			4		
W			4			1
V	2	6	3			
U						

24



	A	B	C	D	E	F
Z				1		
Y		3			2	
X	5		6			
W				6		4
V		5			3	
U			1			

Su Doku Puzzles 25 ~ 30

25

	A	B	C	D	E	F	G	H	I
Z		3						8	
Y			6		4		5		
X	4			5		7			3
W		6	1				8	5	
V	3			4		6			1
U		4	2				6	3	
T	1			8		3			2
S			9		1		3		
R		5						7	

26

	A	B	C	D	E	F	G	H	I
Z		1		2		5		9	
Y	7	3		4	8	9		5	6
X									
W	4	8						2	1
V			3				9		
U	6	9						8	5
T									
S	9	7		6	5	4		3	8
R		5		1		3		7	

27

	A	B	C	D	E	F	G	H	I
Z				9		5			
Y	8	7						9	1
X			5		8		6		
W	9			8		6			3
V	5		8	3		4	7		9
U	2			5		1			8
T			1		6		8		
S	4	2						7	5
R				2		7			

28

	A	B	C	D	E	F	G	H	I
Z		2	6	9					
Y		8			3	1			9
X	9			6		5			8
W	7		5						
V			2		4		8		
U							4		1
T	2			1		9			3
S	3			2	6			8	
R						4	1	9	

29

	A	B	C	D	E	F	G	H	I
Z	5	2						7	9
Y				8		6			
X			3				4		
W	2	9		4		8		5	7
V	8				6				3
U	3	7		9		5		6	8
T			2				8		
S				1		9			
R	6	3						9	5

30

	A	B	C	D	E	F	G	H	I
Z	9			6		7			5
Y		3	5				1	7	
X		6			4			9	
W			1		9		5		
V			2	3		1	8		
U			6		8		4		
T		7			5			8	
S		5	9				6	2	
R	2			8		9			4

Su Doku:13

Su Doku Puzzles 31 ~ 36

31

	A	B	C	D	E	F	G	H	I
Z			8	6					7
Y						8		4	2
X					2				
W	2				5		3		
V	4		3				2		9
U			7		8				1
T					6				
S	8	3		2					
R	5					9	1		

32

	A	B	C	D	E	F	G	H	I
Z				2	4				
Y			7				1		8
X	4	5			1		6		
W			2			3		6	
V	8								7
U		6		7			9		
T			1		2			5	6
S	5		4				8		
R					7	8			

33

	A	B	C	D	E	F	G	H	I
Z	7			5		6			
Y			8	1			6		
X					9		2	5	
W	6							3	
V		7			3			4	
U		8							2
T		9	4		7				
S			5			4	7		
R				2		3			1

34

	A	B	C	D	E	F	G	H	I
Z				4				7	
Y						1	8	9	
X	6					2	4		
W					4			6	8
V			5		1		3		
U	7	8			6				
T			6	3					1
S		1	2	5					
R		3				9			

35

	A	B	C	D	E	F	G	H	I
Z		5			7				3
Y		2		4					
X		6	3			1	4	7	
W		4				5		2	
V									
U		7		8				5	
T		8		7			5	4	
S						4		9	
R	9				2			8	

36

	A	B	C	D	E	F	G	H	I
Z	3		8						
Y				9					5
X		4	9		2	8			
W		2		5	4				
V		8						3	
U					8	9		2	
T				3	9		6	5	
S	7					4			
R							2		7

Very clearly they are not here!

But then you don't really need them do you? Just turn the puzzles over to the class and, when one is found to be 'impossible', everyone has a go at it.

A printed set of solutions to all 36 puzzles does exist, but if you really must have them you will have to do a little work to get them.

Let me explain.

I have been running the TRoL Web-site since 1997 but know very little about the people who use the materials. I know the number of calls made each month on the various files so have a good idea of the relative popularities of the different resources.

> In case you are interested, the most consistently popular is *Geometric Patterns* followed by *Calculator Exercises* and then *Artefacts*.
>
> There are 'seasonal' variations of course. November/December sees great demand for the various *Calendar Models* (*Teddy Bears* and *Geometric Patterns* being top favourites there). And the end of every term is signalled by a surge in demand for the various Games and Puzzles.

But that is simply a matter of statistics and the trouble with that is, as Sherlock Holmes once remarked, "While statistics may tell us everything about 1000 people, it tells us nothing about an individual." We may question that 'everything' but we know what he means.

In a similar way I know very little about the people using this stuff and, after all these years, I am curious. So I offer a trade. I will give you the solutions (or tell where they are to be found) in exchange for some information about yourself. Nothing personal I hasten to add, only professional stuff.

Like, your main teaching subject, how many years you have been teaching, with what age/grade/level do you work, where do you use some of the items (Sudoku for instance), how do you organise the collecting and distribution of the material, what difficulties you may have encountered and well, anything else that gives me a picture of where and how all those thousands of downloads (over 60,000 a month) are finishing up. You can even suggest something else you would like to see included in TRoL.

I did contemplate making a form but do not like the formality of that, (the above list is suggestive not prescriptive) and would like you to write in your own way. After all you are, in a manner of speaking, professional communicators.

It may sound like a mammoth piece of writing but I do not want it to be, keep it terse, make it brief but readable!

Send your details and request for solutions in an Email (NO attachments please - they make me nervous) to the 'manager' whose address is given near the bottom of the opening menu at

www.ex.ac.uk/trol/

(I did say you would have to work for it)

Do make sure the subject line has a suitable entry (like — *Sudoku Solutions*) because Emails with an empty subject line are automatically deleted.

Perhaps I should add that names, addresses, or any other details will NOT be passed on to any other persons. This is for my eyes and personal information only. I should just like to have a composite profile of a 'typical' user.

Z				
Y				
X				
W				
	A	B	C	D

Z				
Y				
X				
W				
	A	B	C	D

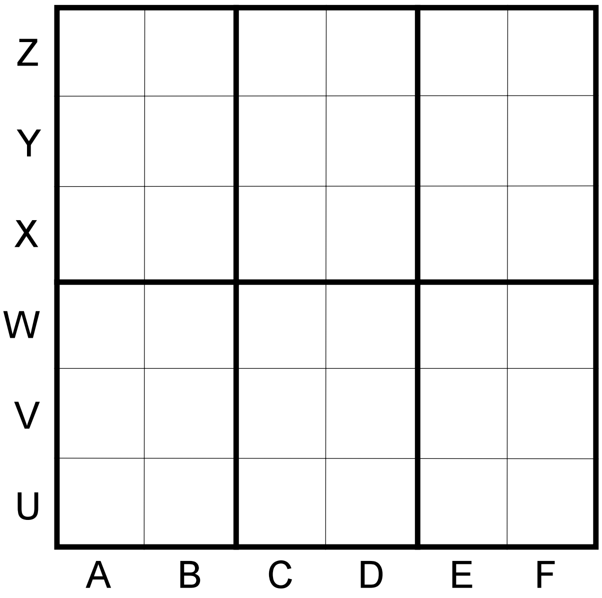
Z				
Y				
X				
W				
	A	B	C	D

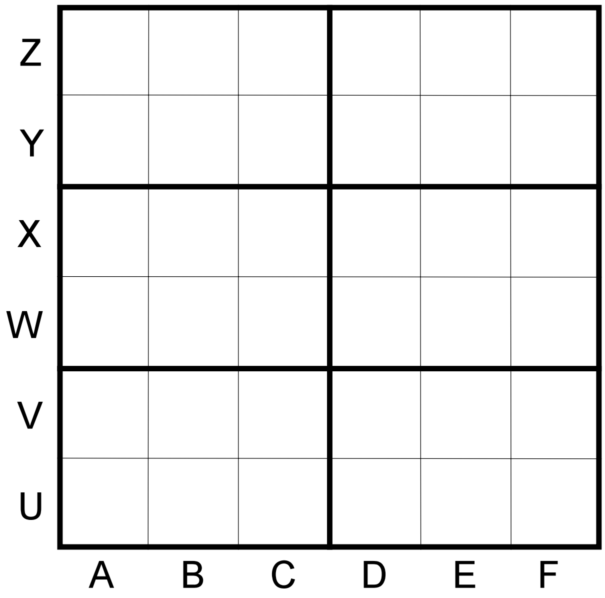
Z				
Y				
X				
W				
	A	B	C	D

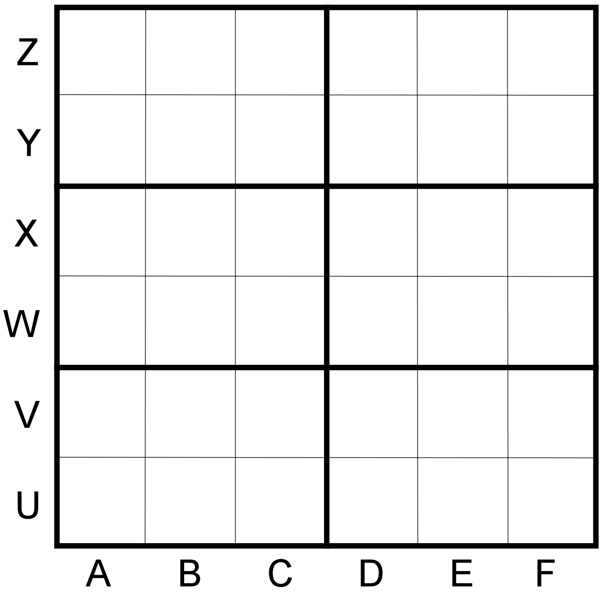
Z				
Y				
X				
W				
	A	B	C	D

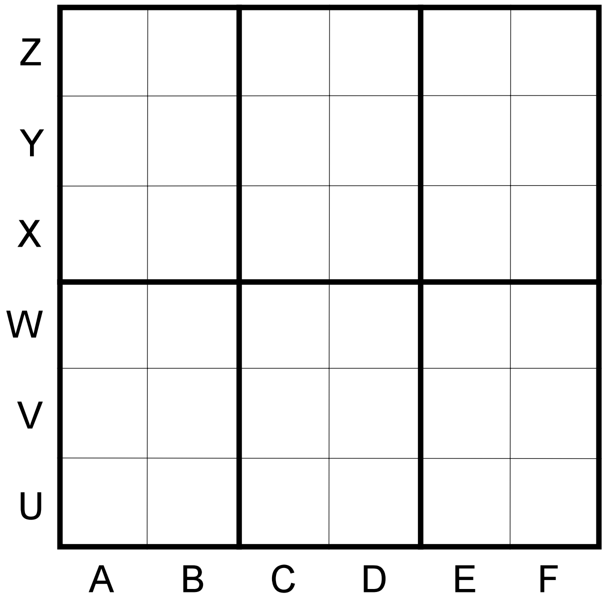
Z				
Y				
X				
W				
	A	B	C	D

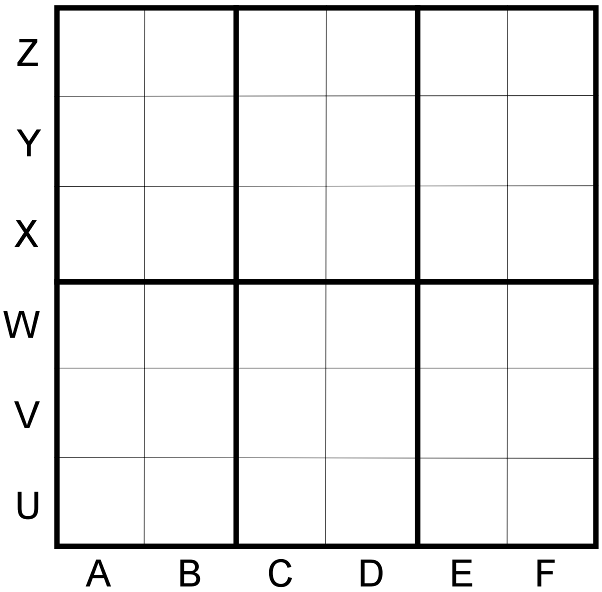
Su Doku Blanks for 6 x 6

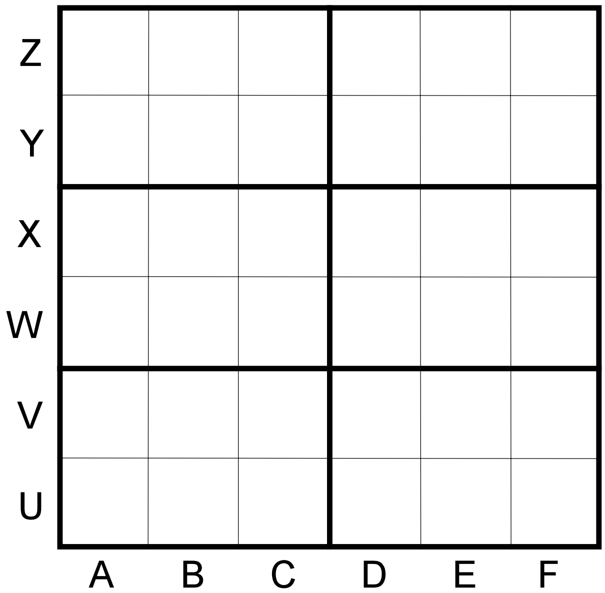












Su Doku Blanks for 9 x 9

	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

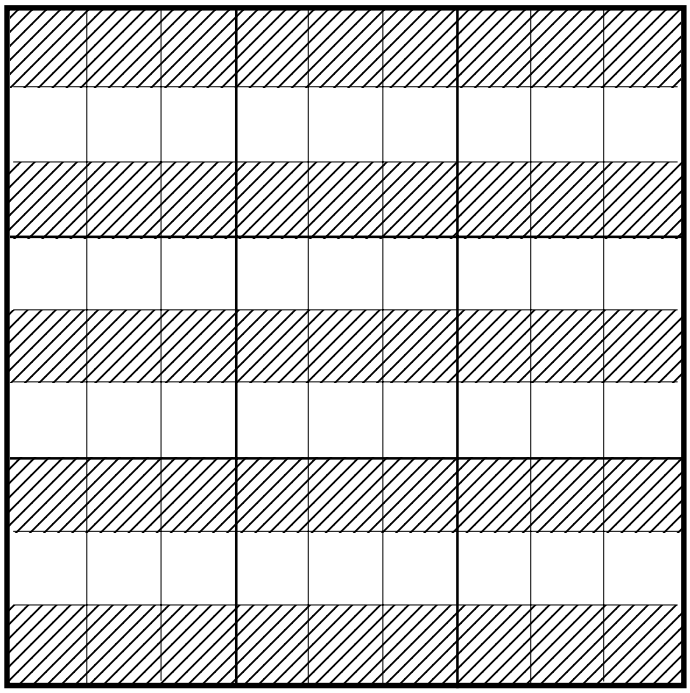
	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

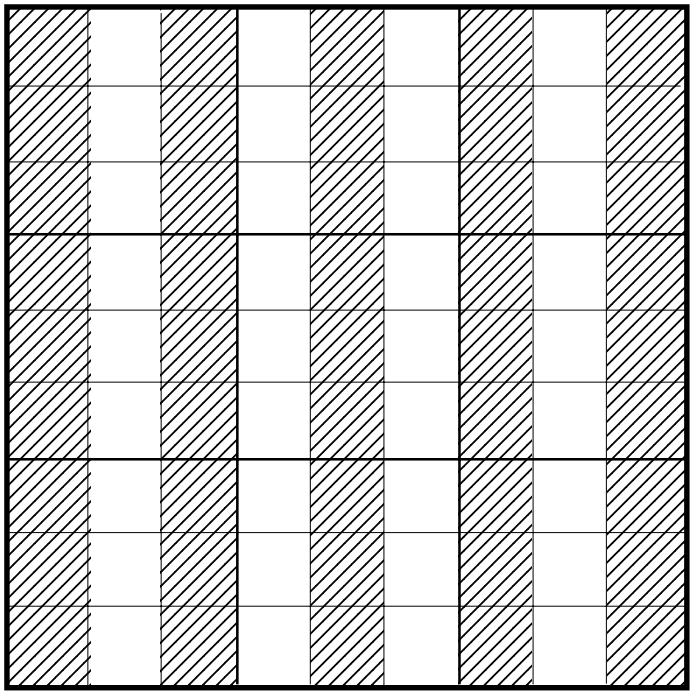
	A	B	C	D	E	F	G	H	I
Z									
Y									
X									
W									
V									
U									
T									
S									
R									

A Su Doku Grid

Rows



Columns

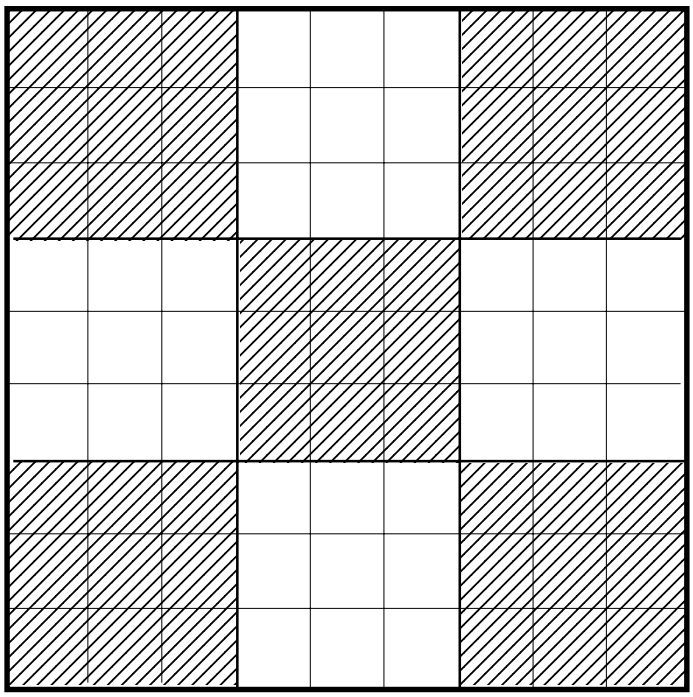


A Su Doku Grid

Blocks

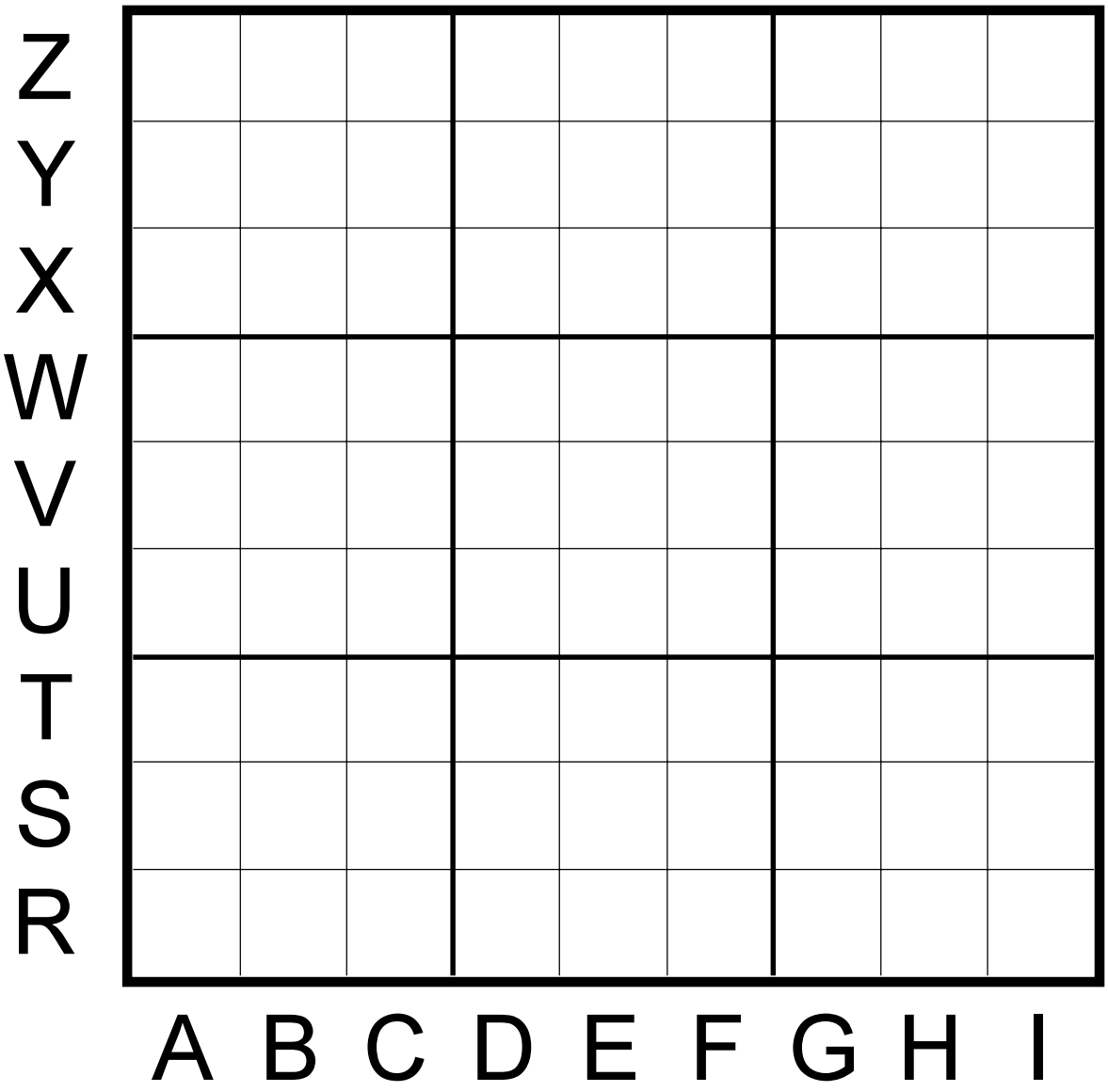
or

Boxes

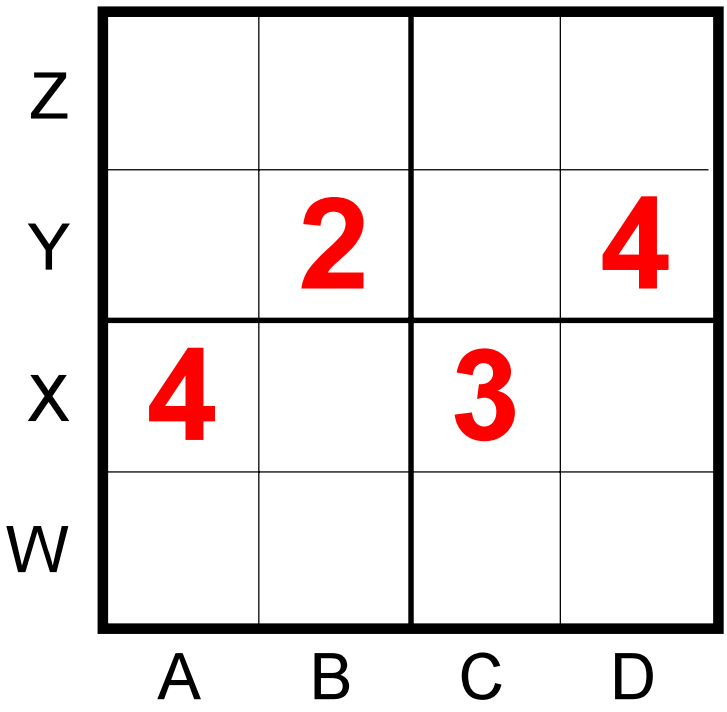


A Su Doku Grid

Identifiers



A Su Doku Puzzle (4 x 4)



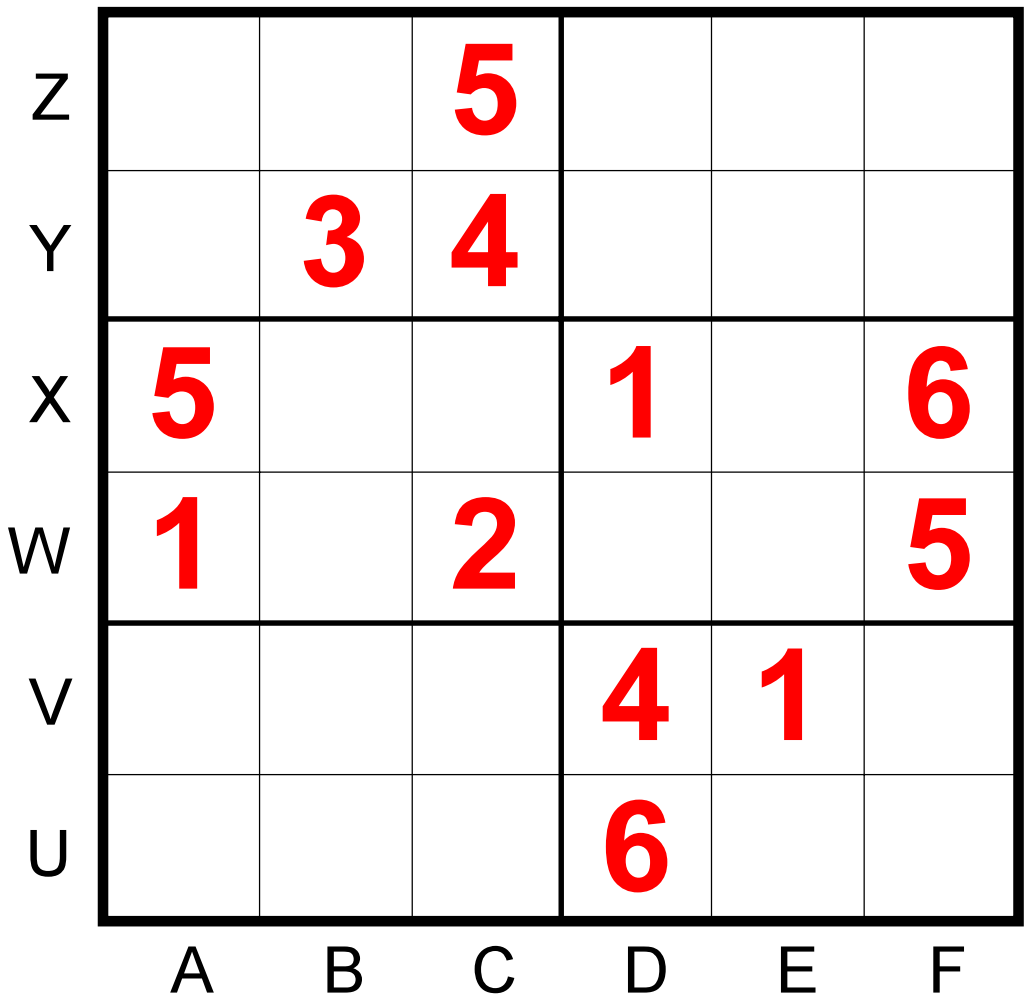
Su Doku:22

A Su Doku Puzzle (4 x 4) ~ Solution

	A	B	C	D
Z	1	4	2	3
Y	3	2	1	4
X	4	1	3	2
W	2	3	4	1

Su Doku:23

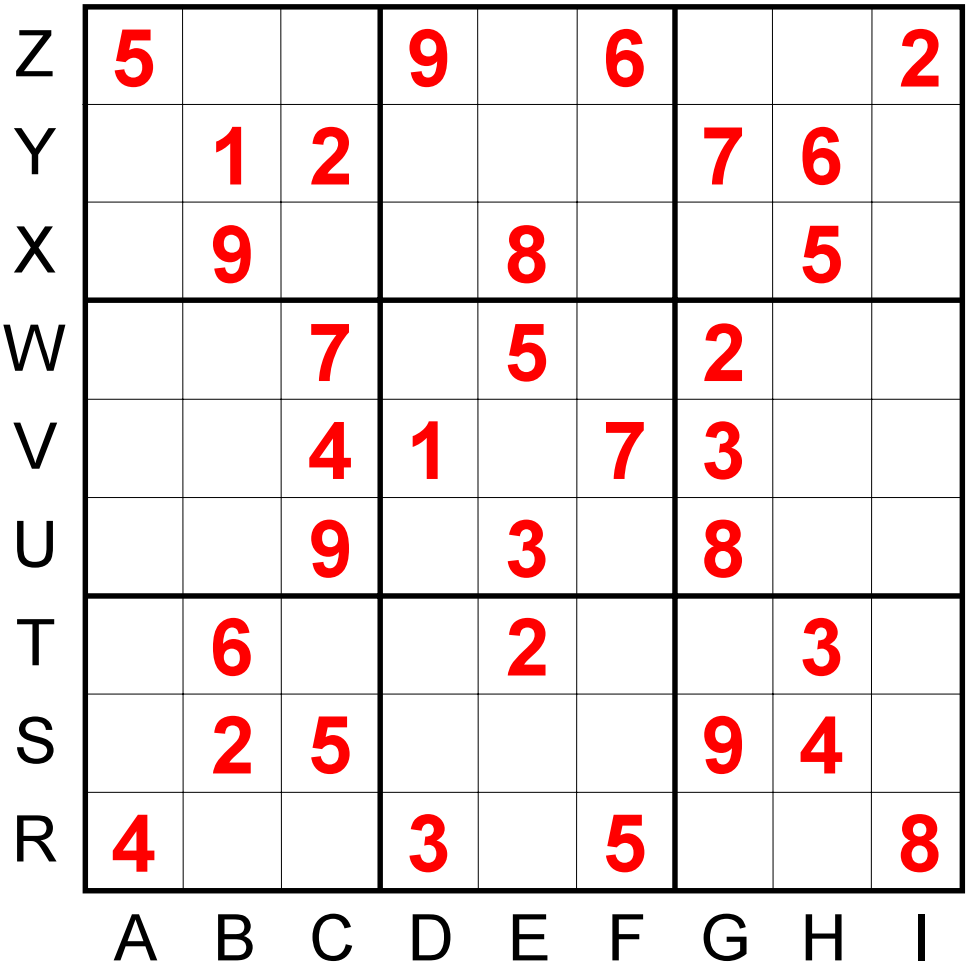
A Su Doku Puzzle (6 x 6)



A Su Doku Puzzle (6 x 6) ~ Solution

	A	B	C	D	E	F
Z	6	1	5	2	3	4
Y	2	3	4	5	6	1
X	5	4	3	1	2	6
W	1	6	2	3	4	5
V	3	5	6	4	1	2
U	4	2	1	6	5	3

A Su Doku Puzzle (9 x 9)



A Su Doku Puzzle (9 x 9) ~ Solution

	A	B	C	D	E	F	G	H	I
Z	5	4	3	9	7	6	1	8	2
Y	8	1	2	5	4	3	7	6	9
X	7	9	6	2	8	1	4	5	3
W	6	3	7	8	5	9	2	1	4
V	2	8	4	1	6	7	3	9	5
U	1	5	9	4	3	2	8	7	6
T	9	6	8	7	2	4	5	3	1
S	3	2	5	6	1	8	9	4	7
R	4	7	1	3	9	5	6	2	8