Sudoku Players' Forums

Rating rules / Puzzles. Ordering the rules

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Author	Message
ronk Joined: 02 Nov 2005 Posts: 2388 Location: Southeastern USA	Posted: Tue Jul 07, 2009 4:06 pm Post subject: quote **denis_berthier wrote:** I don't see how your failure to understand such things as: - complementarity of Naked/Hidden Subsets can be related to ... You've gotta be kidding **denis_berthier wrote:** I don't see how your failure to understand such things as: - considering right-linking objects which are mere Naked or Hidden Subsets modulo the target and the previous right-linking candidates can be related to ... You've gotta be kidding **denis_berthier wrote:** I don't see how your failure to understand such things as: - supersymmetry can be related to ... Somewhat true perhaps, but since **re'born** and I posted the first illustrations of rn-space [edit: in this forum] -- something you should have been doing, I believe I understand a fair amount. BTW have you ever posted an illustration of bn-space ... and discussed how to interpret it BTW2 does anyone actually solve puzzles with rn-space and nc-space using **Ruud**'s SudoCue or any other solver Last edited by ronk on Tue Jul 07, 2009 6:02 pm; edited 1 time in total
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denis_berthier Joined: 19 Jun 2007 Posts: 667 Location: Paris, France	Posted: Tue Jul 07, 2009 4:49 pm Post subject: quote edit **Ronk**, You should have used a full page and repeated your message 10 times, least someone misses so invaluable spam. The first examples of using rn-space (in addition, of course, to the Naked/Hidden/SuperHidden dualities) were in the first edition of my book: hidden xy-, xyt- and xyzt- chains. With 3D chains, I introduced a little later the combined usage of rc, rn, cn and bn spaces. As the only goal of all your posts to me has always been to conclude that all my stuff is junk, why do you keep reading it? Very bad for your health.
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coloin

Posted: Wed Jul 08, 2009 6:47 am Post subject: quote

Joined: 06 May 2005
Posts: 1008
Location: Oxford

I performed a {-2+2} on 5x[21,22,23,24,25,25,27] puzzles This is a small sample and indeed there is large variation within puzzles. Probably good enough to demonstrate the trend.

This was the distribution

Code:

```
lines:518795 average clues:23.754602
   21  36858
   22  76180
   23  109747
   24  145938
   25  73748
   26  57350
   27  18974
```

? the same bias as introduced by the "building up method"

More relevant.....interestingly a discussion between dukuso and gsf

http://www.setbb.com/phpbb/viewtopic.php?t=248&mforum=sudoku

dukuso wrote:

> what's the average number of clues in a random minimal sudoku generated by your method ?
>
> I get 24.3 when starting from a full random grid and 23.9 when starting from an empty grid.

gsf wrote:

> 25.3 starting with 30 randomly placed givens

C

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denis_berthier

Posted: Wed Jul 08, 2009 7:17 am Post subject: quote edit

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

Classification of puzzles for 4 generators : preliminary results

I've been considering ***4 generators***:
2 top-down : suxgx.x and Allan's new generator
2 bottom-up : suexg14 and Mike's bottomup generator

I've used the corresponding ***4 collections of puzzles***:
sudogen0_1M (1,000,000 puzzles) and rab1mran (1,000,000 puzzles)
suexg14_1M (1,000,000 puzzles) and Mike#5 (64,000 puzzles)

Except for sudogen0_1M, for which I had already done all the computations on the full collection, I've used smaller sub-collections for some computations that'd take too much time otherwise, as specified in detail below:
- computations that involve only the number of clues are based on the whole collections,
- computations that involve only the SER (and possibly the number of clues) are limited to 400,000 puzzles for rab1mran and to 200,000 for suexg14_1M (but they will soon be replaced by the whole collection - soon means "as soon as the SER computations that are running are over", i.e. in a few days),
- computations that involve the NRCZT rating are limited to 10,000 puzzles for rab1mran and suexg14_1M and to 50,000 for Mike#5.

These limitations are purely opportunistic and don't imply any a priori judgment on the 4 generators. They are enough in practice to validate the general results stated below.

Results
The most striking results are:

- the ***close similarity between the 2 top-down generators:***
  same mean number of clues,
  same distribution of the number of clues,
  close mean SER and mean NRCZT, globally and for each number of clues;

- the ***close similarity between the 2 bottom-up generators:***
  same mean number of clues,
  same distribution of the number of clues,
  close mean SER and mean NRCZT, globally and for each number of clues;

- the ***clear difference between the top-down and bottom-up generators:***
  notably larger mean number of clues for the top-down generators (24.38 vs 23.88),
  notably different distributions of the number of clues,
  different mean SER and mean NRCZT for each number of clues, with a slightly but systematically higher SER and NRCZT for the top-down generators,
  globally larger mean SER and mean NRCZT for the top-down ones;

- ***for the 4 generators, a trend for increasing SER or NRCZT with increasing number of clues between 21 and 29*** (not enough data to allow any conclusion below 21 or above 29 - except for sudogen0_1M, for which the trend appears in the whole 20-30 span);

- nevertheless, ***for the 4 generators, a very small (~0.1) correlation coefficient between the number of clues and the SER or NRCZT, which implies that the number of clues can't be used for predictions of the (SER or NRCZT) complexity of an individual puzzle***.

I have html tables with all the details, but the software here doesn't allow html code.

Last edited by denis_berthier on Wed Jul 08, 2009 7:18 am; edited 1 time in total

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Allan Barker

Posted: Wed Jul 08, 2009 7:17 am Post subject: quote

Joined: 21 Feb 2008
Posts: 285
Location: Bangkok

Quote:

> **denis_berthier wrote:**
>
> > Supersymmetry adds that ,e.g., HS(4), NS(4) and SHS(4) (Jellyfish) have the same complexity.
> >
> > I now extend all this to ALS, AHS,A-Fish, A*LS, A*HS, A*-Fish, just by "forgetting" the additional candidates/places.
>
> No argument there, but I see this all, i.e., the rating, as using the minimum count of strong sets, which makes me question why ...
>
> **to Allan Barker, denis_berthier wrote:**
>
> > Yes, good example. In complete nrczt notation, the corresponding whip(ALS) has length 9 ...
>
> ... when Allan's illustration shows 7 strong sets.
>
> **Quote:**
>
> > zt-whip(ALS)[9] r1{n4c9 NT({n5 n8 n9}{c4 c8 c9}) n4c7*} - r6{n8c4 NQ({n1 n3 n5 n8}{c4 c6 c7 c9}) n9r6c7#1 n9r6c9#1} - r4c9{n3 n2 n4*} - r3c9{n2 . n4*} => r3c7 <> 4

I think I understand after looking a bit closer. My example and Denis's example are similar but are not the

same logic. His uses 9 truths and mine uses 7 with one right (left?) linking candidate. The difference may be that the two solutions came from two different solvers. In my solver A*LS/A*HS are a subgroup of a much broader class of allowed logic and are thus fully integrated. Below is the logic diagram for the 7 truth solution.

Code:

```
Logic diagram, candidates in RCN notation
     3n9  4n9  3r6  1r6  8r6  8r1  9c7  9b3  4b3 (cover)
TRUTH
2C9: 239==249
      |    |
3C9:  |   349==369
      |         |
6N6:  |        366==166
      |             |
6N7:  |            167==867=======967 (extra candidate)
      |                  |         |
8C4:  |                 864==814   |
      |                       |    |
1N7:  |                       |  (917)=917==417
      |                       |         |    |
1N9:  |                      819=======919==419
      |                                      |
2V1: 439 <-------------------------------------+
```

In my previous post here http://www.sudoku.com/boards/viewtopic.php?p=78818#78818. I showed some data suggesting that the number of intrinsic truths (and difficulty) can be related to other intrinsic properties. However, a definition might me useful.

Intrinsic Truth *For any valid Sudoku grid, the minimum number of truths required to eliminate any candidate using any form of logic, independent of methods, is an intrinsic property of the grid. This number cannot change.*

Maximum Intrinsic Truth *For any valid Sudoku puzzle, considering all grids along all solution paths, there must be an intrinsic maximum number of truths required to solve the puzzle* (This is probably called a saddle point, a maximum minimum)

This may seem a bit obvious and although provable, they are meant to be self evident. In fact, the idea of relating the number of truths to difficulty probably dates back to the beginning of Sudoku time. If one accepts that the number of truths used in a logical dedution relates to difficulty, then puzzles must have an intrinsic difficulty.

So the difference between 7 and 9 may be a difference between the intrinsic truth for that grid and, a value found by a set of rules or a solver. Then it's easy to see how trading off between various AHS/ALS forms may help to better approximate intrinsic truth (assuming the other form really fits the logic). My solver found the following 28 solutions for removing 4r3c7 with the following distribution. There was a variety of logical style.

Truths/Solutions
5 / 0
6 / 0
7 / 6
8 / 12
9 / 10

In addition, it found 68 solutions for various candidates that used 7 truths. It, and another, bizarre solver found nothing that could be removed with less than 7 candidates. Conclusion, this grid requires 7 truths to solve.

Of course, there is nothing at all undesirable about using a solver or a set of rules as a rating system. In fact, if different rating systems are tuned to come close to the intrinsic truth, then those rating systems will also be closer to each other.

However, as Moulder used to say, "*The truth is out there*"

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denis_berthier

Posted: Wed Jul 08, 2009 7:22 am Post subject: quote edit

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

Allan,
Due to my inexperience with ALS, there was an error in my whip(ALS). I now have a much simpler ordinary braid:
nrczt-braid-cn[8] r1c7{n4 n9} - r1c9{n9 n8 n4*} - r1c4{n8 n5} - r6c4{n5 n8} - r6c7{n8 n1 n9#1} - r6c6{n1 n3} -- n2c9{r3 r4} - n3c9{r4 . r6#6} => r3c9 <> 4
(The double "--" indicates that the cell following it is not nrc-linked to that preceding it, as it would in a whip. Here, it is nrc-linked to the target)
Notice that this wasn't produced by SudoRules (I don't even know which puzzl ethis comes from) but is only an interpretation of your pattern in terms of braids.

I think the difference between my 8 and your 7 is mainly due to the convention I use that I count the last (contradictory) cell as 1 instead of 0.

What would be your length for a Naked Pair?

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eleven

Posted: Wed Jul 08, 2009 10:50 am Post subject: quote

Joined: 10 Feb 2008
Posts: 323

coloin wrote:

> I performed a {-2+2} on 5x[21,22,23,24,25,25,27] puzzles This is a small sample and indeed there is large variation within puzzles. Probably good enough to demonstrate the trend.

After some tests yesterday i dont think anymore, that its worth to try to get the real distribution with {-n+m} statistics. There are too much uncertainties. e.g. look at my quick results:

Code:

```
{-2+1} with 1000 puzzles each
    from n+1   minimal  %
26  1210883    196995  16
25   792888    226424  28
24   463118    212436  45
23   225153    147810  65
```

Does not look that bad, but

Code:

```
{-1+2} with 20 puzzles each
   from n-1     min.   %
26  302656      9360   3
25  283518     28925  10
24  237228     52890  22
23  187626     76561  41
```

Here i dont have any explanation for the strong bias to lower clues (while the different percentages of minimal puzzles might be explained by the method).
I wanted to do {-2+1}{-1+2} for 3x10 puzzles over night, but it turned out to take too long for me.

Now looking at your result

coloin wrote:

Code:

```
lines:518795 average clues:23.754602
   21  36858
   22  76180
   23  109747
   24  145938
   25  73748
   26  57350
   27  18974
```

? the same bias as introduced by the "building up method"

There always should be a bias to lower clues. Suppose 17 clue and minimal 35 clue puzzles would have the same average number of neighbours within {-2+2}. Then because of the wider area i would expect much more 35 clue puzzles than 17's (the distances between puzzles in the 35 space should be larger on average).

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denis_berthier

Posted: Wed Jul 08, 2009 11:37 am Post subject: quote edit

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

Classification of puzzles for 4 generators : complements

As I couldn't put the detailed html tables on this forum, I've put them on my web pages:

http://www.carva.org/denis.berthier/HLS/Classification/index.html
BEWARE: after partly re-arranging my web pages, this url supersedes any url I can have given previously for part of the the data or the results presented in this thread.
Notice that the information made available through this page represents months of CPU time.

Don't take section 1 into account: it is a old remainder that I haven't had time to update.

Section 2.1 gives access to:
- the code of the generators, when available,

Section 2.5 gives access to:
- the detailed tables of results reported in my previous post,
- the complete lists of puzzles,
- the list of their number of clues,
- the list of their NRCZT,
- the list of their SER,
- the list of their solutions,

... well, except for the results, this is currently true only of sudogen0_1M, but it will become true ASAP for the other collections as well.

Mike:
- do you allow me to put your 64,000 bottom-up collection on my web pages? (with a reference to you, of course)
- is the description of your generator OK?

Allan: for your collection, I plan to give only the address you mentionned in a previous post. Is that OK?

If anyone has done any other computations with these collections, or if other statistical classification results on very large collections are available with corresponding detail, it will be a pleasure for me to mention them here.

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Allan Barker

Posted: Wed Jul 08, 2009 12:05 pm Post subject: quote

Joined: 21 Feb 2008
Posts: 285
Location: Bangkok

denis_berthier wrote:

> nrczt-braid-cn[8] r1c7{n4 n9} - r1c9{n9 n8 n4*} - r1c4{n8 n5} - r6c4{n5 n8} - r6c7{n8 n1 n9#1} - r6c6{n1 n3} -- n2c9{r3 r4} - n3c9{r4 . r6#6} => r3c9 <> 4
> (The double "--" indicates that the cell following it is not nrc-linked to that preceding it, as it would in a whip. Here, it is nrc-linked to the target)
> Notice that this wasn't produced by SudoRules (I don't even know which puzzl ethis comes from) but is only an interpretation of your pattern in terms of braids.

Understood, here's the grid with this (your new) example.

Code:

```
nrczt-braid-cn[8] r1c7{n4 n9} - r1c9{n9 n8 n4*} - r1c4{n8 n5} - r6c4{n5
n8} - r6c7{n8 n1 n9#1} - r6c6{n1 n3} -- n2c9{r3 r4} - n3c9{r4 . r6#6} =>
r3c9 <> 4
+-----------------+---------------+---------------------+
| 7     6    459  | (58)  1   2   | (49)   3     (489)  |
| 389   2    389  | 37    4   6   | 5      79    1      |
| 134   135  1345 | 37    58  9   | 6      247   8-4(2) |
+-----------------+---------------+---------------------+
| 136   8    7    | 9     56  134 | 124    12456 4(23)  |
| 5     39   139  | 2     68  134 | 148    1469  7      |
| 1369  4    2    | (58)  7   (13)| (189)  1569  59(3)  |
+-----------------+---------------+---------------------+
| 2     15   6    | 14    9   7   | 3      8     45     |
| 3489  379  3489 | 6     2   5   | 1479   149   49     |
| 149   579  1459 | 14    3   8   | 2479   2459  6      |
+-----------------+---------------+---------------------+
```

Note also that this whip goes to 7 truths if you replace the Naked Pair 58 in column 4 with a bi-local 5 (column set 5c4). So this too comes to the minimum of 7 truths. The point to the post was that there is an intrinsic value that can be used as a reference. I would think that NRCZT would come fairly close, and then, by correlation, SER would as well.

> **denis_berthier wrote:**
>
> What would be your length for a Naked Pair?

Now I see what you mean. One answer is 2, because the definition of a naked pair is based on two cells that both contain a truth. The best answer is perhaps that the number of truths used in a logical deduction are what matter. In the above case, the NP has cleared the grid leaving behind a bi-local pair and only one is needed by the logic. Normally such an NP wouldn't be in the logic but if it were there for pratical reasons then the bi-local can be substituted. (Good example!)

> **denis_berthier wrote:**
>
> Allan: for your collection, I plan to give only the address you mentionned in a previous post. Is that OK?

Sure.

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m_b_metcalf

Joined: 15 May 2006
Posts: 2186
Location: Berlin

Posted: Wed Jul 08, 2009 1:00 pm Post subject: quote

> **denis_berthier wrote:**
>
> **Mike**:
> - do you allow me to put your 64,000 bottom-up collection on my web pages? (with a reference to you, of course)
> - is the description of your generator OK?

Denis, yes and yes. You may concatenate the second set of 55000 with the 64000. Also, I discovered that I had inadvertently got an optimization option in my compiler wrongly set. With the correct setting and an improvement to the zero-solution detecton the program runs six times faster, at 42 puzzles per second @ 2GHz. Thus, new sets can be conveniently generated.

Regards,

Mike Metcalf

Last edited by m_b_metcalf on Wed Jul 08, 2009 2:18 pm; edited 2 times in total

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aran

Joined: 02 Mar 2007

Posted: Wed Jul 08, 2009 1:35 pm Post subject: quote

> **Allan Barker wrote:**
>
> **Code:**

Posts: 318

```
nrczt-braid-cn[8] r1c7{n4 n9} - r1c9{n9 n8 n4*} - r1c4{n8 n5} -
r6c4{n5 n8} - r6c7{n8 n1 n9#1} - r6c6{n1 n3} -- n2c9{r3 r4} -
n3c9{r4 . r6#6} => r3c9 <> 4
+-----------------+----------------+----------------------+
| 7     6    459  | (58)  1   2    | (49)   3     (489)   |
| 389   2    389  | 37    4   6    | 5      79    1       |
| 134   135  1345 | 37    58  9    | 6      247   8-4(2)  |
+-----------------+----------------+----------------------+
| 136   8    7    | 9     56  134  | 124    12456 4(23)   |
| 5     39   139  | 2     68  134  | 148    1469  7       |
| 1369  4    2    | (58)  7   (13) | (189)  1569  59(3)   |
+-----------------+----------------+----------------------+
| 2     15   6    | 14    9   7    | 3      8     45      |
| 3489  379  3489 | 6     2   5    | 1479   149   49      |
| 149   579  1459 | 14    3   8    | 2479   2459  6       |
+-----------------+----------------+----------------------+
```

Allan, off topic but with reference to the above :
As you have illustrated, rank 1 logic reduced to rank -1 logic if 4 is true in r3c9 spells curtains for the latter.
Denis' approach for those wishing to apply the spirit of it without having gone into the detail might be termed "forget and remember" ("z+t")
where once a target is in view, one can forget what will in any case eliminate that target, and remember anything established.
eg : with a very slightly different approach for the same elimination
target 4r3c9
forget 4r1c7
remember 9r1c7
then either 134r3c123 or
5r3c23-(5=8)r3c5-8r5c5=8r6c4-(89*=1)r6c7-(1=3)r6c6-3r6c9=(3-2)r4c9=(2-4)r3c9
*established/remembered

Last edited by aran on Wed Jul 08, 2009 2:09 pm; edited 1 time in total

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denis_berthier

Posted: Wed Jul 08, 2009 1:45 pm Post subject: quote edit

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

> **Allan Barker wrote:**
>
> Note also that this whip goes to 7 truths if you replace the Naked Pair 58 in column 4 with a bi-local 5 (column set 5c4). So this too comes to the minimum of 7 truths.

I don't know exacty what you mean, but the point of my definition of length is the following:
- most Pairs, Triplets and Quads, whether they are Naked, Hidden or Super-Hidden (Fish), can also be considered as chains;
- any consistent definition of length of a pattern must give these elementary patterns the same length as the corresponding chains, that is 2 for a Pair, 3 for a Triplet and 4 for a Quad (no longer pattern required, due to complementarity and supersymmetry);
- these elementary patterns can be included as right-linking objects in generalised whips or braids; notice that, in this approach, there is no ALS, AHS, A-Fish or A-whatever;
- in most cases, these generalised whips or braids can also be seen as ordinary whips or braids;
- any consistent definition of length of a whip or braid containing such right-linking objects must therefore count each of them with its proper length.
This is completely clear for whips(ALS) and braids(ALS) and for ALS-chains, which are only a particular case of whips(ALS).

For your patterns, I think that most of them can be interpreted as whips: almost all the minimal puzzles can be solved with whips) and the extremely rare cases that don't can be solved with braids(ALS) (or maybe even whips(ALS). So I think there can be a definition of the length of your patterns consistent with the definition for whips and whips(ALS).

> **Allan Barker wrote:**

> The point to the post was that there is an intrinsic value that can be used as a reference. I would think that NRCZT would come fairly close, and then, by correlation, SER would as well.

The NRCZT-rating *is* purely intrinsic: it is defined as the level of the weakest nrczt (first-order logic) theory that can solve it.

If you're claiming that there might exist other intrinsic ratings, I agree. There is e.g. the NRCZT(ALS) rating, as I defined it above via my extended notion of length. It is strongly correlated with the NRCZT-rating, but it may be different (smaller) in extremely rare cases.

If you're claiming that there is only one intrinsic rating, smaller than any other, this is obviously true: take min(all intrinsic ratings). But it may be hard to give a more explicit definition.

If you're claiming that this minimal rating is defined by your notion of "number of truths", I don't know if I agree or not, because this notion is not as well defined as you're supposing. What is a truth?
- a value
- the presence of a candidate
- an "exor" relation (which corresponds to a rc, rn, cn or bn cell in my vocabulary; to a set in yours); (I think this is what you mean)
- a "not and" relation (a linkset in your vocabulary)

> **Allan Barker wrote:**
>
> > **denis_berthier wrote:**
> >
> > What would be your length for a Naked Pair?
>
> Now I see what you mean. One answer is 2, because the definition of a naked pair is based on two cells that both contain a truth.

So, a truth is an exor relation.
But I'd merely say, in terms of patterns: "the length is 2, because the definition of a naked pair is based on two rc-cells"

> **Allan Barker wrote:**
>
> The best answer is perhaps that the number of truths used in a logical deduction are what matter. In the above case, the NP has cleared the grid leaving behind a bi-local pair and only one is needed by the logic. Normally such an NP wouldn't be in the logic but if it were there for pratical reasons then the bi-local can be substituted. (Good example!)

Here, I don't understand anything. My definition of length is based on factual patterns and not on how they can be used at the "inference level". I thought yours would be also.
To be more concrete could you state the different sets you're using in your pattern and which size you give each of them?

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denis_berthier

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

Posted: Wed Jul 08, 2009 1:49 pm Post subject: quote edit

> **aran wrote:**
>
> Denis' approach for those wishing to apply the spirit of it without having gone into the detail might be termed "forget and remember" ("z+t")

OK (if you don't consider z as remember and t as forget):
- forget the z and t candidates
- remember the right-linking candidates (so as to be able to justify the future forgettings)

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eleven

Posted: Wed Jul 08, 2009 2:24 pm Post subject: quote

Denis,

Joined: 10 Feb 2008
Posts: 323

if you generated suexg14-0_1M with seed 0, and let it rate by Sudoku Explainer, keep an eye on puzzle nr. 737294. SE failed to rate it due to a bug in its BUG algorithm.
The correct rating would be 7.1.

Code:

```
........5.23....8...6.1..2...8.....9..4.3.2..6.9..5..7..59.7...........7...2..3.
+----------------+----------------+----------------+
| 48    1     7  | 3     68    2  | 46    9     5  |
| 5     2     3  | 7     9     46 | 46    8     1  |
| 9     48    6  | 5     1     48 | 7     2     3  |
+----------------+----------------+----------------+
| 2     5     8  | 46    7     1  | 3     46    9  |
| 1     7     4  | 68    3     9  | 2     5     68 |
| 6     3     9  | 2     48    5  | 18    14    7  |
+----------------+----------------+----------------+
| 3    #468   5  | 9    #468   7  | 1-8   16    2  |
| 48    68    2  | 1     5     3  | 9     7    #468 |
| 7     9     1  | 48    2     68 | 5     3    #468 |
+----------------+----------------+----------------+
```

It says, that in one of the marked 3-value cells there must be 8, otherwise there would be a BUG. But this is wrong.
ronk or someone else, can you explain, why the rule of thumb (2 more in the line/col/box) does not work here ?

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denis_berthier

Posted: Wed Jul 08, 2009 2:40 pm Post subject: quote edit

Joined: 19 Jun 2007
Posts: 667
Location: Paris, France

eleven wrote:

> Denis,
> if you generated suexg14-0_1M with seed 0, and let it rate by Sudoku Explainer, keep an eye on puzzle nr. 737294. SE failed to rate it due to a bug in its BUG algorithm.
> The correct rating would be 7.1.

Thanks, I used seed 0, as the names suggests. But the version of SE I have (downloaded from gsf's page, with serate added) works fine and gives 7.1

BTW, at the present time, only ~300,000 have been evaluated.

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