# Setti‘s rule for Str8ts puzzles

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by BP

# Introduction

This tutorial is a step by step guide how to use the strategy „**Setti's rule**" for solving (extreme) Str8ts puzzles. Setti's rule is named after user Setti who was the first to write about it on www.Str8ts.com/weekly_Str8ts.aspx. In this tutorial I will first explain Setti's rule then show several examples how to apply it most profitably. I will also introduce the so called **Black Cell Analysis**, a very useful tool for applying Setti's rule in more complex cases, for **Setti Considerations** and so called **Combined Settis**.

Please note: The strategies explained here are not my own inventions. They were discussed and are by now common knowledge on www.Str8ts.com/weekly_Str8ts.aspx and in www.forum.str8ts.de. When I know who it is I will give credit to the strategy's inventor.



If you have comments, corrections or criticism please mail to BP.Str8ts@web.de.

Have fun! BP

# Contents

# Setti‘s rule

Setti‘s rule is named after user Setti who first wrote about it in 2010 on [www.Str8ts.com/weekly_Str8ts.aspx](www.Str8ts.com/weekly_Str8ts.aspx). Actually the rule is just a simple observation. It is indeed so simple that at first glance it may be difficult to imagine why it should be a powerful tool for solving Str8ts puzzles, but it is! So, here it comes:

**Setti‘s rule:** In any valid solution of a Str8ts puzzle each digit x occurs in exactly the same number of rows and columns.

This observation follows directly from the Str8ts rules and the fact that each digit may occur at most once in each row and column: If a digit x occurs in exactly n rows then x occurs exactly n times in the solution and therefore in exactly n columns.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| A | | 3 | 2 | 1 | 4 | | 8 | 7 | |
| B | 3 | 2 | 1 | | 5 | 7 | 9 | 8 | 6 |
| C | 2 | 1 | | 9 | 8 | 6 | 7 | | 4 |
| D | 6 | 4 | 9 | 5 | 7 | 8 | | 2 | 3 |
| E | 1 | | 8 | 7 | 6 | | 4 | 3 | 5 |
| F | 5 | 6 | | 4 | | 2 | 3 | | 7 |
| G | 4 | 8 | 7 | 3 | 2 | 1 | 5 | 6 | |
| H | 7 | 9 | 6 | 8 | 3 | 4 | 2 | 5 | 1 |
| J | | 7 | 5 | 6 | | 3 | 1 | 4 | 2 |

To get a feeling for this let‘s look at a finished Str8ts puzzle, **Example 1**, and count the digits:

1 occurs in 7 rows (A,B,C,E,G,H,J) and 7 columns (cols 1,2,3,4,6 ,7,9),
2 occurs in 8 rows and 8 columns,
3 occurs in 8 rows and 8 columns, …

# Setti‘s rule restated

**Note:** Instead of counting the rows/columns in which a digit occurs we might also count the rows/columns in which a digit is missing and get the following result:
1 is missing in 2 rows and 2 columns,
2 is missing in 1 rows and 1 columns,
3 is missing in 1 rows and 1 columns, …

Obviously the following version of Setti‘s rule is also true:

**Setti‘s rule restated:** In any valid solution of a Str8ts puzzle each digit x is missing from exactly the same number of rows and columns.

You might be wondering, why I made this rather obvious observation. The reason is: Setti‘s rule in this second wording is often easier to handle. When applying Setti‘s rule it‘s usually easier to focus on missing digits than on digits that have to be there, because there are fewer of them.
But how is Setti‘s rule applied? Let‘s look at a first example:

# First Application

**Example 2 (#681):**

Let‘s look at this halfsolved puzzle and try to use Setti‘s rule on 4. To do this we first examine the possible presence of 4 in all rows:

4 is **already in** rows B,D,E.

4 is a **sure candidate in** rows C,F,G,H,J.

4 is **missing in** row A.

⇒ 4 belongs to exactly 8 rows and is missing in exactly 1 row.

⇒ By Setti‘s rule 4 must belong to exactly 8 columns and must be missing in exactly 1 column.

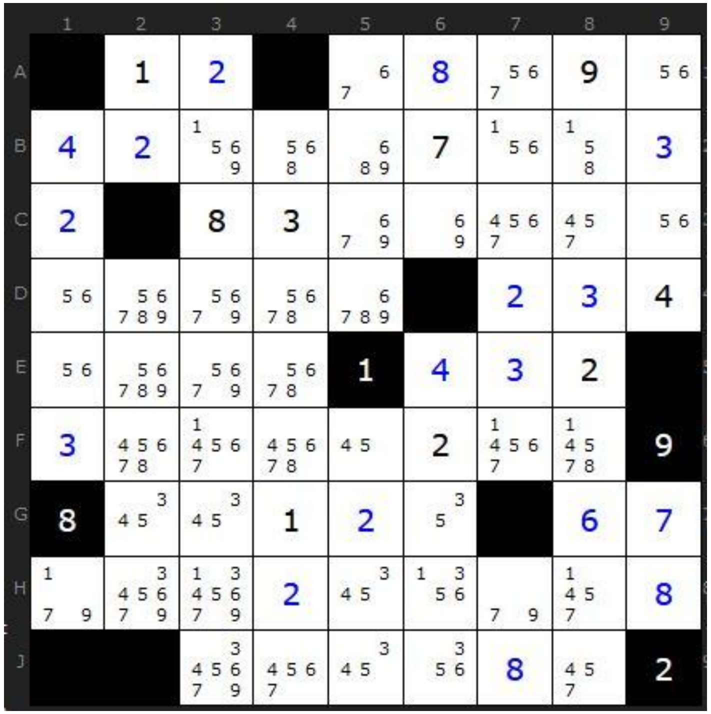
Now look at the columns:

4 is **already in** cols 1,6,9.

4 is a **sure candidate in** cols 3,4,5,7,8.

⇒ 4 is a **possible candidate in** col 2.

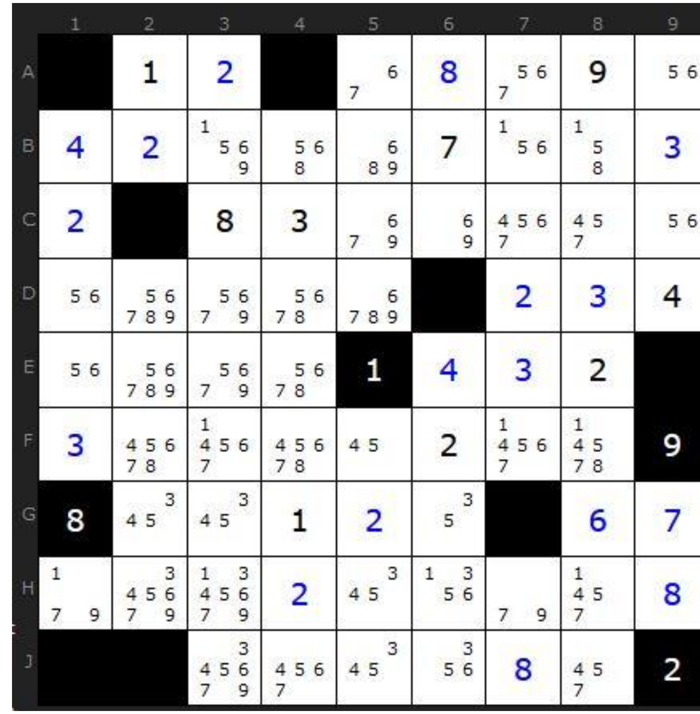
⇒ We know by Setti‘s rule that 4 must be missing from exactly one column. The only candidate is col 2, therefore 4 must be missing from col 2 and can be removed from cells FGH2.



In this example Setti‘s rule helped us to eliminate a candidate from several cells.

# First Application

**Example 2:**
Let‘s now try to use Setti‘s rule on 7. To do this we examine the possible presence of 7 in all rows:
7 is **already in** rows B,G.
7 is a **sure candidate in** rows A,C,D,E,F,H,J.
$\Rightarrow$ 7 belongs to all 9 rows.
$\Rightarrow$ By Setti‘s rule 7 must belong to all 9 columns.
Now look at the columns:
7 is **already in** cols 6,9.
7 is a **sure candidate in** cols 2,3,4,5,8.
7 is a **possible candidate in** cols 1,7.
$\Rightarrow$ By Setti‘s rule 7 must be in cols 1,7.
In col 7 at first glance this does not help us much, because we do not know whether 7 belongs in the upper or lower compartment. But in col 1 we have just one option, so we get H1=7. (From which follows H7=9 and so on …)

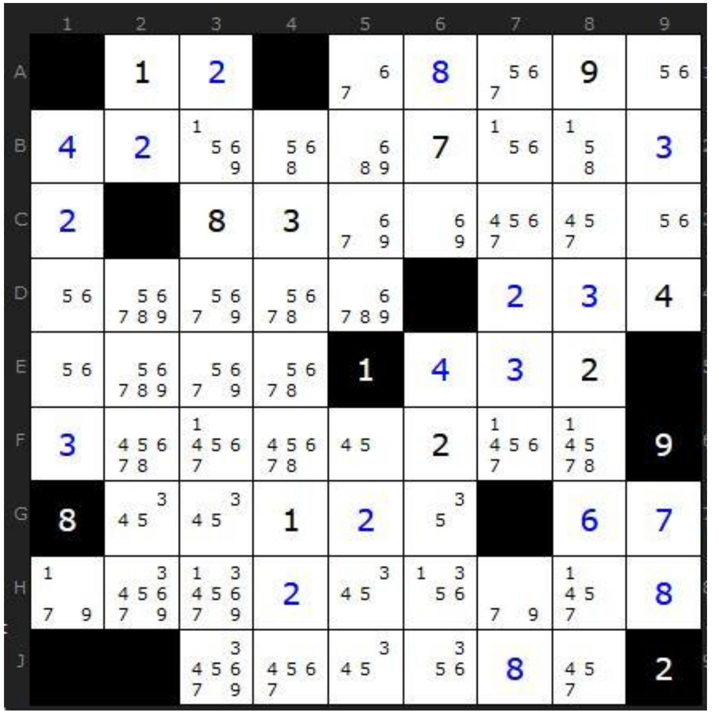


In this example Setti‘s rule helped us to set a cell to a digit.

# White digits in black cells

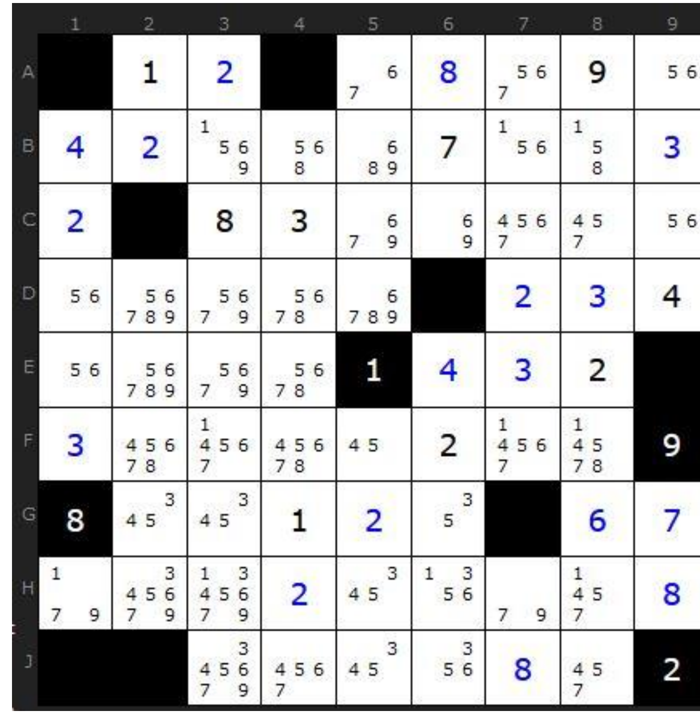
I hope this example already made clear how useful Setti‘s rule can be. It can be used to decide that a certain digit must belong to a certain row or column or that it must be missing from it, thereby eliminating possible candidates from cells or setting cells to certain digits. But there is more to it, as we will see later.

However first take a look at **Example 2** one last time, this time at digit 1.
To apply Setti‘s rule to 1 we again need to examine the possible presence of 1 in all rows and columns. But there is one special point to consider here: The white 1 in the black cell E5. Shall we count this 1 as being present in row E and col 5 or shall we count it as definitely missing, because it mustn‘t appear in the compartments?
The answer is: Both options are valid, and Setti‘s rule holds true for both options, **as long as we use the same method of counting for rows and columns.** In this tutorial I will always count white digits in black cells as being present in the row and column containing that black cell.



# White digits in black cells

**Example 2:**
With this in mind let‘s examine the rows:
1 is already present in rows A,E,G.
1 is a sure candidate in rows B,F,H.
1 is missing in C,D,J.
⇒ 1 occurs in exactly 6 rows.
Columns:
1 is present in cols 2,4,5.
1 is a sure candidate in cols 3,8.
1 is possible in cols 1,6,7.
1 is missing in col 9.
Sadly, in this case Setti‘s rule isn‘t helping us much. Since 1 belongs to exactly 6 rows it has to belong to exactly 6 columns, i.e. to cols 2,3,4,5,8 and to one of cols 1,6,7? But to which? We do not know and have no way of finding out – yet.



In this example Setti‘s rule did not help us.

# Setti‘s rule – Recap

The above example showed how powerful Setti‘s rule can be. Using it on digits 4,7 helped us to get closer to the puzzle‘s solution. However using Setti‘s rule on digit 1 didn‘t yield helpful information. So you might be wondering how to spot digits to which Setti‘s rule might be applied profitably. There are two answers to this question.

**First answer**: If you have some experience in using Setti‘s rule you will probably develop an eye for recognizing digits that might be worth taking a closer look at. Of course these digits depend on the specific puzzle you are trying to solve, it might be 3,4 in one puzzle and 2,7,8 in the next. However quite often it‘s digits that occur in most but not all rows/columns in the puzzle, so it‘s usually not 1 or 9. However, it might be 1 or 9, no rule without exception ☺

**Second answer**: If you find the first answer unsatisfying I agree with you. So luckily there‘s a really good second one, it‘s called **Black Cell Analysis (BCA)**. Unluckily (at least maybe for some users) you need pen and paper to do it.

# Black Cell Analysis (BCA)

The first thing to know about **Black Cell Analysis (BCA)** is that it isn‘t a Str8ts strategy but just a very useful **tool to visualize** missing and possibly missing digits. The name and the method were suggested by user Jens in 2012 on forum.str8ts.de/Extreme Str8ts.
BCA means that we examine the black cells of a puzzle, i.e. we focus on **missing digits**.
To this end we analyze each row and each column of a puzzle and decide for each digit x, whether

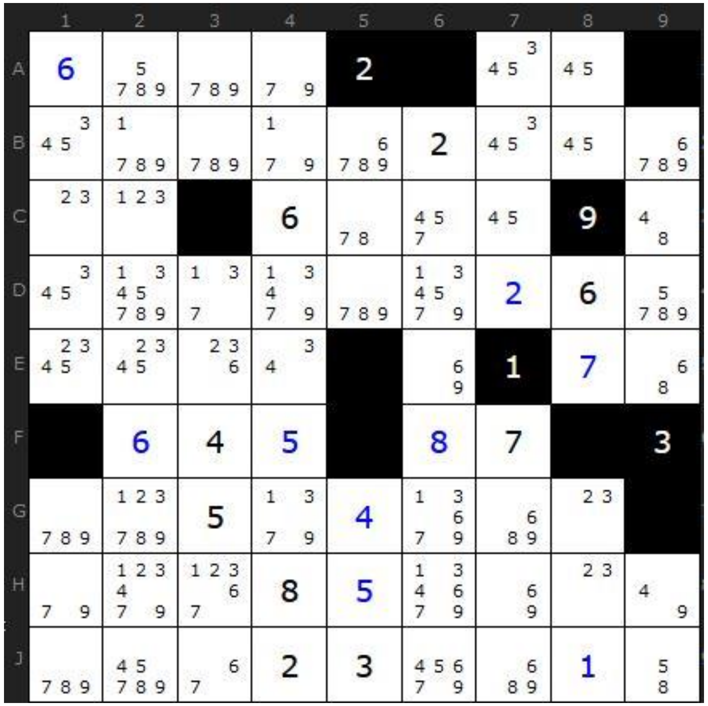
(A) x is **already in** this row/column or x is a **sure candidate** in this row/column
(B) x is a **possible candidate** in this row/column, i.e. x might or might not be in it
(C) x is **definitely missing** from this row/column.

Then we ignore all digits of category (A). The digits of category (B), i.e. the possible candidates, are written in green behind the rows / below the columns and the digits of category (C), i.e. the definitely missing candidates, are written in red behind the rows / below the columns.

By doing this we get a really helpful overview about missing and possibly missing digits as the next example shows.

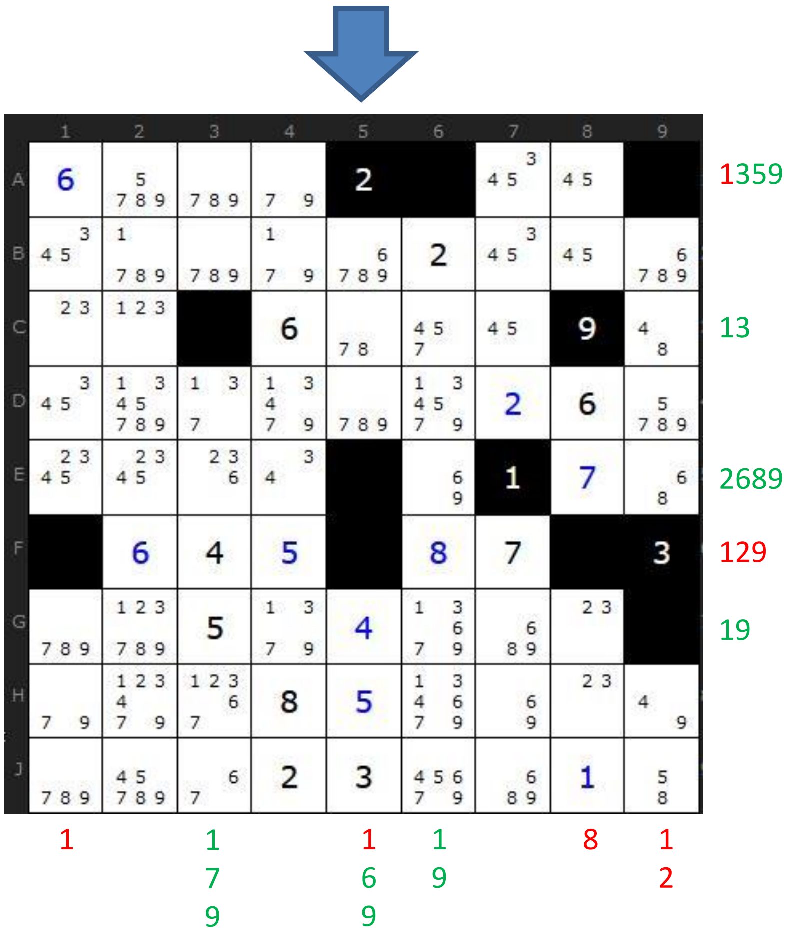
# Black Cell Analysis – Example

**Example 3 (#695):** Let's start with analyzing the columns.
**Col 1:** 1 is missing from col 1 and belongs therefore to category (C), whereas all other digits are either already present (6) or are sure candidates (2,3,4,5,7,8,9) and therefore belong to category (A). So we write 1 below col 1.
**Col 2:** All digits belong to category (A) (present or sure), therefore we write nothing below col 2.
**Col 3:** 4,5 are already present, 8 is sure in AB3, 2,3,6 are sure in DEFGHJ3. 1 is possible in DEFGHJ3, 7 is possible in AB3 and DEFGHJ3, 9 is possible in AB3.
So we write 1,7,9 below col 3.
**Col 4:** nothing to write.
**Col 5:** 2 is present (white digit in black cell, see above), 3,4,5 are present, 7,8 are sure, 6,9 are possible,
1 is missing. So we write 1,6,9 under col 5.
**Col 6:** 1,9.
**Col 7:** nothing to write.
**Col 8:** 8.
**Col 9:** 1,2.
In the same way we analyze all rows and get:



| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 1 | | 1<br>7<br>9 | | 1<br>6<br>9 | 1<br>9 | | 8 | 1<br>2 |

# Black Cell Analysis – Example




We have now an overview about digits that must / might be missing in rows / columns.
We now use this overview to apply Setti's rule:

The **first thing** to notice: No red or green 4's can be seen. That means 4 belongs to all rows/columns and can be ignored from a Setti's point of view.

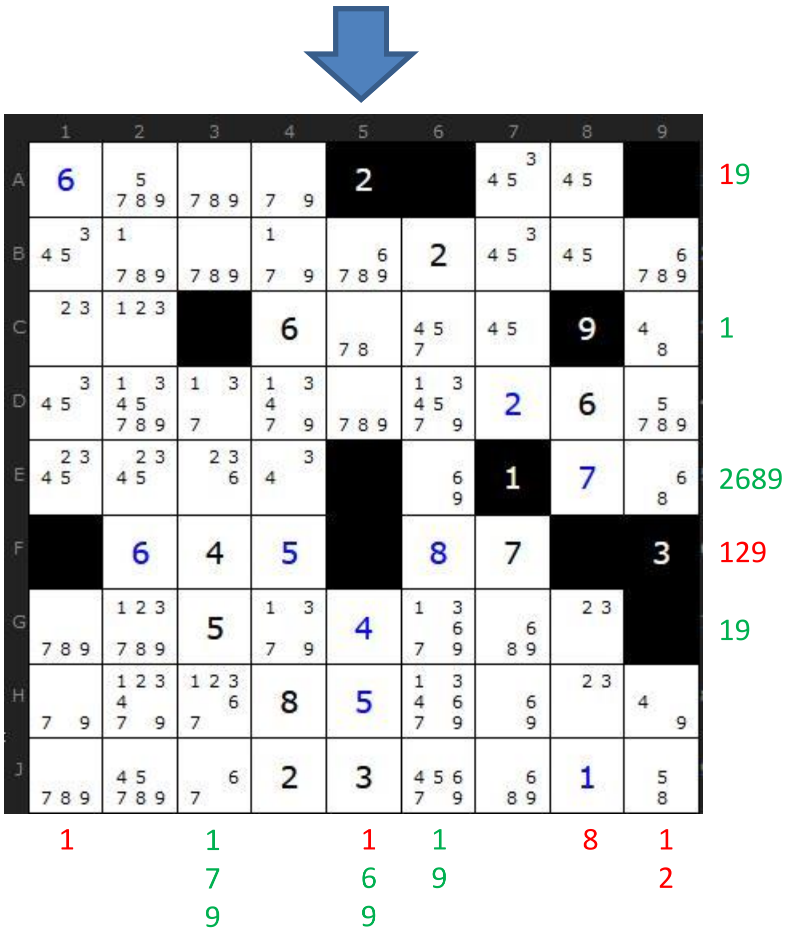
The **second thing** to notice: There are no green or red 7's behind the rows . This means 7 belongs to all rows and therefore by Setti to all columns. So 7 is no longer a possible candidate in col 3, but a sure candidate.

⇒ Delete 7 below col 3.

The **third thing** to notice: No green or red 3's or 5's below the columns. So 3 and 5 belong to all columns and therefore by Setti to all rows.

⇒ Delete 3 and 5 behind row A and 3 behind row C.

# Black Cell Analysis – Example

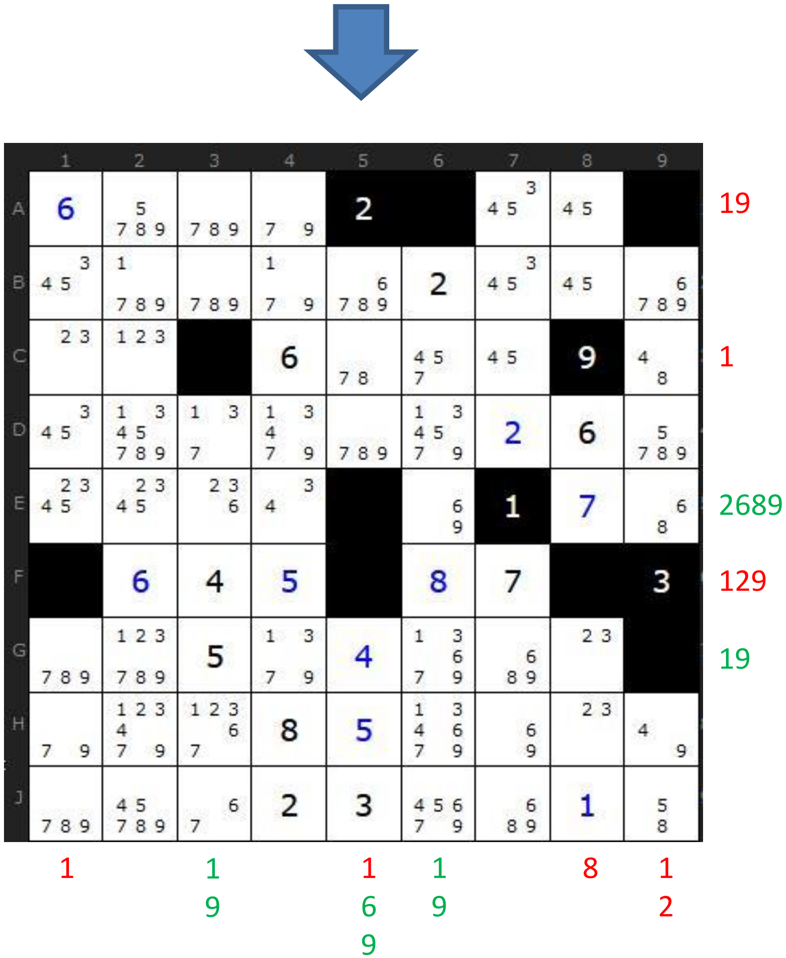



We now come to an **important point**:
Note that deleting 35 behind A leaves just 19 there. Since two digits have to be missing from A, these missing digits must be 1,9 so we can replace 9 by 9 behind A, thus changing 9's status from „possible" to „definitely missing". The same in row C: Deleting 3 behind C leaves just 1 there. Since one digit has to be missing from C, this missing digit must be 1 so we can replace 1 by 1 behind C.

And there's **another important point**:
Replacing 9 by 9 behind A and 1 by 1 behind C means that 9 is now missing in A and 1 is now missing in C, so we can delete 9 from all cells of A and 1 from all cells of C.

Doing this would set A4=7, A3=8, A2=5, A8=4, A7=3, … and thereby really help us in solving the puzzle. So normally we would stop our BCA at this point and go on with the „usual" puzzle solving process. However since this is supposed to be a lesson on BCA, let's continue with the BCA, i.e. focus on the red and green digits and just ignore the candidates in the cells for the moment.

# Black Cell Analysis – Example




Let‘s continue applying Setti‘s rule: We now have to examine the digits that occur behind at least one row and below at least one column. We could do this in any order, but it‘s usually a good idea to start with digits of which there are few red and/or green specimens.

So let‘s **examine 8:**

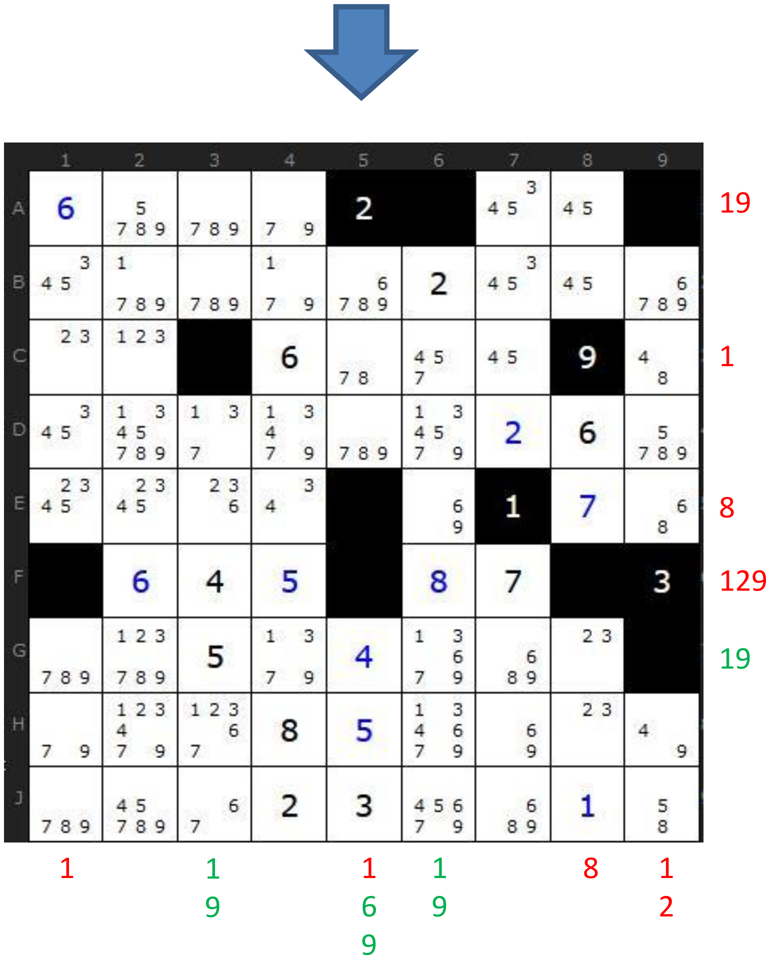
One 8 below columns, one 8 behind rows.

This is a perfect fit: One 8 and no 8 below columns means that 8 is missing from exactly one column and therefore by Setti‘s rule from exactly one row. The only option is row E.

⇒ Replace 8 by 8 behind E (and delete 8 as a candidate from all cells in E).

Note: Since just one digit is missing in E and this is now 8 we can delete 269 behind E thereby upgrading 2,6,9 from possible to sure candidates.

# Black Cell Analysis – Example




Let's **examine 6**:

No 6's left behind the rows.

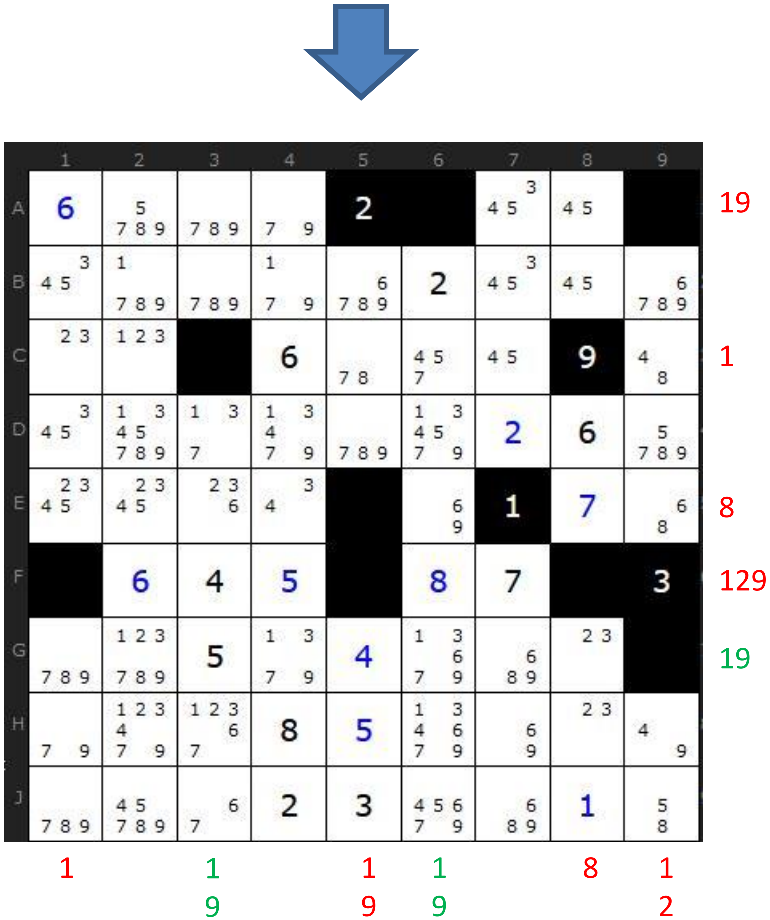
$\Rightarrow$ No 6 is missing from the rows

$\Rightarrow$ By Setti's rule no 6 is missing from the columns.

$\Rightarrow$ Delete 6 below col 5.

$\Rightarrow$ Replace 9 by 9 below col 5 (and delete 9 as a candidate from all cells in col 5).

# Black Cell Analysis – Example




There are three digits left to deal with: 1,2,9:

**Look at 2:** One 2 below cols, one 2 behind rows, no 2's. This is a perfect fit, nothing to do.

**Look at 1:** Three 1 and one 1 behind rows, three 1 and two 1 below columns.

⇒ In this case we cannot conclude much. Since 1 is missing from 3-4 rows it cannot be missing from 5 columns, therefore at least one of cols 3,6 contains a 1. But we don't yet know which one.

**Look at 9:** Two 9 and one 9 behind rows, one 9 and two 9 below columns.

⇒ In this case we cannot conclude much. Since 9 is missing from 2-3 rows it must be missing from col 3 or col 6 as well, but we don't yet know from which. If 9 is missing from G as well it must be missing from col 3 and col 6.

# Black Cell Analysis – Recap

This example showed how powerful a combination of BCA + Setti‘s* rule can be. When we started, there were many green digits, i.e. many rows and columns with unsure candidates. Now just one row and two columns with unsure candidates are left. All other rows and columns are „cleaned up“.

So you have seen that a BCA can be a useful tool. But a BCA takes time. So is it really neccessary or worthwhile doing it? Cannot one just use Setti‘s rule without a BCA? That depends on the puzzle. As long as I have other options for solving I usually use those until I am stuck. Then quite often I have „a feeling“ that applying Setti‘s rule to one promising looking digit might be helpful, so I do that in my head. However when I‘ve exhausted all these options and still haven‘t found the solution I usually do a BCA – and quite often get good results. [And of course I do not neccessarily continue with the BCA until all digits are examined. Quite often examining just one or two digits already gives enough hints for continuing the „regular“ solving process. Then I stop the BCA and only come back and update it when I need to.]

And there are two more reasons for doing a BCA: Setti Considerations and Combined Settis.

(*)**Note:** „BCA + Setti“ is usually shortened to just „BCA“ or just „Setti(s)“.

# Setti Considerations

We have learnt that applying Setti's rule to some digits helps to identify rows and columns the digit definitely belongs to or definitely can be deleted from, while applying Setti's rule to other digits gives no useful information. So let's now take a look at these seemingly useless cases and see whether we can do something about them.

**Example 4**:

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---|---|---|---|---|---|---|---|---|---|
| A | | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | | 123 4 6 789 | 123 4 6 789 | 1234 6789 |
| B | 123 456 789 | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 123 45 | 123 456 789 | 123 456 789 | |
| C | 123 456 789 | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 123 45 | 123 456 789 | 123 456 789 | |
| D | 123 456 789 | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 123 45 | 123 456 789 | 123 456 789 | |
| E | 123 456 789 | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | | 123 789 | 123 789 | 1379 |
| F | 123 456 789 | 3 456 789 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 56 7 9 | 123 456 789 | 123 456 789 | |
| G | 12 89 | | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 56 7 9 | 123 456 789 | 123 456 789 | 1289 |
| H | 123 456 789 | 123 | 123 456 789 | 123 456 789 | 123 456 789 | 123 456 78 | 56 7 9 | 123 456 789 | 123 456 789 | |
| J | | 123 | | 56 7 | 56 7 | 9 | 8 | 56 7 | | 4 123 |
| | 1289 | 139 | 19 | | | | 12459 | | 19 | |

BCA for this example is already done, and it's obvious that Setti's rule can be applied successfully to 4,5,6,7:

6,7: not missing in any column => 6,7 must be in all rows

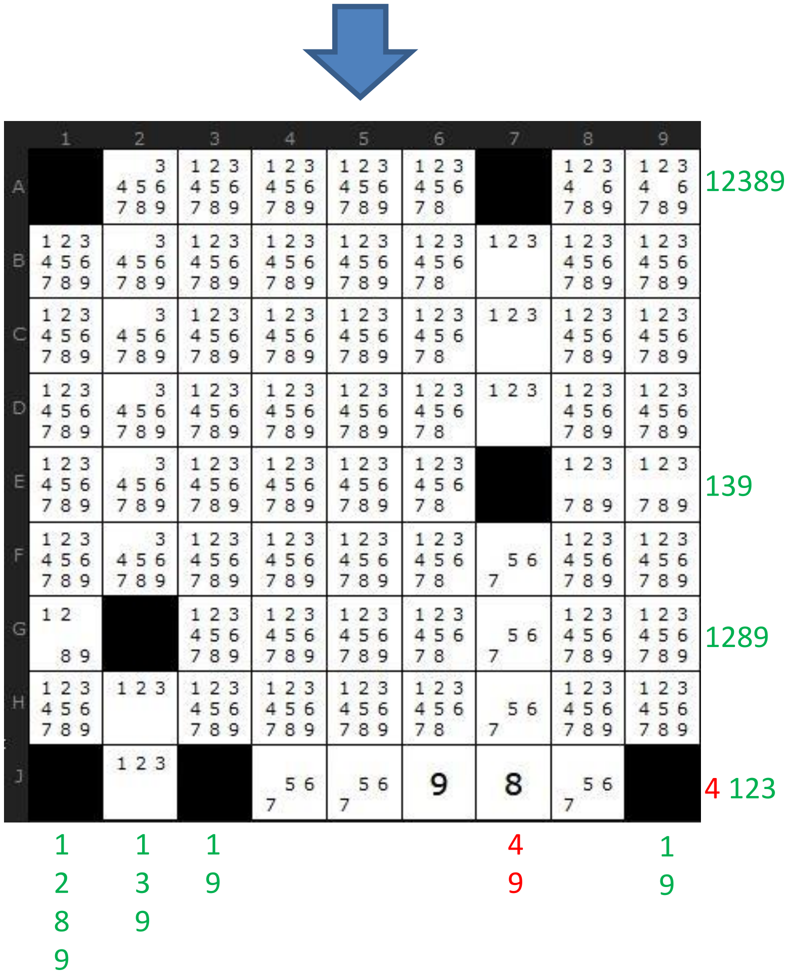
5: not missing in any row => 5 must be in all columns

4: definitely missing from row J and might be missing from row A and col 7

=> 4 must be missing from col 7 and must be in row A.

Updating the BCA and col 7 yields:

# Setti Considerations



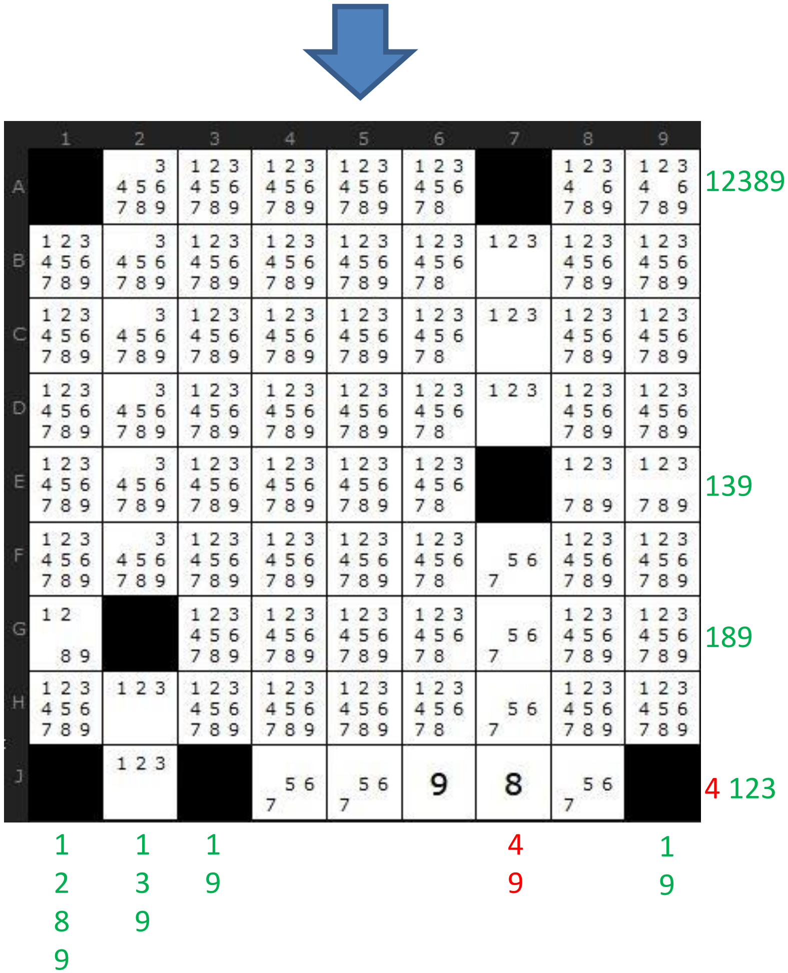

Now there are just 1,2,3,8,9 left as unsure candidates, and at first glance it seems as if we couldn't apply Setti's rule to these digits profitably. For example **look at 2:**

If 2 is in col 1 then it's in all rows including the unsure ones A,G,J. But if 2 is missing from col 1 then we do not know whether it's missing from A or G or J. Or do we?

Look more closely at col 1:
If 2 is not in col 1 then G1=89 which immediately implies that 2 is in row G. Therefore **2 must always be in row G** and we can delete 2 from behind G.

Updating the BCA yields:

# Setti Considerations



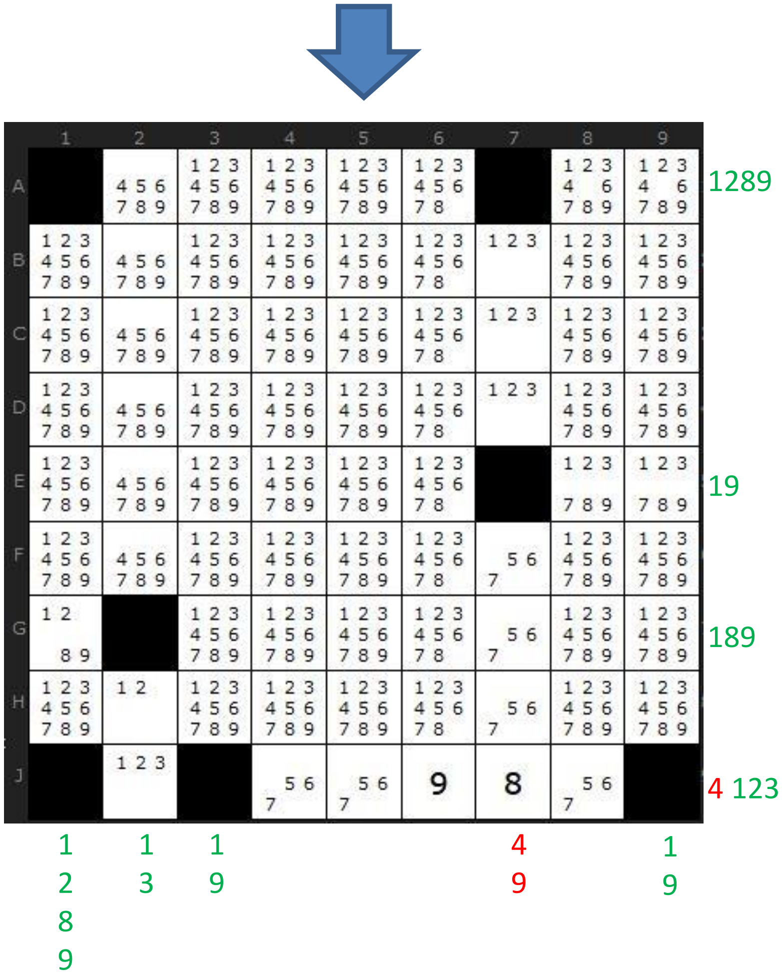

**Look at 3:**
3 might be missing in col 2 and rows A,E,J.

Now look closely at col 2:
If 3 is not in col 2 then HJ2=12 which immediately implies that 3 is missing in row J.
Therefore 3 **can only be missing from J and must be present in A,E**. So we can delete 3 from behind A,E.

Now look again at col 2:
If J2=3 then 3 belongs to col 2 and row J.
If 3 is in ABCDEFH2 then 3 belongs to col2, but not to row J. This means that 3 belongs to all columns but not to row J, which is a **contradiction to Setti's rule**.
Therefore 3 cannot be in ABCDEFH2.

Updating the BCA and col 2 yields:

# Setti Considerations




To recap: Even though at first glance it didn‘t seem profitable to apply Setti‘s rule to digits 2 and 3 analysing the puzzle‘s structure and the dependencies between some of the rows and columns helped us to gain useful information, in this case that 2 must belong to G and 3 must belong to A,E.
This procedure is called **Setti Consideration**.

Of course Setti considerations do not always deliver results. But if you have a digit that might be missing from just one column/row but from several rows/columns it‘s usually a good idea to take a closer look at this one column/row .

**Note:** The Setti considerations in this example were simple. Of course you can do more complicated ones or combine them with head chains.

# Combined Settis

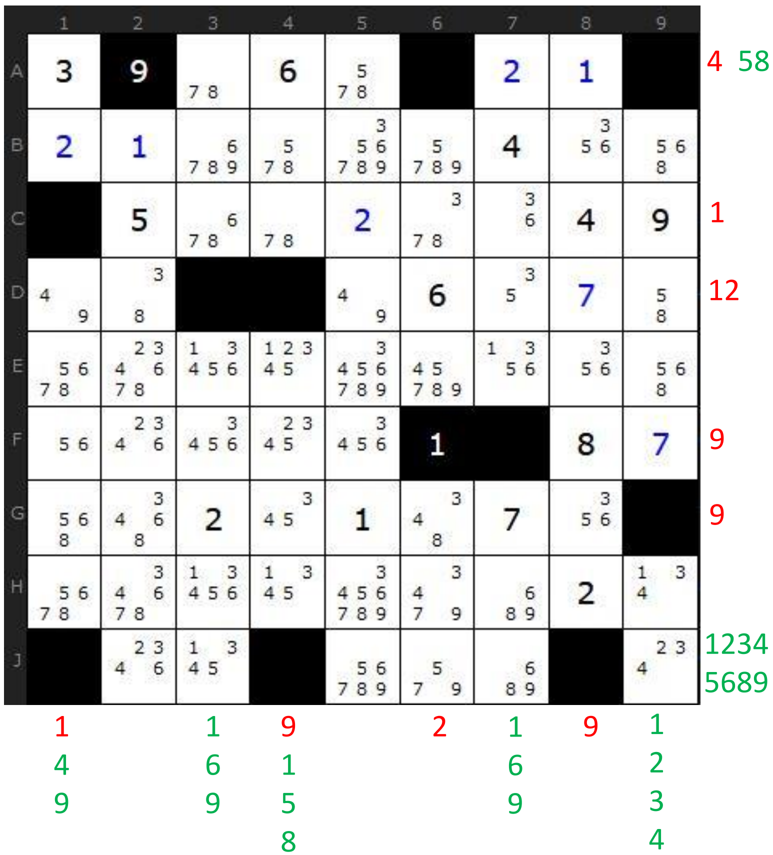
So far we have applied Setti‘s rule and Setti considerations to single digits. Together with other standard tools this is usually enough to solve most extreme Str8ts puzzles. Most but not all. To enable you to tackle some of the so far unsolvable here is one last strategy: **Combined Settis**, where Setti‘s rule is applied not just to one digit but to a **combination of digits**.

The theory behind this is simple: If in a Str8ts puzzle digit x1 is missing in n1 rows and n1 columns and digit x2 is missing in n2 rows and n2 columns then **x1 and x2 together** are missing in **n1+n2 rows** and **n1+n2 columns**. (Note that rows/columns in which both digits are missing are counted twice here!) Thus we can say that Setti‘s rule is also true for sets of digits.

But how do we apply Setti‘s rule to a set of digits? And to which set? Let‘s look at two examples. But before let me give you a little warning: You do not come along combined Settis often, and even if you do, they are usually so hard to find, you might miss them. Actually I‘m not really sure that combined Settis belong into the 5*-puzzle-solving-category. So let‘s take a tour into 6*-country.

# Combined Settis – First Example

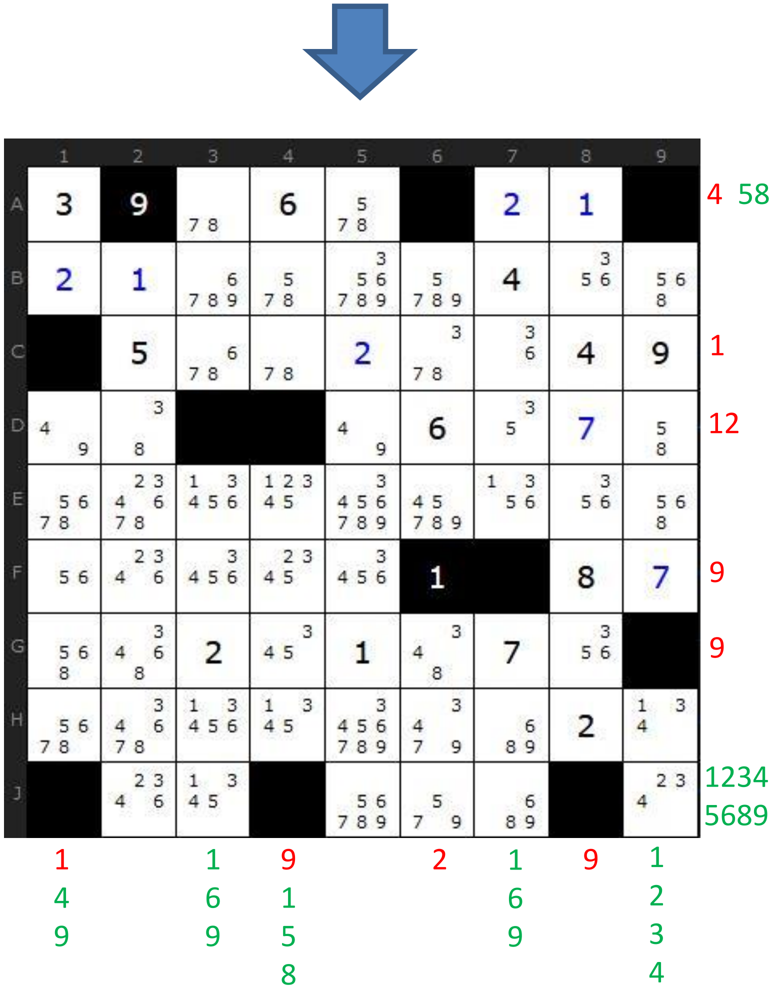
**Example 5 (#247):**




With this puzzle I ran out of options early. I solved a couple of cells, then I did a BCA and applied Setti's rule to all digits, but the result – as you can see – is rather meagre.

But is it really? The BCA has revealed one interesting thing: In row A either 5 or 8 **must be missing**. A look at the columns reveals, that both digits can be missing at most once. This is an indication that **a combined Setti on 5,8** might work. So let's try that.

# Combined Settis – First Example



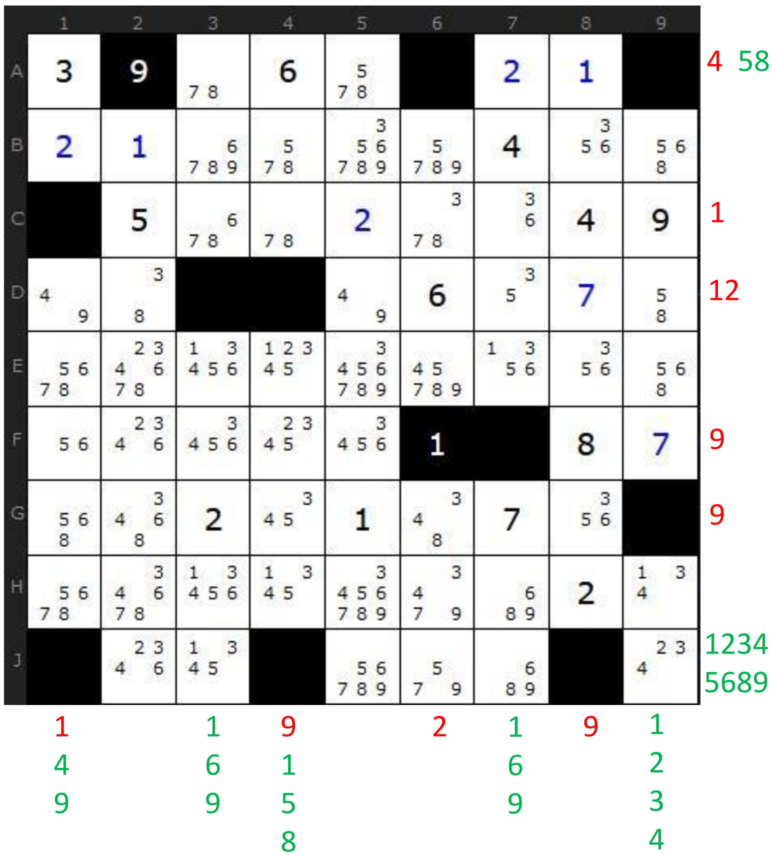

To do a combined Setti on 5,8 we have to analyze the presence of 5 and 8 in rows and columns **together**.

Let‘s start with the columns: 5 and 8 can both be only missing from col 4. But can they both be missing at the same time? Clearly not, since one has to be in ABC4. So:
**5,8 together are missing from 0-1 columns**.

Let‘s look at the rows: Exactly one of 5 and 8 must be missing from row A. For row J we have: 5 and 8 can both be there or one might be missing. (One has to be in J567, so they cannot both be missing at the same time.) So:
**5,8 together are missing from 1-2 rows.**

Now we apply Setti‘s rule: 5,8 together must be missing in the same number of rows (1-2) and columns (0-1). **So together 5,8 must be missing in exactly 1 row and 1 column.**

# Combined Settis – First Example



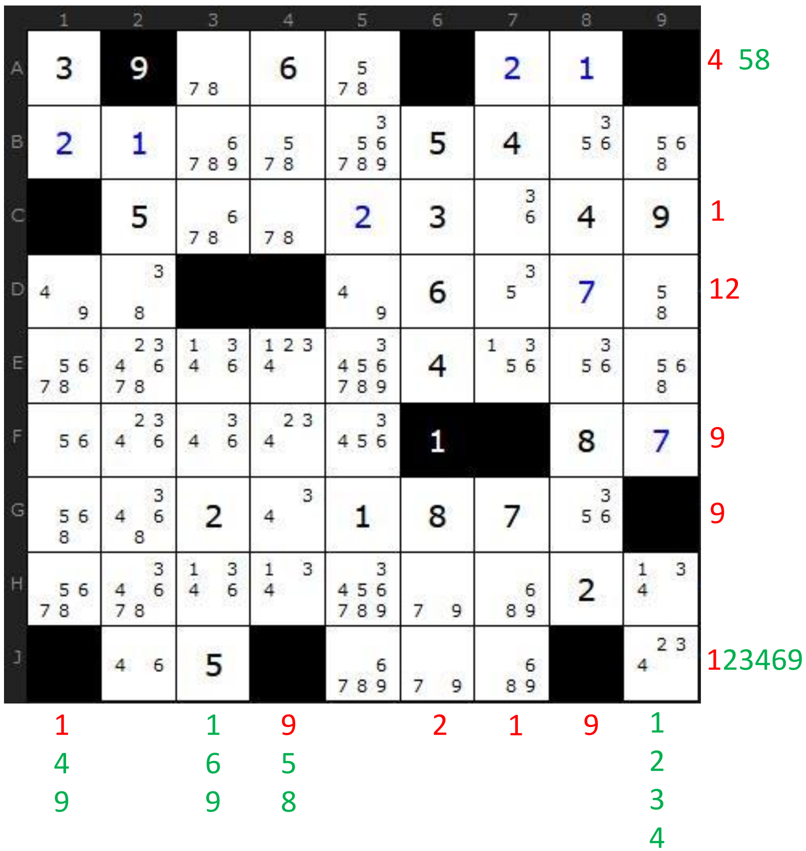

I repeat: **5,8 together must be missing in exactly 1 row and 1 column.**

You might think this is no big deal, but actually it's a game changer, because it has two useful consequences:

1. Either 5 or 8 is missing from col 4, therefore 1 is there and we can delete 5 from EFGH4.
2. 5 and 8 **must both be in row J**. This implies J3=5, J567=6789 and decides the high/low question in col 6.

Let's clean up row J and cols 4,6 and see what we get:

# Combined Settis – First Example

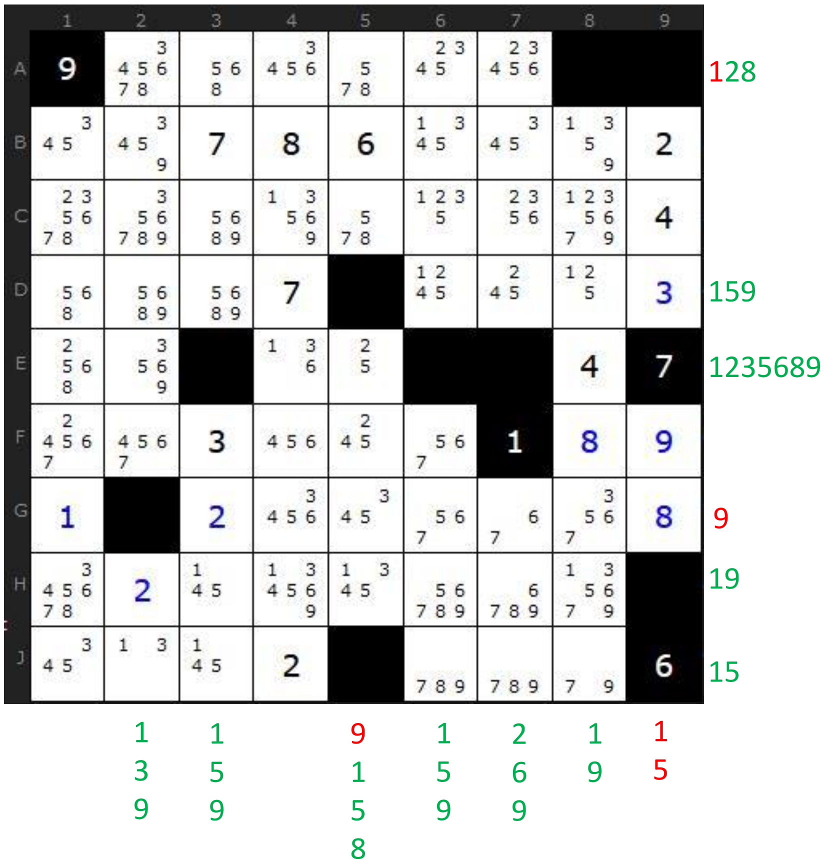



From here on the puzzle is easily solvable!

I hope you agree that doing a combined Setti is not too hard, the difficulty lies in spotting the right combination of digits. So how to do the latter?
Regrettably there is no satisfying answer to that question. It‘s usually helpful to look at sets of digits that might be missing in just few rows and columns and that heavily influence each other – like 5 and 8 did in row A. And after having done a couple of combined Settis you might develop an eye for spotting promising combinations. So to give you some more experience here‘s one more example:

# Combined Settis – Second Example

**Example 6 (#246)**



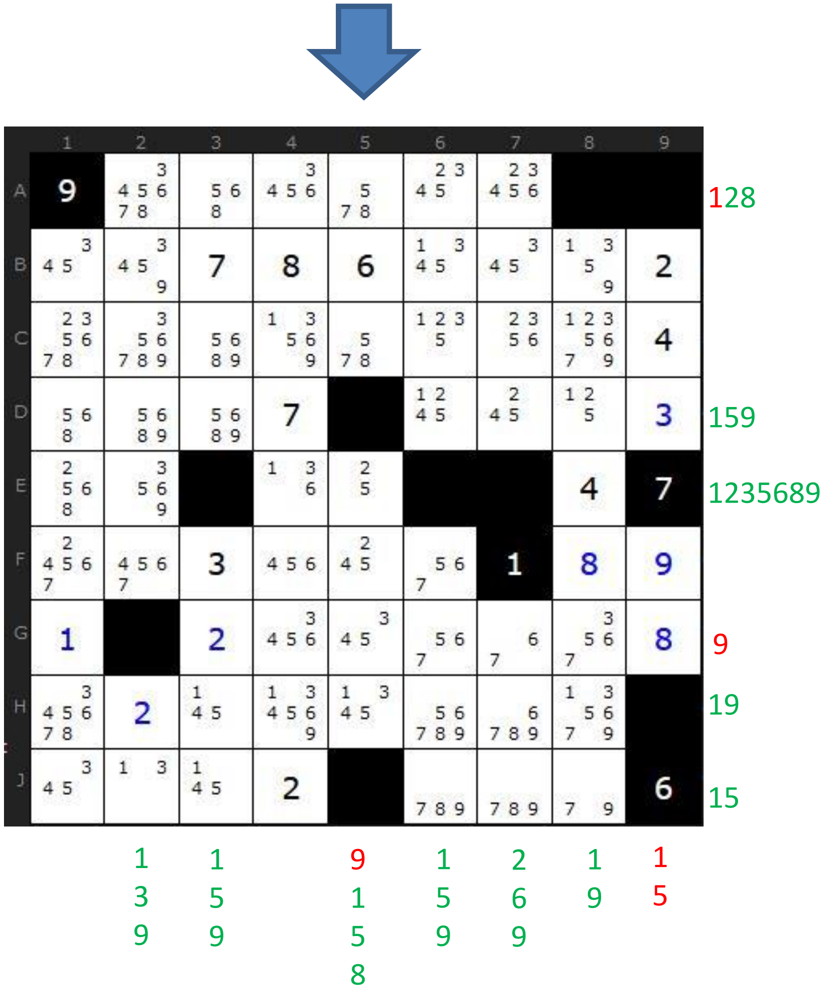

Combined Setti on 2,6,8:

Rows:
Exactly one of 2,8 must be missing in row A.
Exactly one of 2,6,8 must be missing in row E.
⇒ **2,6,8 together are missing from 2 rows.**

Columns:
Col 5: 8 might be missing from col 5.
Col 7: Either 2 and 6 both belong to col 7 or one is missing.
⇒ **2,6,8 together are missing from 0-2 cols.**

**By Setti's rule 2,6,8 must be missing from exactly 2 rows and columns.**

# Combined Settis – Second Example



I repeat: **2,6,8 must be missing from exactly 2 rows and columns.**

Consequences:

1. 8 is missing in col 5, therefore AC5=57, H5=1, E5=2, G5=3, F5=4.
2. 2 or 6 is missing in col 7, therefore 9 must be in col7, therefore G7=7, HJ7=89.
3. No immediate consequences for rows A,E.

The consequences on cols 5,7 are enough to solve the puzzle.

**Note:** In this puzzle the combined Setti on 2,6,8 is equivalent to a combined Setti on 2,4,6,8 (because there are no 4's missing.) A combined Setti on all even or all uneven digits is equivalent to a strategy called sometimes „even/odd argument" or „oddness argument".

# Conclusion

This tutorial explained

- Setti‘s rule,
- how to apply it to a single digit,
- how to do a black cell analysis,
- how to do Setti considerations and
- how to do combined Settis.

The examples used in this tutorial are:

Example 2 (#681) = weekly extreme str8ts #681
Example 3 (#695) = weekly extreme str8ts #695
Example 5 (#247) = weekly extreme str8ts #247
Example 6 (#246) = weekly extreme str8ts #246

I hope this text was helpful to you. If you‘d like to share comments or constructive criticism or have ideas/requests for more tutorials on special topics please mail to BP.Str8ts@web.de.

Thanks to users optimator, ben, hone, Jens and jgrab for helpful comments and corrections!